



SmartShop Fiber Laser DLP - Precision *Fiber* Laser Engraving

Owner's Manual

- Machine Briefing.
- Machine Set-Up.
- Operations Instructions.
- Parts & Service.
- Warranties & Return Policies.

Features:

- IPG Power Supplies Up To 12KW.
- Tube Cutting Option Available In 10 & 20 Feet.
- Optional Shuttle Table System.
- Optional Enclosures.
- 5×10 & 6×13 Table Sizes.



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CO2 Laser Machine © 2021 Laguna Tools 5/31/2021

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Safety-

Security Policy-

Before operating the machine and performing routine maintenance, the operator must read this section carefully to understand the machine safety precautions and requirements and to comply with the relevant safety precautions.

- 1.) Designate the security administrator to determine the scope of their duties and provide training in laser operations operators for safe operation and safety protection.
- 2.) Specify the laser safety management area, set warning signs at the entrance, and exit of the management area, including laser processing machine power, laser type, prohibiting outsiders from entering, pay attention to protect the eyes and the name of the safety management personnel.
- 3.) The operator of the laser processing machine must be specially trained to reach a certain level and put into use with the consent of the safety administrator.

Safety-

Security Policy (Cont'd.)-

4.) The main harm of laser to the human body is the eyes and skin. Any part of the body exposed to the laser can cause burns. Avoid placing any part of your body in the working light path of the laser device to avoid injury due to misuse. **Laser Safety Protection-**

The operator of the laser cutting machine or the person who approaches the laser during laser operation should wear a laser protective lens with a wavelength of 1064 μm or above.



In the area where the protective lens is worn, there must be good indoor illumination to ensure smooth operation of the operator. Do not place any part of the body under the beam, otherwise it will cause burns or even life-threatening to the human body. No one should, at any time, be facing the direction in which the laser (including the red indicator light) is ejected.

Safety (Cont'd.)-

When the shutter is opened, the human and non-working objects are prohibited from being exposed to the laser. It is strictly forbidden for the operator to leave during the operation of the machine. If an abnormality occurs during the use of the device, immediately press the emergency stop switch. The cooling water temperature and the auxiliary gas pressure should be checked frequently during use.

Laser Safety Protection-

Operate the equipment with the operation permit and observe the safety operation procedures. It is strictly forbidden for the equipment staff to operate. The laser of this equipment is a Class IV laser product. The fiber laser is invisible. The beam emitted by the lens, the reflection of the lens and the diffuse reflection of the light may cause damage to the human body (especially the eye). The personnel present should pay attention to the protection and prevent the fire from happening.. Exhaust gas generated during laser cutting is harmful to the operator. Please ensure that the equipment's dust suction device is operating normally, and the working site is ventilated.

Electrical Safety Precautions-

Do not touch any switches with wet hands to avoid electric shock. All parts of the machine with warning signs indicate that there are high-voltage electrical or electrical components in these areas. Operators should be careful when approaching these parts or repairing to avoid electric shock. Such as: protective cover of the position of the servo motor, equipment transformer,

Electrical Safety Precautions-

electrical cabinet door, etc. Read the machine manual and electrical schematic carefully and thoroughly to familiarize yourself with the functions and corresponding key operation methods. It is forbidden to change the set machine parameters privately. If changes are required, they must be trained by an equipment manufacturer and approved by an authorized professional, and the values of the parameters before the change must be recorded so that the original state can be restored if necessary.

Electrical Safety Precautions (Cont'd.)

Lasers for processing, generally with a supply voltage of several thousand volts to tens of thousands of volts, should protect against the danger of X-ray damage from the high-voltage and high-voltage electrons of the laser. Do not touch live components in the electrical cabinet during power-on, such as numerical control devices, servos, transformers, fans, etc.

Warming Machine!

After power off, you must wait for more than 5 minutes before touching the terminal. A high voltage is left between the power line terminals for a period after the power is turned off. To avoid electric shock, do not touch it immediately. Oxygen is often used in laser cutting, and sparks are splashed during cutting. Oxygen is a danger of fire. Therefore, there should be no flammable or explosive materials in the work area, and appropriate preventive facilities, such as fire extinguishers.

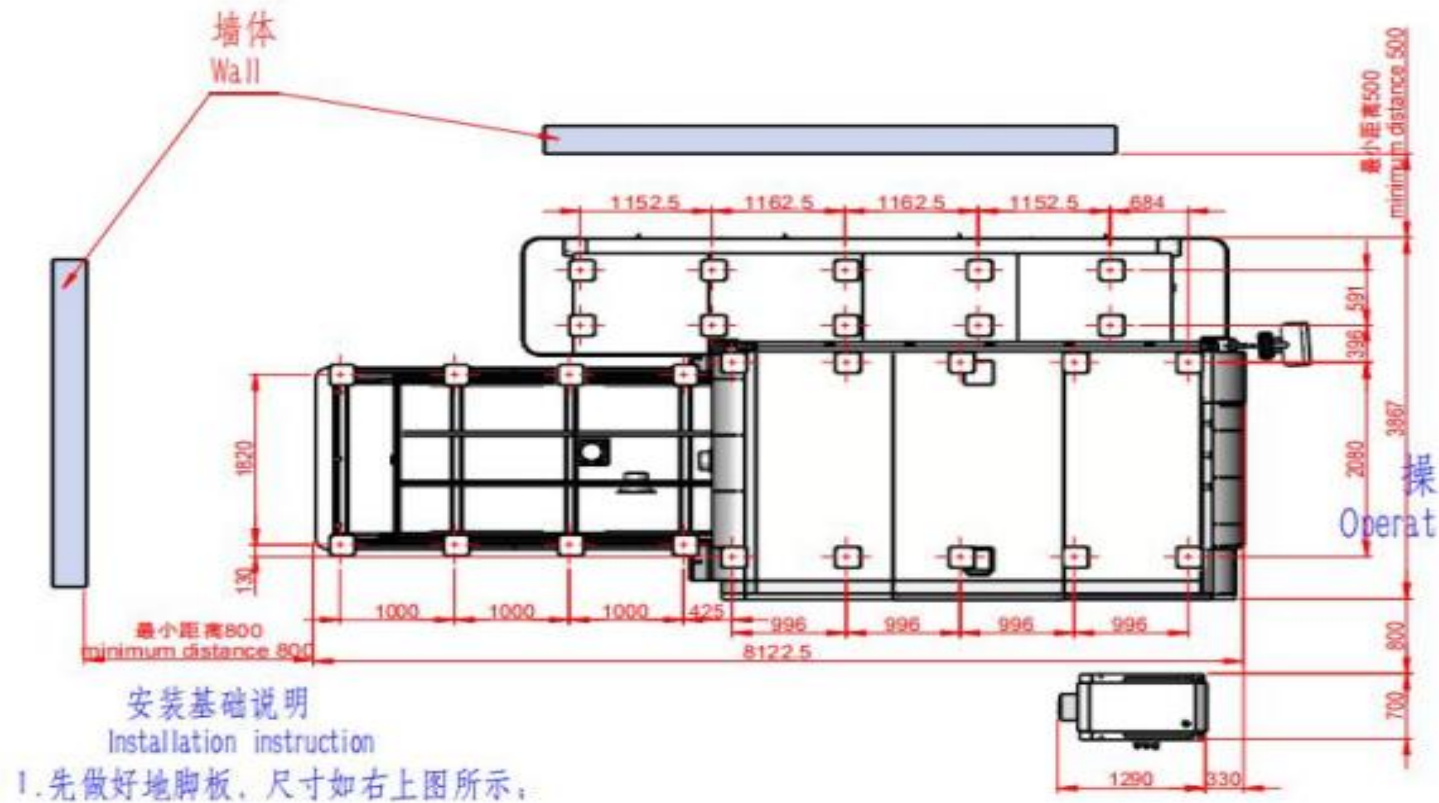
Preparation materials before installation-

Number	Name	Specification	Unit	Quantity	Note(s)
1	Deionized Water /Distilled Water /Purified Water	18 Liters/Barrel	Liter	4	1.) 500W-1500W: 40 liters. 2.) 2000W-3000W: 70 Liters. 3.) 4000W: 120 Liters. 4.) 6000W: 160 Liters.
2	Nitrogen	Nitrogen purity $\geq 99.9\%$	Batch	1	Not less than 4 bottles.
3	Oxygen	Oxygen purity $\geq 99.9\%$	Batch	1	Not less than 2 bottles.
4	Air Switch	4P/AC380V/63A	Piece	1	Machine Mains Power.
5	Air Switch	3P/AC380V/50A	Piece	1	Chiller.
6	Air Switch	3P/AC380V/32A	Set	1	Exhaust Fan.
7	Power Supply	20KVA~100KVA-AC380V	Set	1	Laser Cutting Machine Power Input. 1.) 500W-750W: 20KVA. 2.) 1000W-1500W: 30KVA. 3.) 2000W-3000W: 50KVA. 4.) 4000W: 80KVA. 5.) 6000W: 100KVA.
8	Air Compressor	Need to remove oil and remove water.	Set	1	Output pressure $\geq 2\text{Mpa}$.
9	Dryer	High precision oil water separator.	Set	1	
10	Ground Pin	Copper or Galvanized, length $> 1.5\text{ m}$, diameter $> 15\text{ mm}$.	Piece	3	The machine host needs 2 pieces; Laser source need 1 piece.
11	Vaporizer	Meter /Minute, withstand Voltage 4.0 MPA.	Piece	2	Used in combination with liquid nitrogen and liquid oxygen.
12	Nitrogen Pressure reducing valve (used abroad).		Piece	1	Enter: $\geq 15\text{MPa}$, Output: 0.2~3.0M
13	Oxygen pressure reducing valve (used abroad).		Piece	1	Enter: $\geq 15\text{MPa}$, Output: 0.05~1.5M

Safety (Cont'd.)-

Note: All air switches above are recommended without leakage protection. If the leakage protection function is provided, the rated leakage protection current shall not be less than 300mA, and it is recommended to be 500mA or more. A rated leakage protection current of less than 300 mA may cause leakage protection to trip.

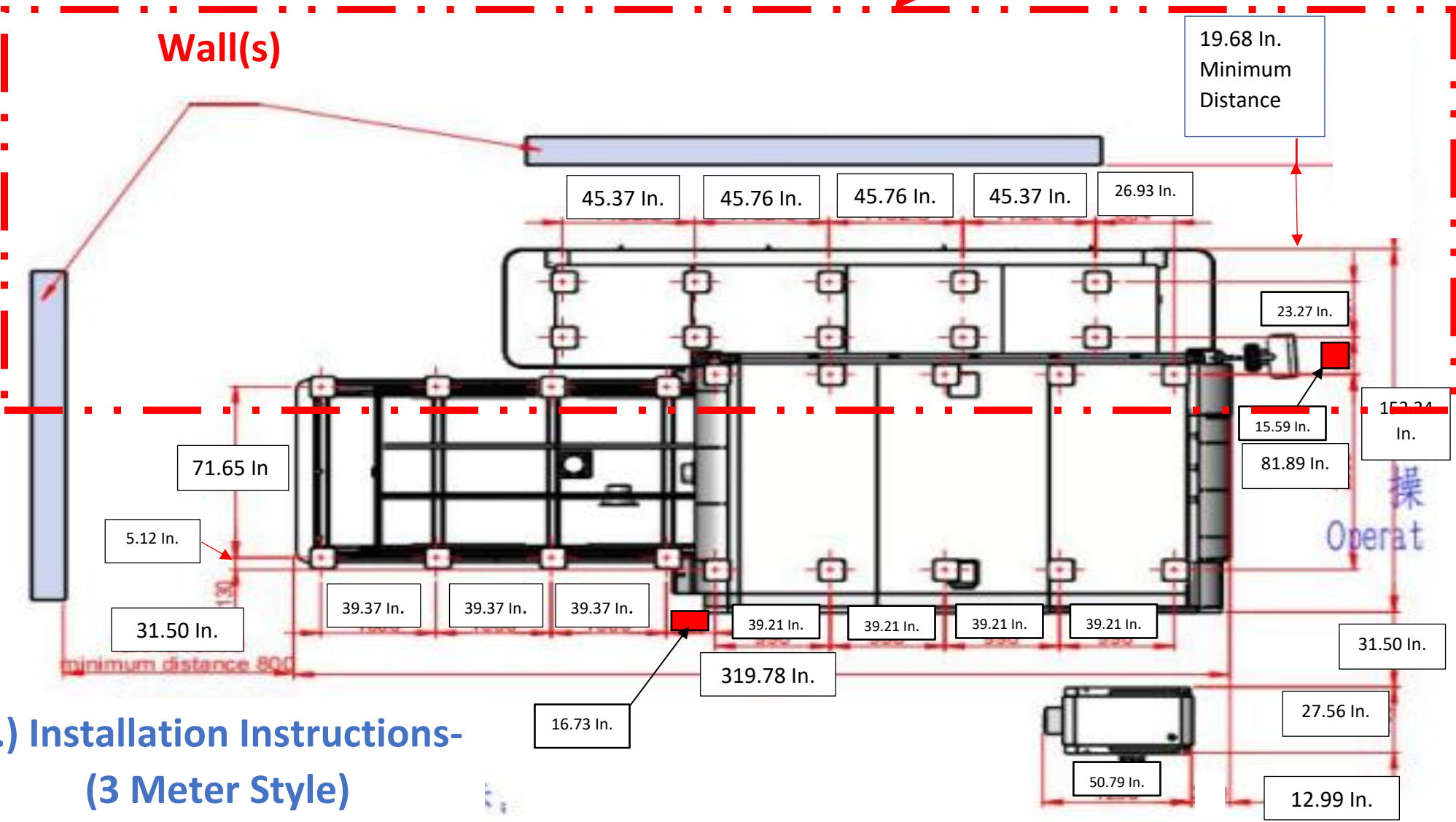
Workshop Size Preparation before Installation (3 Meters Type or Optional 6 Meter Type)-



Safety (Cont'd.)-

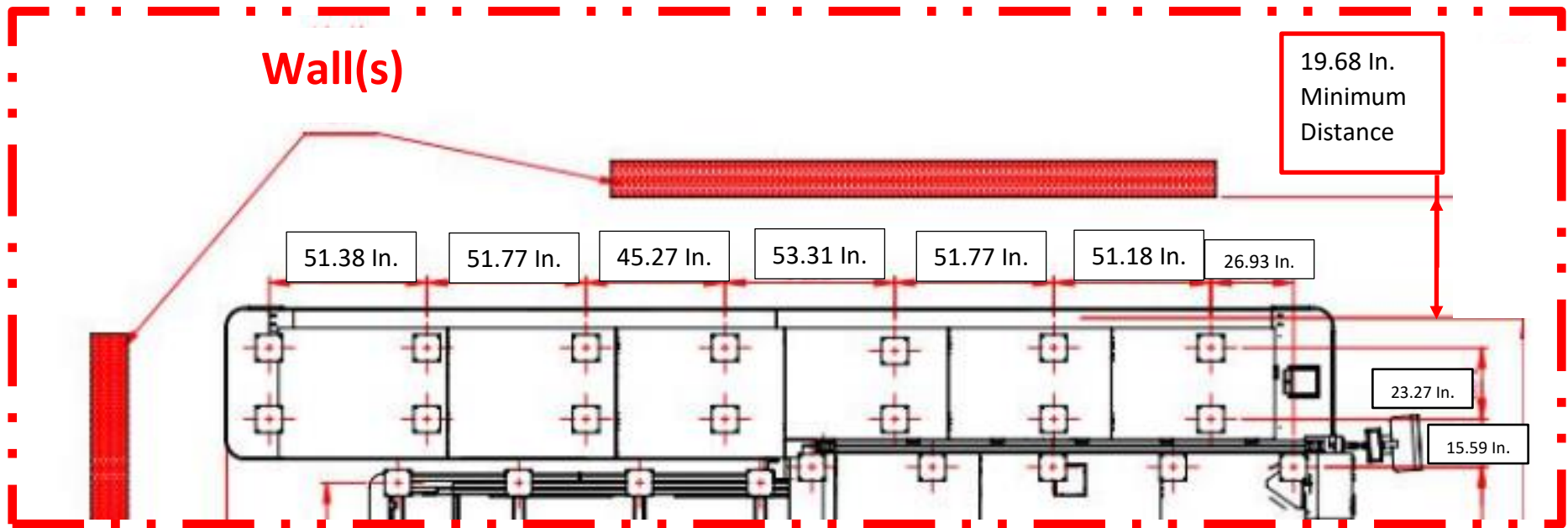
Workshop Size Preparation before Installation (3 Meters Type)-

(Optional 6 Meters Type Section)-



Safety (Cont'd.)-

Workshop Size Preparation before Installation (Optional 6 Meters Type)-



1 a.) Installation Instructions-(6 Meter Style)

Note: The ground level is not more than $\pm 10\text{mm}$ and can withstand more than 6 tons of heavy objects. The thickness of the concrete on the entire installation surface of the bed and the table legs shall not be less than 200mm, the compressive strength shall not be less than 30N/mm^2 , and the load shall be greater than 30KN/m^2 . Installation of the foundation requires no large vibrations around the ground. If so, you need to drill a shock ditch.

Safety (Cont'd.)-

Machine's Use Condition:

Power Supply Specifications: (3) three-phase (5) five-wire system, 380V 50Hz.

- **Quality:** Three-phase unbalance $< 5\%$. Single phase $220V \pm 5\%$. The machine must be equipped with a regulated power supply. The regulated power supply can ensure the stability of the input voltage of the machine, so that the entire machine tool and laser work in a relatively good state. Air compressors and fans should not pass through the regulated power supply to prevent the instantaneous high current changes of high-power devices from interfering with the power output of the laser.
- **Grounding Requirements:** Set the grounding pin to the grounding wire 1 meter away from the machine. The grounding resistance should be less than 4 ohms. The total number of ground needles is ≥ 3 , the material is pure copper or galvanized, the ground needle diameter is $\geq 15\text{mm}$, and the length is $\geq 1.5\text{m}$.
- **Environmental Requirements:** A site with good ventilation, no dust, no corrosion, no pollution, no water leakage. The recommended ambient temperature is between $+5^{\circ}\text{C}$ and $+33^{\circ}\text{C}$.

Safety (Cont'd.)-

Note: Avoid thermal deformation on one side of direct sunlight and one side of the wind (for example, louvers can be installed when installing in the window position to avoid these situations).

- **Water-Cooling System:** The water-cooling machine is equipped with water for circulating flow. It is used to cool special equipment such as lasers and cutting heads. **The circulating water needs to use “High-Quality Pure Water” or “Distilled Water”. It is strictly forbidden to use “Mineral Water”. When the ambient temperature is $< 0^{\circ}\text{C}$ to avoid freezing damage to the equipment, please, pay special attention!**

The distance between the left and rear sides of the machine tool should be above 1.2M; the laser and water-cooling machine should be above 1.0M from the wall. The control unit, servo unit and display and control panel are the core components of the machine tool, which have certain requirements on the environment, and should avoid electromagnetic interference from the machine tool, such as arc welding and electric discharge machine, so as not to affect the normal operation of the machine tool.

- **Fire Safety:** To prevent the occurrence of fire, the processing site should be equipped with appropriate fire extinguishers and reserve certain fire exits.

Safety (Cont'd.)-

- **Requirements for Gas Standards:**

1.) **Oxygen:** If liquid oxygen is used, a vaporizer must be added to raise the liquid to a normal temperature. High pressure liquid bottle withstand pressure 4.5MPa, vaporizer withstand pressure 4.5MPa, flow rate: 1.0 cubic meters / minute, output pressure: 2.0MPa.

2.) **Nitrogen:** If liquid nitrogen is used, a vaporizer must be added to raise the liquid to a normal temperature. High pressure liquid bottle withstand pressure 4.5MPa, vaporizer withstand pressure 4.5MPa, flow rate: 1.0 cubic meters / minute, output pressure: 3.0MPa.

3.) **Air:** If high-pressure air is used to cut the board, pure and dry high-pressure air (maximum air pressure 3.0MPa) is required.

Precautions:

Never use the gas completely. When the cylinder is returned, the residual pressure in the bottle must be at least one atmosphere above the air pressure. When the cutting oxygen

gas pressure is low, the laser cutting machine control system will alarm. Please change your gas in time.

Safety (Cont'd.)-

Unloading Requirements-

The equipment is transported to the final installation site with a truck, which must be prepared and implemented by the user. The route of the machine to the installation site must be declared in time before delivery. It is necessary to check the size of the door opening, the height of the pillar, the height of the cable holder, and whether the armor can be used for the road surface. The scale of the machine marked on the drawing must be taken into consideration during transportation!

1.) Auxiliary and Handling Tools-

The following items must be prepared by the user:

- Truck cranes for machine tools, lasers, and attachments. It is recommended to have a hydraulic crane with a gravity of at least 10t; if a larger boom is required depending on local conditions, the truck crane must have a greater lifting capacity.
- Forklift (capacity 10 t).
- Bridge crane: bearing capacity 10tons.
- Armored rollers (1 steerable, 2 solid).
- At least 2 hydraulic jacks with a lifting force of at least 5 ton (minimum height setting: 30 mm).
- Crowbar (1 m) and extensions.

Safety (Cont'd.)-

2.) What the user should do:^λ

- All transportation work must be carried out in accordance with the relevant transportation rules.
- Do not allow the machine to be placed on the floor without a bottom plate, otherwise the bottom of each component may be damaged! The bottom plate of the machine tool must be less than 100 mm from the ground, and then move the machine to the installation site. This distance must also be guaranteed during the movement.
- The foundation conditions of the installation site must meet the requirements in the installation conditions. The work of slitting, punching, etc. on the floor of the installation location must be prepared by the user according to the basic plan before the machine arrives.
- The machine tool uses a truck crane with corresponding gravity to unload the machine from the truck.
- Laser source, refrigeration units, suction units, etc. can be transported directly from the truck to the machine installation site using a forklift.
- Carry the machine from the outside to the factory on the armored rollers.

Safety (Cont'd.)-

- Use a bridge crane with considerable capacity in the plant or continue to carry the machine to the installation site on the armored rollers.

Precautions for Unpacking-

The chiller, laser, power distribution cabinet and other accessories of the fiber laser cutting machine are packed in polyethylene foam and wooden boxes. For other parts, the packaging is wrapped with polyethylene foam and protective film on the outside to protect them. The external parts of the laser cutter are damaged by external objects, and the foam is removed when it is removed.

Checking the Content-

- 1.) After opening the package, please confirm whether it is the product you purchased.
- 2.) Check the product for damage during transportation.
- 3.) Confirm that all components are complete and damaged.
- 4.) If there is any product type mismatch, lack of accessories or shipping damage, please contact our company in time.

Safety (Cont'd.)-

Engineers Install and Training Services-

- Check, inventory, and clean the machine for scratches, rust, accessories, and tools.
- Installation of Main Components: equipment level adjustment. Water cooler installation. Fiber optic installation. Installation of laser head. Gas connection. Fan installation.
- Machine Installation: Display installation. Connection of the whole machine and electrical cabinet. Installation of sheet metal parts.
- Power-On Test: Check before power-on External voltage check Origin limit switch test Each axis moves and returns to the machine origin Water-cooled machine is energized Fiber-optic power supply Fan power-on.
- Trial Cutting: Feeding opening, air opening, checking red light, nozzle dimming, material calibration and automatic edge finding, graphic processing, parameter setting, cutting.

Safety (Cont'd.)-

- Functions and Connection Methods of Key Components: Connection between laser and water cooler and cutting head. Connection between fiber optic and board. Connection of gas and equipment. Connection of control cabinet and external line. Installation of control card wireless controller and driver the way.
- Installation and Introduction of the Cutting Head: Structure description of the cutting head Focusing instructions Daily maintenance.
- Introduction of the Console Button: Emergency stop switch Key switch Gas button Enable switch.
- Switching Machine Steps: The booting sequence and shutdown sequence of the whole machine.
- Sheet Cutting Operation Steps: Control Software Operation Steps.
- Equipment and Personal Safety: Safety introduction and precautions for operators.
- Guide customers to practice: Allowing customers to operate independently is the focus of this training.
- Cutting Process/Debugging: Cutting of conventional materials and different materials using different nozzle types and focus and cutting parameters.

Machine Briefing:

The Smartshop DLP Fiber Laser has the power and precision of our FC Laser with the addition of our pipe cutting system.

Fitting Pipes from 20mm – 200mm (.79" – 7.9") and lots of power options allow this laser to fit any manufacturing need.

Features:

- IPG Power Supplies Up To 12KW.
- Tube Cutting Option Available In 10 & 20 Feet.
- Optional Shuttle Table System.
- Optional Enclosures.
- 5×10 & 6×13 Table Size.

Additional Features:

- Re-positioning Accuracy: 0.02mm.
- Power Options: From 700 Watts to 6000 Watts.
- G Power Supplies Up To 12KW.
- Tube Cutting Option Available In 10 & 20 Feet.
- Optional Shuttle Table System.
- Optional Enclosures.

Machine Briefing (Cont'd.):

Additional Features (Cont'd.):

- 5×10 & 6×13 Table Size.
- Re-positioning Accuracy: 0.02mm.
- Power Options: From 700 Watts to 6000 Watts.
- Ray-Tools Laser Cutting Head.
- CypCut Control System.
- Japanese Yaskawa Servo Motors (X & Y Axes).
- Panasonic Servo Motors (Z Axis).
- German Atlanta Gearwheel & Rack.
- French Schneider Electronic Components.
- 3 Meter Tube Cutting w/ Axis Turning.
(Optional 6 Meter Available)
- TFLW Water Chiller.

WARNING!
WARNING! Never perform any setup, maintenance or adjustments with the machine connected to the power source!
WARNING! If you have any doubt about the described procedure, seek professional assistance. Do not attempt any procedure that you feel is unsafe, or that you do not have the physical capability of achieving.
WARNING! Only operate the Laser machine after proper installation of the Chiller, Air Pump, & Exhaust System. Never operate machine without all systems running.
WARNING! When removing packaging banding, extreme caution must be used as the banding will spring when cut.
CAUTION! The machine is heavy. Ensure that you have enough people to do the job safely.
CAUTION! Use extreme caution when handling the fragile glass laser tube.
NOTE: There may be sawdust in or around your new machine as a result of thorough testing before shipping.

Instructions for Operations-

- Areas of Focus **before** Switch Machine is turned on “On”-
- Check the laser, water cooler, main power supply and voltage stabilizer before powering on. Whether each wiring has been connected properly. Ensure that the lines are not reversed or loose.
- Check the whole equipment before Power-On: Mainly check the trajectory of each moving part of the machine and whether there is any foreign object on the worktable.

- **Smartshop Fiber Laser DLP Machine External Device Startup-**

Start the Total Power Supply Equipment: Total Power Switch, Voltage Regulator Equipment.

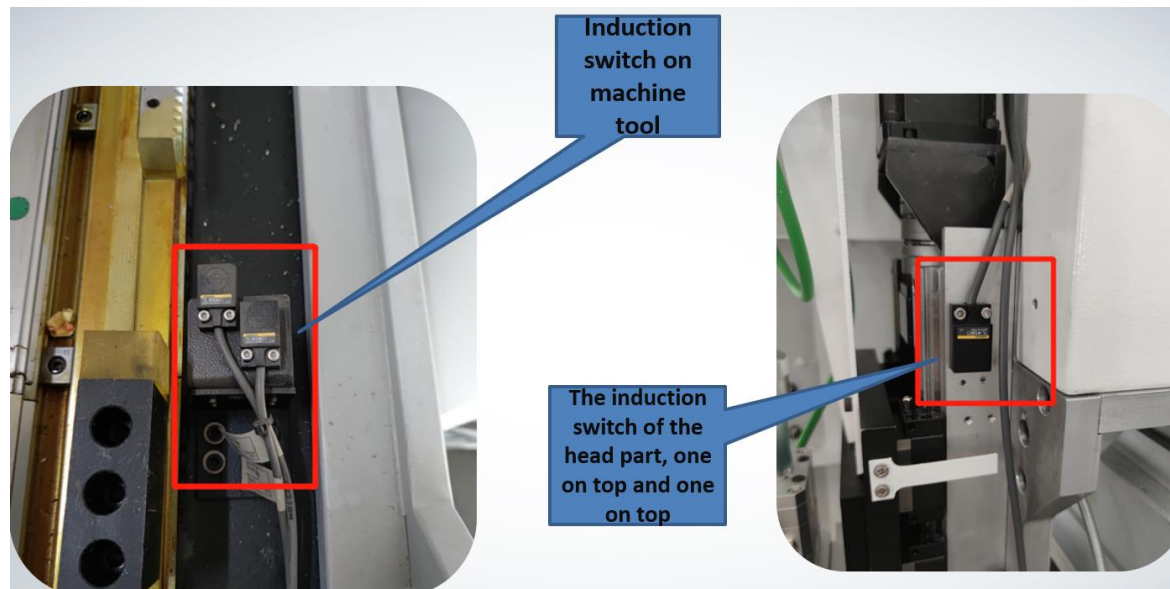
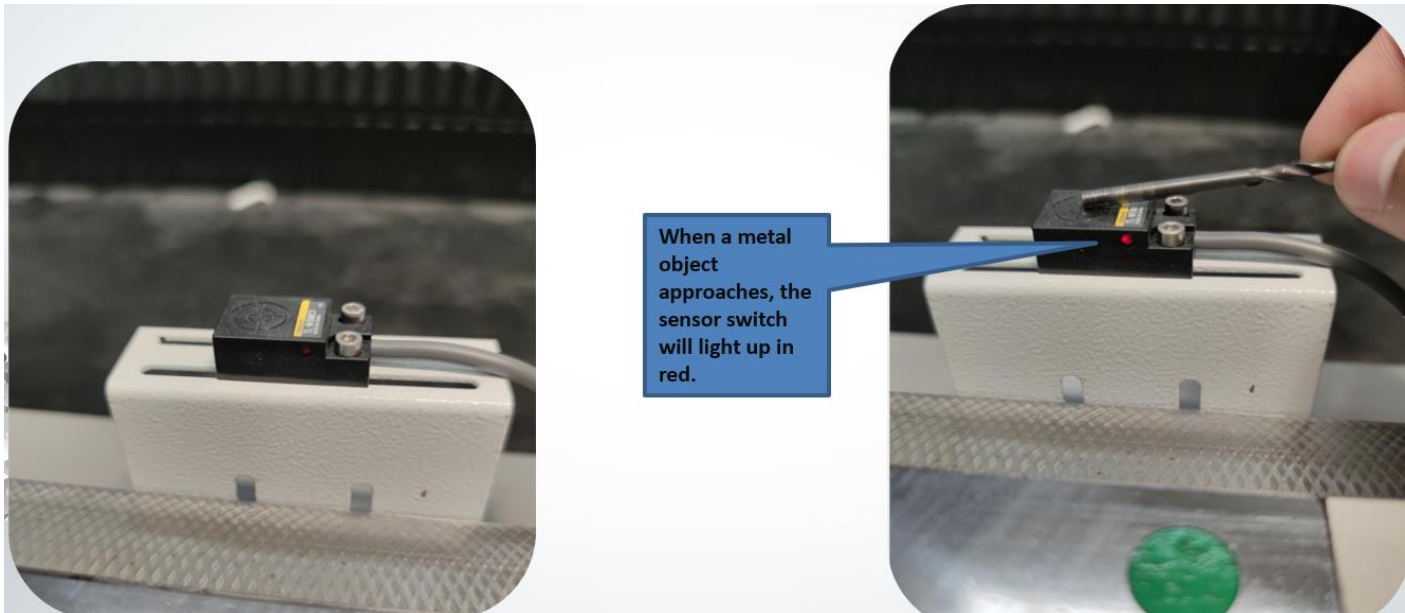
1.) Open and Turn “On” the Main Switch.



After power is on, use a multimeter to measure whether the voltage of the main power supply, voltage stabilizer, laser, and water cooler is within the specified voltage range.

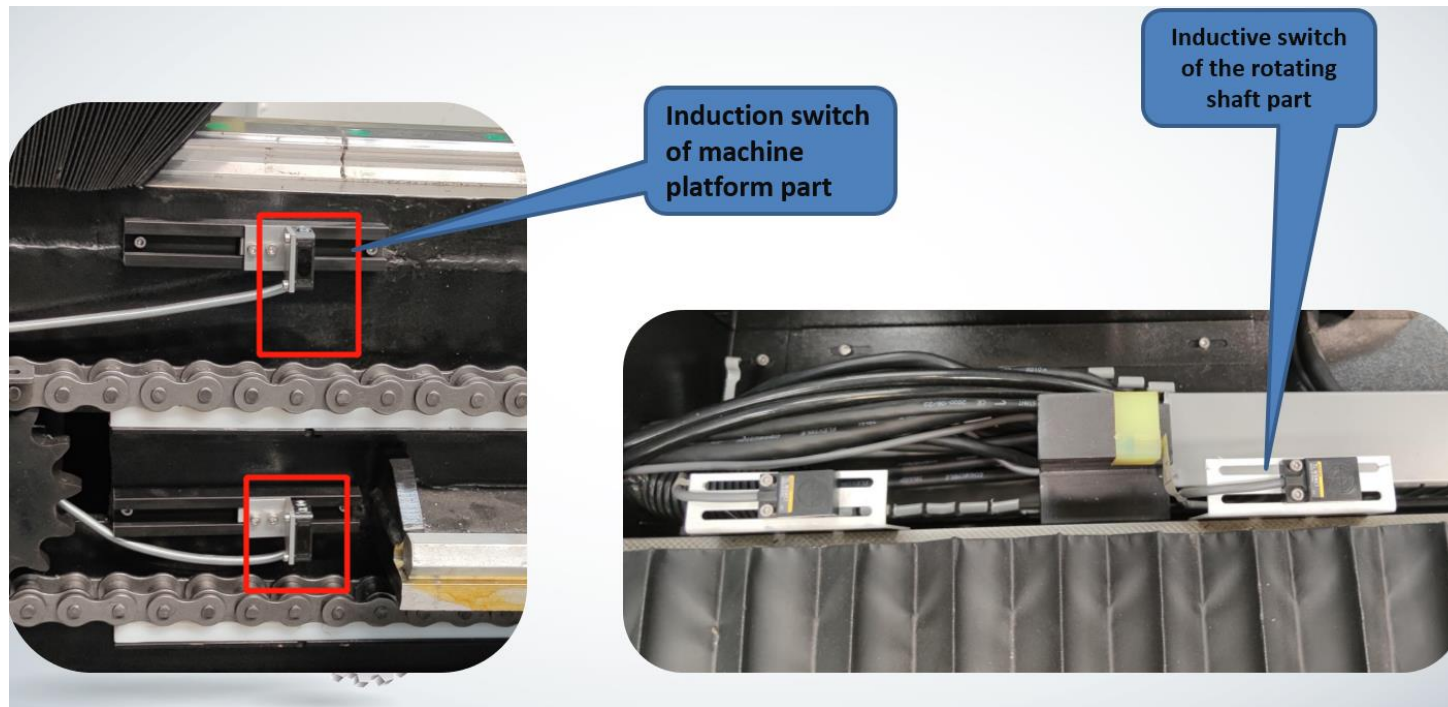
Instructions for Operations-

- Use metal objects close to all the induction switches on the machine to check if they are normal. (When a metal object approaches the sensor switch, the sensor switch will light up in red).



Instructions for Operations (Cont'd.)-

- Use metal objects close to all the induction switches on the machine to check if they are normal. (When a metal object approaches the sensor switch, the sensor switch will light up in red).



Instructions for Operations (Cont'd.)-

2.) Turn "On" the Chiller.



- **The Chiller Starts:** Check whether the status is normal, whether the water supply is normal, and whether there is water leakage in the waterway. Wait for the water temperature to rise to 18 Degrees Celsius or 64.4 Degrees Fahrenheit. The Water Inlet and outlet of the water cooler are respectively connected to the water outlet and the water inlet of the fiber optic.
- The two water pipes for cooling the laser head can be connected to other water inlets and outlets of the water cooler.
- The two water pipes that are cooled by the laser head are connected to the two fiber outlet pipes and are respectively connected to the fiber head and the cutting head.

Instructions for Operations (Cont'd.)

3.) Turn "On" the main power supply of the Control Cabinet.



4.) Turn "On" the emergency stop button on the control cabinet, all the components in the control cabinet are powered on and started.



Instructions for Operations (Cont'd.)

Start the host computer and open the software back to the remote point.

5.) Press the “**COMPUTER Button**” on the control cabinet. Turn on the computer and the display will light up.



When the laser starts, to check for abnormality.

- Start the auxiliary gas, such as an air compressor, open the required air supply valve, and check whether the status of each filter device and each pressure gauge in the air circuit is normal.

Instructions for Operations (Cont'd.)-

When the temperature of the water cooler is above 19 Degrees Celsius or 66.2 Degrees Fahrenheit, turn on the laser.

6.) Fiber Optic/Laser Component- Turn on the “**LASER Key**” on the control cabinet, the green power light in front of the laser will be on.

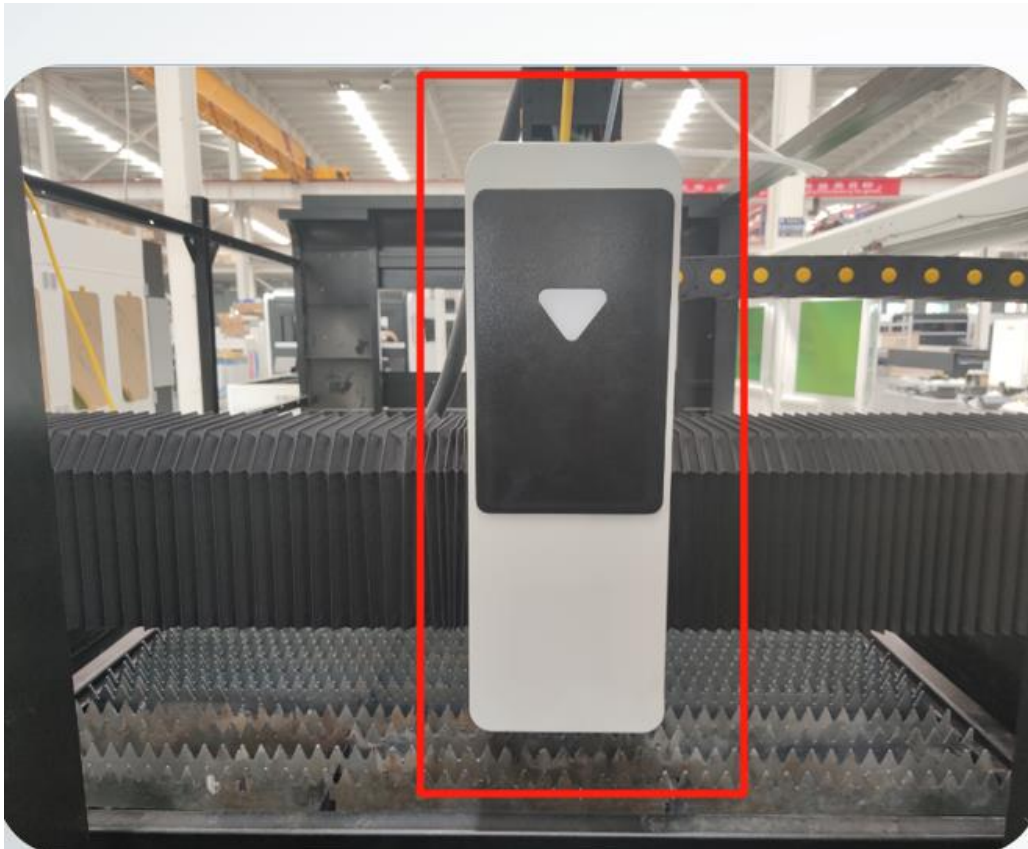


7.) Open the emergency stop on the machine.

Instructions for Operations (Cont'd.)-

Shutdown Steps/Procedure:

- 1.) Return to the Original Point. After clicking back to origin, the machine head part will return to the set zero point.



Instructions for Operations (Cont'd.)-

- 2.) Turn off the Gas Discharge Pipeline Gas.
- 3.) Turn off the Water Cooler.
- 4.) Turn off the Computer operating system.
- 5.) Turn off the fiber laser.
- 6.) Turn off the software emergency stop.
- 7.) Turn off the Main Switch.

The start-up procedure of the laser cutting machine must be strictly observed. Start the laser in strict accordance with the laser start-up procedure.

Instructions for Operations (Cont'd.)-

Software Operation Process of Fiber Laser Cutting Machine Plate-

Making graphic-data--importing-graphics--preprocessing--process-setting--knife planning -pre-processing inspection--machining control



1. **Import the Graphic:** "Click the Open File " **Button**" in the quick launch bar in the upper left corner of the interface to pop up the Open File dialog box, select the one you need. Open the Graphic. The right side of the Open File dialog provides a quick preview window to help you quickly find the files you need.





Instructions for Operations (Cont'd.)-


If you want to draw a part in the field with the CypCut software, click the New button and use the left. One can draw the buttons on the side drawing toolbar, see the related chapters.

2.) **Pre-Processing:** while importing graphics, CypCut will automatically remove very small graphics, remove repetitive lines, merge connected lines, auto-smooth, sort and break up. In general, you can start setting process parameters without other processing. If the automatic process does not meet your requirements, one can open the **Menu "File" - "User Parameters"** to configure. In general, the software believes that the graphics to be processed should be closed graphics. If the file you open contains unclosed graphics, the software may prompt you and

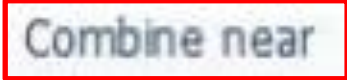
Instructions for Operations (Cont'd.)-

display it in red. However, this feature may be turned off to view the unclosed drawing on the drawing board. Shape, you can click on the common menu bar **"Show" Button"**  and

 **"Buttons"** to highlight unclosed graphics; One can also select all unclosed graphics by **"Clicking the Large Button "Select"** on the leftmost side of the toolbar and then **"Clicking "Select Unclosed Graphics"**. If in some cases you need to manually split the graph,

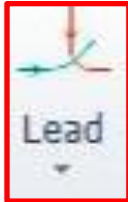
"Click on the "  **" Button"** under the **"Optimize" Button"** under the common menu bar Button, then click the mouse where you want to split.


Need to merge graphics, select the graphics you want to merge, then



"Click"  **" Button."**


Instructions for Operations (Cont'd.)-


3.) **Process Settings:** In this step you may use most of the functions in the **"Process Settings"** column under the common menu bar, including setting introduction **Lead lines, Set**

Compensation, etc. Large Size Button "  **"** can be used to set the lead-in lead,

Button " Seal ▾", Used to set over cut, notch, or seal parameters.


Button " Compensate" for kerf compensation; Button " Micro Joint ▾" for Insert a small segment of the graph that is not cut; the Button " Reverse ▾" reverses the single graph; the

Button " Cooling Point ▾" is used in the Graph. Set the cooling point in the shape.

"Click the " Lead Pos" Button", then click on the place you want to set as the starting point of the graph, you can change the starting point of the graph, if you click outside the graph and then click on the graph, you can draw a drop line by hand. As a quick start tutorial, you can "Press Ctrl+A" to select all the graphics, then "click the "Leader" button, set the parameters of the leader, and then click OK. The software will automatically find the appropriate position according

Instructions for Operations (Cont'd.)-

to your settings line. **"Click the Small Triangle below the "Leader" and select "Check Import and Export" to check the legality of the lead-in line. Select "Differentiate Internal and External Mode" to automatically optimize the lead according to the internal and external modes.**

Detailed cutting process parameters can be set by “Clicking the ”  ” Button” on the right toolbar. The Layer Parameter Settings dialog contains almost all the parameters related to the cutting effect.

4.) **Tool Path Planning:** In this step, the graphics are sorted as needed.



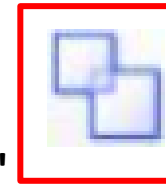
“Click the Sort “  ” Button” under the common or layout menu bar to sort automatically.

“Click the Small Triangle Below the Sort Button” to select the sorting method. You can control whether the automatic sorting process can change the direction of the graph and whether the inner and outer modes are automatically distinguished.

Instructions for Operations (Cont'd.)-



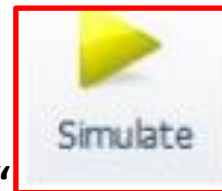
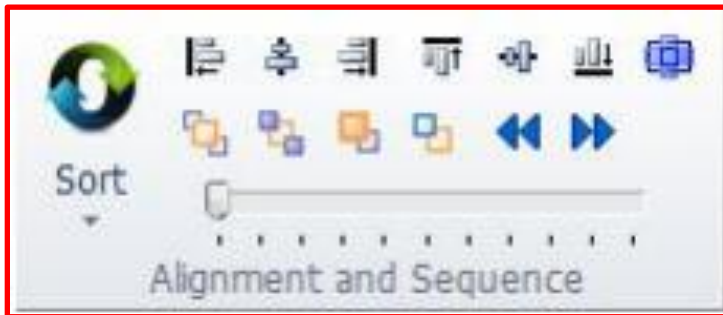
If the automatic sorting does not meet the requirements, you can “Click the “ **Button”** on the left toolbar to enter the manual sort/mode. The order of processing is set by clicking the graph in order with the mouse. By holding down the mouse and drawing a line from one drawing to another, you can specify the order between the two figures.



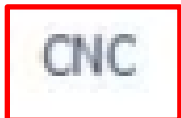
Select several images that have been sorted, and then “Click the Group ” **Button”** under the common or layout menu bar to fix their order. After that, automatic sorting and manual sorting will no longer affect the group. "Internal graphics, "groups" will always be a whole. You can also sort the graphs inside the group by selecting a “group” and then right-clicking to select the sort within the group.

Instructions for Operations (Cont'd.)-

5.) **Pre-Processing Inspection:** The machining path can be checked before the actual cutting. Click each alignment button to align the graphics accordingly. Drag the interactive preview progress bar (under the drawing menu bar) as shown below to quickly view the graphics processing order. Click the interactive preview button to view the graphics processing one by one order.



The simulation can be performed by “Clicking the “**Simulate**” Button” on the “Console”, and the speed of the analog machining can be adjusted by the “Analog Speed” function on the “



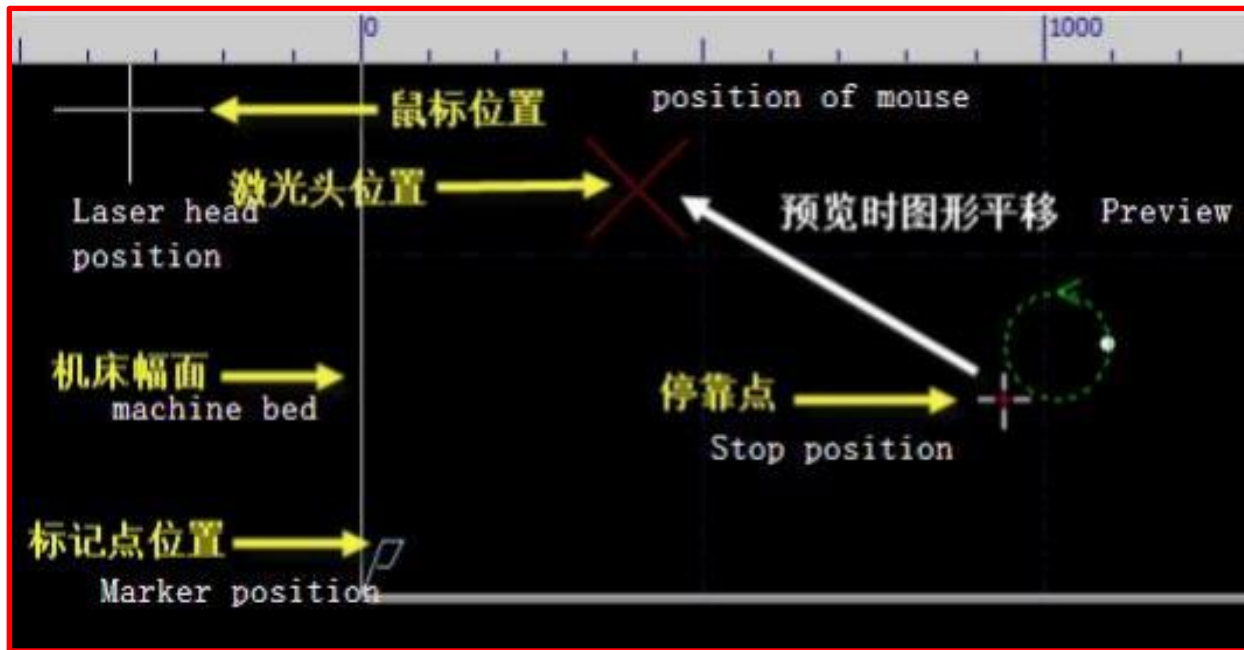
” Tab.

Instructions for Operations (Cont'd.)-

6.) **Actual Machining:** Please note that this step must be run on the actual machine and must be supported by the dongle and control card. Before the formal processing, you need to match the graphics on the screen with the machine tool, **"Click on the left side of the "Control Panel" Arrow**

Preview

Button. " " The button shows the relative positional relationship between the graphic to be machined and the machine's web on the screen, corresponding to the system is calculated by matching the stop mark on the screen with the position of the laser head on the machine. The figure below shows several coordinate markers that are common on the screen. When you click Preview, the Stops will pan to the Laser Head Position, which visually shifts the image.



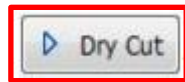
Instructions for Operations (Cont'd.)-

If the “laser head position” indicated by the red cross cursor does not match the laser head position on the actual machine, please check if the machine origin position is correct, and correct it by “CNC”-> “Return to origin”. If the preview finds that all or part of the graphic is outside the machine format, it means that the materials may be exceeded the machining bed.

You can change the relative relationship between the graph and the stop by



“Clicking the “**Dock**” Button” under the common menu bar. For example, the laser head is located for the lower left corner of the workpiece to be machined, set the stop point to the lower left corner, and so on. After checking the screen, “Click the “**Walking Border**” Button” on the “**Control System**” and the software will control the cutting head to be added. The outer frame of the work pattern is taken one turn, so you can check if the machining position is correct. It is also possible to check the machining operation in more detailed manner by



“Clicking the “**Empty Walk**” Button” to complete the operation of the graphic to be processed without opening the laser.

Instructions for Operations (Cont'd.)-

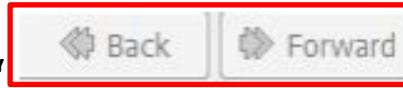
Finally, “Click the “Start” Button” to start the formal processing.



“Click the “Stop” Button” to pause the machining. During the pause, you can manually control the laser head lift, manually switch the laser, gas, etc.



The “Back and Forward” Button is traced along the machining path;



“Click the “Go on” Button” to continue machining.



“Click the “Stop” Button” to abort the machining. According to your settings, the laser head can automatically return to the corresponding point only if you have not changed the shape of the graphic or started a new round of processing,



Instructions for Operations (Cont'd.)-

"Click the "Breakpoint Positioning  " Button" and the software will allow you to

locate it. Where it stops, **"Click the "Breakpoint continues  " Button"** to continue processing from where it left off.

Instructions for Operations (Cont'd.)-

Software Operation process of Fiber Laser Cutting-

1.) Software Quick Start-

a.) Specific Features-

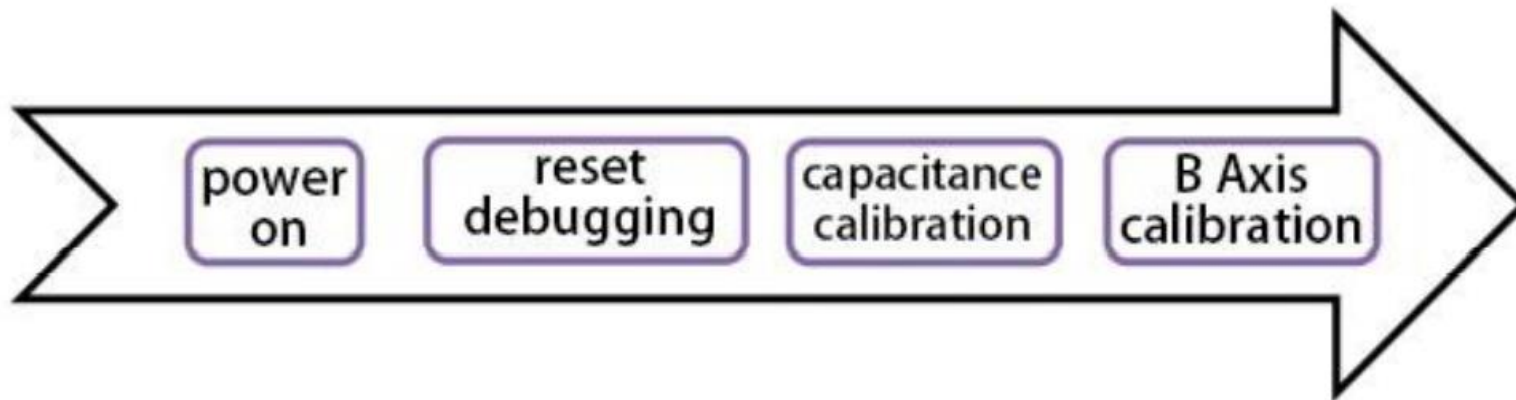
- ◆ Support for IGES graphics data formats.
- ◆ Supports cutting of any stretched body tube.
- ◆ The unique one-button effect square tube level automatically locates the rotating center function of the pipe.
- ◆ Introducing lead-out lines, kerf compensation, etc. in a WYSIWYG manner.
- ◆ Automatically distinguish between inner and outer molds and determine the direction of kerf compensation according to the inner and outer dies and perform lead inspection. Flexible and automatic sorting and manual sorting functions support fixed processing order through group part.
- ◆ Unique processing order browsing function, more interactive viewing processing order than simulation.
- ◆ Supports segmental perforation, progressive perforation, and to support separate laser power, frequency, laser form, gas type, air pressure, follow height, etc. for the perforation process and cutting process.

Instructions for Operations (Cont'd.)-

Software Operation process of Fiber Laser Cutting (Cont'd.)-

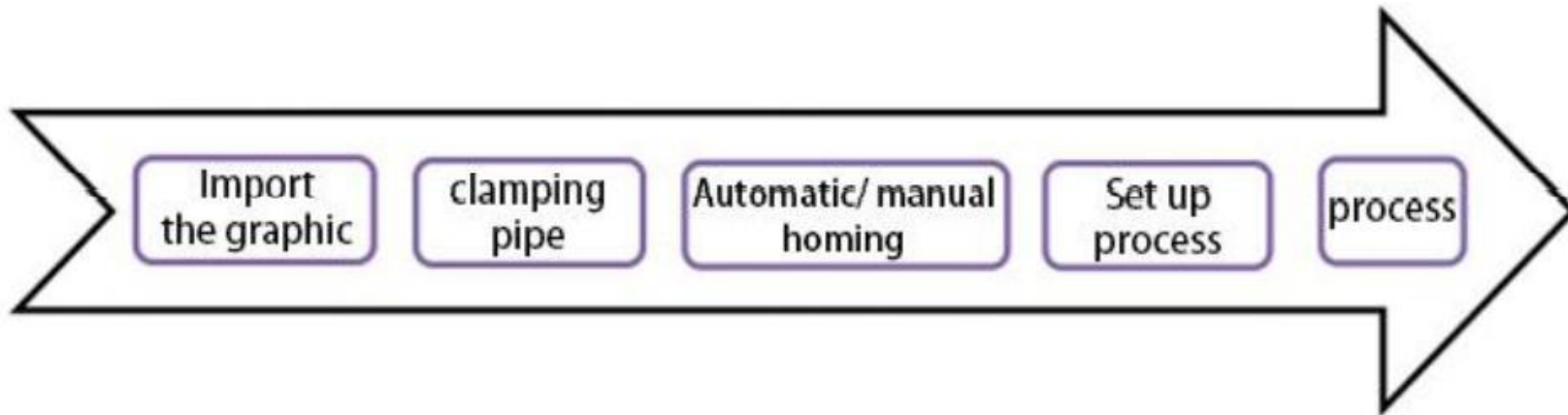
- ◆ Supports speed-dependent power adjustment, which can be set to separate lead-in line speed.
- ◆ A powerful material library function that allows all process parameters to be saved for reuse by the same material.
- ◆ Processing breakpoint memory, breakpoint advancement and backtracking; allowing partial graphics processing.
- ◆ Supports positioning to any point during stop and pause, starting from any position, supporting fixed cutting, automatic edge finding, and off-board lifting and lifting.
- ◆ Powerful expansion capability, up to 15 PLC process edits, more than 30 programmable process programmable I/O ports, programmable alarm inputs.
- ◆ Support remote control of the system via wireless handsets and Ethernet4.

b.) Debugging Process-



Instructions for Operations (Cont'd.)-

c.) Processing Process-



d.) The Use of Specific Features-

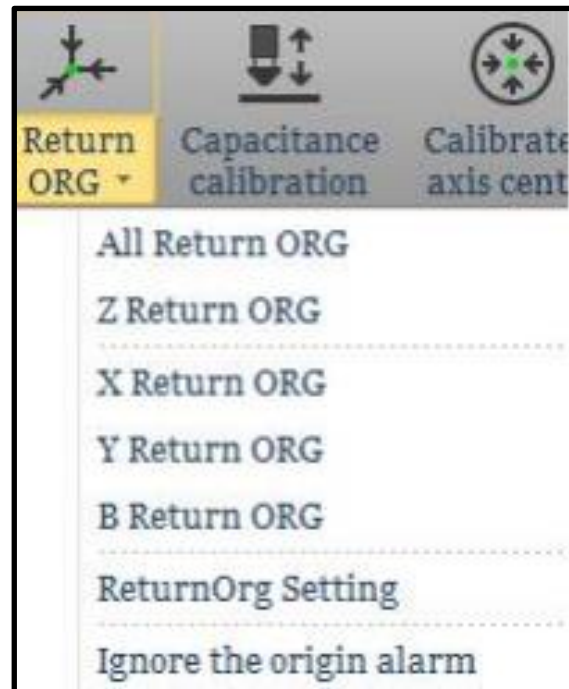


1.) **Open the Software Tubepro Software** and “Click the menu [Return to origin]” ----> [All homing]. The software pops back to the origin operation menu, and the menu prompts the action to return to the origin process: bracket down -> Z axis homing -> X axis homing -> Y axis homing -> B axis homing -> B axis return to origin Pre-state. “Click the [Start homing] Button”, the machine starts to perform the homing action, after returning to the original point, “Click **OK to exit**.”

Instructions for Operations (Cont'd.)-

Software Operation process of Fiber Laser Cutting (Cont'd.)-

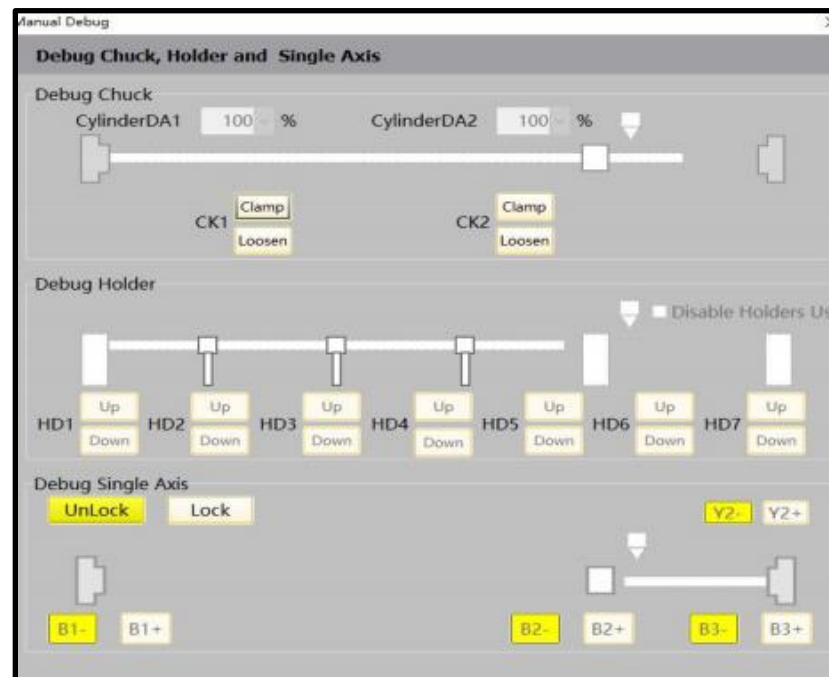
Note: Before the first debugging, before performing all the homing, please perform the single-axis homing test separately.



Instructions for Operations (Cont'd.)-

Software Operation process of Fiber Laser Cutting (Cont'd.)-

2.) Clamping Material Steel Pipe- “Click the Menu Bar [Manual Debugging]” to pop up the chuck, bracket, and single-axis debug menu. Clamp the steel pipe to be machined by clicking on the clamping/releasing of the chuck. If the bracket is configured, you can click the bracket to raise and lower the clip with the growing tubing.

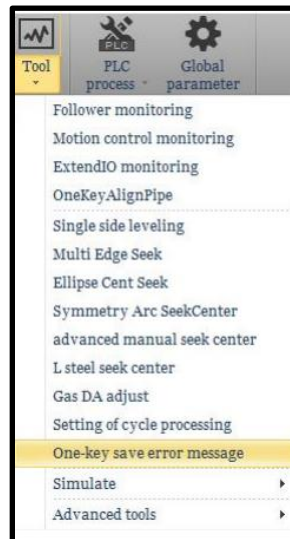


Instructions for Operations (Cont'd.)-

Software Operation process of Fiber Laser Cutting (Cont'd.)-

3.) **Calibration Height Adjuster**- By jogging the X/Y/B axis, move the rectangular steel tube below the cutting head nozzle and adjust the upper surface of the rectangular tube to a basic level, then move the cutting head nozzle close to the surface of the steel tube by jogging the Z axis.

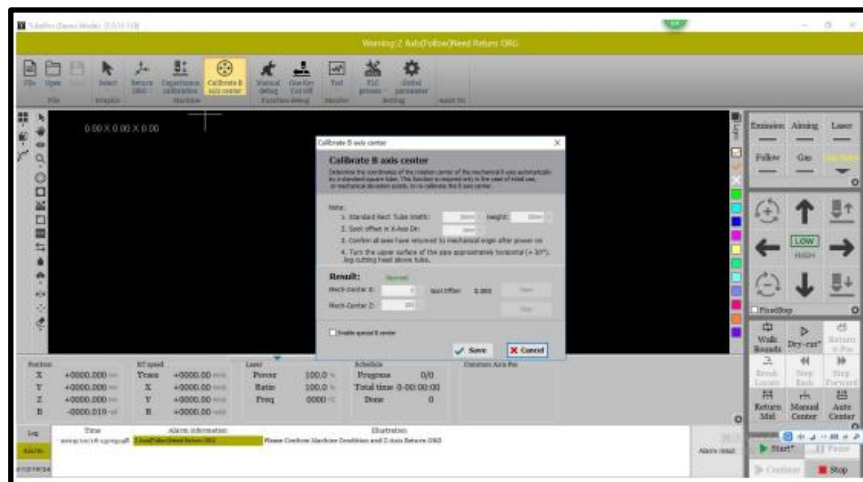
tubePro5000C system, please “**Click the menu bar [One-Click Calibration]**”; tubePro5000A and 5000B system, please “**Click [capacitor calibration]**”, pop-up confirmation security dialog box to determine, then the height adjuster starts calibration.



Instructions for Operations (Cont'd.)-

Software Operation process of Fiber Laser Cutting (Cont'd.)-

4.) **Calibrate the B-Axis Center**- By jogging the X/Y/B axis, move the rectangular steel tube below the cutting head nozzle and adjust the basic level of the upper surface of the rectangular tube. Then **“Click the menu [Calibration B Axis Center]”**, enter the rectangular tube size, and then **“Click [Start Calibration Center]”**. When the measurement result is completed, **“Click [Save]”** to exit.

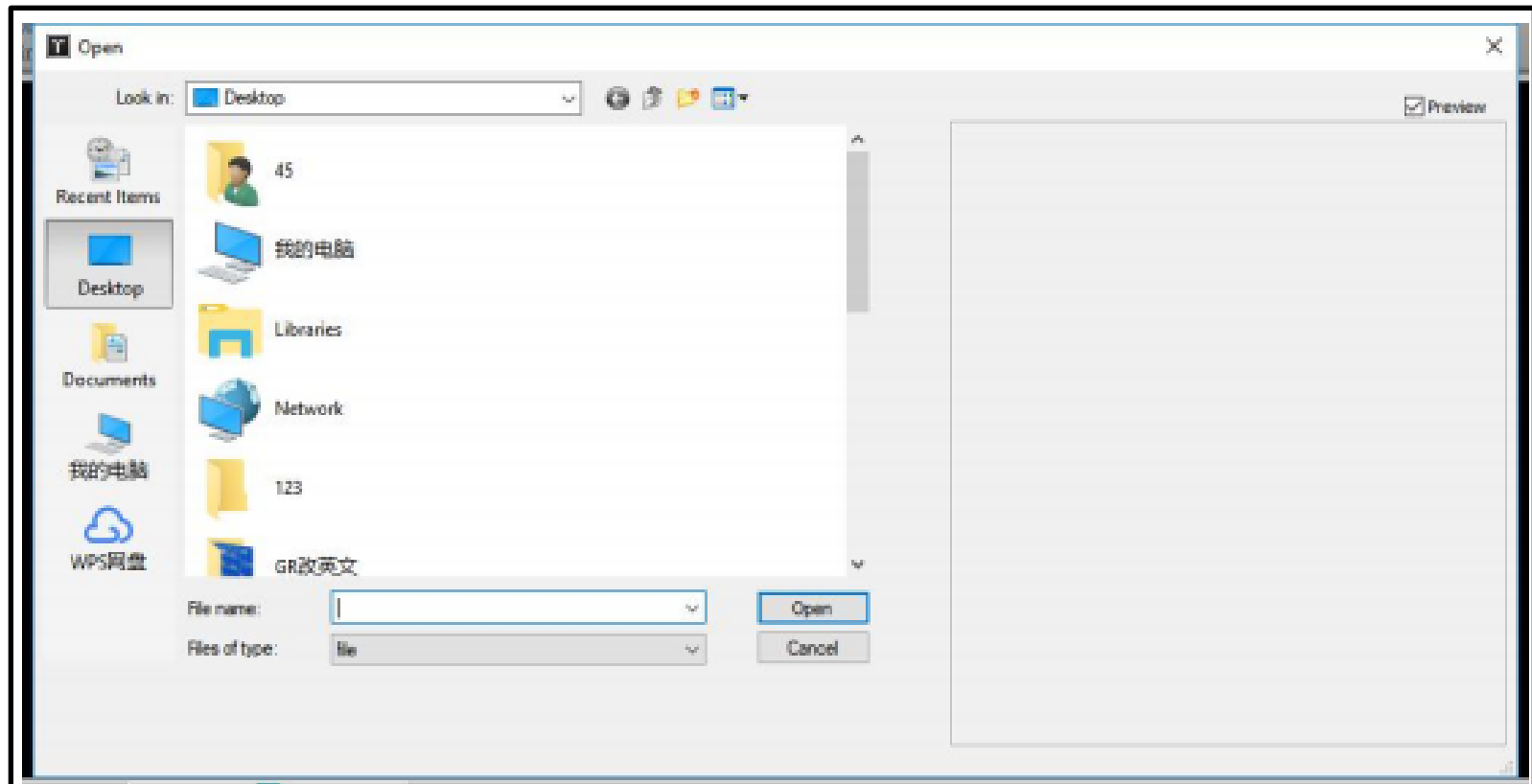


Note: Before calibrating the center of the B axis, accurate and reliable coordinates of the X/Z/B axis are required; that is, before calibrating the center of the B-Axis, perform a homing action on all axes before performing the calibration of the standard pipe. Axis Center.

Instructions for Operations (Cont'd.)-

Software Operation process of Fiber Laser Cutting (Cont'd.)-

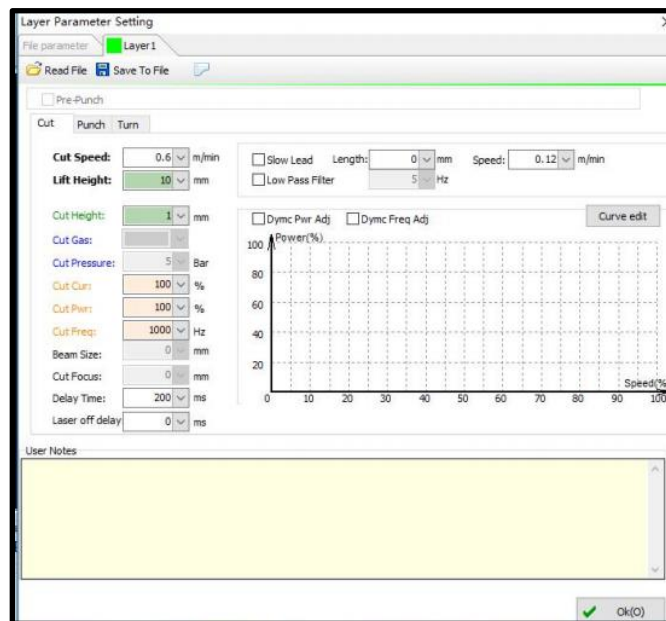
5.) Import graphic settings **“Click the [Open] menu and select the *.zzx file to be processed.”**
Open the right side of the menu to preview the processed graphic and its dimensions.



Instructions for Operations (Cont'd.)-

Software Operation process of Fiber Laser Cutting (Cont'd.)-

6.) **Set the Layer Process-** “Click the [Process] Tool Button” to set the process parameters of the layer. “Click the [Cut] page”, for example, set the cutting speed to 50 mm/sec, set the peak power to 53%, and then enable real-time power adjustment and frequency adjustment. “Click the [Punch] Page” to set the first-level perforation progressive time 1000ms.



“Click the [Punch]” page to set the first-level perforation progressive time 1000m.

Instructions for Operations (Cont'd.)-

Software Operation process of Fiber Laser Cutting (Cont'd.)-

6.) Set the Layer Process-(Cont'd.)

Layer Parameter Setting

File parameter Layer 1

Read File Save To File

☐ Pre-Punch

Cut Punch Turn

Punch Style

☒ No Punch ☐ Punch 1 ☐ Punch 2 ☐ Punch 3

Parameter	Value	Unit
Step Time	1000	S
Piercing Height	1	mm
Piercing Gas		
Piercing Pres	5	BAR
Piercing Curr	100	%
Piercing Pwr	100	%
Piercing Freq	5000	Hz
Beam Size	0	X
Piercing Focus	0	mm
Piercing Time	200	ms
Laser Off Blow	500	ms

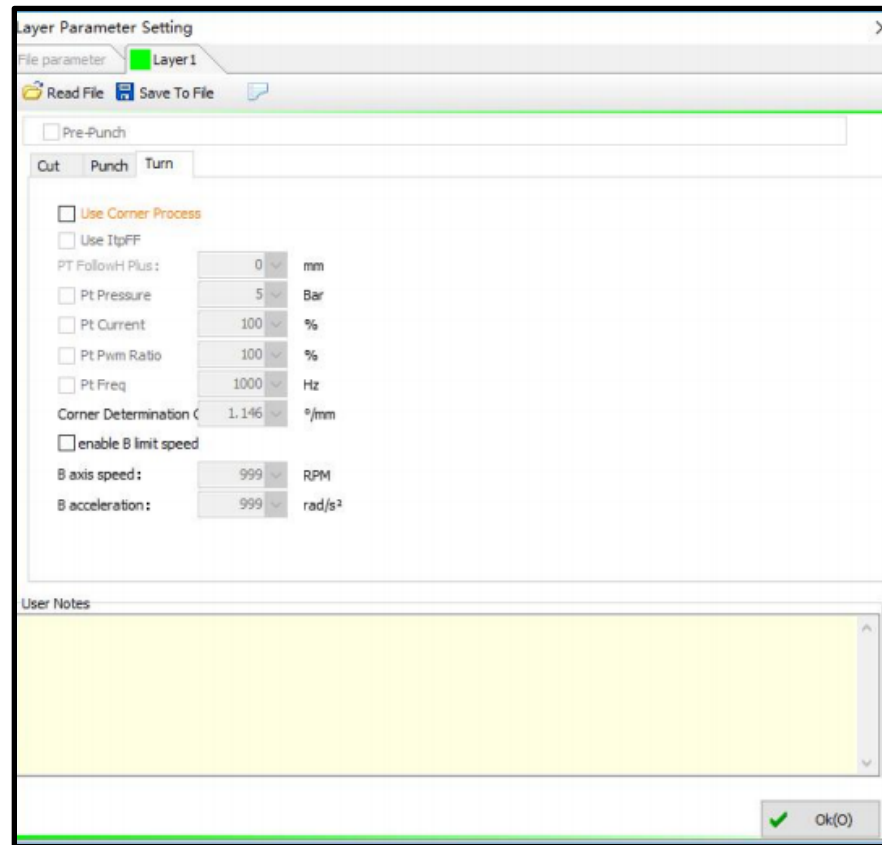
User Notes

Ok(O)

“Click the [tube corner] page” to enable the tube corner process, such as cutting height correction 2mm, setting the duty cycle 40%.

Instructions for Operations (Cont'd.)-

Software Operation process of Fiber Laser Cutting (Cont'd.)-



Instructions for Operations (Cont'd.)-

Software Operation process of Fiber Laser Cutting (Cont'd.)-

7.) **Start Processing:** After importing the zzx file, the other pipe/rectangular pipe/round pipe/angle steel/channel steel, please **“First Click [Automatic Search]”** in the operation bar on the right side to confirm that the size of the pop-up window is the same as the actual steel pipe size, then **“Click [Start Search] Button”**, wait for the search to end, **“Click [Save]”** to exit.

The elliptical tube/runway tube/shaped tube cannot be automatically searched. Please fine-tune the rotary axis to make the tube and zzx pattern match. Set the current position horizontal state on the manual centering pop-up window to ensure that the B-axis zero point of the shaped tube is consistent with the graphic.

4 points center search

4 points center search

Analyze the cross section automatically according the current file, then find the deviation

Note:

1. Input Rectangular tube Width: 50mm Height: 50mm
2. Make sure all axes returned to mechanical origin after powered on.
3. Make sure returning origin and leveling are complete.

Center search result:

Center offset X: 0

Center offset Z: 0

Start

Stop

Complete

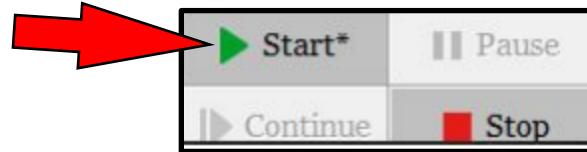
Save Cancel

Instructions for Operations (Cont'd.)-

Software Operation process of Fiber Laser Cutting (Cont'd.)-

7.) Start Processing: (Cont'd.)

Then "Click the [Start] Button" in the action bar to process the Graph.



7a.) Start Processing: (Cont'd.)

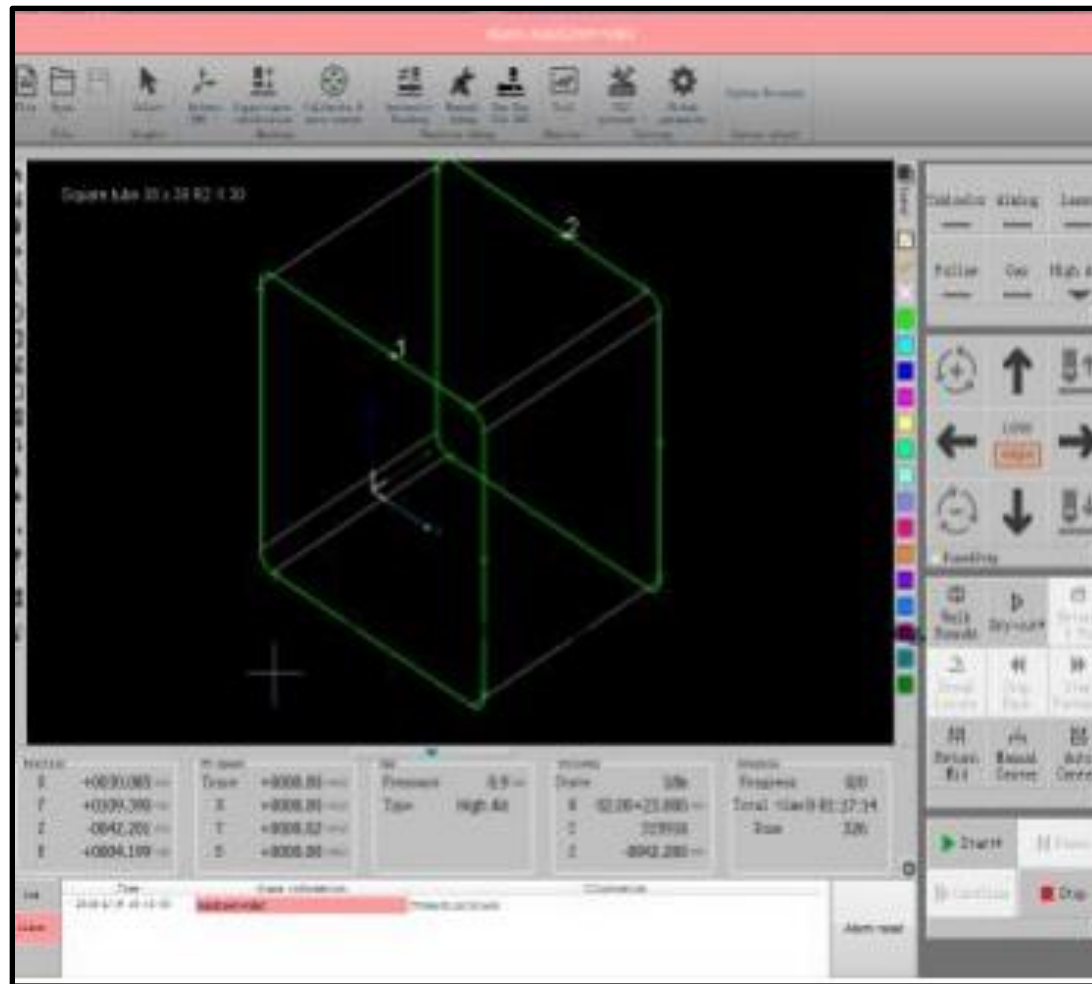
The processing progress of the part can be seen in the status bar during processing.

Schedule	
Progress	0/0
Total time	0-00:00:00
Done	0

Instructions for Operations (Cont'd.)-

Software Operation process of Fiber Laser Cutting (Cont'd.)-

8.) **Alarm Display:** During the operation of the system, an alarm or warning will appear in the top alarm status column, and the alarm time and related information will be displayed in the alarm description at the bottom.



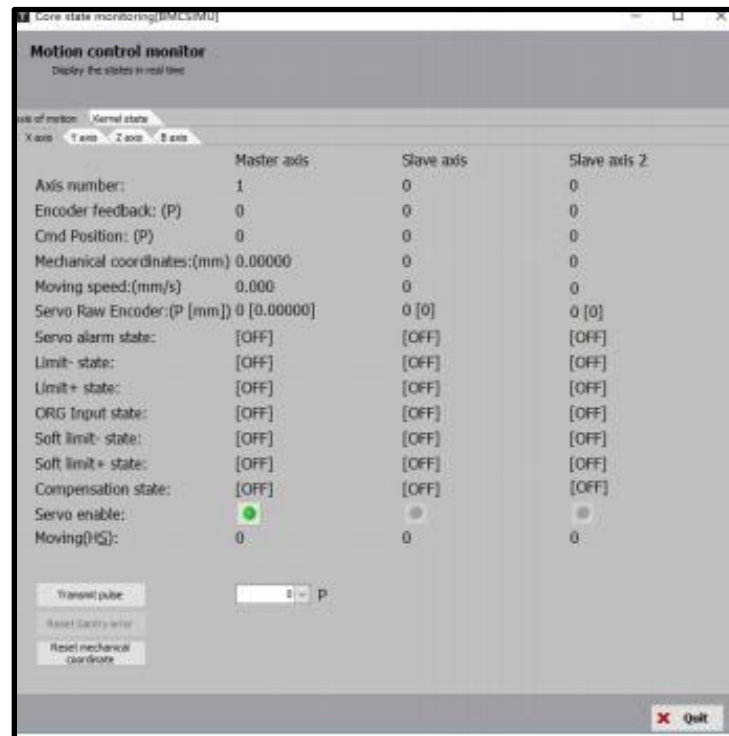
Instructions for Operations (Cont'd.)-

Software Operation process of Fiber Laser Cutting (Cont'd.)-

8.) Alarm Display: (Cont'd.)

You can view the status of the X axis by opening the Tools menu -----> Motion Control Monitor.
The current positive limit is triggered.

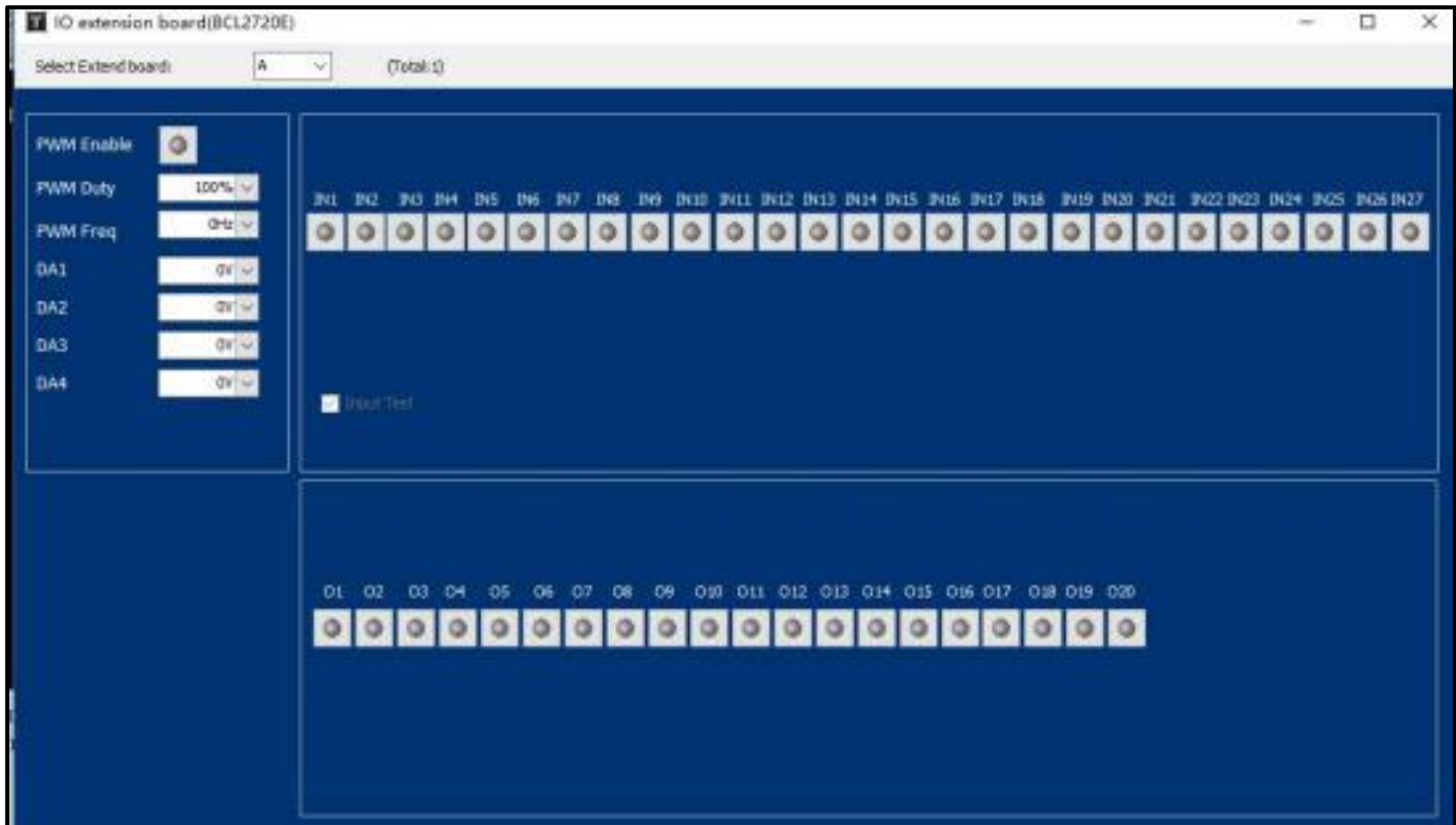
Open the Tools menu ---> BCL4516E or other expansion board monitors to see the status of the input.



Instructions for Operations (Cont'd.)-

Software Operation process of Fiber Laser Cutting (Cont'd.)-

8.) Alarm Display: (Cont'd.)

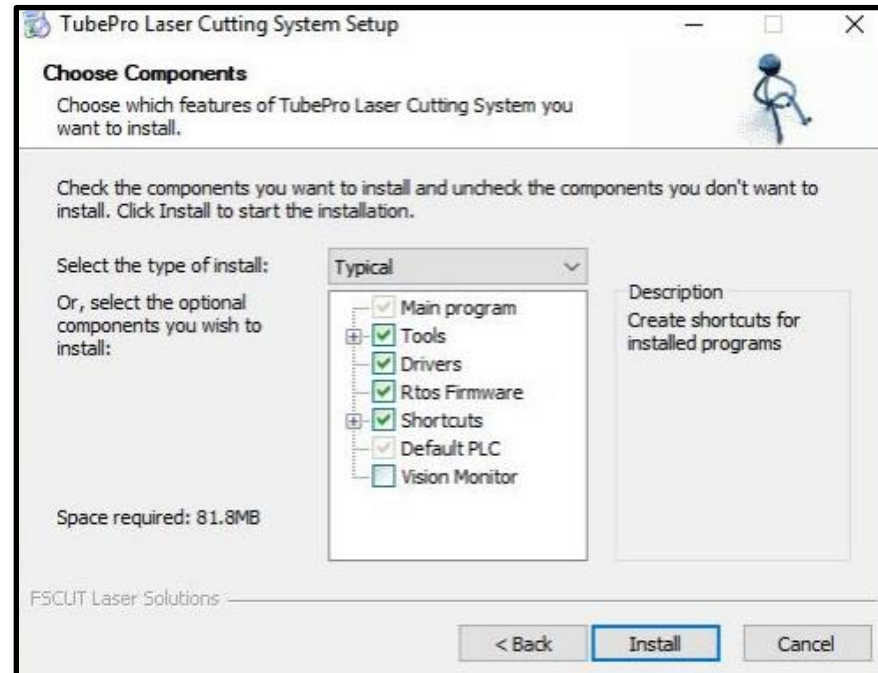


Instructions for Operations (Cont'd.)-

Software Operation process of Fiber Laser Cutting (Cont'd.)-

e.) Software Installation-

1.) Software Installation:

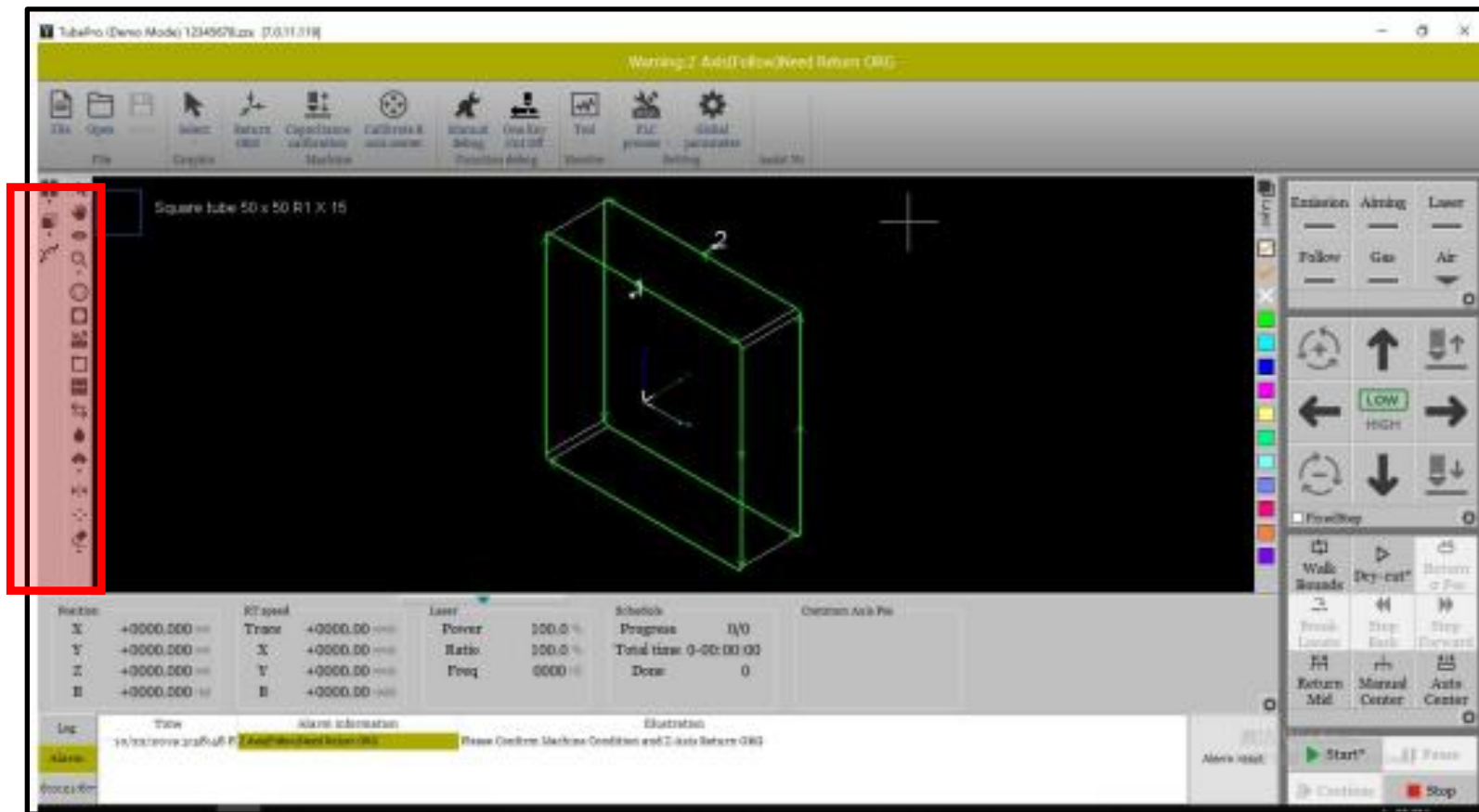


e.) Detailed Instructions for Using TubePro Software-

Instructions for Operations (Cont'd.)-

Shortcut Toolbar-

The shortcut toolbar contains selection lines, select parts, drag, 3D view, zoom, kerf compensation, inside and outside, lead line, start point, micro connect, reverse, cooling point, weld compensation, seek, clear, Display Tool Buttons such as “Mode” and “View Selection”.



Instructions for Operations (Cont'd.)-

e.) Detailed Instructions for Using TubePro Software-

Shortcut Toolbar- (Cont'd.)



: Select a line and select the specified.



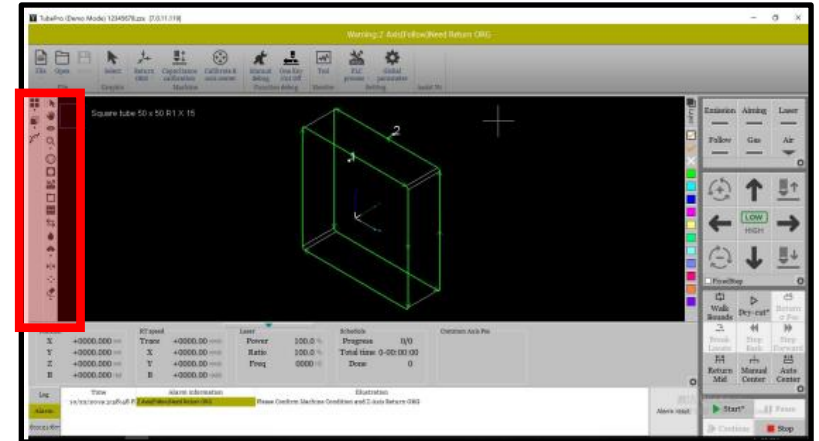
: Select a part and select the specified part. **“Click the part area with the mouse to select all the graphics of the part at one time”**; the front side of the co-edge part will not be selected.



: “Click and Drag the Graphic View” or hold down the Ctrl Key + Mouse Wheel to drag the graphic view.



: 3D view, 3D rotation view of the graph. Or you can enter the 3D viewing mode by directly holding down the mouse wheel and dragging the mouse. Hold down the Shift key + mouse wheel and drag the mouse to rotate the graphic around the center axis of the tube.



Instructions for Operations (Cont'd.)-

e.) Detailed Instructions for Using TubePro Software-

Shortcut Toolbar- (Cont'd.)



: Zoom, zoom in and out of the graph. Or you can zoom by scrolling the mouse wheel.



: Slot Compensation set internal compensation or external compensation (Cancel Compensation / Automatic Judgment / Internal Reduction / Expansion) for the selected graphic and set the kerf width.



: Inside and outside, when the automatic judgment of the kerf compensation pattern is selected, the kerf compensation can be switched to internal compensation or external compensation, and the kerf width; and whether the position of the lead is the inner lead, or the outer lead can be switched.



: Lead the knife line, set the track lead mode and length in the graph.



: Start point, set the starting position of each track in the graph.

e.) Detailed Instructions for Using TubePro Software-

Shortcut Toolbar- (Cont'd.)



: Micro Connection-Set the micro connection distance and set the position of the micro connection.



: Reverse- The direction of motion of the track in the machined image.



: Cooling Point- The position of the cooling point during processing will stop blowing and blowing. The cooling point delay is configured in the global parameters.



: Weld compensation. Set whether the graphic section position uses weld compensation.



: Looking for to set the starting point of the drawing in the drawing. Double-click the icon to automatically set the centering point by distance or set the centering point by part position. You can also set the search for this position by selecting a curve separately.

e.) Detailed Instructions for Using TubePro Software-

Shortcut Toolbar- (Cont'd.)



: Clear-Optional to clear kerf compensation / lead / micro connect / cool point / seek / clear all.



: Display Mode-Select display or not to display unclosed graphics / machining order / trajectory start / trajectory direction / empty path / section / surface rendering / normal vector.



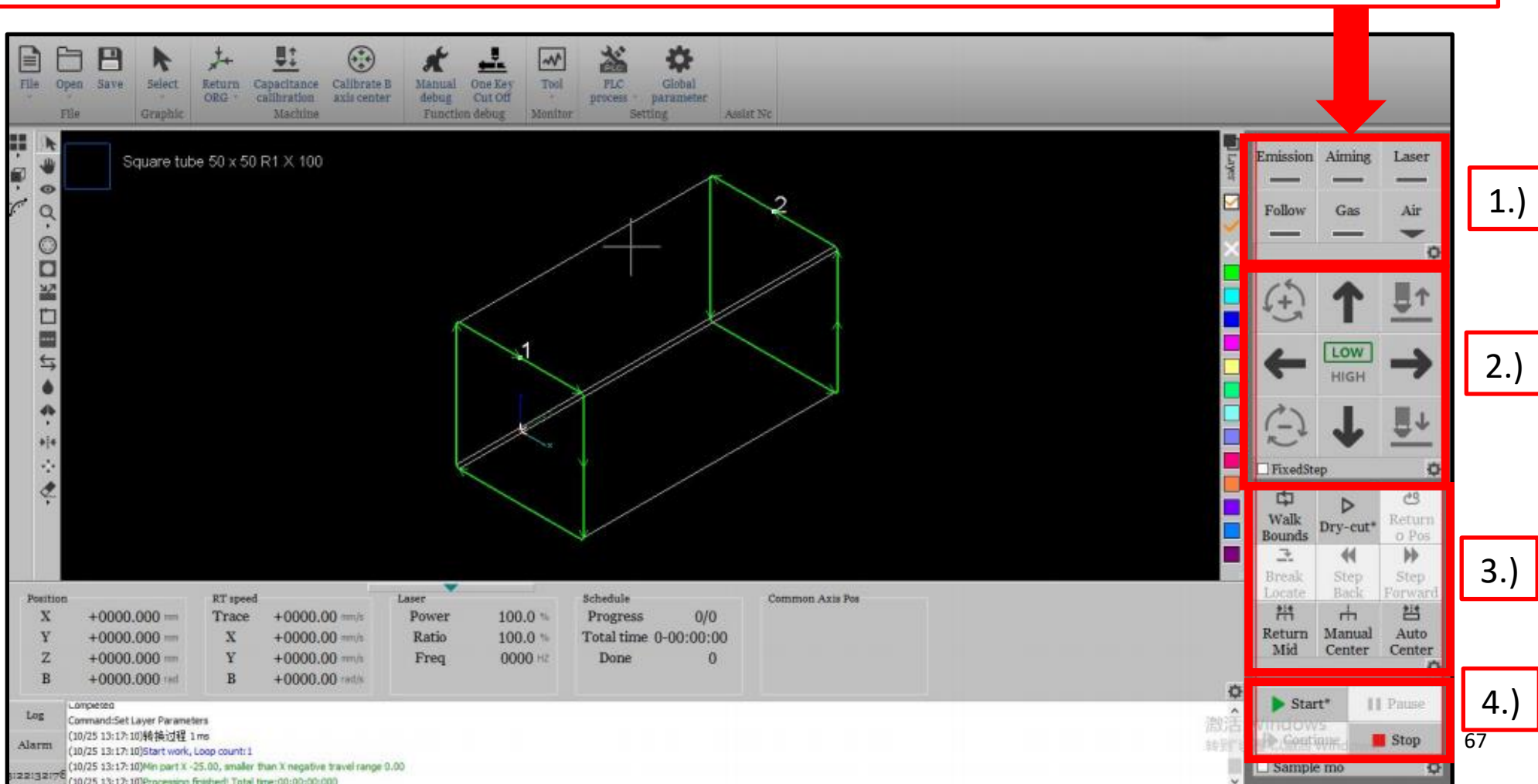
: Select View Mode-You can choose the default view / top view / main view / bottom view / back view / right view / left view / southwest isometric view / northeast isometric view / southeast isometric view / southeast isometric view / northwest isometric view.

e.) Detailed Instructions for Using TubePro Software-

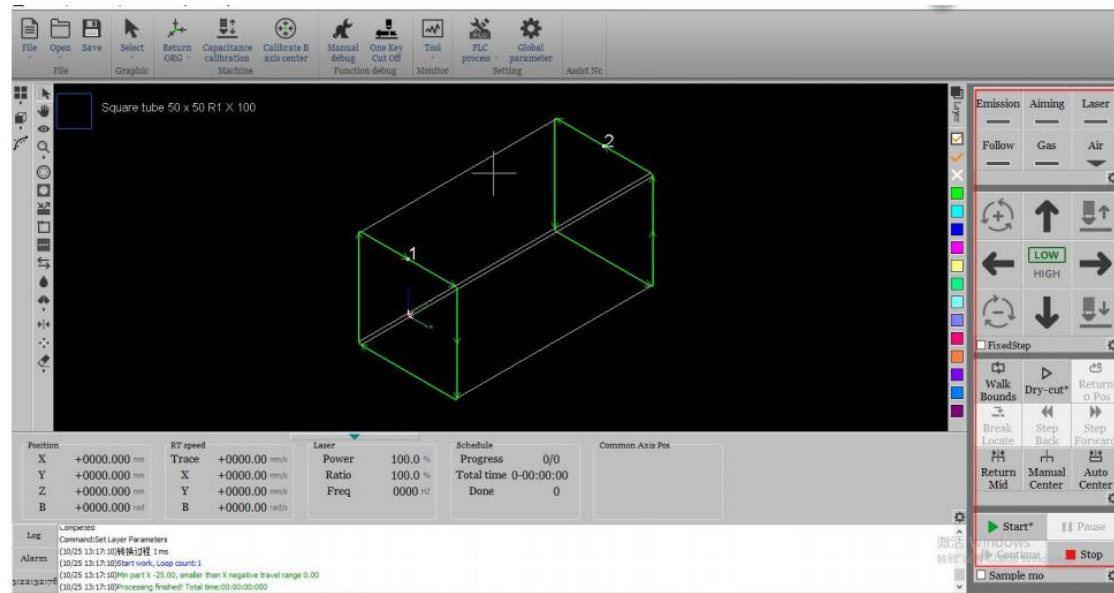
Processing Operation Bar-

As shown in the figure below, the machining operation column includes the following:

1.) The Shooting Operation Bar, 2.) The Jog Operation Bar, 3.) The Machining Preparation Operation Column, and 4.) The Machining Operation Column.

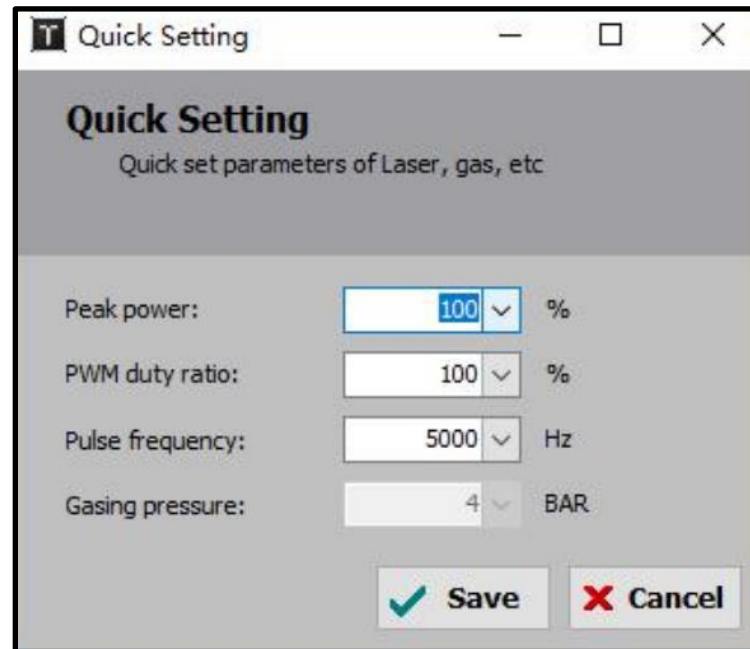


e.) Detailed Instructions for Using TubePro Software-



Parameter Name	Meaning-Definition
Shutter	Laser Shutter.
Red Light	Laser Red Light.
Laser	The laser shoots. Left click is the laser shot, right click to open the laser continuously.
Follow	Height Adjuster.
Blowing Gas	Press to turn on the Gas.
Gas Selection	Select the type of gas that can be used in the configuration.
Spot Shot Quick Set	Set the power, duty cycle, pulse frequency, gas pressure of the spot light.

e.) Detailed Instructions for Using TubePro Software-



The screenshot shows a 'Quick Setting' dialog box with a title bar containing a 'T' icon and standard window controls. The dialog has a subtitle 'Quick set parameters of Laser, gas, etc'. It contains four settings, each with a label, a numeric input field, and a unit: 'Peak power' (100 %), 'PWM duty ratio' (100 %), 'Pulse frequency' (5000 Hz), and 'Gasing pressure' (4 BAR). At the bottom are 'Save' and 'Cancel' buttons with checkmark and X icons respectively.

Parameter Name	Value	Unit
Peak power:	100	%
PWM duty ratio:	100	%
Pulse frequency:	5000	Hz
Gasing pressure:	4	BAR

Parameter Name	Meaning-Definition
Peak Power	Spot laser power.
PWM Duty Ratio	Laser signal duty cycle.
Pulse Frequency	Spotted laser signal.
Gasing Pressure	Blowing air pressure set.

e.) Detailed Instructions for Using TubePro Software-



Parameter Name	Meaning-Definition
Jog Panel	X/Y/Z/B axis jog or stepping.
LOW/HIGH	Set low speed / high speed jog or step.
Stepping	Check the step and jog the arrow to specify the axis to run in steps. Unchecked to move in jog mode.
Jog Quick Setting	Set the jog speed of the X/Y/Z/B axis, jog low speed, step distance, and enable the soft limit.

e.) Detailed Instructions for Using TubePro Software-

Quick setting of Jog

Quick jog setting
Quick setting of parameters, such as high / low jog speed, step distance ,etc.

	X	Y	B
High jog speed:	9.94m/min	59.94m/m	30RPM
Low jog speed:	59.94m/m	59.94m/m	4RPM
Step distance:	999999mn	999999mn	1°

☒ Enable soft limit protection

Save **Cancel**

Parameter Name	Meaning-Definition
Jog High Speed	Set X/Y/B high speed jog/stepping speed.
Jog Low Speed	Set X/Y/B low speed jog/stepping speed.
Step Distance	Set X/Y/B low speed stepping distance.
Enable Soft Limit	Set whether the system enables soft limit protection, and the software limit travel is set in the platform configuration tool.

e.) Detailed Instructions for Using TubePro Software-



Parameter Name	Meaning-Definition
Walk Bounds	According to the range of the graphic, a rectangular range is taken in the machine format.

e.) Detailed Instructions for Using TubePro Software-



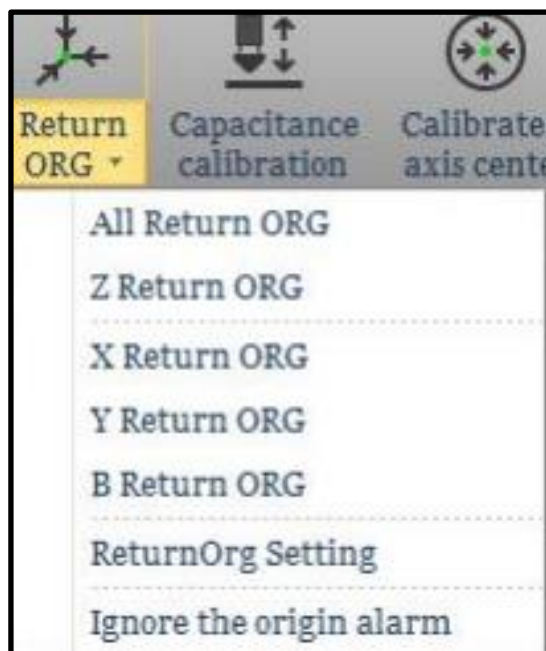
Parameter Name	Meaning-Definition
Dry-Cut*	The machine moves according to the graphics, but does not emit light, does not follow, does not vent.
Return 0 Pos	The machine moves to the zero point of the graph, where X, Y, Z, B will move.
Return Mid	Machine X, B-Axis moves to program zero (B-Axis calibration or manual centering results).
Break Locate	An abnormality occurs during the machining process. After the alarm is triggered and the stop is stopped, the position of the stop interruption can be located by the breakpoint positioning, and then the machining is continued.
Step Forward/Step Back	After performing breakpoint positioning or pause operation, you can click Forward/Rewind to adjust the position of the machining point.

e.) Detailed Instructions for Using TubePro Software



Parameter Name	Meaning-Definition
Manual Center	The horizontal position of the workpiece for the elliptical tube/waist tube/shaped tube and the deviation of the workpiece can be set through this interface.
Auto Center	The deviation of the rectangular tube/round tube/channel steel/angle steel can be determined by automatic searching to ensure the accuracy of the processing track during the machining process.
Walking Border	Set the speed value of the border.
Forward Retreat Distance	Set the forward and reverse distance. When the part is cut, the forward and backward can be used in conjunction with the breakpoint positioning for positioning to accurately position the position.
Central Search Method	According to the actual condition of the pipe clamped, choose the appropriate automatic search mode. The four-point search is faster than the five-point search, but the five-point search has a leveling function that is suitable for tube twist deformation.
Start	Start Processing *: indicates that the graphic parameters have been modified; A: the automatic loading and unloading function is enabled; F: The automatic feeding function is turned on; L: the circulating processing is turned on; S: the seven-axis pulling function is turned on.
Suspend	Suspend execution of system Instructions.
Continue	Continue to execute system instructions.
Stop	Stop current system command.

e.) Detailed Instructions for Using TubePro Software-



Parameter Name	Meaning-Definition
ALL Return ORG	First execute the Z axis (adjuster) to
Z Return ORG	Execute the Z axis (adjuster) to the Origin.
X Return O	If the Y-axis synchronization is released and the homing is independent, all the Y-axis will perform an independent homing. Otherwise, perform the Y-axis synchronization homing.
B Return ORG	If the B-Axis is synchronously released and the homing is independent, all B-Axes will perform independent homing and retreat their respective distances. The relative position of the B-Axis is inconsistent. Otherwise, the B-Axis is synchronized back to the origin, and the B-Axis is the same action throughout the process.
Y1/Y2/B1/B2/B3-Axis Origin	For the TubePro 5000A system, you can specify an independent axis to return to the origin. After returning to the origin, the associated logical axis will be decoupled.

e.) Detailed Instructions for Using TubePro Software-

Setting ORG Params
Setting ORG Common Params

☒ Follower ORG First when Single Axis ORG

☐ All Return ORG, B-Axis also Return ORG

☐ All Return ORG, Y-Axis also Return ORG

☒ Before Y-Axis ORG, All Holders Down

☐ Focus Axis ORG First when ORG

☐ Dual Y-Axis Return ORG Indept.

Z1 ORG Fall Back: 10 mm

Z2 ORG Fall Back: 0 mm

Z3 ORG Fall Back: 0 mm

☐ Dual B-Axis Return ORG Indept.

B1 ORG Fall Back: 0.174533


B2 ORG Fall Back: 0

B3 ORG Fall Back: 0

Save Cancel

Parameter Name	Meaning-Definition
Follower ORG First when single Axis ORG	For safety, you can check the Z_Axis back to the origin, the Y-Axis back to the origin or the B-Axis to the origin. You can check this option to let the Z-Axis return.
All return ORG,B-Axis also return OR	It is not checked by default. The B-axis of some models does not have an origin switch installed, so the B-Axis homing cannot be performed when all the homing points are returned. This type of model cannot be checked. Some models of the two-wheel drive B-Axis are equipped with two origins. When checking the independent homing point, it is also recommended to uncheck this item.
All return ORG,Y-Axis also return ORG	It is not checked by default. If the user wants to return to the origin of the Y axis when performing all homing, you can check this option. It is recommended not to check this item to avoid all the homing action after the pipe is clamped, which will cause the chuck to hang down or fall under gravity.

e.) Detailed Instructions for Using TubePro Software-


Setting ORG Params
—
□
×

Setting ORG Params

Setting ORG Common Params

☒ Follower ORG First when Single Axis ORG
☐ All Return ORG, B-Axis also Return ORG
☐ All Return ORG, Y-Axis also Return ORG
☒ Before Y-Axis ORG, All Holders Down
☐ Focus Axis ORG First when ORG
☐ Dual Y-Axis Return ORG Indept

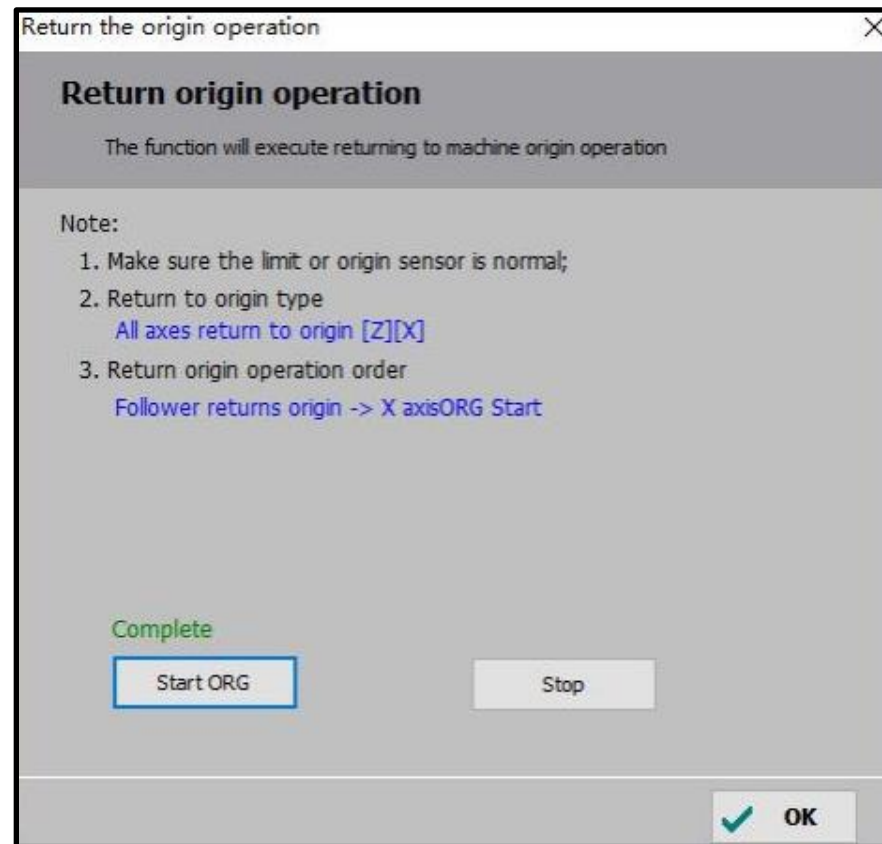
Y1 ORG Fall Back: mm
 Y2 ORG Fall Back: mm
 Y3 ORG Fall Back: mm

☐ Dual B-Axis Return ORG Indept
 B1 ORG Fall Back: °
 B2 ORG Fall Back: °
 B3 ORG Fall Back: °

☒ Save
 ☐ Cancel

Parameter Name	Meaning-Definition
Before Y-Axis ORG, All holders down	Checked by default. For safety reasons, the bracket is preferably lowered during the return of the Y-Axis to prevent the bracket from being bumped.
Dual Y-Axis return ORG indept	For the TubePro 5000A system, the Y1 and Y2 axes need to be independently homing. You need to check this option. The Y1 and Y2 axes need to set their respective homing switches or homing limits.
Y1/Y2 homing return distance	For the TubePro 5000A system, the Y synchronization axis is used to cancel the synchronization and then the homing is independent. You can set the retraction distance of each of the two Y axes.
Dual B-Axis return ORG indept	For most double-clamp models, the origin switch is set for both the B1 and B2 axes. For some reason, B1 and B2 will be out of sync with the two-wheel drive. In this case, the dual-drive axes B1 and B2 need to be returned to the original position, and then the set distance is retracted. This arrangement allows B1 and B2 to be at exactly the same angle for easy installation of the steel tube, avoiding the need to artificially push the B-axis for synchronization.
B1/B2/B3 homing return distance	The B-Axis is used to independently return to the origin, and the respective retraction distances of B1/B2/B3 are such that they are just at the same level or at the same angle after returning to the origin.

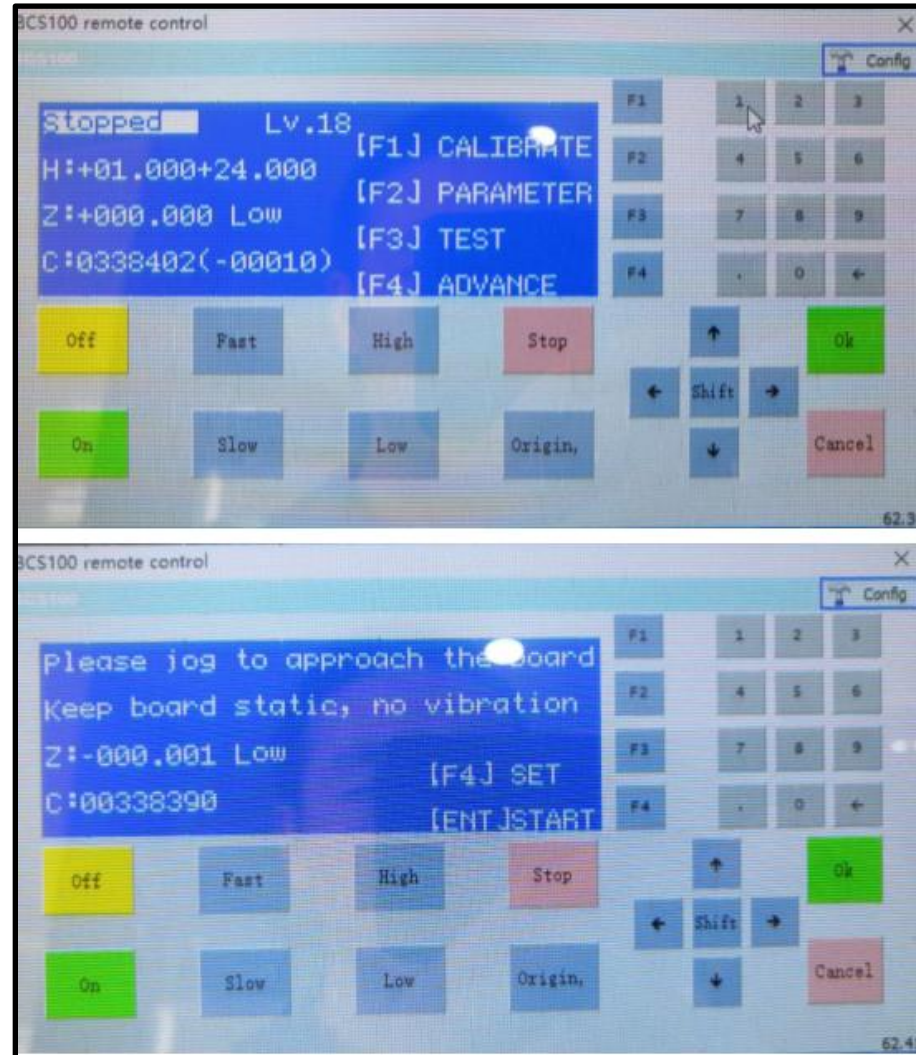
e.) Detailed Instructions for Using TubePro Software-



2.) Calibration Height Adjuster-

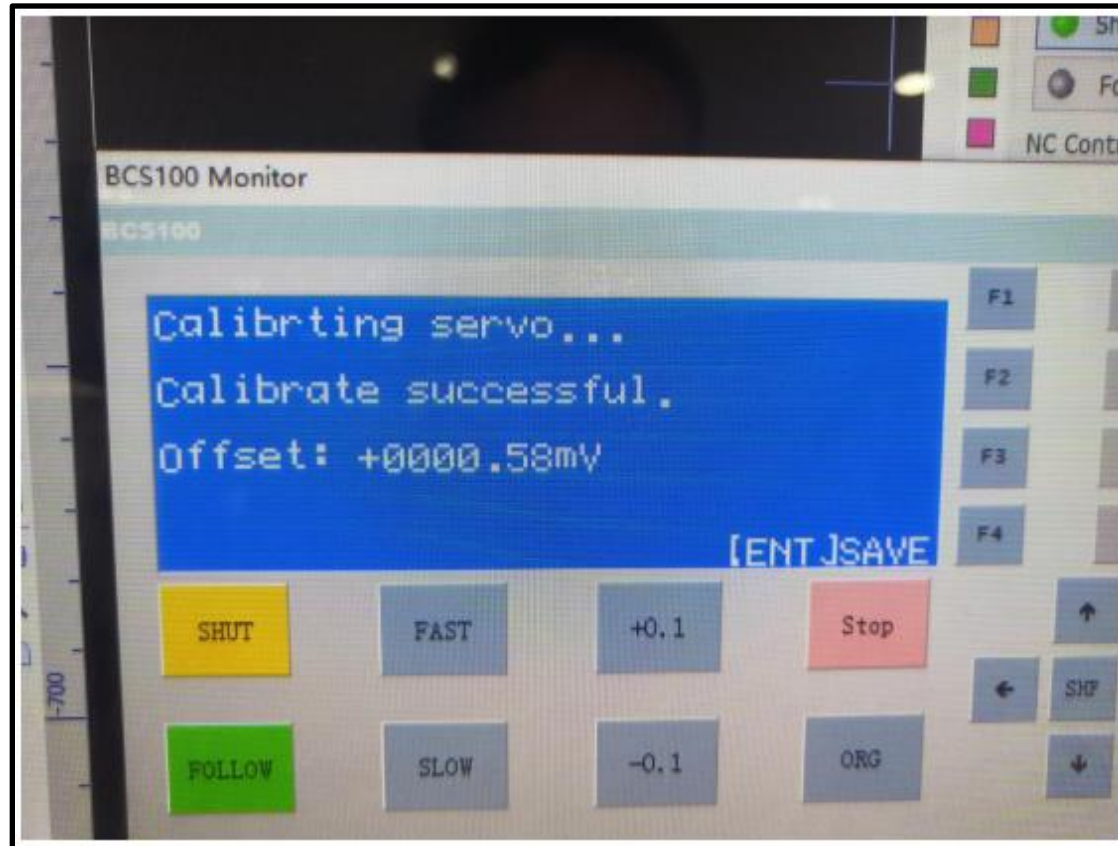
e.) Detailed Instructions for Using TubePro Software-

The TubePro 5000A and 5000B use the BCS100E bus height adjuster. Before the calibration, the laser nozzle should be moved about 2mm above the surface of the metal pipe, and then” Click **[Start Calibration]**” to wait for the calibration to succeed.



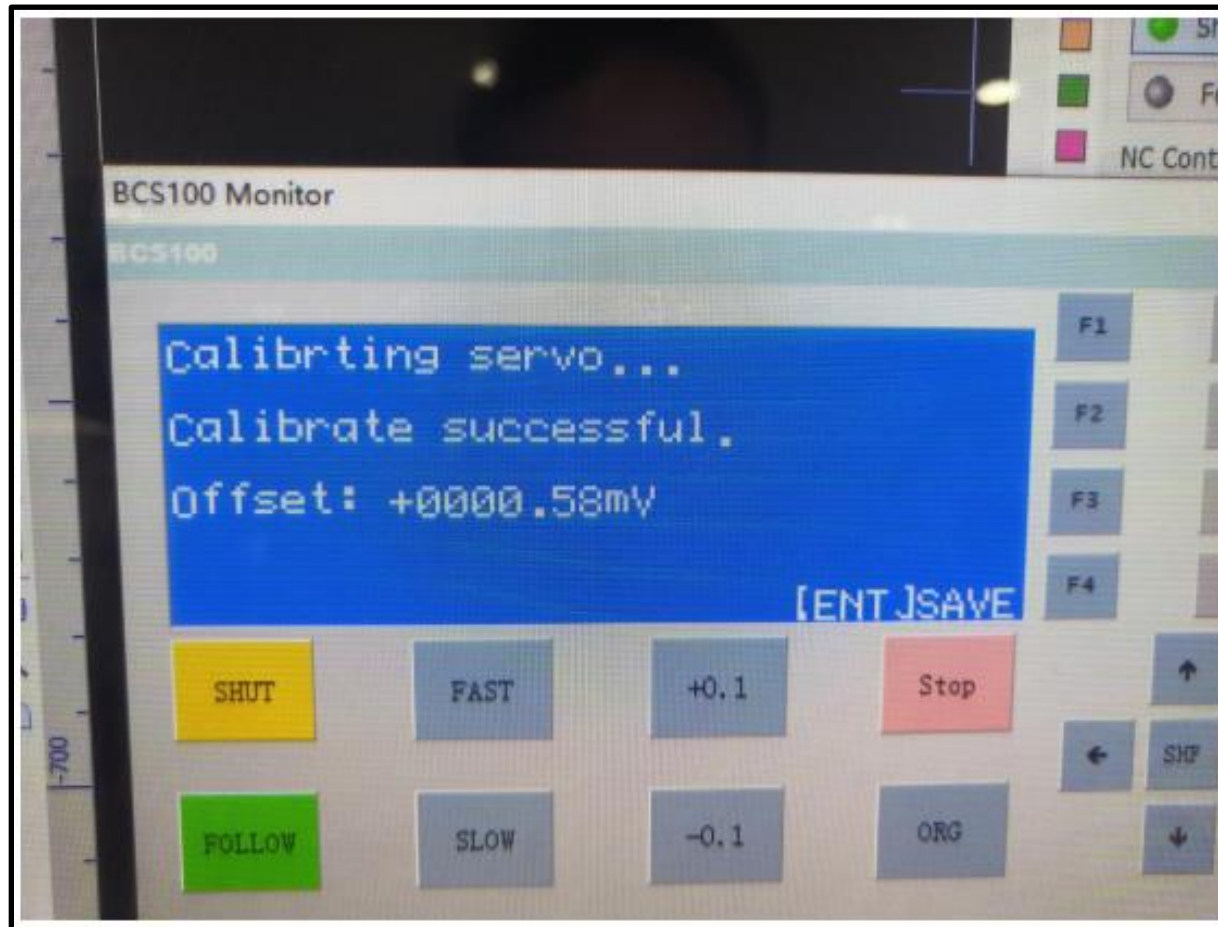
e.) Detailed Instructions for Using TubePro Software-

The TubePro 5000C system uses the BCS100 height adjuster. Before the calibration, the laser nozzle should be moved about 2mm above the surface of the metal pipe, and then click the one-button calibration to complete the calibration.



e.) Detailed Instructions for Using TubePro Software-

3.) **Calibration B-Axis Center**: Mechanical System, the B-Axis has an inherent rotation coordinate. The coordinates of the center of the B-Axis can be determined by calibrating the center of the B-Axis. Measuring the center of the B-Axis requires a standard rectangular tube without chamfering.



e.) Detailed Instructions for Using TubePro Software-

3.) Calibration B-Axis Center (Cont'd.):

Before calibrating, make sure that the system X, Z, and B-Axes have returned to the origin, then move the cutting head nozzle over the standard tube, enter the standard tube width and height, and finally **“Click to start the calibration center”**. If there is no alarm in the middle, you can see that the calibration is complete, then **“Click Save”**.

Calibrate B axis center

Calibrate B axis center

Determine the coordinates of the rotation center of the mechanical B axis automatically by a standard square tube. This function is required only in the case of initial use, or mechanical deviation exists, to re-calibrate the B axis center.

Note:

- Standard Rect Tube Width: 50mm Height: 50mm
- Spot offset in X-Axis Dir: 0mm
- Confirm all axes have returned to mechanical origin after power on
- Turn the upper surface of the pipe approximately horizontal (+ 30°). Jog cutting head above tube.

Result: Normal

Mech-Center X: 0 Spot Offset 0.000 Start

Mech-Center Z: 100 Stop

☐ Enable special B center

Save Cancel

Parameter Name	Meaning-Definition
Rectangular Tube Size	To set the width and height of a standard rectangular tube, it is recommended to use a standard rectangular tube without chamfering.
Spot Shift	Set the spot offset error of the current machine head. Application scenario: TubePro measures the center of the B axis based on the center of the nozzle. It is generally difficult to ensure that the laser spot is just at the center of the nozzle. Therefore, the cut has a certain deviation from the perforation. Dividing the deviation by 2 fills the spot shift.
The Measurement Results	Displays the mechanical rotation center coordinate value.
Preserve/Cancel	Save will record the measurement result as the center of the B axis, and cancel it will not save.

e.) Detailed Instructions for Using TubePro Software-

Function Debugging Software-

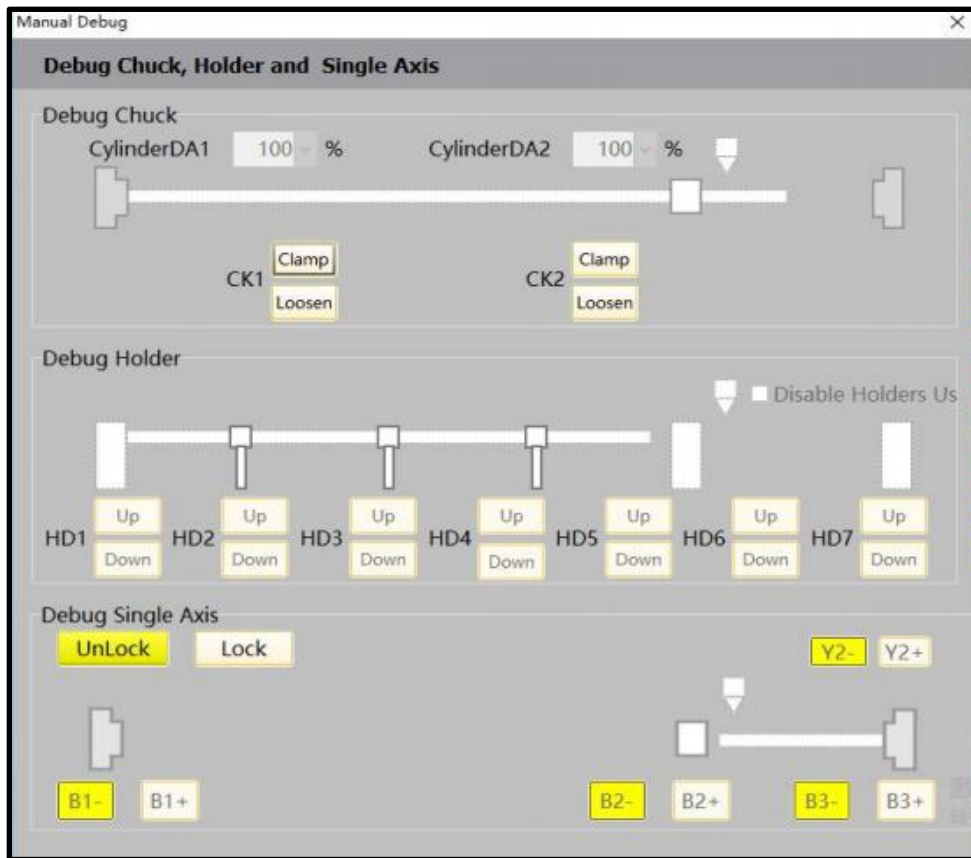
1.) Manual Debugging-

Chuck Debugging: When configuring the manual test chuck clamping/releasing action, you first need to use the stopwatch to measure the time required for the chuck to open and close, and then configure the time into the chuck in-position time in the platform configuration tool. After the configuration is completed, test whether the in-place time is set properly. If the platform configuration tool is configured with the middle card auxiliary chuck, the manual debugging interface will display the related button debugging function. If there is no configuration interface, the middle card auxiliary chuck will not be displayed. **Bracket Debugging:** The brackets in the safe area can be used to debug the rise of the bracket and the function of the bracket. **Single-drive debugging:** The TubePro 5000B and 5000C systems first unlock the input password 61259023 for unlocking and can click the independent axis of the system for synchronization test, and finally lock the synchronization. This function is a method for measuring the return distance of B1 and B2. The back-off distances of B1 and B2 are equal during the initial installation, and the actual chucks are not synchronized. At this time, B1 and B2 are unlocked, then B1 and B2 can be leveled by jogging or stepping, then Locked. At this point you can open [Tools]-> [Motion Control Monitor]-> [Motion Axis]->[B-Axis] to see how many radians of the mechanical coordinates of B1 and B2 differ, and then convert the radians into angles (1 radians is approximately equal to

e.) Detailed Instructions for Using TubePro Software-

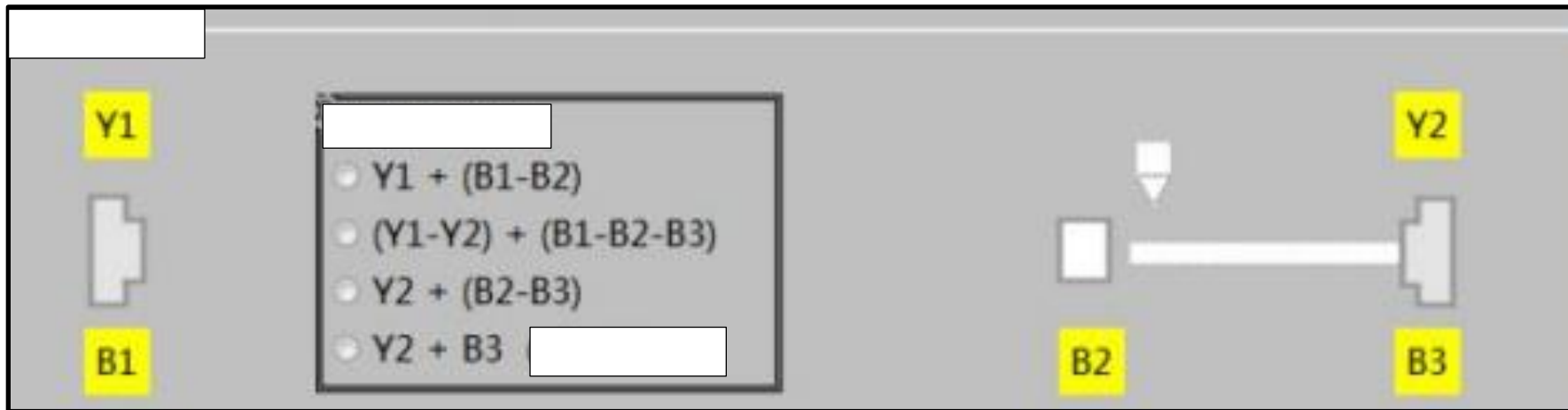
Function Debugging Software (Cont'd.)-

57.2974) Degree), then the angle value of the difference is the difference between the B1 and B2 back-off distances. For example, if the motion control monitor sees $B1-B2=0.53$ rad, that is, $0.53 \times 57.2974 \approx 30.3676^\circ$, then if the setback distance of B1 is 40° , then the retraction distance of B2 should be $40^\circ - 30.3676^\circ = 9.6324^\circ$



The 4-four mode switching of the TubePro 5000A seven-axis system is a common operation, so the seven-axis debugging replaces the locking and unlocking box for single-axis debugging. You only need to directly check the corresponding mode, no need to enter the password. When the B-axis is out of synchronization warning pops up when it is back, you need to switch the mode to Y2+B3 (back to medium mode) and then go back.

e.) Detailed Instructions for Using TubePro Software-



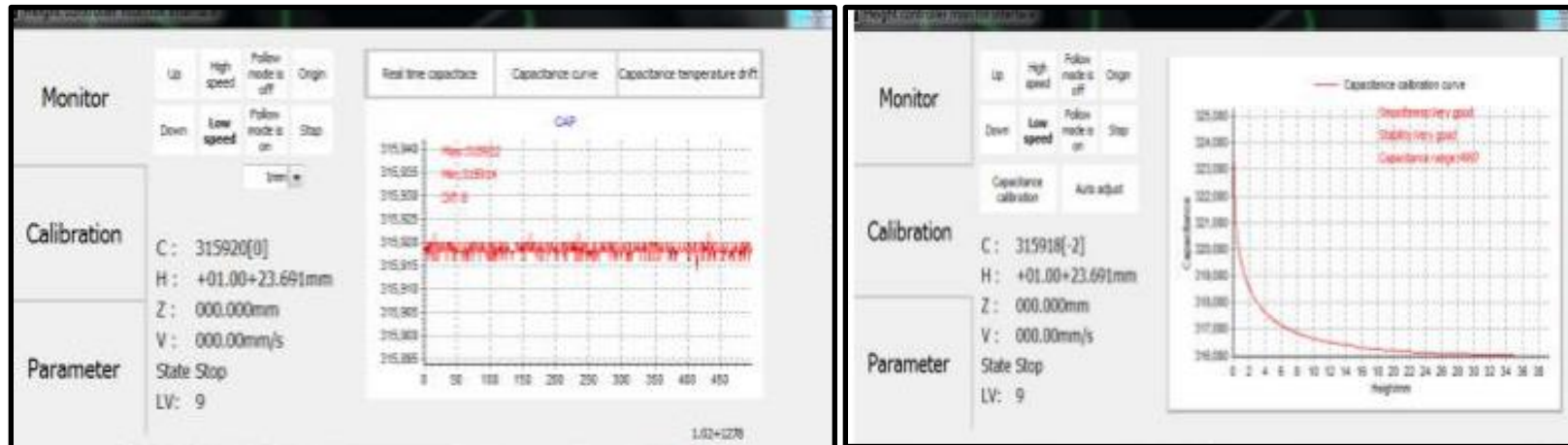
2.) **One-Button Cut:** TubePro provides a one-button cut-off function that shuts down the position clockwise or counterclockwise. If the use of the starting point is checked, a starting point search will be performed before cutting.



e.) Detailed Instructions for Using TubePro Software-

Monitoring Tools-

1.) **Height Monitor:** Monitoring here is a brief introduction to the BCS100E in the 5000A and 5000B systems. For the 5000C system height adjuster configuration, please refer to the BCS100 Standalone Capacitor Height User Manual V3.



Parameter Name	Meaning-Definition
Up and Down	Jog the Height Adjuster Z-Axis.
High speed /Low Speed	Select jog high speed or low speed.
Follow On/Off	Set to follow "On" or follow Off". Can set the following height to 1mm for testing.
Return to "Origin".	The Z-Axis is homed.
Stop	The height adjuster stops moving.
C	Height Adjuster capacitance.
H	Spacing between the nozzle and the sheet metal.
Z	Z -Axis Coordinate.
V	Z-Axis Speed.

e.) Detailed Instructions for Using TubePro Software-

The screenshot displays the TubePro software interface, which is organized into three main sections: Monitor, Calibration, and Parameter. Each section contains various settings that can be adjusted using dropdown menus, checkboxes, and buttons.

Section	Parameter	Value
Monitor	Hlt board alarm delay	5ms
	Hlt board alarm delay	100ms
	Hlt board alarm delay	600ms
Calibration	Follow deviation alarm	50mm
	Follow deviation delay	13ms
	Capacitance decrease	500
	Real time calibration	<input checked="" type="radio"/> Off <input checked="" type="radio"/> On
	Calibration range	25mm
	Max following height	8mm
Parameter	Height deviation opt	20mm/s
	Feed forward	100%
	Feed forward	100%
	Vibration suppress	<input type="radio"/> Off <input checked="" type="radio"/> On
	Suppression time	20ms
	Following level	9
	Reset speed	40mm/s
	Dock in origin	<input type="radio"/> Off <input checked="" type="radio"/> On
	Z axis travel range	-999mm
	Dock coordinates	-40mm
	Self limit protect	<input type="radio"/> Off <input checked="" type="radio"/> On
	Following speed	150mm/s
Following accel	9000mm/s ²	
Jog high speed	100mm/s	
Jog low speed	10mm/s	
Unlock parameter		Write parameters

e.) Detailed Instructions for Using TubePro Software-



Parameter Name	Meaning-Definition
Empty Shifting Board Alarm Delay.	When the system is stopped, if the duration of the touch panel reaches this time, the floating head will automatically lift the protection and output an alarm signal. When this value is set to 0, the touch panel alarm will no longer be triggered in the stop state.
Cutting the Board Alarm Delay.	During the cutting process, if the duration of the touch panel (capacitance is 0) reaches this time, the floating head will automatically lift up the protection and output an alarm signal. When this value is set to 0, the touch panel alarm will no longer be triggered during the cutting process.
Punch Board Alarm Delay.	During the piercing process, when the duration of the touch panel (Capacitance is 0) reaches this time, the floating head will automatically lift up the protection and output an alarm signal. If this value is set appropriately, it is possible to avoid false alarms caused by anti-slag during piercing. When this value is set to 0, the touch panel alarm is disabled when punching.
Follow Deviation Alarm.	The maximum following error allowed by the BCS100. After the cutting head follows the position, the controller will generate an over-error warning when the following error exceeds the set alarm value due to the movement beyond the boundary of the sheet or the sharp vibration of the sheet.

Parameter Name	Meaning-Definition
Following Deviation Delay.	Set the filter time to follow the error alarm. The larger the value, the longer the time allowed to generate tracking error, and the stronger the ability to filter out interference.
Real-Time Calibration.	The real-time calibration function is turned on. The height adjuster will automatically calibrate the body capacitance of the cutting head after each machining to reduce the number of manual calibration of the height adjuster. When using this function, please ensure that the cutting head at the stop point is more than 30mm away from the board surface.
Calibration Range.	The distance raised by the standard is recorded, and the corresponding data is recorded. The default is 25mm.
Maximum Height to Follow.	The maximum height directly followed. When the following height H exceeds this height, the height adjuster first follows to 1 mm and then back (H-1) mm.
Jitter Suppression.	The vibration suppression function is turned on. This function can suppress the vibration caused by the cutting airflow disturbing the structurally weaker plate, thereby reducing the cross-sectional wave pattern. It can effectively suppress the jitter caused
Inhibition Time.	This parameter is the intensity of the vibration suppression function. The larger the value, the more obvious the vibration suppression function is, but it will reduce the response of the height adjuster. The default is 20ms and the recommended range is

e.) Detailed Instructions for Using TubePro Software

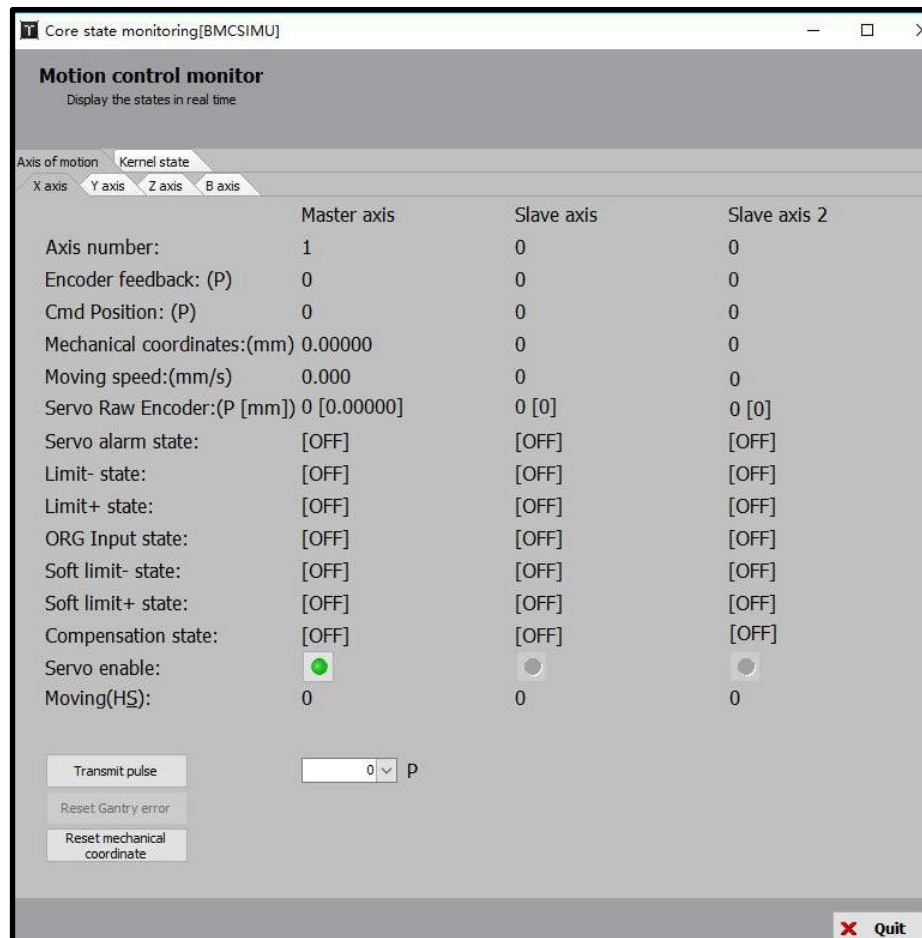


Parameter Name	Meaning-Definition
Following Level.	The follow-up gain level is from 1 to 30, and the default is 17 levels. The larger the number of stages, the smaller the average error of follow-up, the faster the follow-up action, and the stronger the ability to climb the slope. But if the gain is too strong, the system will generate self-oscillation. This parameter can be obtained by automatic adjustment.
Reset Speed.	Speed of Homing.
Reset Back to Dock.	Whether to return to the docking coordinates after returning to the
Z-Axis Travel.	Z-Axis travel range.
Docking Coordinates.	Z-Axis stop coordinates.
Soft Limit Protection.	Set whether the height adjuster enables soft limit protection.
Airspeed.	Height Shifter.
Airborne Acceleration.	Air movement of the height adjuster.
Jog High Speed.	Set Jog high speed.
Jog Low Speed.	Set Jog low speed.

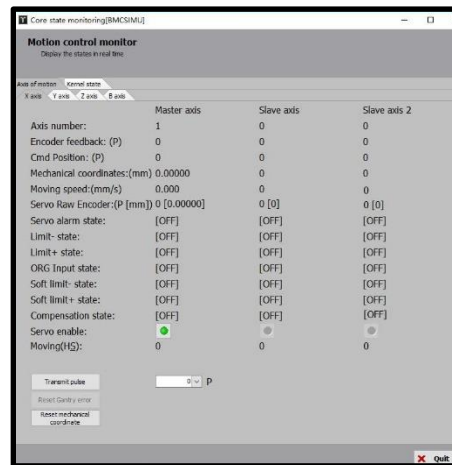
e.) Detailed Instructions for Using TubePro Software

2.) Motion Control Monitoring-

Motion control monitoring tool with motion axis monitoring and kernel status monitoring. On the motion axis monitoring page, you can view the enable status, alarm status, hardware limit status, software limit status, home switch status, screw compensation status, physical axis command position, feedback position, and mechanical coordinates of each servo axis. Movement speed. At the same time, it can also send servo enable and disable enable commands, send pulse debugging, clear coordinates, and clear double drive alarm.



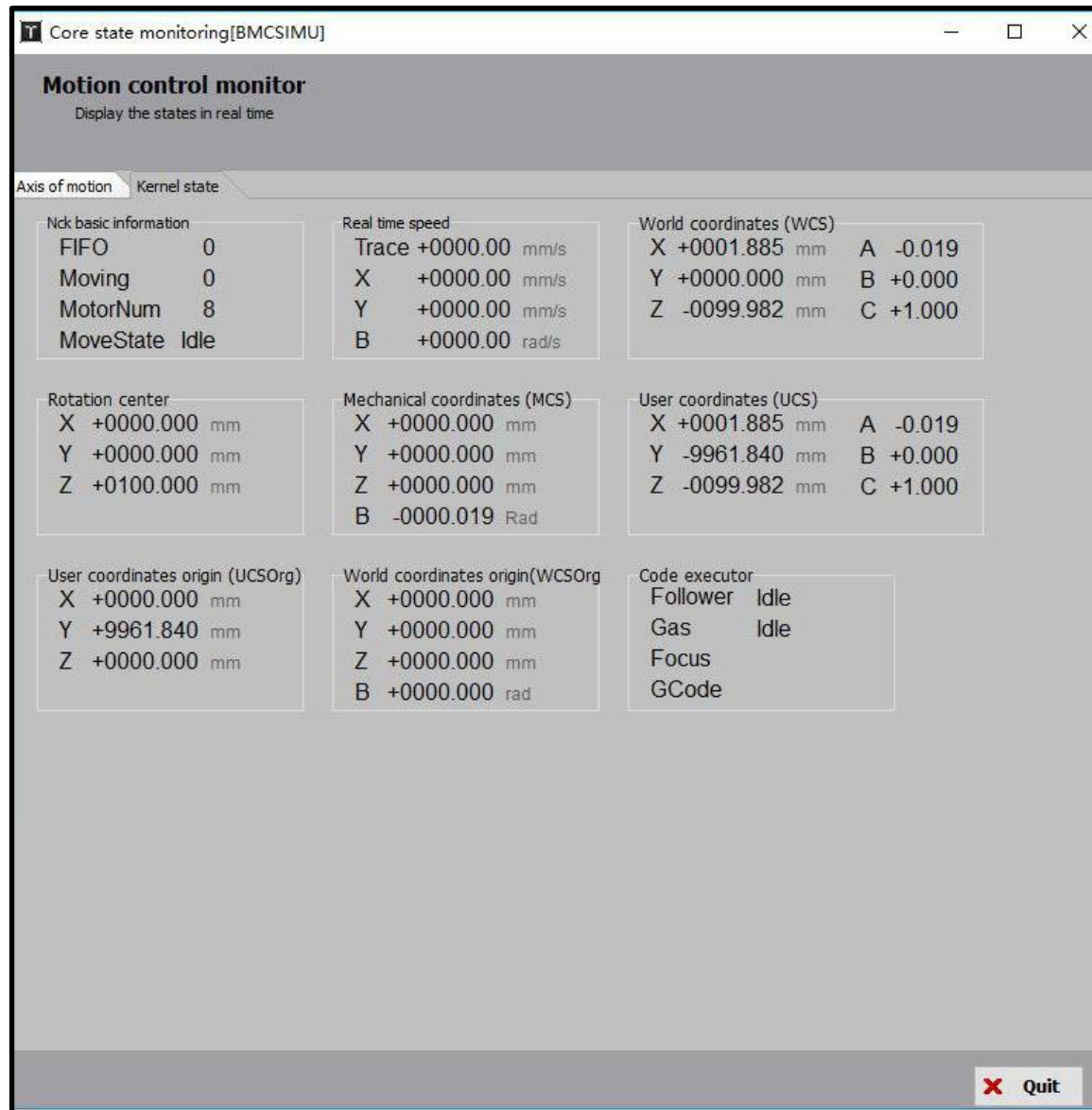
e.) Detailed Instructions for Using TubePro Software



Parameter Name	Meaning-Definition
Axis Number	Configured Physical Axis Number.
Encoder Feedback	Servo encoder feedback value, unit pulse.
Command Position	Command position, unit pulse.
Mechanical Coordinates	Machine Coordinate, the Coordinate Position of the System Command, in mm or rad.
Movement Speed	Current Servo real-time feedback speed.
Servo Alarm Status	Current Servo Alarm status.
Negative Limit Switch Status	Current Negative hard limit input status.
Positive Limit Switch Status	Current positive limit input status.
Origin Switch Status	Current origin input status.
Negative Soft Limit Switch Status	Current negative software limit input status.
Positive soft limit switch status	Current positive software limit input status.
Servo Status	Servo enable status, click to switch the servo enable status.
Send Pulse	The specified pulse can be generated for testing when the system is stopped.
Double Drive Error Clear	Clear double drive error.
Mechanical Coordinate Clear	Set the physical axis coordinates to 0.

e.) Detailed Instructions for Using TubePro Software

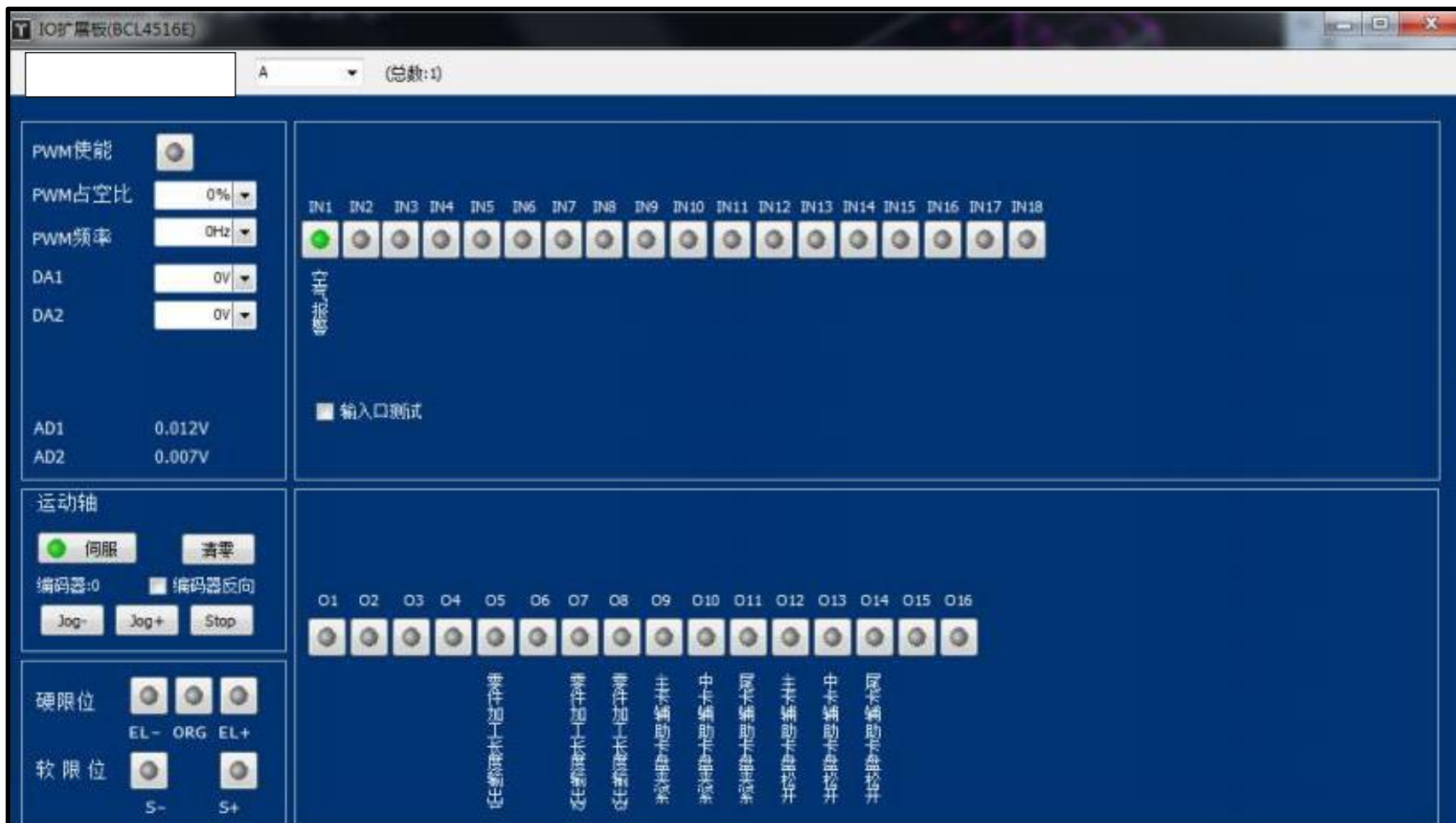
On the kernel status monitoring page, you can view some of the more underlying kernel status information, such as Machine Coordinates, Program User Coordinates, Buffer Quantity, and “G” Code command information. The concept is more complicated and will not be described in detail here.



e.) Detailed Instructions for Using TubePro Software-

3.) BCL4516/4516E/2720E Monitoring-

Through the monitoring interface of the expansion board, the output port switch can be turned “On/Off”, the state of the input port can be monitored, and the analog input port test can be completed. The expansion board monitoring interface allows you to perform some debugging tests on PWM and DA to monitor the AD sampling results. In the case of the BCL4516e expansion board, jog tests and hard limit monitoring can also be performed on the focus axis.



e.) Detailed Instructions for Using TubePro Software-

Other Tools-

1.) Single-Sided Leveling-

For profiled tube cutting, the normal method of searching cannot be applied normally. For example, only one surface is flat, and the other surfaces are uneven. Single-Sided leveling can be used to level the shaped tube with a flat side and then cut.

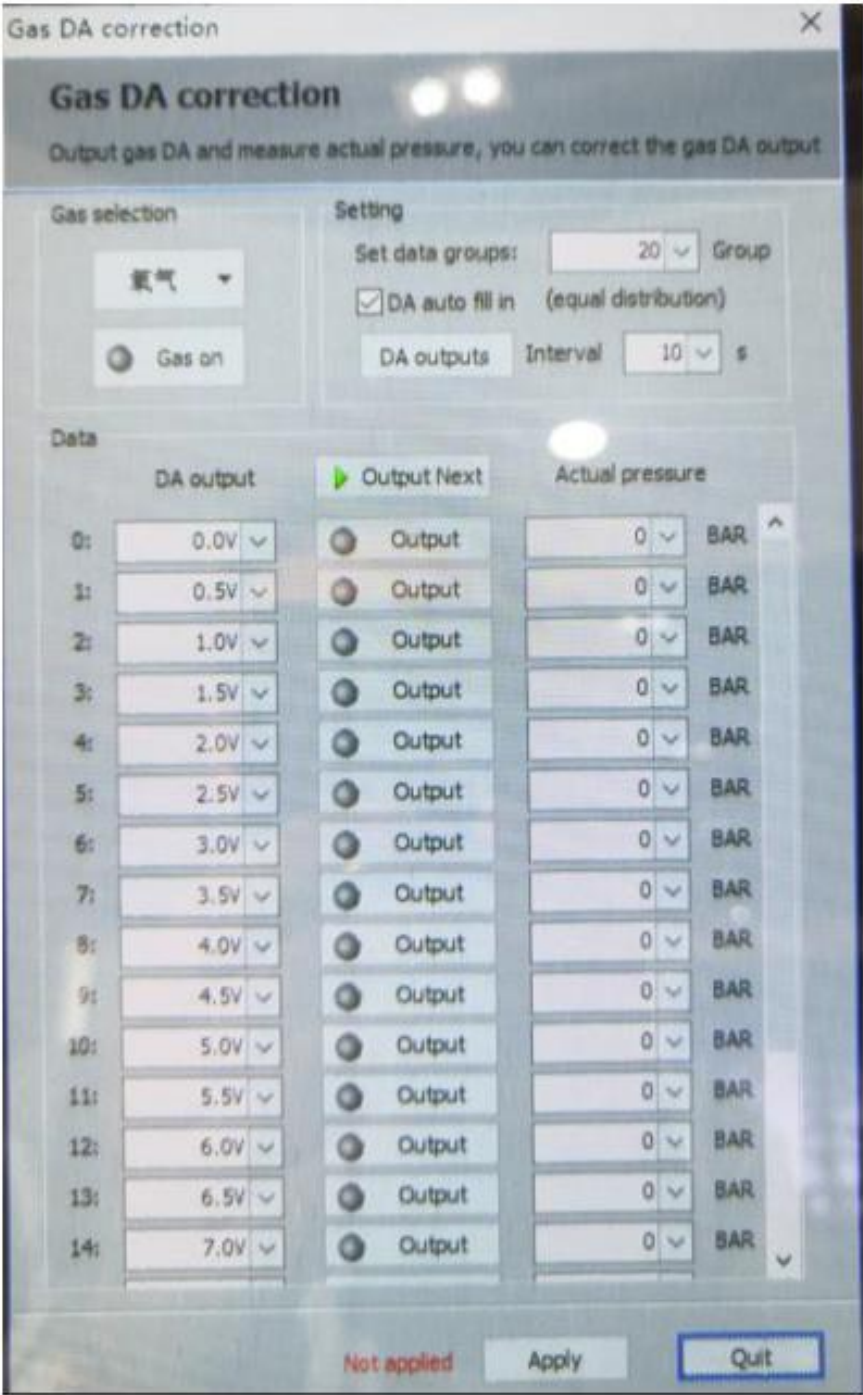
Ordinary D-Beams can be leveled in this way.

Parameter Name	Meaning-Definition
Gas Selection	Select the currently configured gas: Air/Oxygen/Nitrogen-Select the currently configured gas: Air/Oxygen/Nitrogen.
Open/Close Gas	Open/Close Gas.
Set the number of Data Sets.	Set the number of Data Linear Nodes.
DA Automatically fills in.	Equally set the DA distribution value automatically.
DA output sequentially	Order the DA values in the data table in sequence.
Output Next	Manually output the next DA value.
DA output	DA Output.
Actual Pressure	Actual Pressure

e.) Detailed Instructions for Using TubePro Software-

Other Tools-

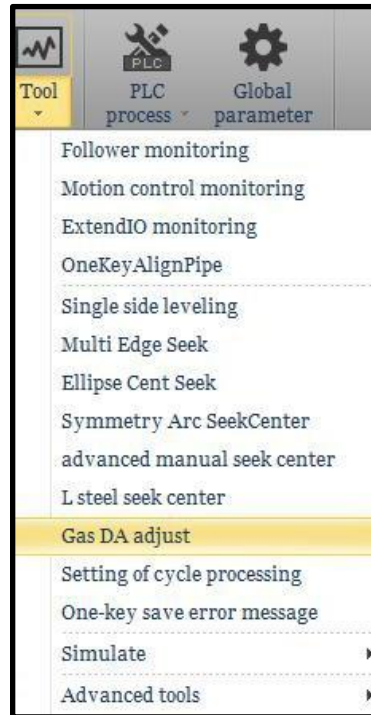
2.) Gas Correction-



e.) Detailed Instructions for Using TubePro Software-

Other Tools-

2.) Gas Correction-



Parameter Name	Meaning-Definition
Gas Selection	Select the currently configured gas: Air/Oxygen/Nitrogen-Select the currently configured gas: Air/Oxygen/Nitrogen.
Open/Close Gas	Open/Close Gas.
Set the number of Data Sets.	Set the number of Data Linear Nodes.
DA Automatically fills in.	Equally set the DA distribution value automatically.
DA output sequentially	Order the DA values in the data table in sequence.
Output Next	Manually output the next DA value.
DA output	DA Output.
Actual Pressure	Actual Pressure

e.) Detailed Instructions for Using TubePro Software-

Other Tools-

3.) Cycle Processing-

Cyclic machining setting, used to solve the exhibition demonstration, it is necessary to cycle some graphics without light output; or with the automatic loading and unloading PLC, complete the cycle processing of the whole tube.

The screenshot shows a dialog box titled "Setting of cycle processing" with a standard Windows window frame (minimize, maximize, close buttons). The dialog has a title bar with a 'T' icon. The main content area has a header section with the title "Setting of cycle processing" and the subtitle "Related parameters of cycle processing". Below this, there is a "Planned Pause:" label followed by a dropdown menu currently set to "Non". Underneath is a section titled "Cycle processing parameters" which contains several controls: "Cycle processing:" with two radio buttons, "Off" (selected) and "On"; "Planned work times :" followed by a text input field containing "0", a dropdown arrow, and the unit "Ts"; "Recycled times :" followed by a text input field containing "0", a dropdown arrow, and the unit "Ts"; and "Interval:" followed by a text input field containing "0", a dropdown arrow, and the unit "Sec". To the right of these three input fields is a "Clear" button. At the bottom right of the dialog are two buttons: "Save" (with a green checkmark icon) and "Cancel" (with a red X icon).

e.) Detailed Instructions for Using TubePro Software-

Other Tools-

3.) Cycle Processing-

Setting of cycle processing
Related parameters of cycle processing

Planned Pause: Non

Cycle processing parameters

Cycle processing: ☒ Off ☐ On

Planned work times : 0 Ts

Recycled times : 0 Ts

Interval: 0 Sec

Clear

Save Cancel

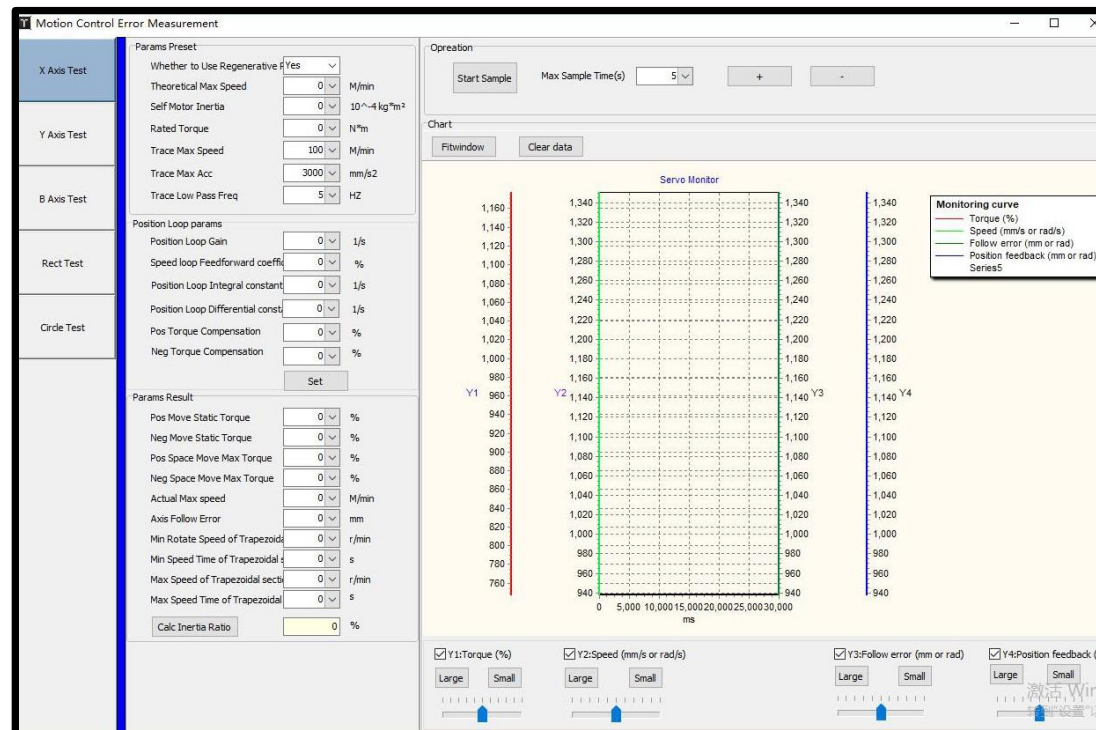
Parameter Name	Meaning-Definition
Planned Suspension	Do not pause; Pause after machining the current track; pause after machining the current part; pause after processing the current file.
Cyclic Processing	Turn on cycle processing; turn off cycle processing.
Planned Cycle Times	The number of cycles of processing.
Cycle Interval	Interval between each cycle.

e.) Detailed Instructions for Using TubePro Software-

Other Tools-

4.) Real-Time Monitoring-

Real-time monitoring, accurate sampling of servo axis command position, command speed, feedback position, feedback speed, feedback force, command position deviation, double drive position deviation, buffer quantity, height adjustment height in real time every millisecond. Each monitoring can select four kinds of signals (Y1, Y2, Y3, Y4) for monitoring. The monitoring time range can be between 5 seconds and 20 minutes. Each monitoring can detect all the four signals of the servo. By default, four signal curves are drawn, passing through the bottom (Y1~Y4). Uncheck the box to display the signal you do not want to view or scale the specified curve separately within a certain range.



e.) Detailed Instructions for Using TubePro Software-

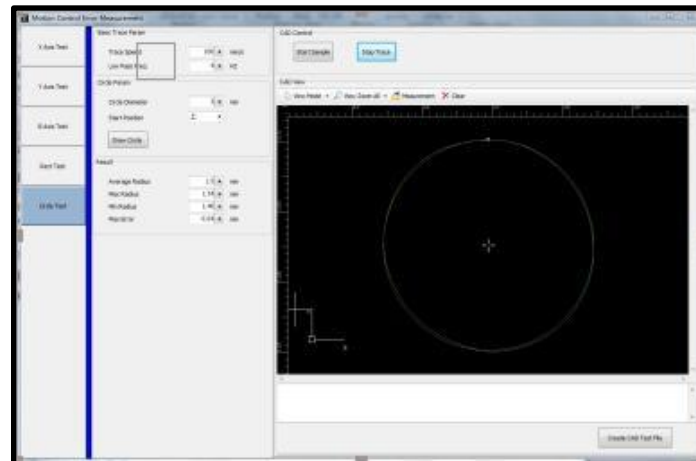
Other Tools-

4.) Real-Time Monitoring (Cont'd.)-

The vertical axis of the curve is scaled by the mouse's scroll wheel. The horizontal axis of the curve is zoomed by the right mouse button to select the curve within the specified time range. You can restore the graphic to the appropriate window by holding down the right mouse button and dragging it. Press and hold the left mouse button to pan the graph. **“Click the Left Button”** of the mouse to display all the curve values at the position specified by the mouse. **“Click the Right Button”** of the mouse to display all the curve values at the position specified by the mouse.

5.) Error Measurement-

The error measurement is divided into single axis test and X-Y plane linkage test. This feature is available for TubePro 5000A and TubePro5000B. The single-axis measurement is mainly used to check whether the inertia ratio of the single-axis servo is correct and whether the static torque is normal. The X-Y plane linkage test tests the command and feedback position error values for machining rectangular and circular paths.



e.) Detailed Instructions for Using TubePro Software-

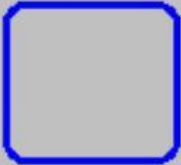
Other Tools-

6.) Generate CAD Test Graphics-

To facilitate TubePro's ease of trial cutting, TubePro provides a CAD test tool for creating perforations on a rectangular tube. Users can quickly create a perforated graphic directly through it and then perform a simple test.

Create CAD Test File

Create New File, Marking common graphics on surfaces of Tube, to test the actual cutting accuracy of machine. The graph is created at the center of a square tube. The -X width and square length should be long enough for the section of the square tube.

Pipe - X	60 mm			
Pipe - Z	20 mm			
Pipe - Radius	1 mm		Clab Type	Rect
Pipe Length	100 mm		Width	10 mm
Distance Left	20 mm		Height	10 mm
		Radius	0 mm	

Next Step: New Test File

e.) Detailed Instructions for Using TubePro Software-


Other Tools-

6.) Generate CAD Test Graphics (Cont'd.)-

Create CAD Test File

Create Test CAD File

Create New File, Marking common graphics on surfaces of Tube, to test the actual cutting accuracy of machine. The graph is created at the center of a square tube. The -X width and square length should be long enough for the section of the square tube.

Pipe - X	60 mm		Clab Type	Rect
Pipe - Z	20 mm		Width	10 mm
Pipe - Radius	1 mm		Heigh	10 mm
Pipe Length	100 mm		Radius	0 mm
Distance Left	20 mm			

Next Step: New Test File

Parameter Name	Meaning-Definition
Square Tube Section	X/Z Width, Chamfer Radius.
Graphic Length	Generate the length of the Graphic.
Plane Graphic Distance from near end face	Distance from Perforation to the Proximal End.
Coated Type	Select a Circle/Rectangle for the Perforation and Set the Radius/Length and Width.

e.) Detailed Instructions for Using TubePro Software-

Other Tools-

7.) Looking for the Middle-

For L-shaped and C-shaped steel or rectangular tubes with uneven surface, the edge-finding method can be used for workpiece deviation measurement.

Wierd Pipe Seek Center By Two Edge

Get the central deviation by searching and averaging the adjacent two edges

Warning:

1. Choose appropriate plan for Edge-Seek method:
2. Make sure all axes returned to mechanical origin after powered on. »
3. Make sure returning origin and leveling are complete.
4. Please input size of pipe. width : Height :

Results:

Center offset X :

Center offset Z :

e.) Detailed Instructions for Using TubePro Software-

Other Tools-

7.) Looking for the Middle (Cont'd.)-

Wierd Pipe Seek Center By Two Edge

Get the central deviation by searching and averaging the adjacent two edges

Warning:

1. Choose appropriate plan for Edge-Seek method:
2. Make sure all axes returned to mechanical origin after powered on. »
3. Make sure returning origin and leveling are complete.
4. Please input size of pipe. width : Height :

Results:

Center offset X :

Center offset Z :

Parameter Name	Meaning-Definition
Modifythe Edge Finding Scheme	Select 1-2 Face search / 2-3 Face search / 3-4 Face search / 1-4 Face search in Four Ways.
Rectangular Tube Size	Rectangular Tube Width and Height.
Start looking for	Start performing the search for edges.
Search Results	Displays the eccentricity of the workpiece. The eccentricity value is equal to the workpiece center coordinate minus the rotation center coordinate value.
Save /Cancel	If you find a successful or manual deviation value, you can save the application, or cancel it.

e.) Detailed Instructions for Using TubePro Software-

Other Tools-

8.) **Square Tube Automatic Search:** (Square Tube Five-Point Search) The square tube five-point search can complete the rapid flattening of the rectangular tube and the measurement of the workpiece deviation.

4 points center search

4 points center search

Analyze the cross section automatically according the current file, then find the deviation b

Note:

1. Input Rectangular tube Width: 50mm Height: 50mm
2. Make sure all axes returned to mechanical origin after powered on.
3. Make sure returning origin and leveling are complete.

Center search result:

Center offset X: 0

Center offset Z: 0

Start

Stop

Complete

Save Cancel

e.) Detailed Instructions for Using TubePro Software-

Other Tools-

9.) Square Tube / Round Tube / Runway Tube Four Points to Find-

The square tube is found in four points, and the eccentricity measurement of the rectangular/circular pipe can be completed.

4 points center search

4 points center search

Analyze the cross section automatically according the current file, then find the deviation b

Note:

1. Input Rectangular tube Width: 50mm

Height: 50mm

2. Make sure all axes returned to mechanical origin after powered on.

3. Make sure returning origin and leveling are complete.

Center search result:

Center offset X: 0

Center offset Z: 0

Start

Stop

Complete

✓ Save

✗ Cancel

e.) Detailed Instructions for Using TubePro Software-

Other Tools-

9.) Square Tube / Round Tube / Runway Tube Four Points to Find (Cont'd.)-

4 points center search

4 points center search

Analyze the cross section automatically according the current file, then find the deviation b

Note:

1. Input Rectangular tube Width: 50mm Height: 50mm
2. Make sure all axes returned to mechanical origin after powered on.
3. Make sure returning origin and leveling are complete.

Center search result:

Center offset X: 0

Center offset Z: 0

Start

Stop

Complete

Save Cancel

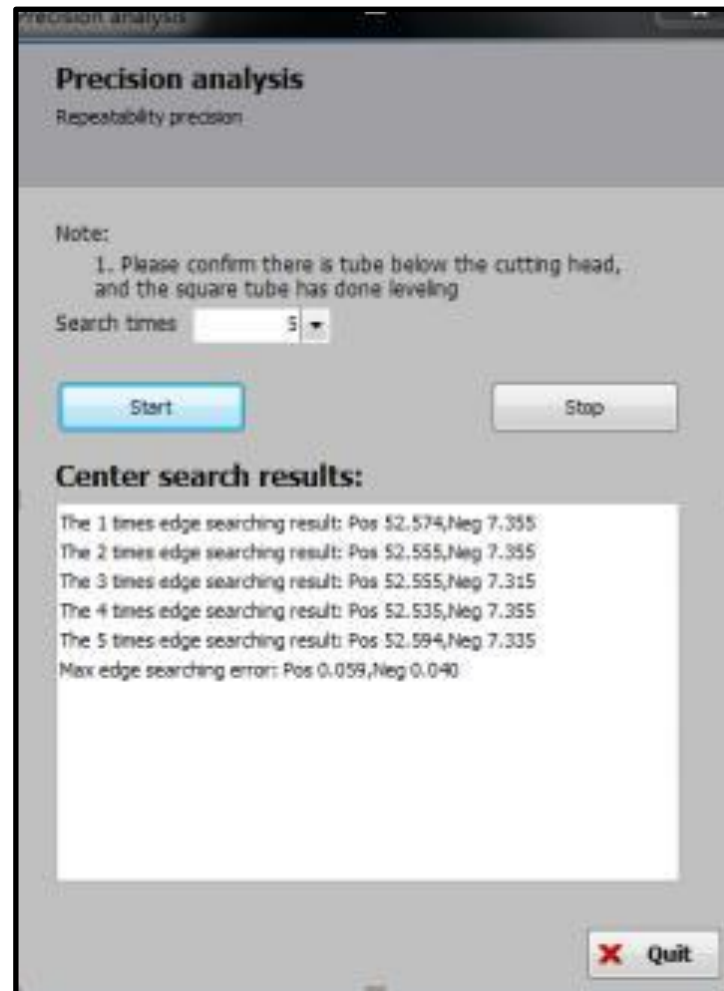
Parameter Name	Meaning-Definition
Rectangular Tube Size	Rectangular Tube Width and Height.
Start looking for	Start performing a Four-Point Search.
Search Results	Displays the eccentricity of the workpiece. The eccentricity value is equal to the workpiece center coordinate minus the rotation center coordinate value.
Save /Cancel	If you find a successful or Manual Deviation Value, you can save the application, or cancel it.

e.) Detailed Instructions for Using TubePro Software-

Other Tools-

10.) Finding Repeated Tests-

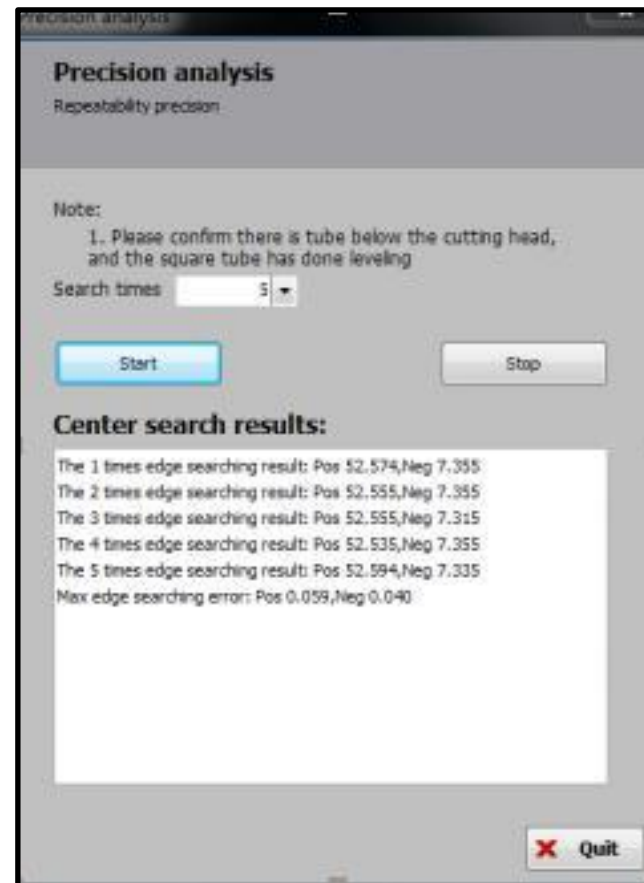
For the edge-finding performance test of the height adjuster, check whether the height adjuster performance is qualified. The maximum error of normal two-dimensional nozzle edge finding is within 8 wires, and the three-dimensional nozzle is within 12 wires.



e.) Detailed Instructions for Using TubePro Software-

Other Tools-

10.) Finding Repeated Tests (Cont'd.)-



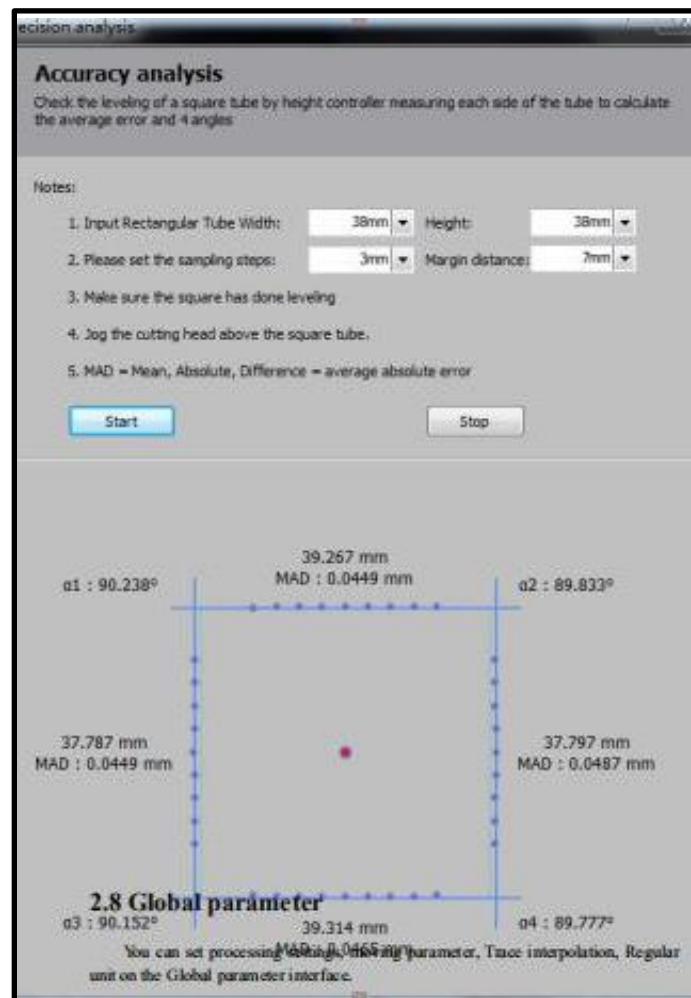
Parameter Name	Meaning-Definition
Number of Edges	Set the Number of Repetitions of Edge Finding.
Start looking for Edges	Start Performing Repeated Edge Finding.
Edge finding result	The edge finding repeat result is displayed, each time checking the Coordinate Values of the left and right edges of the Rectangular Tube, and the Maximum Error Value.

e.) Detailed Instructions for Using TubePro Software-

Other Tools-

11.) Square Tube Section Analysis-

Through the section analysis, you can view the appearance of the rectangular tube and test the deviation between the current real steel tube and the ideal rectangular tube. Whether the right-angle deviation is greater than 1 degree, the length and width of the rectangular tube and the error of the ideal length and width are large.



e.) Detailed Instructions for Using TubePro Software-

Global Parameters-

The Global Parameters include settings for Machining Settings, Space Shift Parameters, Track Interpolation, and General Units.

The screenshot shows the 'Global parameter settings' dialog box. It has a title bar with a close button. The main area is titled 'Global parameter settings' with a subtitle 'Set the global processing parameters and motion parameters. These parameters are generally related to the machine and application scenarios'.

Processing Settings

Y Axis Return Type After Work:	Remote	Gas delay:	2000	ms
B Axis Rotates After Work:	0	Switch delay:	500	ms
Fast leapfrog distance:	15	Cooling point delay:	1000	ms
Lift height when rotation above 30°:	100	Gas off delay:	0	ms

☒ Enable leap-frog
☒ Enable Optimization
☒ Detection of X soft limit before Cutting
☐ Holders Follow Before Cutting
☐ Enable Auto Load Feed
☐ Enable Auto UnLoad Feed
☐ Check chuck status before cutting
☐ Holders Follow After ReturnZero

Moving Parameter

	X	Y	B
Moving Speed:	6 m/min	6 m/min	60 RPM
Max Moving Acc:	3000 mm/s ²	3000 mm/s ²	120 rad/s ²
Low-pass Filter:	5 Hz		

Trace Interpolation

	X	Y	Z	B
Max Work Speed:	12 m/min	12 m/min	12 m/min	60 RPM
Max Work Acc:	2000 mm/s ²	2000 mm/s ²	2000 mm/s ²	120 rad/s ²
Const Circle Time	60 ms	60 ms		60 ms
Trace Freq:	5 Hz	<input checked="" type="checkbox"/> Square tube Corner Acc		

Regular

Speed unit: m/min

Buttons: Save, Cancel

e.) Detailed Instructions for Using TubePro Software-

Global Parameters (Cont'd.)-

1.) Process Settings-

Parameter Name	Meaning-Definition
After machining Y-Axis return	Zero / Near End / Far End /End Point.
After machining, the B axis is rotated.	It is used for special machine processing, which is convenient for narrow-faced materials. It needs to be processed 90 degrees.
The way to find when processing.	4-Point search /5 seek/find seek/B-Axis and square tube search.
Air Release Delay	After the gas path is opened, the time for the gas to arrive is
Ventilation Delay	Time to ensure the arrival of new gas after opening a new gas path.
Cooling Point Delay	Cooling Air Blowing Time.
Delayed Gas	After the cutting is completed, the gas is turned off for a while. Accelerate short-distance
Reduce Re-opening.	Reduce Re-opening.
Fast Leapfrog Distance.	Short-distance fast leapfrog for the same plane, shortening leap frog
Rotating height above 30 degrees	In the case of no space shift optimization, one of the safety height parameters for the face cutting and the height adjustment of
Open the Leapfrog up	The idling process uses a leapfrog.
Turn on null shift optimization	Using the air movement optimization, the height adjuster will be lifted according to the size of the steel pipe in the figure.
Pre-machining detection X-Axis soft limit	For large-diameter pipe cutting, the cutting process does not actually need to go to the frame, and there is no need to check the soft limit.
Turn on automatic loading	Click to start machining, the file starts to be executed before the PLC
Turn on automatic cutting	After processing ends, the blanking PLC action after the end of the file

e.) Detailed Instructions for Using TubePro Software-

Global Parameters (Cont'd.)-

2.) Air Shift Parameters-

Parameter Name	Meaning-Definition
X/Y/B Air Movement Speed	Constraining single-axis machining speed.
X/Y/Z/B Machining Acceleration	Constraining the acceleration of uniaxial machining.
X/Y/B Null Shift Low Pass Filter Frequency	Set the low-pass filtering frequency of the null shift. This parameter is related to the mechanical performance. The default is 5Hz. If the cutting error is large, you can try to change this parameter.

3.) Track Interpolation Parameters-

Parameter Name	Meaning-Definition
X/Y/Z/B maximum processing speed	Constraining single-axis machining speed.
X/Y/Z/B machining acceleration	Constraining the acceleration of uniaxial machining.
X/Y/Z/B turning acceleration	Constraining uniaxial turning.
X/Y/Z/B turning acceleration factor	The default is 1.
X/Y/Z/B processing low pass filter frequency	Processing low pass filter frequency, the default is 5Hz. The lower the filter frequency, the slower the speed and the higher the accuracy.

e.) Detailed Instructions for Using TubePro Software-

Global Parameters (Cont'd.)-

4.) Speed Unit-

Parameter Name	Meaning-Definition
Speed Unit	Mm/s, m/s, m/min, in/min, in/s

Layer Parameters-

If the drawing contains multiple layers, each layer contains a process that the user can set as needed.



1.) Cutting Process-

The cutting process can set parameters such as speed, air pressure, power, and delay of the trajectory during processing.

Layer Parameters -

1.) Cutting Process (Cont'd.)-

Layer Parameter Setting

File parameter: **Layer1**

Read File Save To File

☐ Pre-Punch

Cut Punch Turn

Cut Speed: 0.6 m/min

Lift Height: 10 mm

Cut Height: 1 mm

Cut Gas:

Cut Pressure: 5 Bar

Cut Curr: 100 %

Cut Pwr: 100 %

Cut Freq: 1000 Hz

Beam Size: 0 mm

Cut Focus: 0 mm

Delay Time: 200 ms

Laser off delay: 0 ms

☐ Slow Lead Length: 0 mm Speed: 0.12 m/min

☐ Low Pass Filter 5 Hz

☐ Dymc Pwr Adj ☐ Dymc Freq Adj Curve edit

Power(%)

Speed(%)

User Notes

Ok(O)

Layer Parameters -

1.) Cutting Process (Cont'd.)-

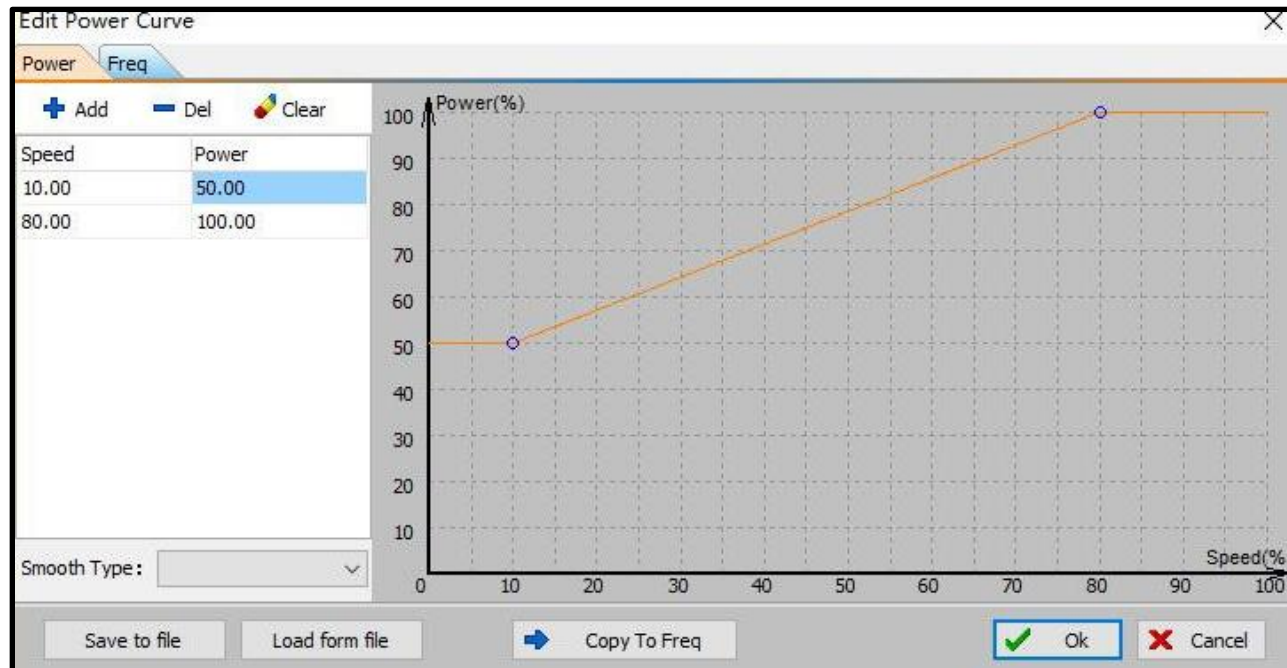
Parameter Name	Meaning-Definition
Cutting Speed	Set the maximum speed of curve cutting when cutting.
Lifting Height	During normal machining, when the trajectory is cut, the height of the height adjuster is raised when the conventional air is moved to another curve.
Nozzle Height	The following height of the system when cutting.
Gas	Air/oxygen/nitrogen gas selected during processing.
Air Pressure	Pressure Value.
Peak Power	Set the peak power of the laser during the cutting process.
Duty Cycle	Set the duty cycle of the laser during the cutting process.
Pulse Frequency	Set the pulse frequency of the laser during the cutting process.
Spot Diameter	If the focus axis is used, you can set the focus spot size when cutting.
Focus Position	If the focus axis is used, the focus position at the time of cutting can be set.
Residence Time	The time after the light is turned to the trajectory.
Delay Before Closing	Time from the end of the trajectory to the light.
Slow Start Distance	The distance from the beginning of each track is considered to be the starting segment.
Slow Start Speed	The set speed of the slow start section.
Slow Start Low Pass Filter Frequency	Set the filter frequency for slow start processing.
Adjust Power in Real Time	Setting the relationship between trajectory machining laser power and trajectory speed.
Adjust Frequency in Real Time	Setting the relationship between the trajectory processing laser frequency and the trajectory speed.

Layer Parameters -

1.) Cutting Process (Cont'd.)-

“Double-Click on the Curve Edit” to edit the power and frequency curves. On the left side you can “Click on Add Node” and you can select the smoothing type:

Segmentation / Linear / Smooth.



Parameter Name	Meaning-Definition
Power/Frequency	Power/Frequency Curve Node Settings.
Speed	Node's abscissa cutting speed.
Power	The ordinate of the Node cuts the Laser Power.
Frequency	The ordinate of the Node cuts the Laser Frequency.
Smoothing Method	Segmentation / Linear / Smooth, Default is Linear.

Layer Parameters -

2.) Perforation Process-

In the perforation process, the perforation mode can be set to be non-perforated, one-stage perforation, two-stage perforation, and three-stage perforation. Each level of perforation can be set with progressive perforation time, nozzle height, gas type, gas pressure, laser peak power, laser duty cycle, laser pulse frequency, set dwell time, and stop light blowing time. If the cutting head supports the focusing function, you can also set the spot diameter and focus position.

Layer Parameter Setting

File parameter: Layer 1

Read File Save To File

☐ Pre-Punch

Cut Punch Turn

Punch Style

☒ No Punch ☐ Punch 1 ☐ Punch 2 ☐ Punch 3

Parameter	No Punch	Punch 1	Punch 2
Step Time:	1000 S	1000 ms	1000 ms
Piercing Height:	1 mm	5 mm	15 mm
Piercing Gas:			
Piercing Pres:	5 BAR	5 Bar	5 Bar
Piercing Cur:	100 %	100 %	100 %
Piercing Pwr:	100 %	100 %	50 %
Piercing Freq:	5000 Hz	100 Hz	5000 Hz
Beam Size:	0 X	0 X	0 X
Piercing Focus:	0 mm	0 mm	0 mm
Piercing Time:	200 ms	200 ms	200 ms
LaserOff Blow:	500 ms	500 ms	500 ms

User Notes

Ok(O)

Layer Parameters –

2.) Perforation Process (Cont'd.)-

Parameter Name	Meaning-Definition
Perforation Method	According to the thickness and material of the sheet metal, no perforation/first perforation/secondary perforation/third perforation.
Progressive Time	At each stage of the perforation process, the nozzle height is slowly progressive.
Nozzle Height	Pierce process nozzle height.
Gas Type	Set the gas type for the perforation process.
Air Pressure	Set the air pressure during the piercing process.
Peak Power	Set the laser peak power of the punching process.
Duty Cycle	Set the laser duty cycle of the punching process.
Pulse Frequency	Set the laser frequency of the perforation process.
Spot Diameter	If the focusing axis is configured, the perforation spot diameter can be set.
Focus Position	If the focus axis is configured, you can set the perforation focus position.
Residence Time	The piercing time after the laser is turned on.
Stop Light Blowing	Stopping and blowing after piercing.

Layer Parameters –

3.) Corner Craft-

Enabling the cornering process can make the rectangular tube corner cut better. In the corner process, the control unit is integrated, the corner air pressure, the peak power (need to configure the laser DA), the duty cycle, and the pulse frequency. Round tubes cannot be used in corner processes. The 5000A and 5000B support the integrated control, and the 5000C does not enable the cornering process.

The screenshot shows a software window titled "Layer Parameter Setting" with a close button (X) in the top right corner. The window has a tabbed interface with "File parameter" and "Layer1" (selected). Below the tabs is a toolbar with "Read File", "Save To File", and a help icon. A "Pre-Punch" checkbox is located below the toolbar. There are three tabs: "Cut", "Punch", and "Turn", with "Cut" currently selected. The main area contains several settings, each with a checkbox and a value field with a unit:

- ☐ Use Corner Process
- ☐ Use ItpFF
- PT FollowH Plus: 0 mm
- ☐ Pt Pressure: 5 Bar
- ☐ Pt Current: 100 %
- ☐ Pt Pwm Ratio: 100 %
- ☐ Pt Freq: 1000 Hz
- Corner Determination C: 1.146 °/mm
- ☐ enable B limit speed
- B axis speed: 999 RPM
- B acceleration: 999 rad/s²

At the bottom of the window is a "User Notes" section with a large yellow text area. In the bottom right corner, there is a green checkmark icon and the text "Ok(O)".

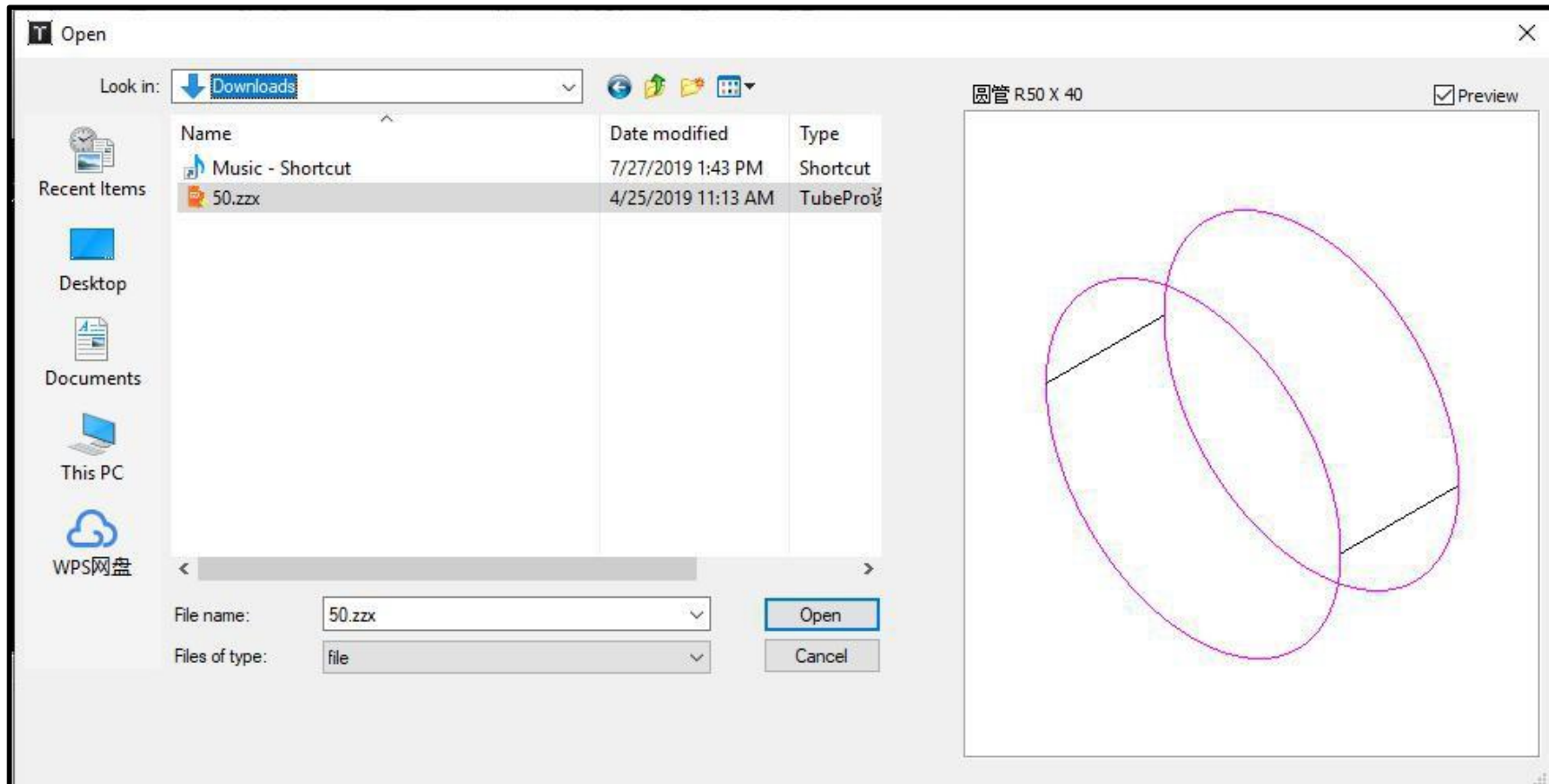
Layer Parameters –

4.) Operation Process-

Import Graphics-



“Click the Open File Button in the Quick Launch Bar” in the upper left corner of the interface to bring up the Open File dialog box and select the graphic you want to open. The right side of the Open File dialog provides a quick preview window to help you quickly find the files you need.



Layer Parameters –

4.) Operation Process-

Import Graphics (Cont'd.)-

Note: Make sure that the graphics you are importing are oriented in the same direction as your drawing, otherwise it may cause incorrect import graphics. It is also recommended to introduce a small, rounded transition during drawing to make the machining rotation smoother.

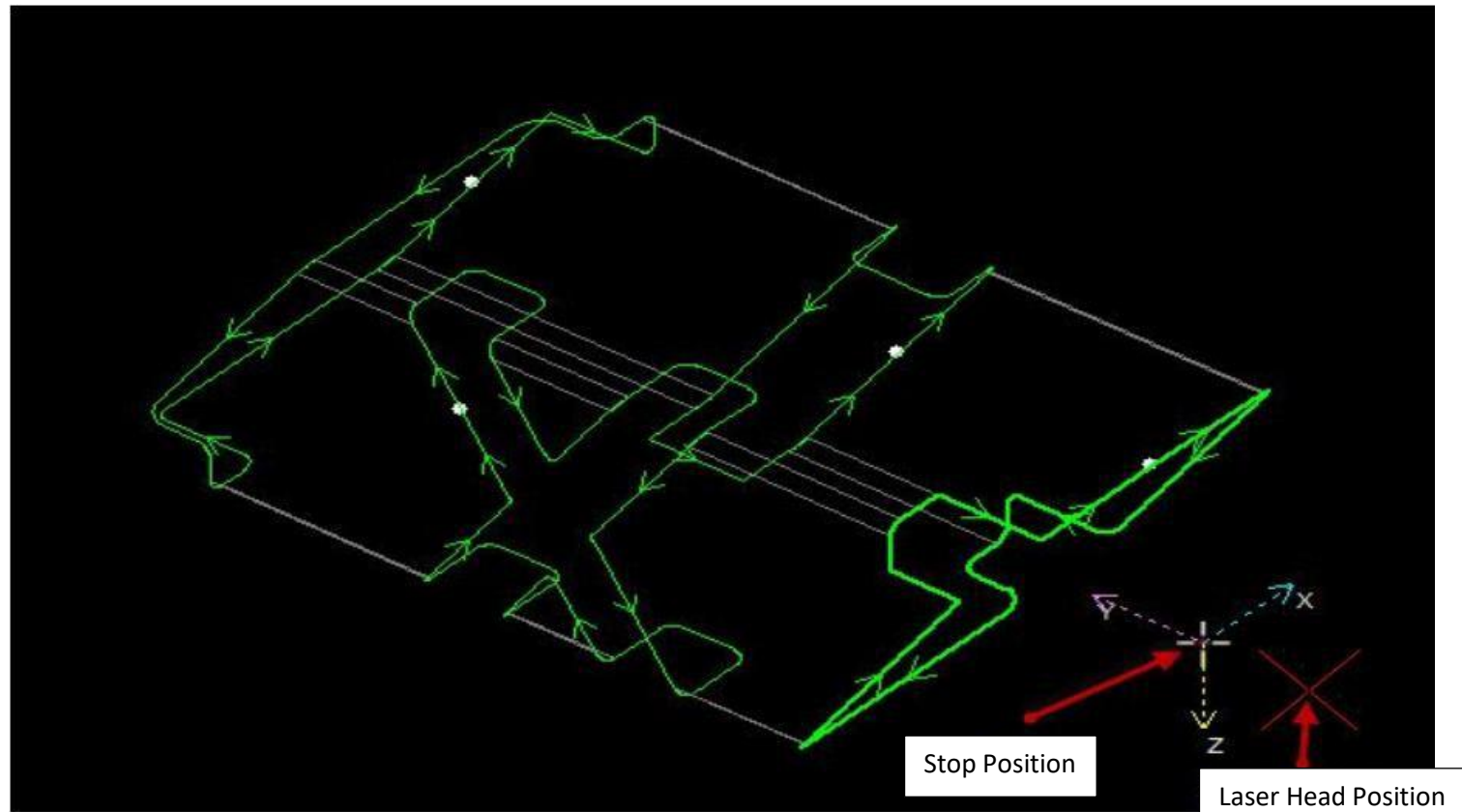
And the software will automatically recognize the contour trajectory that you need to process, and the auxiliary lines that are identified as not needing to be processed are indicated by gray lines.

Before the formal processing, you need to map the graphics on the screen to the machine. After clamping the square tube parts, place the cutting head on top of the tube, and then click the “automatic edge finding” button on the wireless handheld box. The software will automatically calibrate the square tube level and find the center of rotation. Once you have found the center of rotation, click the button on the software to record the center of rotation.

Layer Parameters –

4.) Operation Process-

Import Graphics (Cont'd.)-



If the "laser head position" indicated by the red cross cursor does not match the laser head position on the actual machine, check if the program zero or mechanical zero is correct. You can change the relative relationship between the graph and the stop by clicking

Layer Parameters –

4.) Operation Process-

Import Graphics (Cont'd.)-

the Dock button on the toolbar. For example, if the laser head is located at the "nearest end" of the workpiece to be machined, the part is machined from Y- to Y+; when "most end" is selected, the part is machined from Y+ to Y-direction.

The direction of the kerf compensation can be manually selected, or it can be automatically judged according to the positive cutting and the negative cutting. The male cutting is compensated outward, and the negative cutting is compensated inward.

For kerf compensation, you can choose whether to fill the corner with a rounded corner or a right angle, as shown in the following figure: the vertical line made at the corner of the original image. It can be seen from the figure that the compensation of both sides of the vertical line can ensure that the edge of the slit coincides with the original image, but the corner needs a transition. Usually, the rounded transition ensures that the edge of the kerf remains coincident with the original image during the transition and runs lighter. To cancel the compensation, select the graphic you want to cancel the compensation, then click the "Clear" button and select "Cancel Compensation".

2.) Layer Parameters-

The software provides 15 layers, each of which can be individually set to include process parameters such as cutting speed, laser power, air pressure, and cutting height. Click the Layers button on the toolbar to open the Layer Parameter Settings dialog, which contains almost all the process parameters required for machining. The first page of the dialog is "Global Parameters", which is used to control parameters outside the layer, such as airspeed, spot power, etc., as well as speed and acceleration units. The other pages of the dialog box list all the layers currently in use. Click on each layer to set the parameters of the layer separately. Hold down the "layer*" and drag to change the order between the layers. The previous layer is processed first.

Please Note: The contents of the "Layer Parameter Settings" dialog box may display different options depending on the laser used, the gas pipeline configuration, and the height adjuster used. The following figure is for reference only, please use your software. The actual display is correct.

2.) Layer Parameters (Cont'd.)-

Layer Parameter Setting

File parameter **Layer3**

Read File Save To File

☐ Pre-Punch

Cut Punch Turn

Cut Speed: 0.6 m/min

Lift Height: 10 mm

Cut Height: 1 mm

Cut Gas: Air

Cut Pressure: 5 Bar

Cut Cur: 100 %

Cut Pwr: 100 %

Cut Freq: 1000 Hz

Beam Size: 0 mm

Cut Focus: 0 mm

Delay Time: 200 ms

Laser off delay: 0 ms

☐ Slow Lead Length: 0 mm Speed: 0.12 m/min

☐ Low Pass Filter 5 Hz

☐ Dymc Pwr Adj ☐ Dymc Freq Adj **Curve edit**

Power(%)

Speed(%)

User Notes

Ok(O)

2.) Layer Parameter Description(s) -

The following table gives a brief description of some of the parameters in the layer:

Parameter Name	Parameter Meaning-Definition
Cutting Speed	Set the sections target speed of the cutting the actual track and cut. The Due to bend. In the first and acceleration last and deceleration, the actual cutting speed is often less than this speed.
Piercing Time	The time required to break the cut sheet. Set according to the thickness and material of the actual board. (The parameter can be set very small or even set to 0 when progressively puncturing).
Lifting Height	Set the height of the laser head up after cutting a curve. When the cutting is paused, the Z axis will also be lifted to a certain height, which is also the lifting height.
Peak Current	Set the peak current of the fiber laser, which is the peak power. The peak power determines the maximum cutting power that the machine can achieve. For a 500W cutting machine, if the peak current is set to 80%, the peak power that can be achieved during cutting is $500W * 80\% = 400W$.

2.) Layer Parameter Description(s) -

The following table gives a brief description of some of the parameters in the layer:

<u>CUTTING TYPE</u>	
Cutting Directly	Perforation and cutting use the same parameters, often used for sheet cutting.
Segment Perforation	Perforation and cutting use different parameters and are often used for thick plate cutting.
Progressive Perforation	On the basis of the segmented perforation, a perforation method with a variable defocusing amount which is slowly lowered while being perforated is used for thick plate cutting. The perforation time can be set very small during progressive perforation, such as 100MS, where the actual perforation time = 100MS + the time required to slowly descend from the perforation height to the cutting height.
Three-Level Perforation	On the basis of the perforation described above, the blasting height is reduced from the blasting height to the perforation height by a gradual or segmented method, which is often used for slab perforation.
Fixed Height Cutting	The first time the following is set to the height of the cutting distance from the sheet, the closing is followed, and the Z-axis coordinate is maintained for cutting.
Off-Board Follow	Cut directly into the board from the outside of the board without punching, often used for thick plates or high precision requirements. Part cutting, you need to use the "Save Reference Height" function of the global parameters.

2.) Layer Parameter Description(s) -

The following table gives a brief description of some of the parameters in the layer:

<u>CUTTING PARAMETER</u>	
Cutting Power	Set the laser power used for cutting, that is the duty cycle of the PWM modulation signal.
Cutting Height	Set the height of the laser head from the sheet when cutting.
Cutting Air Pressure	Set the air pressure of the auxiliary gas during cutting, and use it with a proportional valve or a multi-valve valve.
Cutting Frequency	When setting the perforation, the carrier frequency of the PWM modulation signal is generally lower at the time of perforation, and pulse perforation is used to avoid blasting.
Cutting Gas	Set the type of assist gas used for cutting.

<u>PERFORATION PARAMETER</u>	
Progressive Speed	Sets the speed from the perforation height to the cutting height when using progressive perforations.
Punch Power	Set the laser power used for the hole, that is, the duty cycle of the PWM modulation signal.
Piercing Height	Set the height of the laser head from the sheet when piercing.
Perforation Pressure	Set the air pressure of the auxiliary gas during perforation, and use it with proportional valve or multi-valve.
Piercing Frequency	When setting the perforation, the carrier frequency of the PWM modulation signal is generally lower at the time of perforation, and pulse perforation is used to avoid blasting.
Perforated Gas	Set the type of assist gas used for perforation.

2.) Layer Parameter Description(s) -

The following table gives a brief description of some of the parameters in the layer:

<u>OTHER PARAMETER</u>	
Enable Short Distance Without Lifting	When this function is enabled, if the air movement distance between two graphics is smaller than the setting value of the "maximum air movement length of short distance not uplift" in the global parameter, the Z axis will not be lifted after the previous graphics processing is completed, and it is directly empty. Move to the beginning of the next drawing to start machining.
This layer does not follow	The height adjuster is used for cutting motion when cutting.
Film Cutting	For the part to be "burned" with a lower power at a higher follower height, then cut along the trajectory.
Adjust Power in Real Time based on Speed	When this function is enabled, the system will adjust the laser power (duty of the PWM signal) in real time according to the actual cutting speed during machining, which will greatly help to optimize the cutting quality of the corner.

The CypCut Laser Cutting Control System- **Using & Programming**

QuickStart

Features

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

- ▣ standard G code generated by Master Cam, Type3 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. Automatic optimization process can be defined, and the above each function can also be carried out manually.

To support common editing and typesetting functions, including zooming in, and zooming out,

- ▣ rotation, alignment, copying, combination, smoothness, and connection and so on.

To use the easiest way to set the lead, slotted compensation, micro connection, bridge

- ▣ connection, over cut, lead seal gap and so on.

- ▣ 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.
- ▣ To support curve splitting and connection, curve smoothness, text-to-curve, component integration and exploding.
- ▣ With Flexible automatic sorting and manual sorting functions, to support the function to fix the processing order through group.
- ▣ With 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.

▣

- ▣ The same set of software supports round pipe cutting and plane cutting, and the way of programming is the same; to support intersecting line cutting.
- ▣ To support Cover cut, auto seek edge, cutter starting and cutter lifting¹.
With powerful expansion capacity, as much as 15 PLC process edit and more than 30 programmable process.
- ▣ Programmable input and output outlet, programmable alarm input².
To support the remote control of the system through wireless teach box and Ethernet³

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 of Desktop/Laptop:**

- The operating system should be above Windows 2000.
- CPU with basic frequency above 1.0G.
- 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.
- The memory should be 512Mb at least.
- 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, 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.

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.

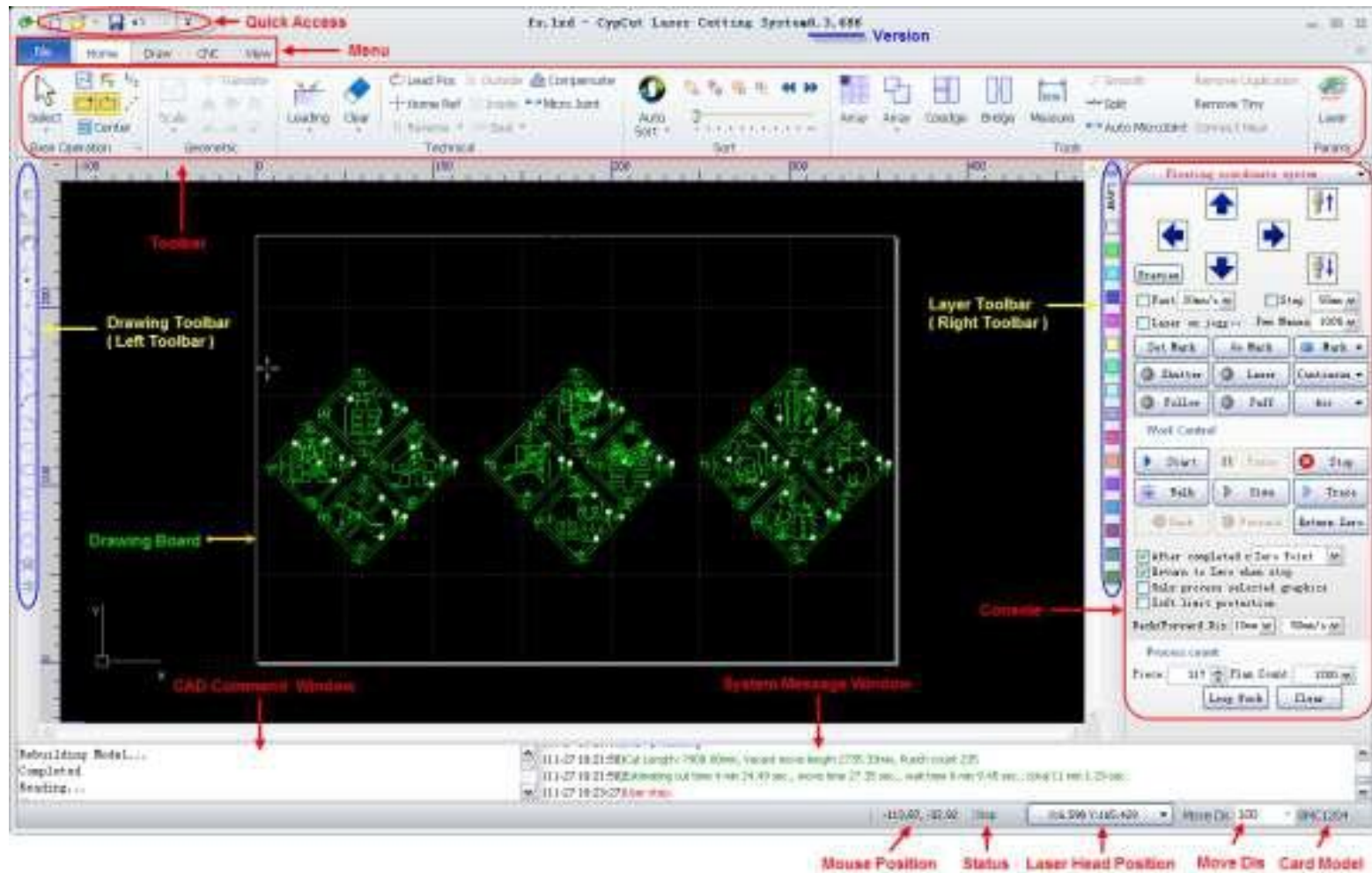
Starting to Use CypCut Program-

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



“Double” clicking shown icon.

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 grey grids. The staff gauges at the top and the left of the drawing area and the grey 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 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 —**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 a graph and a new graph can be inserted in the drawing board by clicking these buttons.

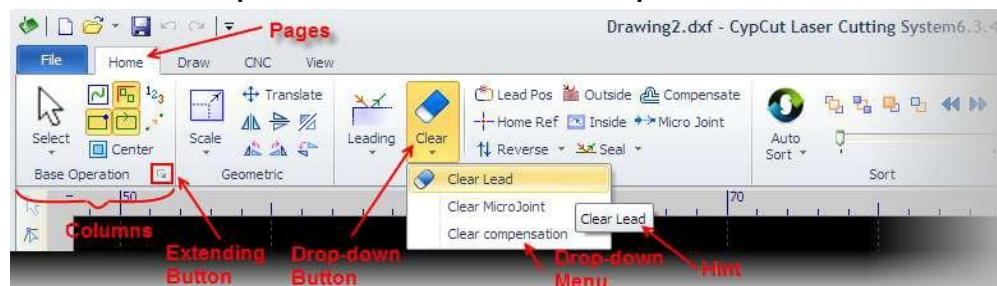
At the right of the drawing area is —**Layer Toolbar**||, which is called directly Right Toolbar|| in the following introduction. It includes a —Layer|| button and sixteen color square buttons.

—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**||, and you can input CAD instructions or coordinates. The related prompting messages of all the drawing instructions will be shown here. The right one is —**System Message Window**||, and other system messages all 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, 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. In some versions, off-board cutting control is also included.

Tool Bar-

The toolbar of CypCut uses a style called Ribbon. It puts the common functions by column and area and 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|| and —Geometric transformation||. 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.

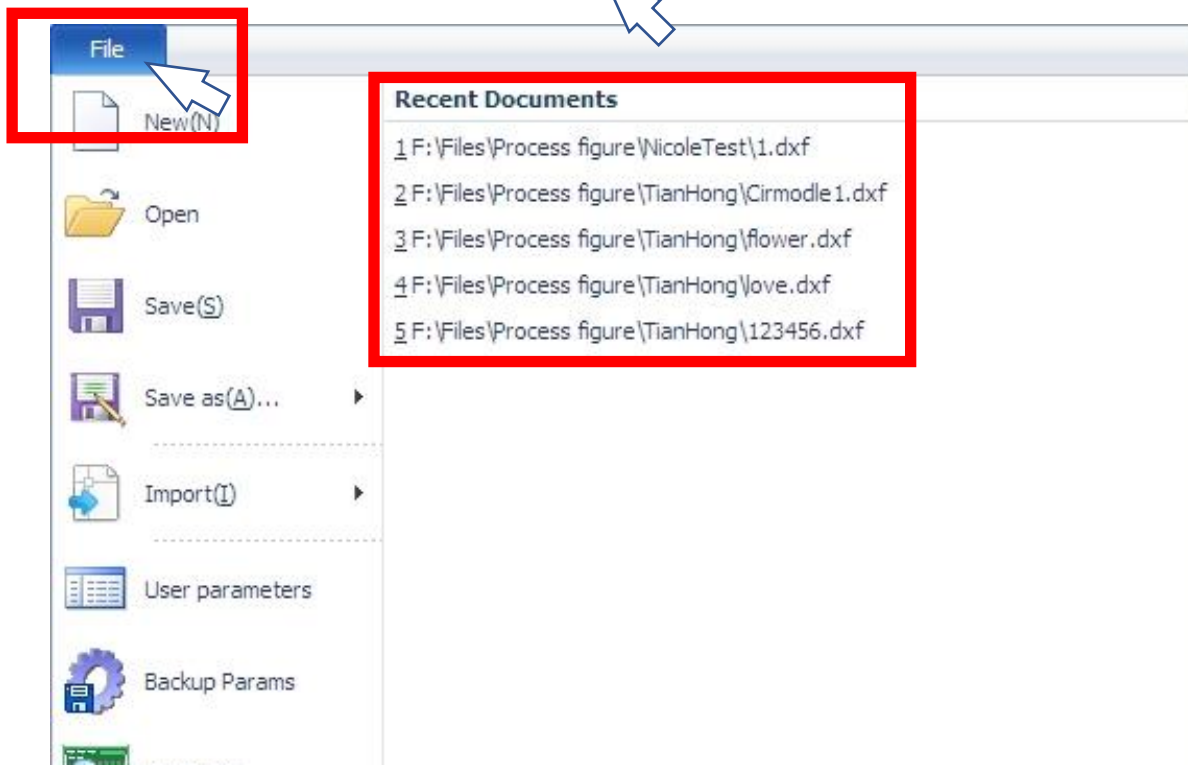
Note: there are small triangles below some large-size buttons, which are called —Drop-down Buttons||, a related —Drop-down Menu|| will appear after pressing the button, and the menu can offer richer operation options. When the mouse is moved to the top of the button, two obviously different rectangles 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 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.

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 —  **” as shown below:**



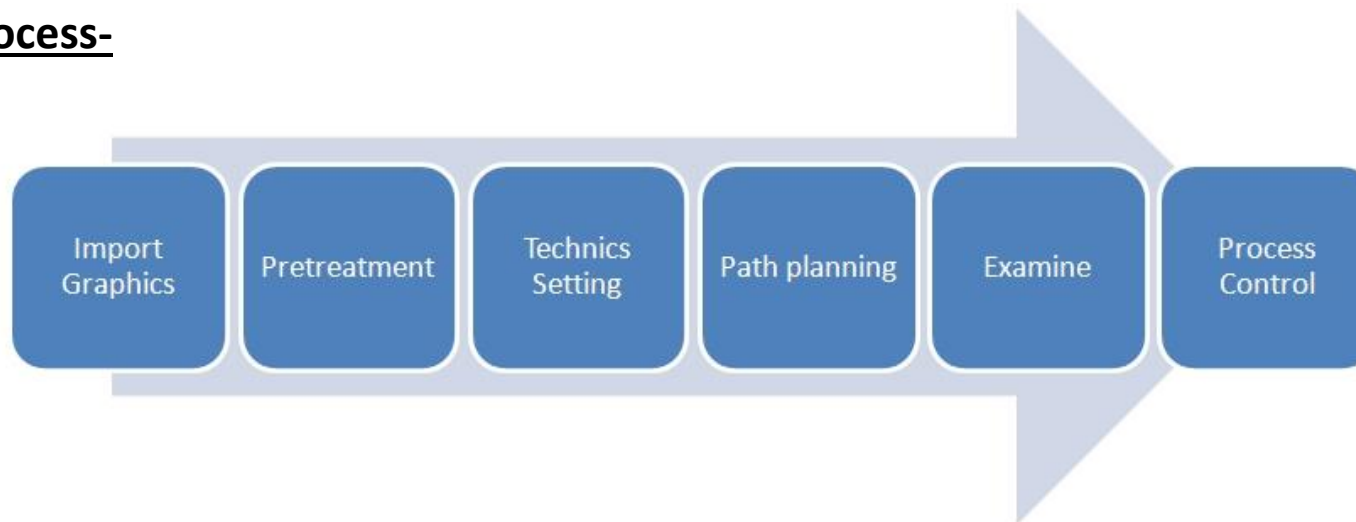
Please note that at the right of the menu the recently used files are listed. While the files saved by CypCut are marked with the icon—  , and in this way it is convenient for you to find the designed documents of last time.

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**.

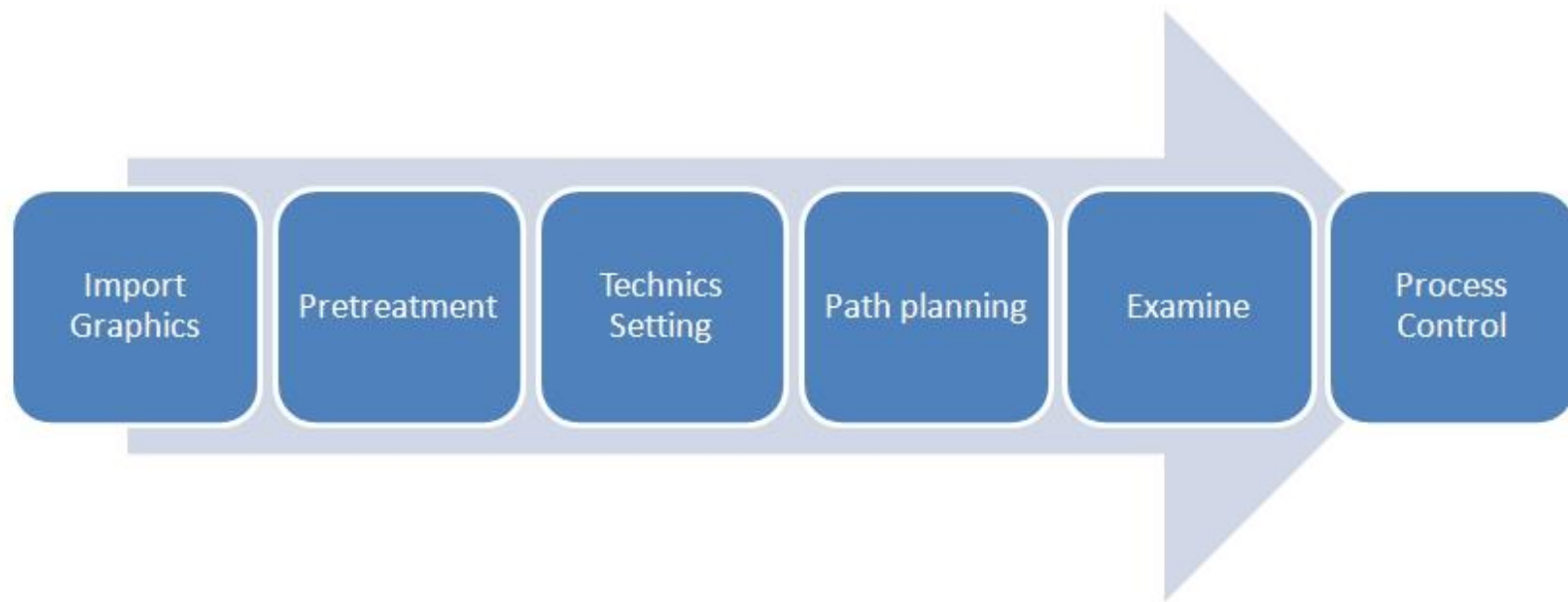
The menu —User **Parameters** is used to set some parameters related to the using habits; and the menu —Parameter Backup is used by users to backup all parameters as a compressed file, while the menu —**Diagnosis** is used for system diagnosis and monitoring.

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


Operation Process-



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 quickly find the file you need.

1.) Import Graphics (Cont'd.)



If you hope to draw a part on the spot through CypCut software, please

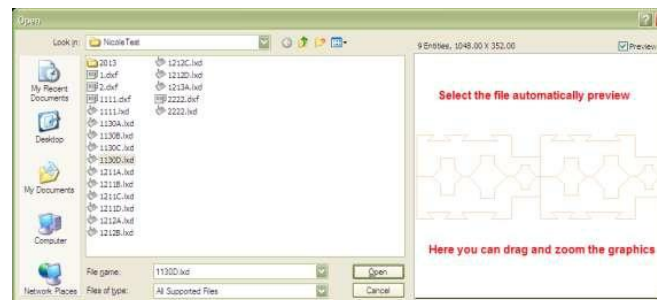
“Click the Create Button—  ||” and then draw pictures with the buttons of the drawing toolbar at the left. See the details in related chapters.

2.) Preprocessing-

When importing the graphics, CypCut will automatically remove tiny curves and duplicated lines, combine connected lines well as automatically distinguish the overcast cut and yang cut and conduct sorting at the same time. 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.

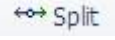

Generally, the graphics to be processed based on the requirements of software as closed curves. Therefore, if the files you opened include unclosed curves, the software will prompt you and the unclosed curves will be displayed in red. However, this function may be closed. Thus, if you would

like to look over the unclosed curves in the drawing board, you can **“Click the Buttons —  || and  ||”** in the toolbar to highlight them. You can also click the big button


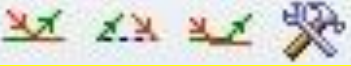






—Selection|| at the leftmost side of the toolbar, and then “Click —**Select Unclosed Curve||**” to choose all of them.

2.) Preprocessing (Cont’d.)-

In some cases, you must split the graphics manually, please click the button—  Split || in the toolbar 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 —**  **||”**.

3.) 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 —**  **||”** can be used to set lead, and the **“Button side by side —**  **||”** is used to set lead seal over, lead seal gap or lead seal parameters. The **“Button —||**  **Compensate ”** is used for cutting compensation, while the **“button—**  **Micro Joint ||”** can insert cannot let micro joint of not cutting into the graphics, 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 lead-in manually.


3.) Technical Parameter (Cont'd.)-

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.

4.) 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 can change the direction of the graphics during the automatic sorting by clicking the small triangle under the button.

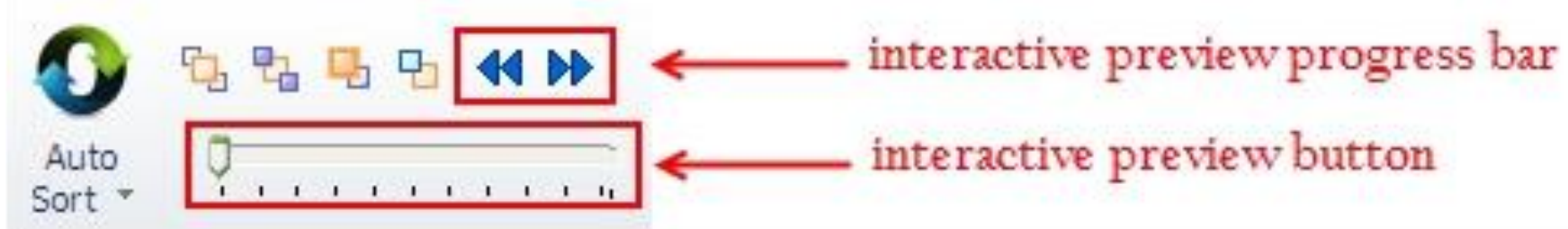
If the automatic sorting cannot meet the requirements, you can **“Click the Button—  ||”** in the toolbar at the left to enter the manual sorting mode, and click the graphics with mouse one by one, and in this way, you can set the working order. You can specify the order between these two graphics through 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 —Group||”**. The following automatic sorting and manual sorting will not influence the graphics inside the **—Group||**, and the **—Group||** will always work as a whole.

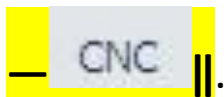
You can conduct automatic sorting for the graphics within the group by selecting a **—Group||** and then **clicking the right key**.

5.) 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”**.

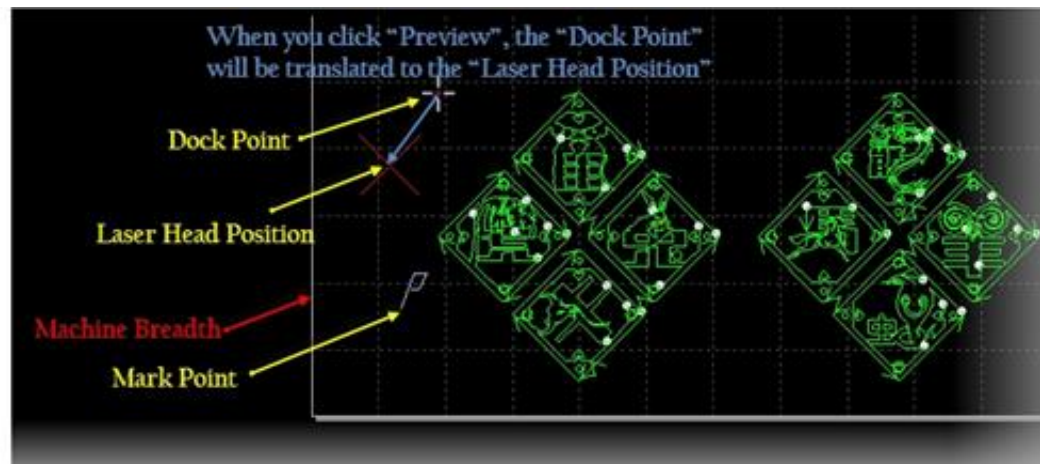


You can simulate process by **“Clicking the button —▶ Simu ||”** on the console, and you can adjust the speed of the simulation processing through the function **—simulation speed||** on the page



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 — ”** 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 overall.



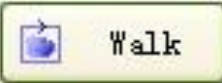
If the **—Laser Head Position—** shown by the red cross cursor does not match the actual laser head position of the machine, please check whether the position of the machine origin is correct, and it can be corrected through **—Numerical Control— —Go Origin—**.

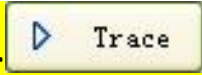
6.) Actual Processing (Cont'd.)-

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.



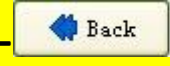

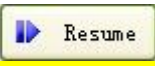
You can change the relative relationship between the graphics and the dock points by **“Clicking the Button —  Home Ref ||”** on the toolbar.

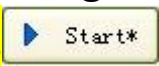
For example, if the laser head is at the lower left corner of the upcoming processing workpiece, you can set the lower left corner as the dock point and so forth.

If there is no error on the screen after checking, you can **“Click the button—  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.

6.) Actual Processing (Cont'd.)-

Finally, please **“Click the button —  ||”** to start the formal processing, and one can **“Click the Button—  ||”** to suspend the processing. During the suspension, one can control the laser head to go up and down manually, and switch the laser, gas and so on manually, besides, one can also trace back along the working route through the buttons —   ||. One can continue to work by **“Clicking the Button —  ||”**.

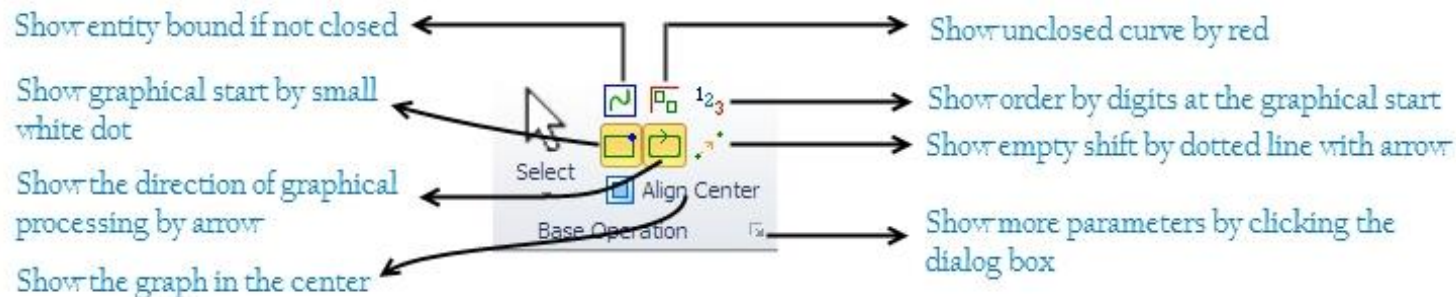
One can **“Click the Button —||”** to stop the processing and the laser head may return to the zero point according to your setting. If you do not make any modification there is no marker **—*||** on the **“Button—  ||”**, the system will allow one to continue the processing from the position of last stopping at when you **“Click the Button —Start||”** again,.

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 like 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 Bochu Electron for help. We will introduce some special graphical operations of CypCut as the software for laser cutting.



2.1 Graphical Display Effect

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.

When a graph is selected, by “**Clicking the Button** — ||”, 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.

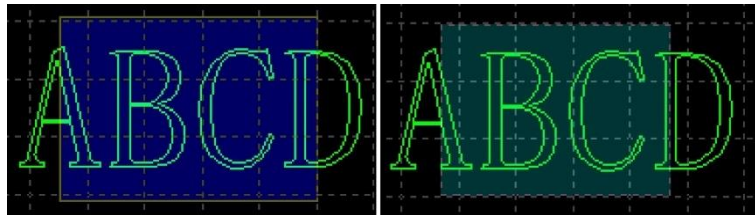
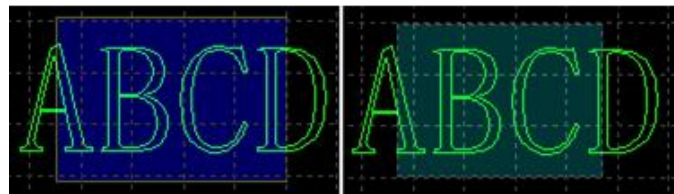
The views can be zoomed by scrolling the mouse wheel in the drawing board. By clicking F3, all the graphs will be shown in the center of the screen. By clicking F4, the machine breadth range will be displayed in the center, while the selected graph will be centered in the screen by clicking F5. The above operations can be selected by clicking the right key of the mouse in the drawing board.

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 above 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 if 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 select, you can add or cancel selected graphics without the need for clearing the original selection.

When you click the button —Selection||, a drop-down menu will appear, through which you can conduct senior selection operation, including the selection of unclosed graphics and similar graphics.

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 5mm by selecting a circle with a diameter of 5mm and then **Clicking —Select Similar Curve**||.

Geometric Transformation-

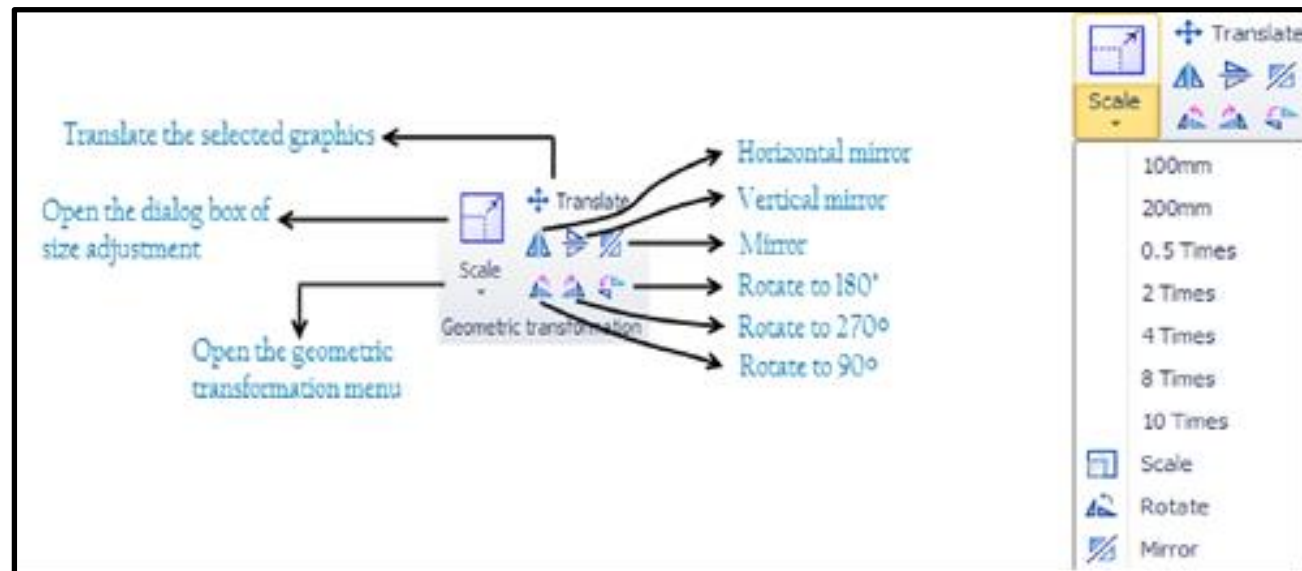
No matter it is —**Click Selection**|| or —**Box Selection**||, if you **Press —Shift**|| while you select, you can add or cancel selected graphics without the need for clearing the original selection.

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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 5mm by selecting a circle with a diameter of 5mm and then **Clicking — Select Similar Curve||**.

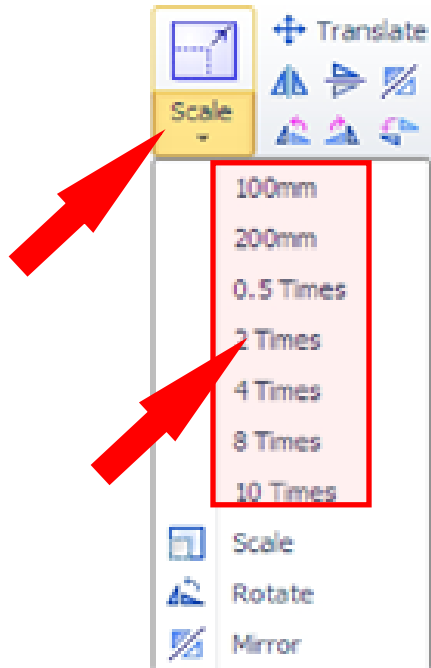
Geometric Transformation-

The column — **Geometric Transformation||** of toolbar provides geometric transformation functions, so most of the commonly used geometric transformations can be completed only by clicking a button, for examples: mirror X, mirror Y, rotate for 90°. As shown below:



When you click the small triangle below the button **—Size||**, and you can open a drop-down menu, it provides more operations, including rotation and mirror. Such as showed as the bottom-right graphics:




1.) Size Transformation-



CypCut provides 7 fast size transformations, which can be completed by the drop-down menu below the **“Button —Size||”**. 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 —” size||**”, 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.

Interactive Geometric Transformation-

CypCut provides 3 kinds of interactive geometric transformation:

- Interactive Zooming
- Rotation
- Mirror

and one 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.) One needs to click the small triangle below the —Size|| 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:

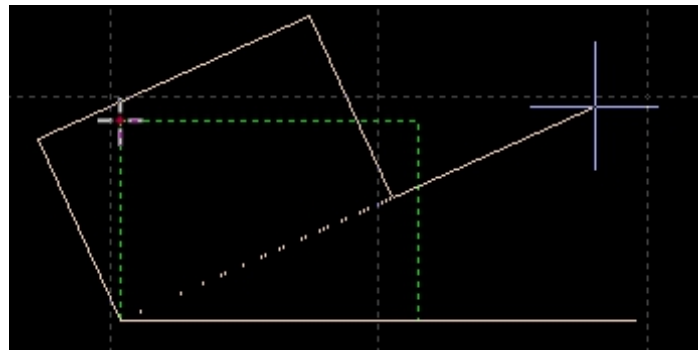


4.) One needs to **“Click the Mouse”**, and then there will be a prompt — **Specify Start Point of Rotation** or **Input Rotation Angle||** at the bottom of the screen.

5.) One can complete the operations by directly **“Inputting 45 and then Clicking Enter”**.

6.) If one does not know the angle of rotation in advance but want to rotate the rectangle to the position aligning with another graphic, please conduct the following operations from Step 5.


7.) Please move the mouse to the lower left corner of the rectangle to form a horizontal line and take it as the start line of rotation. As shown below:



8.) You need to click the mouse, and then 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. The operations of interactive zooming and mirror are similar with this, so there is no further explanation.

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—  || 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 one can **“Press —Ctrl+ Rightward”**, the selected graphics will be copied at the position with 100mm on the right.


Input of Coordinates and Parameters-

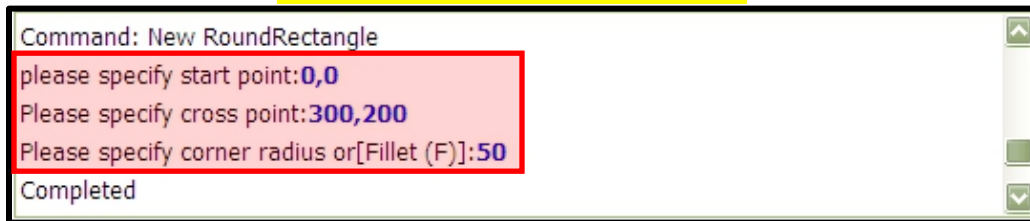
In some cases, you may hope to draw with precise coordinates. And CypCut allows you to input the coordinates directly and the input format of coordinates is as follows:

<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 —  ||”**, 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.




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.

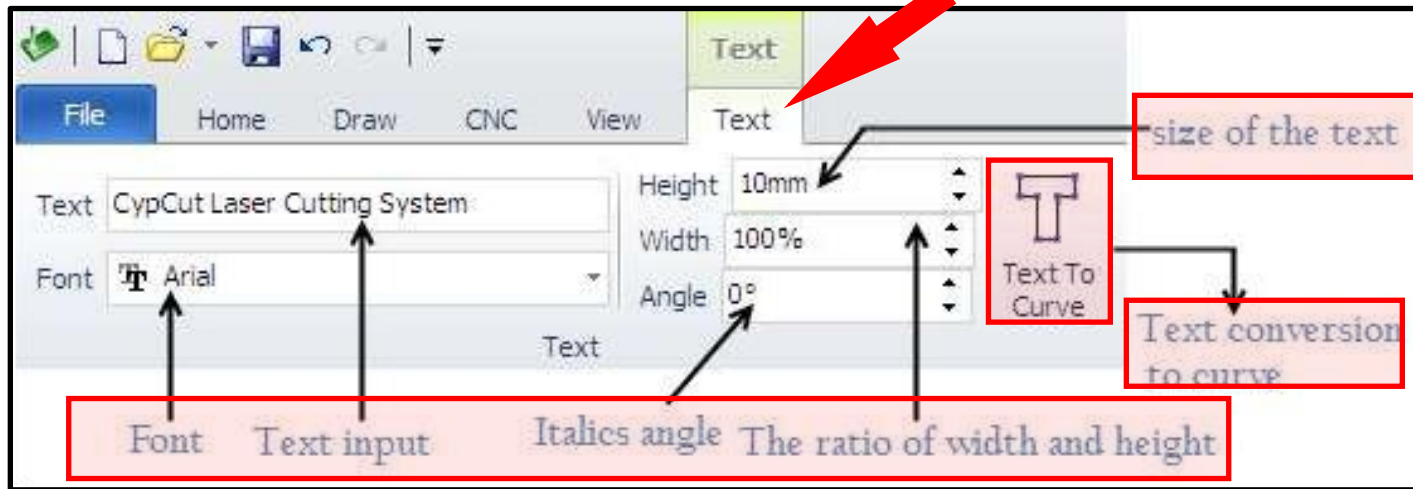
You can close the functions of automatic adsorption, and the operation steps are as follows:

“Click the menu —  ||”, 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.

Text Input-

CypCut supports text input and text conversion to curve. After “Clicking the Button—  ||” 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.

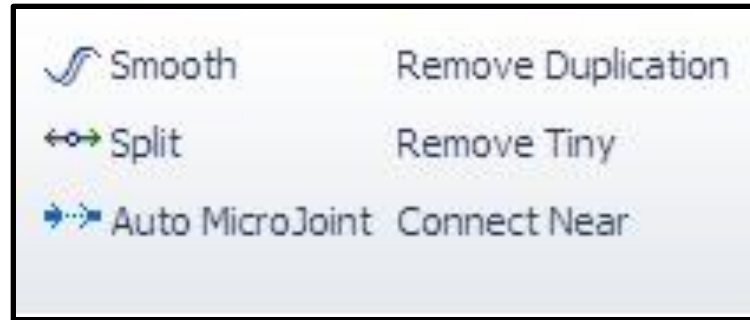
After selecting the text at any moment, a new page **—Text||** will appear in the toolbar, and you can modify the content, the style, and the size of the text and so on using it. As shown below:



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.

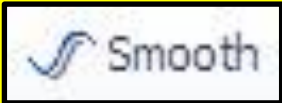
Graphical Optimization-

When importing the external graphics, CypCut can optimize the graphics automatically. If you must 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.

1.) Smooth


Please select the polylines to be optimized, then **“Click  on the Toolbar”**, a prompt—please specify fit tolerance|| will be shown on the command window.
Please **“Click the mouse directly or input the expected fit tolerance and then Press Enter”**.

The contrast between the original curve and the smoothed curve is as shown below:

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.

3.) Connect Near

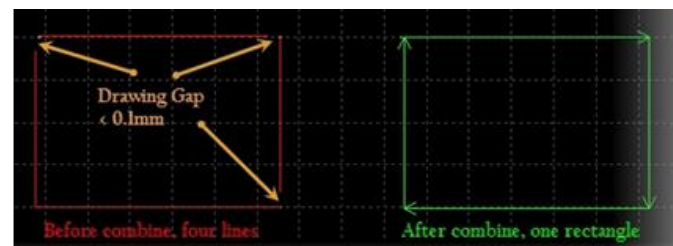
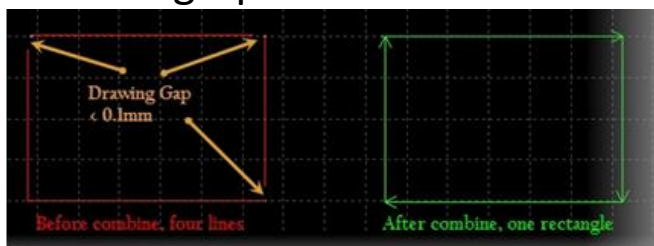
The graphics drawn by using AutoCAD often include the graphs which connect visually while do not connect. Through connecting near, they can be combined. Please select the graphics to be merged,

then **“Click —  ||”** 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 Curve||**, and then can be combined.

4.) 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 Tiny Objects||**. You may **“Click the Button —Remove Tiny Objects||”**, 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.



5.) 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 Duplicated Lines||”**.

Technical Parameters-

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.



Lead Lines-

1.) Distinguish Overcast Cut and Yang Cut-


When opening the external files such as **DXF** and so on, CypCut 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.

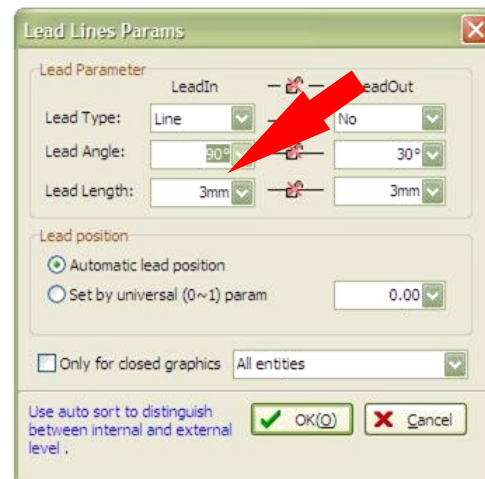
CypCut distinguishes overcast cut and yang cut in accordance with the surrounded relations, and it always takes the outermost layer as yang cut, while the next one as overcast cut, then yang cut and so forth. Besides, an unclosed graphics cannot form a layer. If you would like to start yang cut from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

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 led in from the inside.

When setting an **“Overcast Cut and Yang Cut Manually”**, please select the graphics to be set, and then **“Click the Buttons —  Outside  Inside ||”** on the toolbar.

2.) Automatic Lead Lines-

Please select the graphics to be set with lead lines, **“Click the Icon —  ||”** on the toolbar, then set the lead lines parameters in the popped window. As shown below:

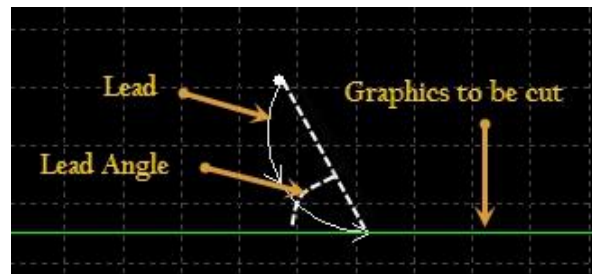


The supported lead types include circular arc and straight lines, while the supported parameters consist of lead type, lead angle and lead length. You can set lead lines at the same time by


“Clicking the Icon — ” in the above figure.

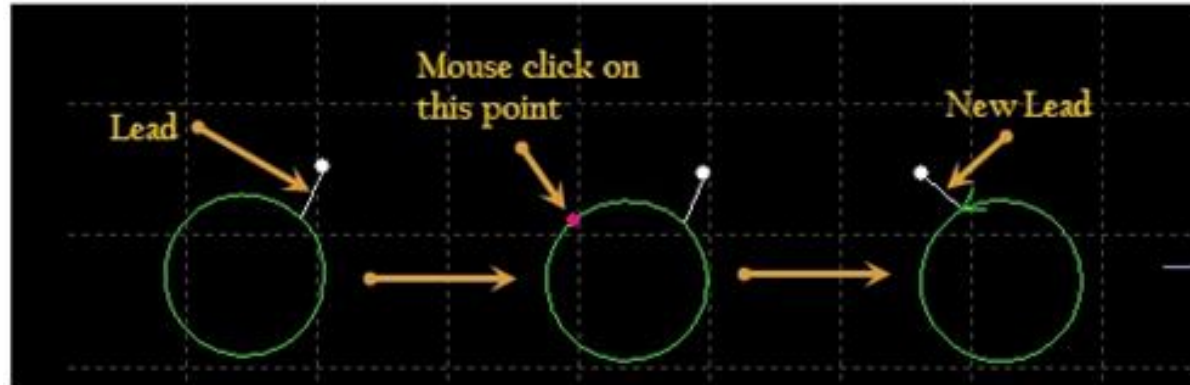
When you select circular arc leading, the end of the circular arc needs to keep in tangent with the graphics to be cut (no matter how big the set angle is). As shown in the figure below. In fact, the angle set at this moment is an included angle between the connecting line of the start point and the end point of the lead line and the graphics to be cut. The lead out lines is like it.

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.



Set Leading Manually-

You can modify the leaning manually by **“Clicking the Button —  Lead Pos”** on the toolbar. If you **“Click on the Graphics”**, you can change the position of the leading; however, you cannot modify the angle and the length.

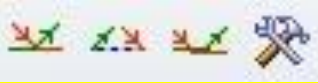


Firstly, please **“Click (point A) Outside the Graphics”**, then **“Click (point B) on the Graphics”**, in this way you can draw a leading from point A to point B.

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


5. Lead Seal Over Cut, Lead Seal Gap, and Lead Seal-

The “Side-by-Side Buttons in the Toolbar of —Technical Parameter|| —  ||” are used to set lead seal, lead seal gap, lead seal over cut and the size of —Gaps or Over Cut||. Please select the graphics you need to set, and then click the corresponding buttons. The size set of —Gaps or Over-Cut|| can only be valid when resetting gaps or over cut later, and the size which has been set before will remain unchanged.



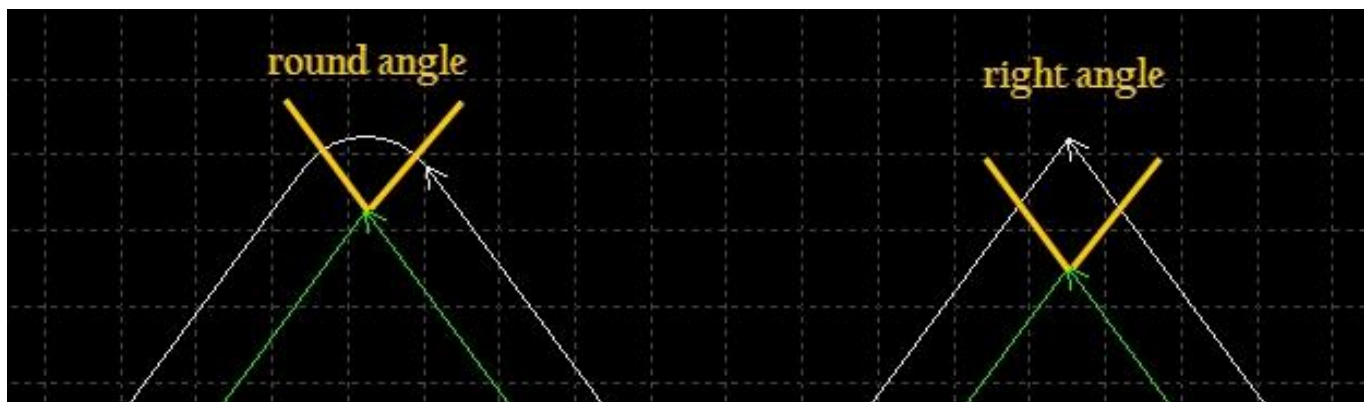
Cutting Compensation-

Please select the graphics to be compensated, and then

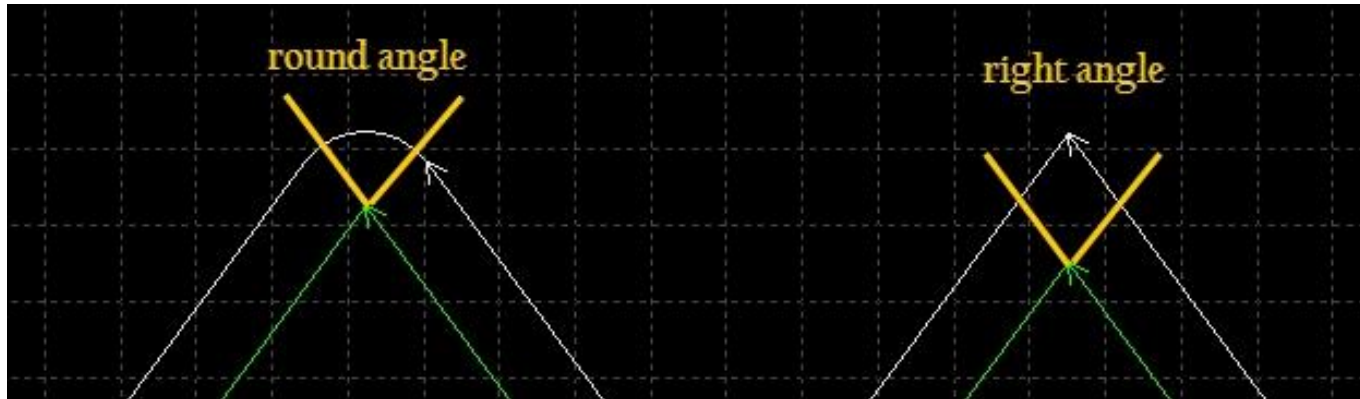
“Click the Button —  Compensate ||” on the toolbar for cutting compensation. The cutting width will be obtained in accordance with the actual cutting results. The compensated track will be shown in white on the drawing board and the system will run along the compensated track during processing. The compensated original drawing will not be processed and will be displayed on the drawing board only 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:



Cutting Compensation (Cont')-

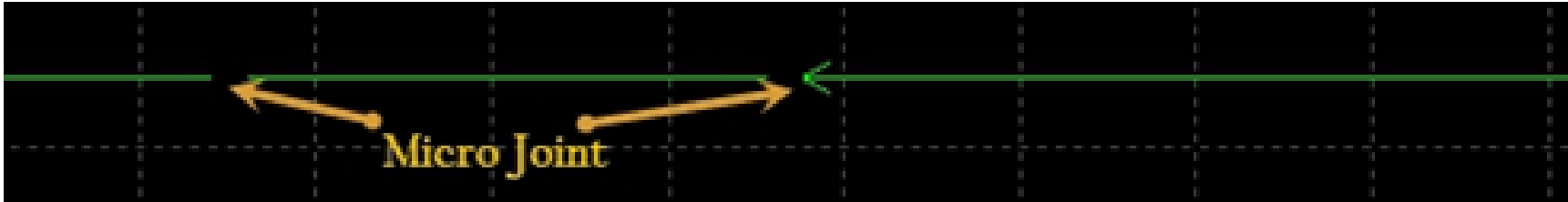



In the figure the green is the original, the white is the compensated track, and the light yellow is the vertical lines drawn from the corner. From the figure you can find that the cutting edges can coincide with the original after both sides of the vertical lines are compensated, while the corner needs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

To clear compensation, please select the needed graphics, then
“Click the Button —clear|| and choose —Clear Compensation||”.


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.

The length parameter of the micro joint can be set by clicking the **Button —  ||** on the toolbar, and the new parameters will be valid for the following operations.

Except adding the micro joints manually, CypCut also provides the function of inserting micro

joints automatically. Users can **“Click the Button —  Auto MicroJoint ||”**, 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.

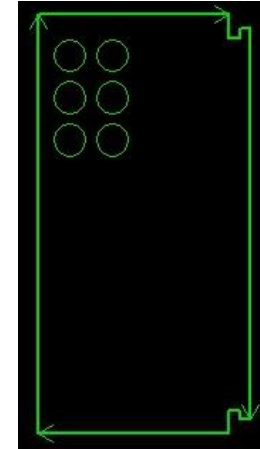
To clear the micro joints, users need to select the needed graphics, then

“Click the button —Clear|| and choose —Clear Micro Joint||”.

Group-

—Group|| in CypCut refers that multiple graphics and even multiple —Groups|| are combined to form a —Group||, and the entire —group|| will be regarded. 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

and **“Click the Button—****||”** to combine the selected graphics to a group.



Group (Cont'd.)-

If you need to cancel the group, please select the group, and then **“Click —Cancel||”** on the toolbar. If you would like to explode all the groups on the drawing board, please **“Click the small triangle below —Group||”**, then select **—explode all groups||**.

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||**. **The —Outer Contour||** of the **—Part||** will be shown in bold on the drawing board.

A **—Part||** should have **—Outer Contour||** and **—Inner Hole||**. And this is the basis of stock layout between **—Part||** and **—Part||**.

Although CypCut software allows you to group any graphics and operate them, 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.

1.) Sorting of Group-

The part will be regarded 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 overcast cut and yang cut automatically according to the geometrical containing relations.

2.) Processing of Group-

The group (the part) will be considered 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.

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

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 **“Coedging”**.

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 —CAD messages”** 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 Coedging will be combined to **form a —Group** after Coedging. 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 Coedging 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.

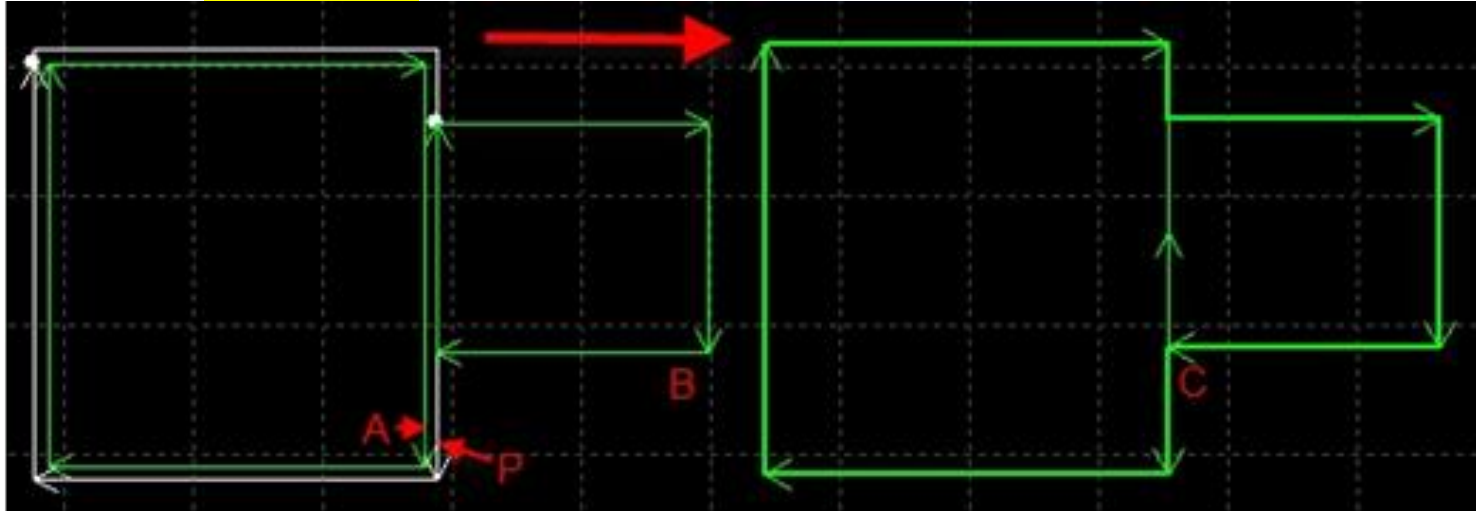
1.) Coedge Automatic Adsorption-

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 **"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 —Cancel Group||"** on the toolbar. You can combine them again through the **"Button —Group||"** after editing.

2.) Compensated Coedge-

If you hope to still retain the cutting compensation after Coedging, 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:



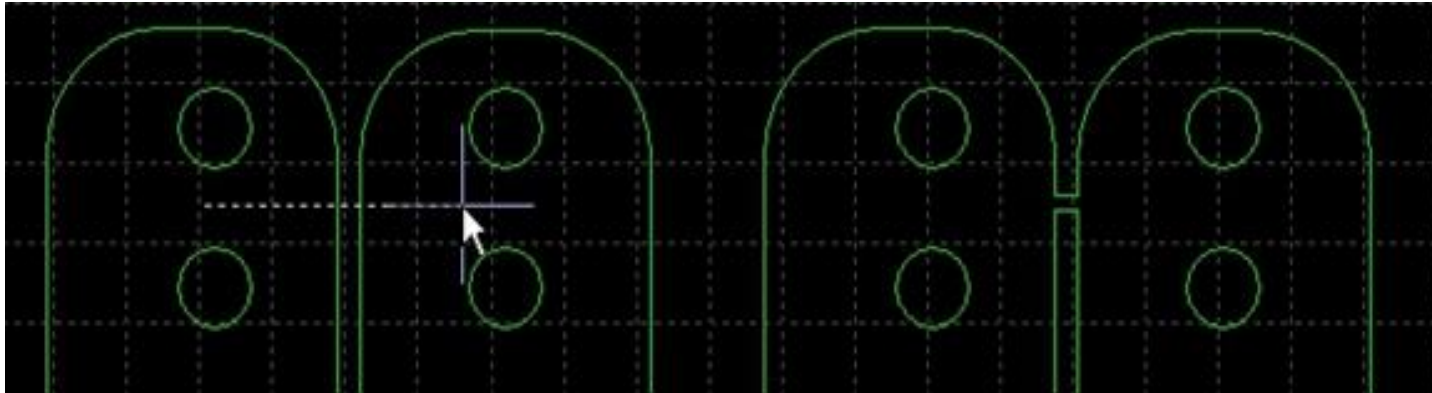
In fact, in the figure above, the original A cannot be Coedged with the graphic B, and only the compensated track P can be Coedged with it. Even if you move the graphic B to the position near to the original A, you still cannot Coedge them because it is not the track to be processed.

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 punch 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 —**  **”**, 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.

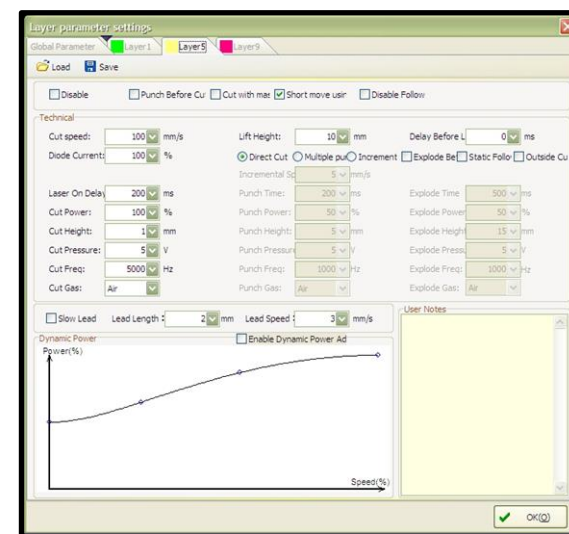
- 1) The first parameter specifies the Maximum distance between Two Adjacent Curves, and you can bridge them when the distance between two graphics is less than the specified parameter.
- 2) The second parameter specifies the Width of Bridge.

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.

Layer Parameters-

CypCut 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-

Descriptions/Technical of 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 machine can reach. As far as 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	Set the height from the laser head to the board during 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 P/W/M 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 P/W/M 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 P/W/M 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 P/W/M modulation signal during punching. Generally, low frequency is used during punching, and pulse punching is used to avoid burst.

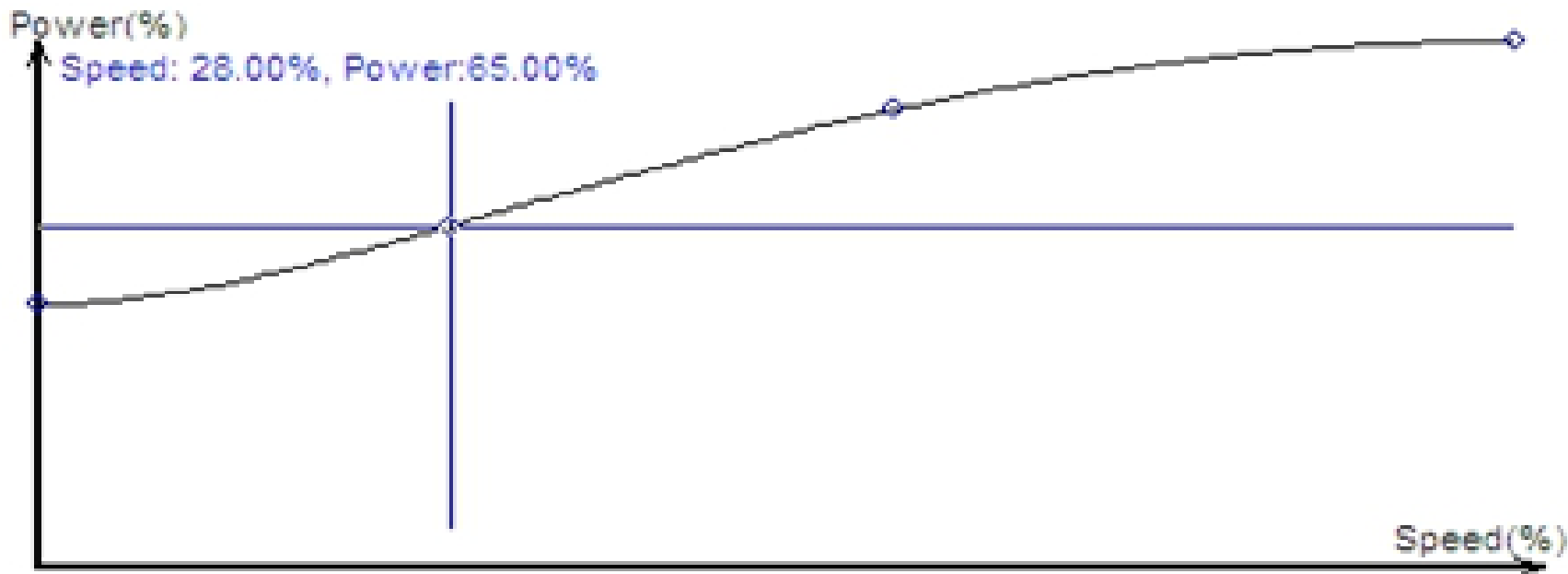
1.) Descriptions of Parameters (Cont'd.)-

<u>Descriptions/Technical of Parameters</u>	
Other Parameters	
Short Move Using Separate Laser Parameters.	
Disable Follow	Not use follower for following movement during
Enable Dynamic Power Adjusting	After starting the function, the system will conduct real-time adjustment for the laser power (duty ratio of P'wM) 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 leading. 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 lead-out. 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:

$$500W \times 90\% \times 80\% \times 62.43\% = 223.75W$$

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

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

If  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: $500W \times 90\% \times 80\% = 360W$.

3.) Punching Ways-

CypCut presets three punching ways, namely direct cutting, multiple punching, and incremental punching. Multiple punching and the incremental punching can be achieved only with the support of BCS100 follower. The specific processes of these three punching ways will be controlled by the preset PLC process. According to the default settings, the punching process of

—Direct Cutting|| is as follows:

- ☐ Follow to cut height
- ☐ Open gas
- ☐ Set cut press
- ☐ Gas delay
- ☐ Set cut frequency
- ☐ Set cut power
- ☐ Set cut mode
- ☐ Laser on
- ☐ Punch delay

The processes of **—Multiple punching** and **—Incremental punching** are as follows:

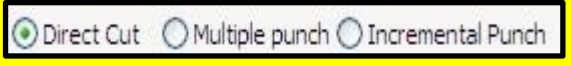
- ☐ Follow to punch height
- ☐ Hold
- ☐ Open gas
- ☐ Set punch press
- ☐ Gas delay
- ☐ Set punch frequency
- ☐ Set punch power
- ☐ Set punch mode
- ☐ Laser on
- ☐ Punch delay
- ☐ Incremental punching
- ☐ Follow to cut height
- ☐ Set cut press
- ☐ Set cut frequency
- ☐ Set cut mode
- ☐ Set cut power
- ☐ Delay

This step will not be performed in multiple punching.

In the incremental punching, it will fall down slowly to the cutting height from the punching height in the

4.) Pre-Punching-

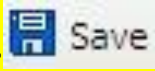
After selecting —  ||, it will punch firstly at all the needed positions when


processing this layer. The punching way will be specified by —  ||

in the layer. We do not recommend users to use —Direct Cutting||, because after completing the pre-punching, another punching still will be performed when cutting and it is the punching process of **—Direct Cutting||**.

5.) Material Lib-

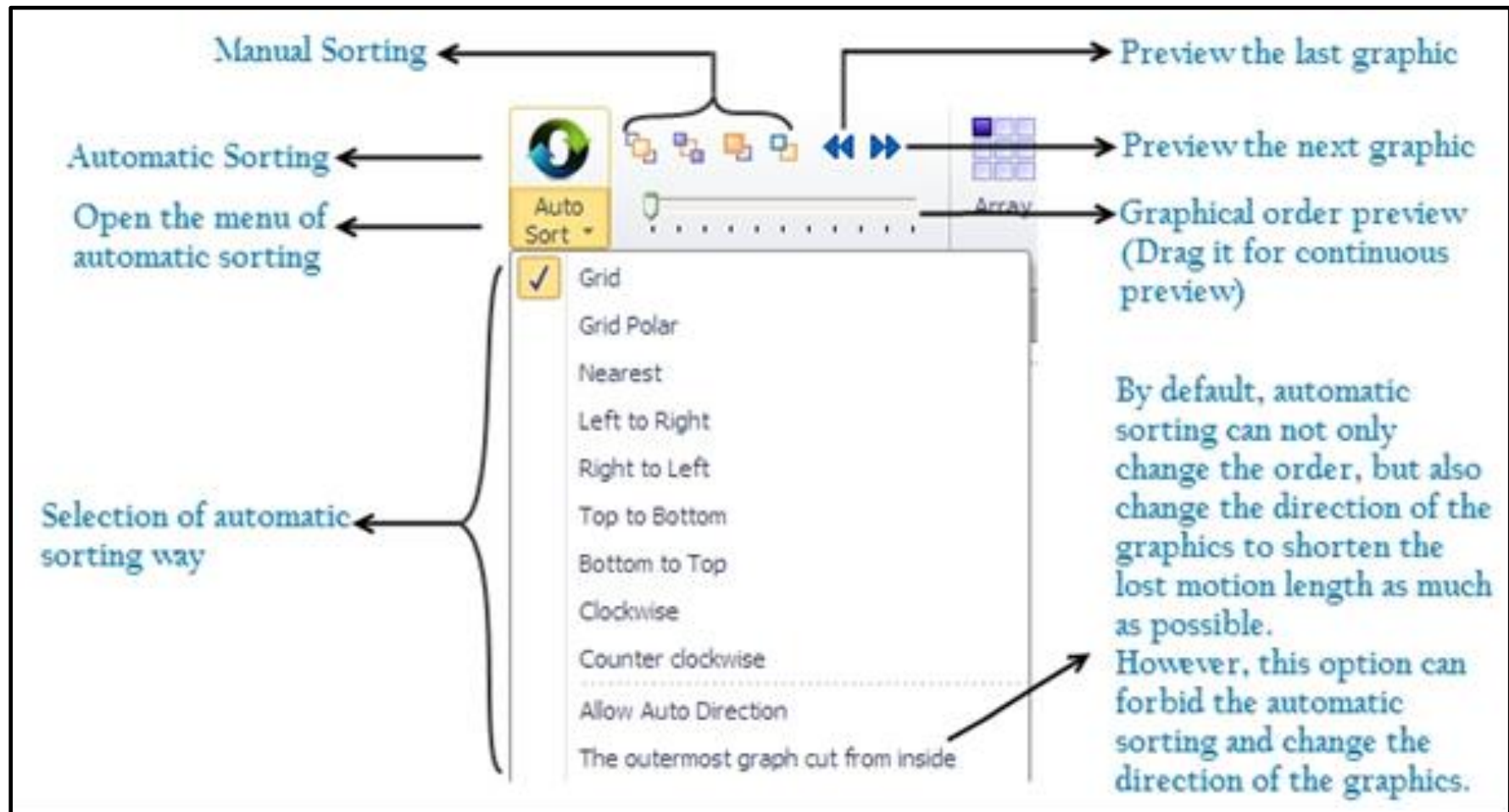
After editing all the parameters of the layers, you can save them to the material lib for the next

use. You can save them to the material lib by **“Clicking the Button —** **”** 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.

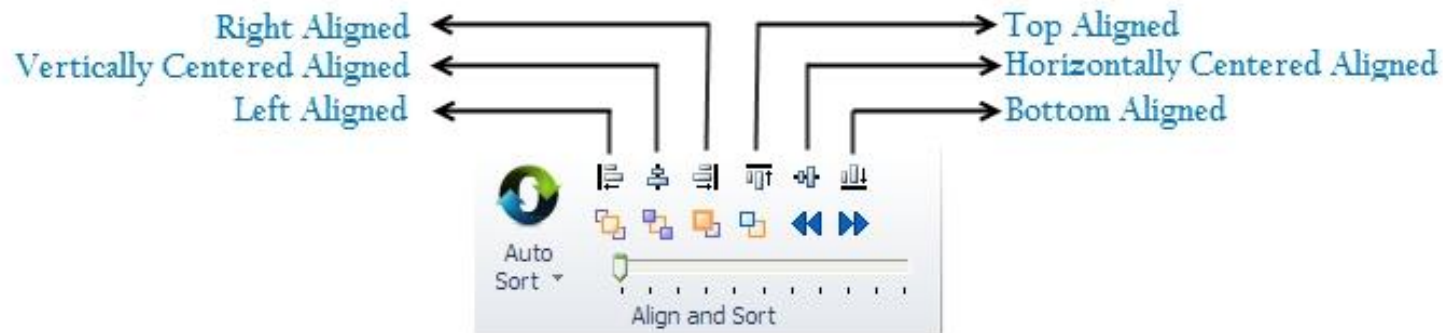
When you need to use the material lib next time, please **“Click the Button —** **”**, and then select the file saved previously. CypCut will prompt you **—Whether Covering the Current Parameters||**, and the system will import the parameters in material lib automatically when you **“Click —Yes||**; if you **“Click —No||”**, the system will cancel the reading operation.

Sorting and Path Planning-

Most of the functions of the path sorting can be found in **—Sort||** on the toolbar. As shown below:




If the window of CypCut is too small, you may not be able to see the entire toolbar as shown in the above figure on the **page —Start||** of the toolbar. In this case, you can find the column shown below in the **page —Drawing||** of the toolbar. It includes all the functions listed in the above figure, furthermore, there are tools for graphical alignment at the top. See the figure below:

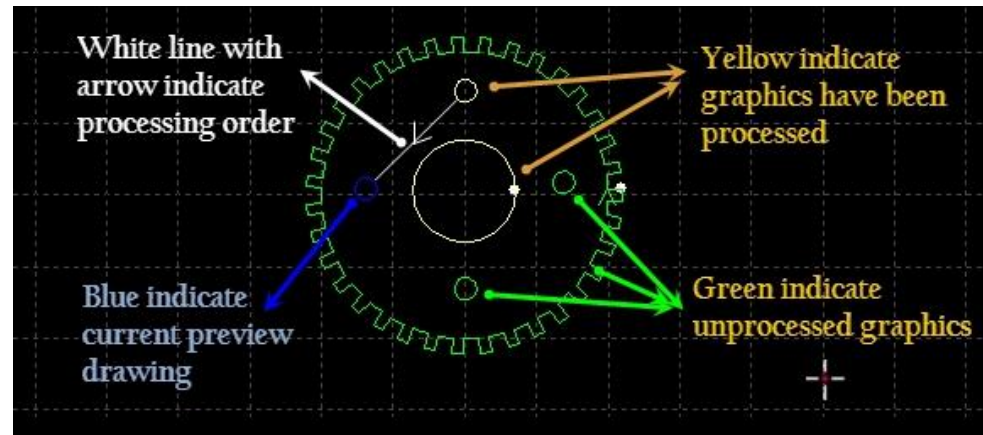



As for the rules of group sort, please see the **chapter —Group||**. If there is no special requirement, we recommend you select the way of **—Grid Sorting||**.

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 lost motion paths will be shown by clicking the button —  || on the toolbar, and they will help you to look over the whole processing order. See the contents in the chapter —Graphical Display Effect||.





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**




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

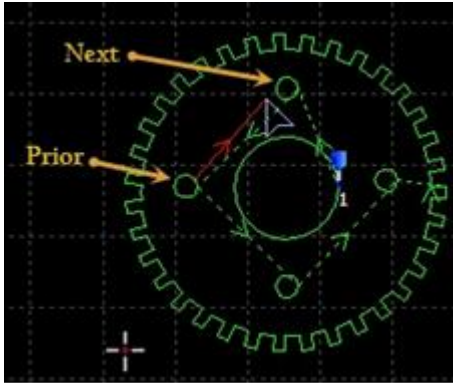
—Layer Parameter Setting||. See the chapter —Layer Parameters||.2.) Manual Sorting (Cont’d.)-
Except the manual sort of fine-tuning, you can also perform the manual sort more intuitively through **—Manual Sorting Mode||**. The system will enter the **—Manual Sorting Mode||** after you



“Click the Button — ” on the left toolbar of the main interface. The lost motion 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 one clicks 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 in the figure at right.

3.) Partition Sorting-

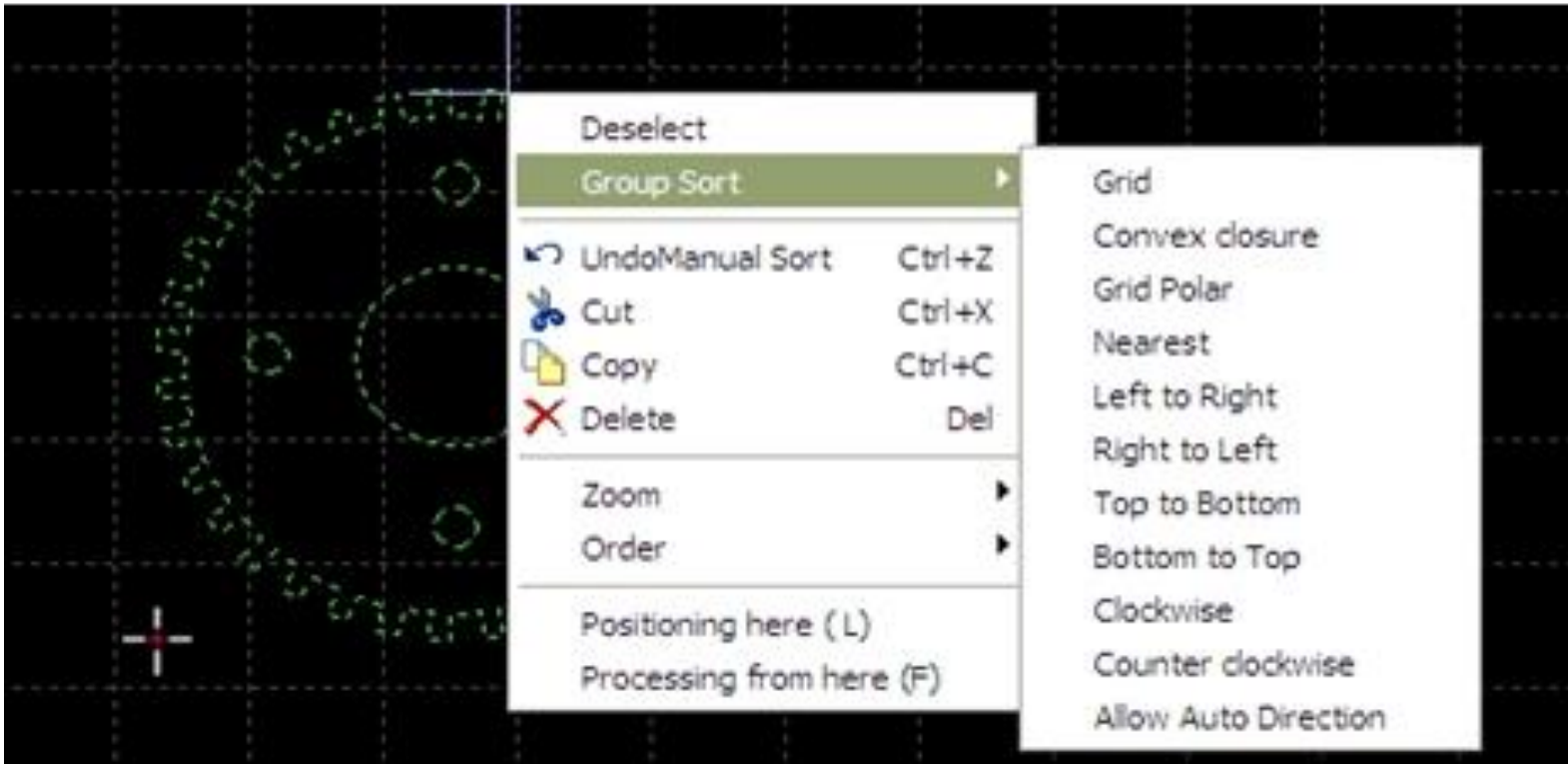
After completing sorting, the order of one part, if you hope to fix it, you can select the graphics needed to fix the order and then **“Click—Group||”**. After that, the order between them will maintain unchanged; besides, the subsequent manual sorting and automatic sorting will not influence the interior 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.


3.) Partition Sorting (Cont'd.)-

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||**.



4.) Simulation Processing-

After finishing the sorting, you can simulate completely the process of the entire file through simulation processing, and it can be done without the machine. In the simulation processing, you can see not only the order between the graphics but also the process within the graphics.


You can start simulation by **“Clicking the Button — ”** on the console. The toolbar will jump automatically to the page —Numerical Control||, and the first column of the page **—Numerical Control||** can adjust the speed of the simulation processing. As shown below.



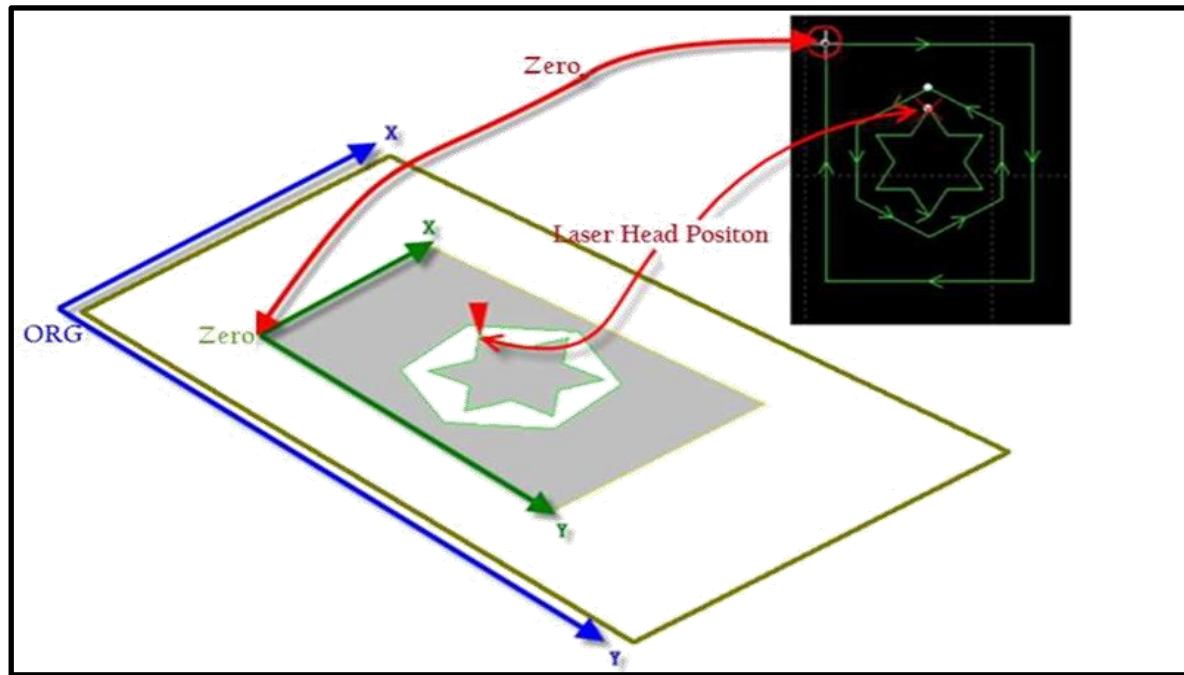
Work Control-

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.

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**

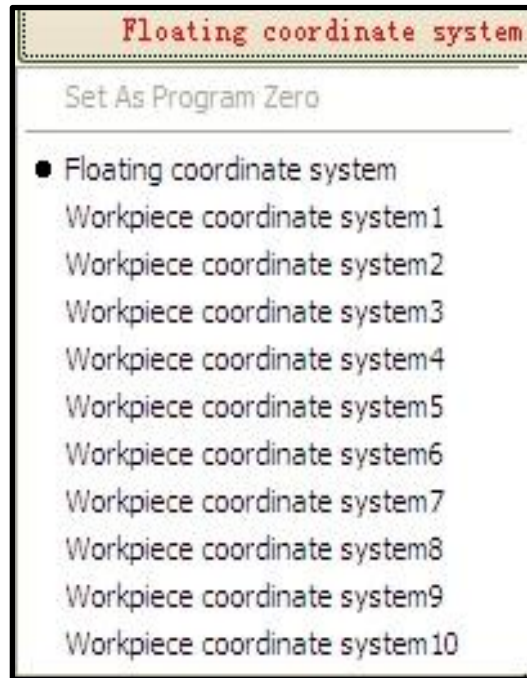
Origin|| after completing the initial installation or when the mechanical coordinate system deviates because of the abnormal reasons.

No matter which kind of mechanical structure is used, the definitions of 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.

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.

(Cont'd.) 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||** and **ten —Workpiece Coordinate Systems||**.

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 1~10, 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 1~10.

3.) Searching Zero Point after Exception Occurs-

Case 1

If the processing is interrupted only due to the exception of external equipment's 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 2

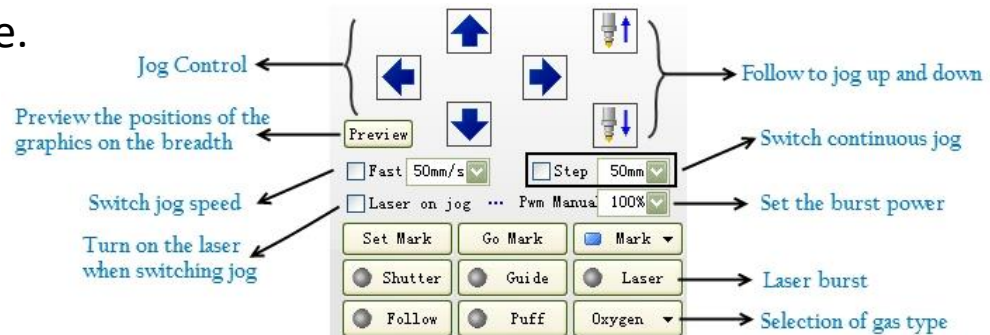
If the mechanical coordinate deviates due to suddenly power failure or servo alarm, we recommend the users to perform **—Return Origin||**, reset the mechanical coordinate system, and then **“Click —Return Zero||”** to find the zero point.

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 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 CypCut 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 pay attention to the information shown by the system 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 —Blowing||”** 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 —  ||”, and the machine can return to the previously recorded position by “Clicking —  ||” if required later. Six positions can be recorded in total, and they will be selected through “—  ||”.

4.4 Soft Limit Protection-

To protect the machine, CypCut 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||**.


4.5 Walk-

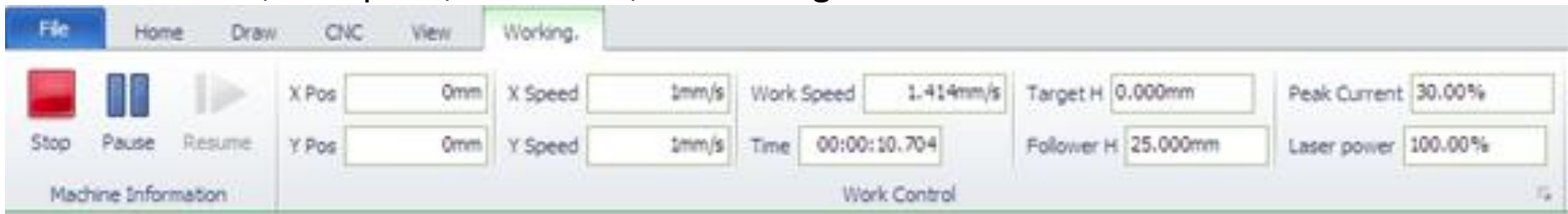
The laser head will dry cut a rectangle along the frame of the graphic to be processed by **“Clicking**

the Button —  **||”** 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||**.

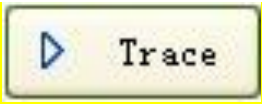
Note: If you look for the edges of the boards automatically using **—Edge Finding||**, the laser head will move along the inclined rectangle during walking move along the actual frame which is corrected by the **—Edge Seek||**. See the Chapter **—Edge Seek||** for the details.

4.6 Processing and Dry Cut-

You can start processing by **“Clicking the Button — ”** 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, 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 — ”** 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 **—Pre-punching**, are exactly same to the actual processing. You can also perform the same operations of pause, continue,

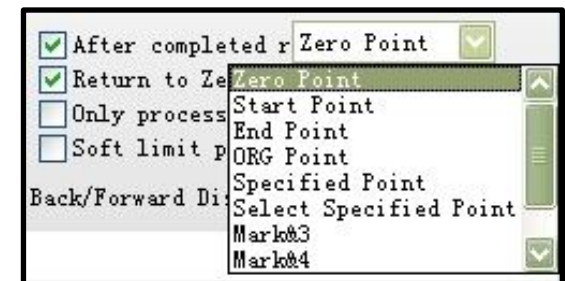
forward and backward; besides, the breakpoint memory after stopping is identical to that of the actual processing; furthermore, you can modify the parameters after pausing, and then continue the operation of dry cut. Thus, dry cut can be used for the comprehensive inspection and simulation of the whole 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—** the laser will not move after the processing. If you use the

—Floating Coordinate System—, we recommend you 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.

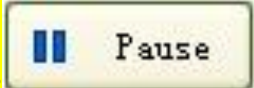
Every time when the processing is finished, the process count on the console will add 1, and when it reaches the preset times, a dialog box will be popped to prompt so that you can control

the production. You can clear the counts by **“Clicking the Button —  ||”**. If you need loop work, please **“Click the Button —  ||”**.

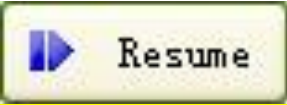
4.7 Stop, Pause and Resume-

If you need to stop the processing, please **“Click the Button —  ||”** on the toolbar or **“the Button —  ||”** 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 —  ||”** 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.

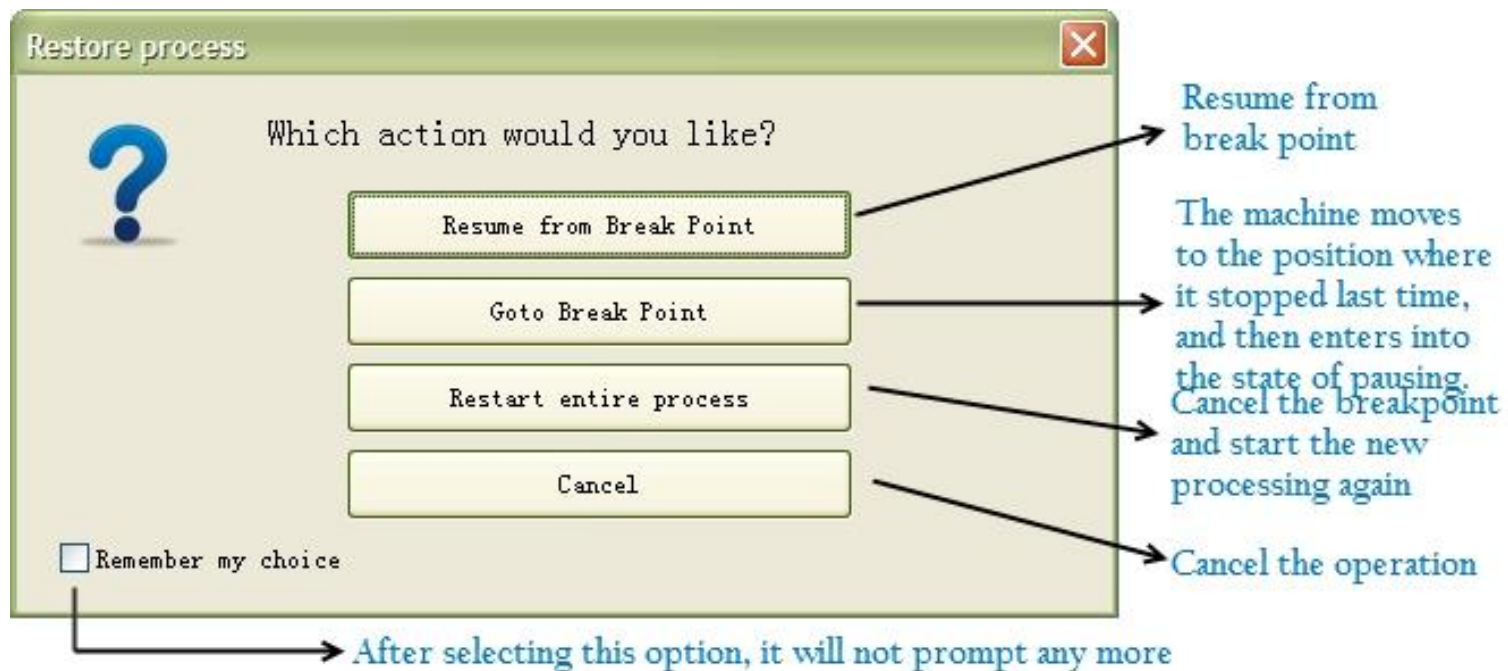
If you need to continue to work, please **“Click the Button —  ||”** on the toolbar or



the **“Button —  ||”** 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 —  ||”** or the **Button —  ||”** 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 —  ||”** on the console.

4.8 Breakpoint Memory-

If the processing stops or suspends due to accidents, the system will keep breakpoint memory. If 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:



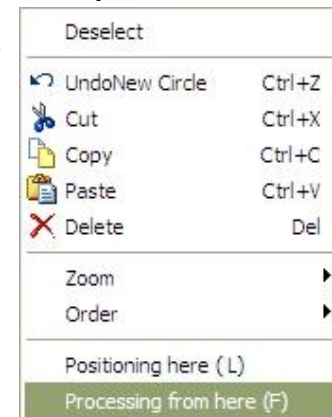
Only when the **“Start Button is in the State —  Start ||”**, the dialog box above will appear. If the **“Starting Button becomes the state —  Start* || with —*||”**, the machine will start to work directly from the starting point by **“Clicking the Button”**.

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 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.

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 ||.**

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.

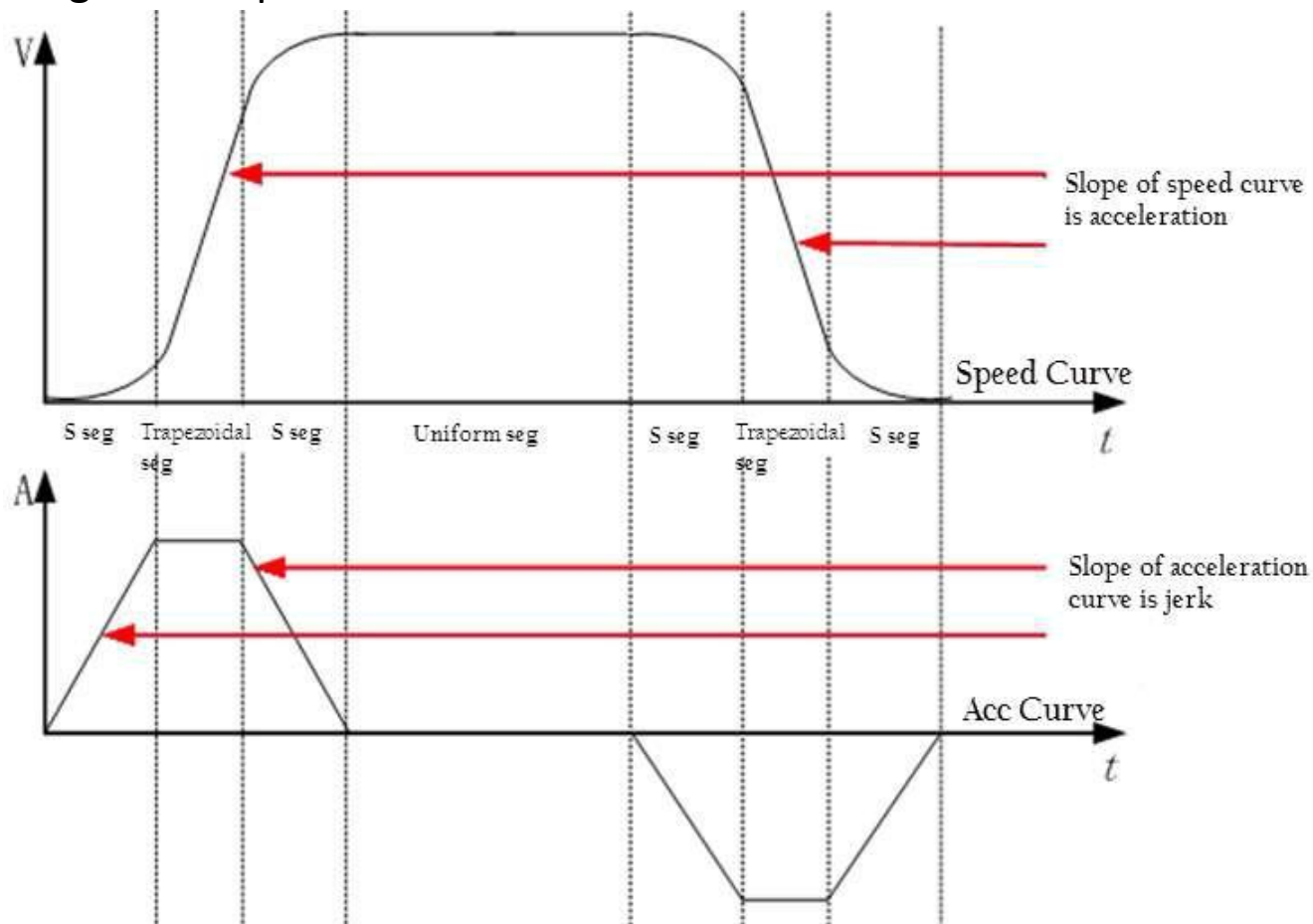
Descriptions of Parameters-

Some parameters of tab —Global ParametersII are list in the table below.

Motion Parameters	
Lost Motion Speed	Speed during lost motion (not the speed during processing).
Working Speed	Speed of walking.
Lost Motion Acceleration	The maximum acceleration of each shaft during lost motion. It needs to be used with move speed.
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.
Turning Jerk	The maximum acceleration when curvature of smooth curve changes sharply during track processing (such as runway type, which has the transition from the arch to a straight line). It is used to limit the

S-Shaped Acceleration and Deceleration-

Characterized by the advantages of continuous changes of acceleration and torque, S-shaped acceleration and deceleration is a flexible acceleration and deceleration algorithm and more suitable for servo motor control. CypCut uses S-shaped acceleration and deceleration to control the changes in the speed of movement, to achieve a more stable control and better processing effect. The drawing of S-shaped acceleration and deceleration is as shown below:



	mechanic shock of smooth curve in the case of abrupt curvature changes.
Processing Jerk	Change rate of acceleration at Segment S of S-type acceleration and deceleration during track processing. The smaller the value is, the smaller the mechanical shock during track movement is and the smaller the acceleration is. Conversely, the greater the value is, the greater the mechanical shock during track movement is and the greater the acceleration is.
Lost Motion Jerk	Change rate of acceleration at Segment S of S-type acceleration and deceleration during lost motion. The smaller the value is, the smaller the mechanical shock during movement is and the smaller the acceleration is. Conversely, the greater the value is, the greater the mechanical shock during lost motion is and the greater the acceleration is.
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
Delay for Retracting	Delay time for retracting when using IO follower in manual mode
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 <u>make a selection</u> according to your use habits, and the units will be switched in the interface.

When the jerk is approaching infinity, S-shaped acceleration and deceleration is equivalent to trapezoidal acceleration and deceleration. Jerk embodies torque, so we should set the jerk in comprehensive consideration of motor characteristics, machine load and other factors, and we should not seek after speed blindly.

Appendix of the Cypcut

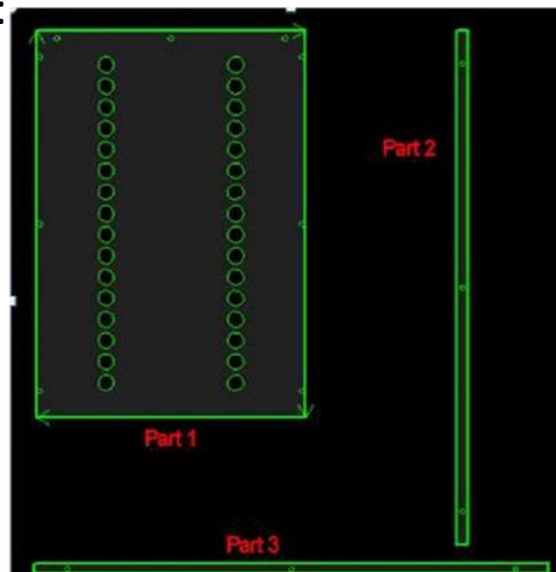
Example of Coedge Nesting-

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 ($9 \times 2 = 18$) 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:



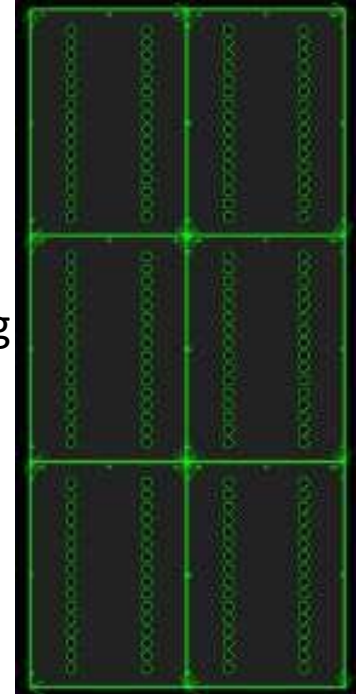
Step 1: First select all graphics of each part, respectively implement **—Group||**. After grouping, the outer contours of parts will be shown in bold.

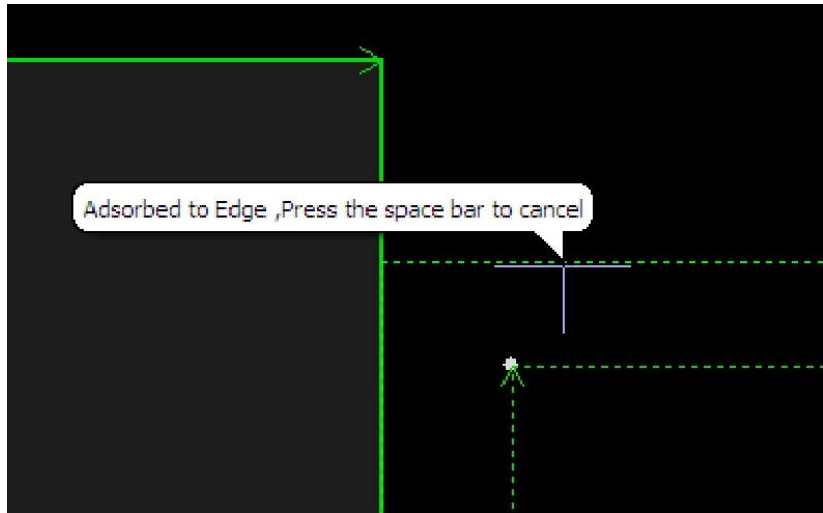


Select Part 1, and then make an array with 3 rows and 2 columns. As shown in the lower right figure.

Select the 6 arrayed parts, and complete coedge for the above 6 parts by clicking **—Coedge||**.

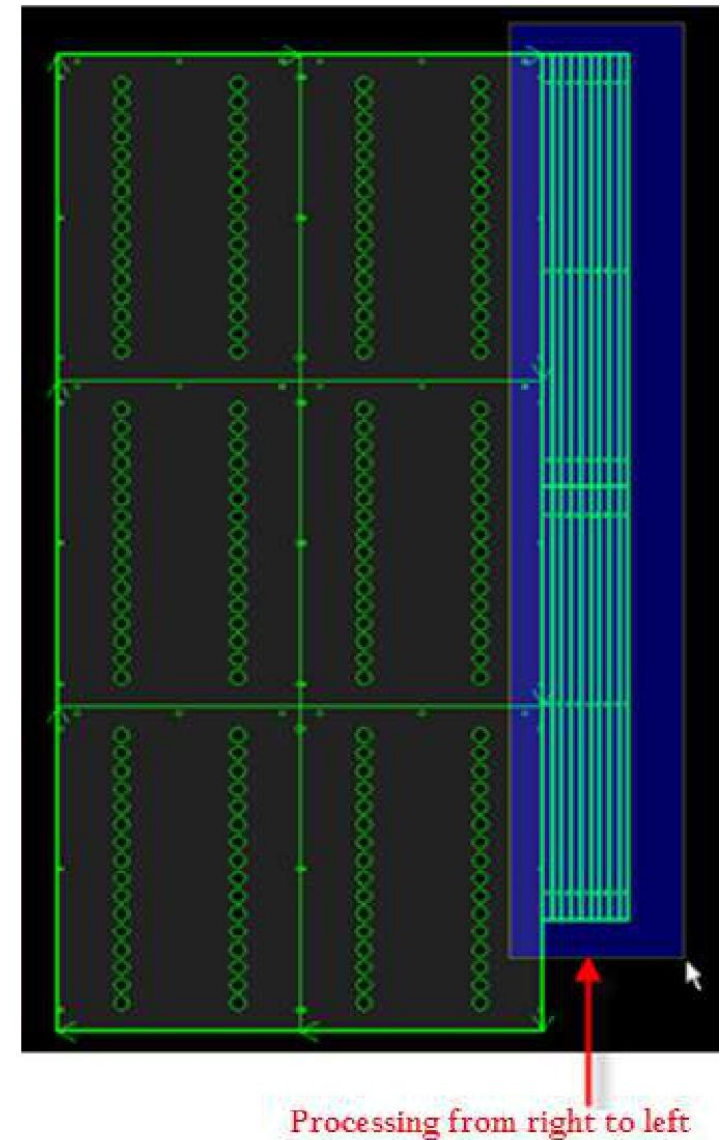
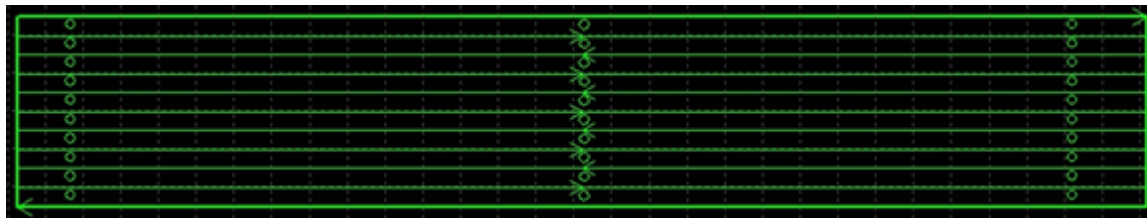
After dragging Part 2 to the position close to the top right position of the above figure, the parts will be automatically adsorbed to the boundary of Part 1 and become top aligned.

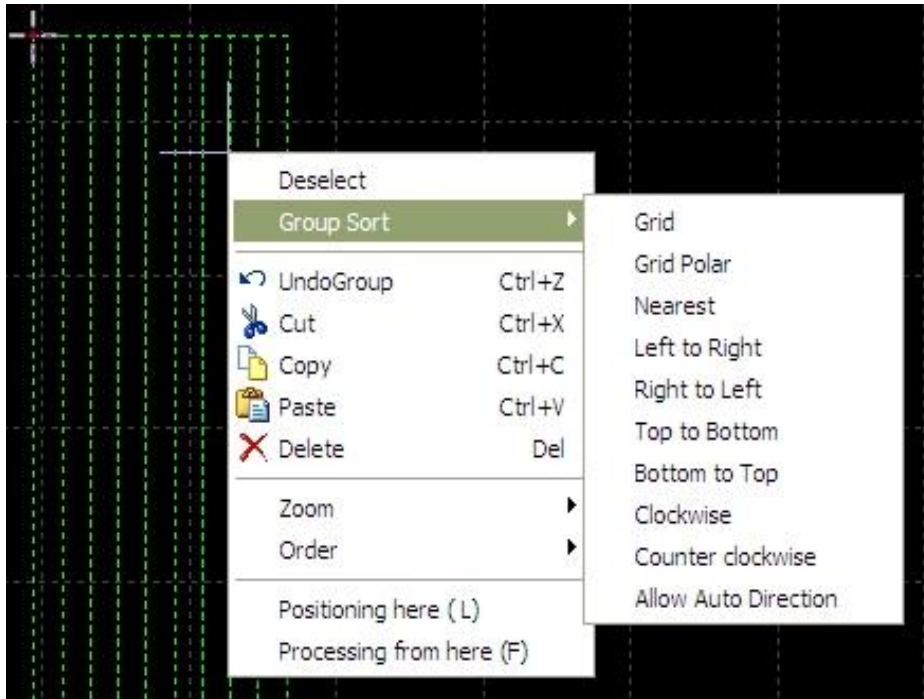




Select Part 2, make an array with 2 rows and 9 columns, and then obtain the figure shown at right.

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.





You can complete the coedge of 18 Part 2 by clicking —Coedgell. 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

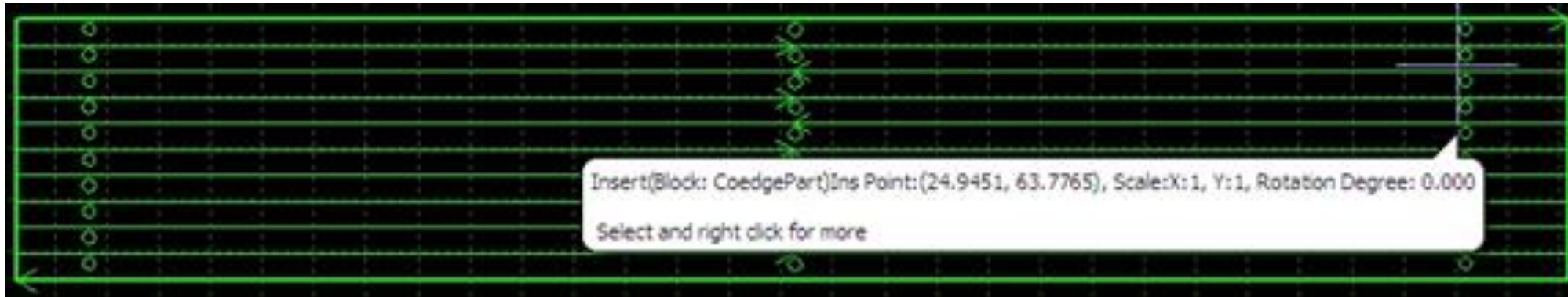
conduct selection.

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.

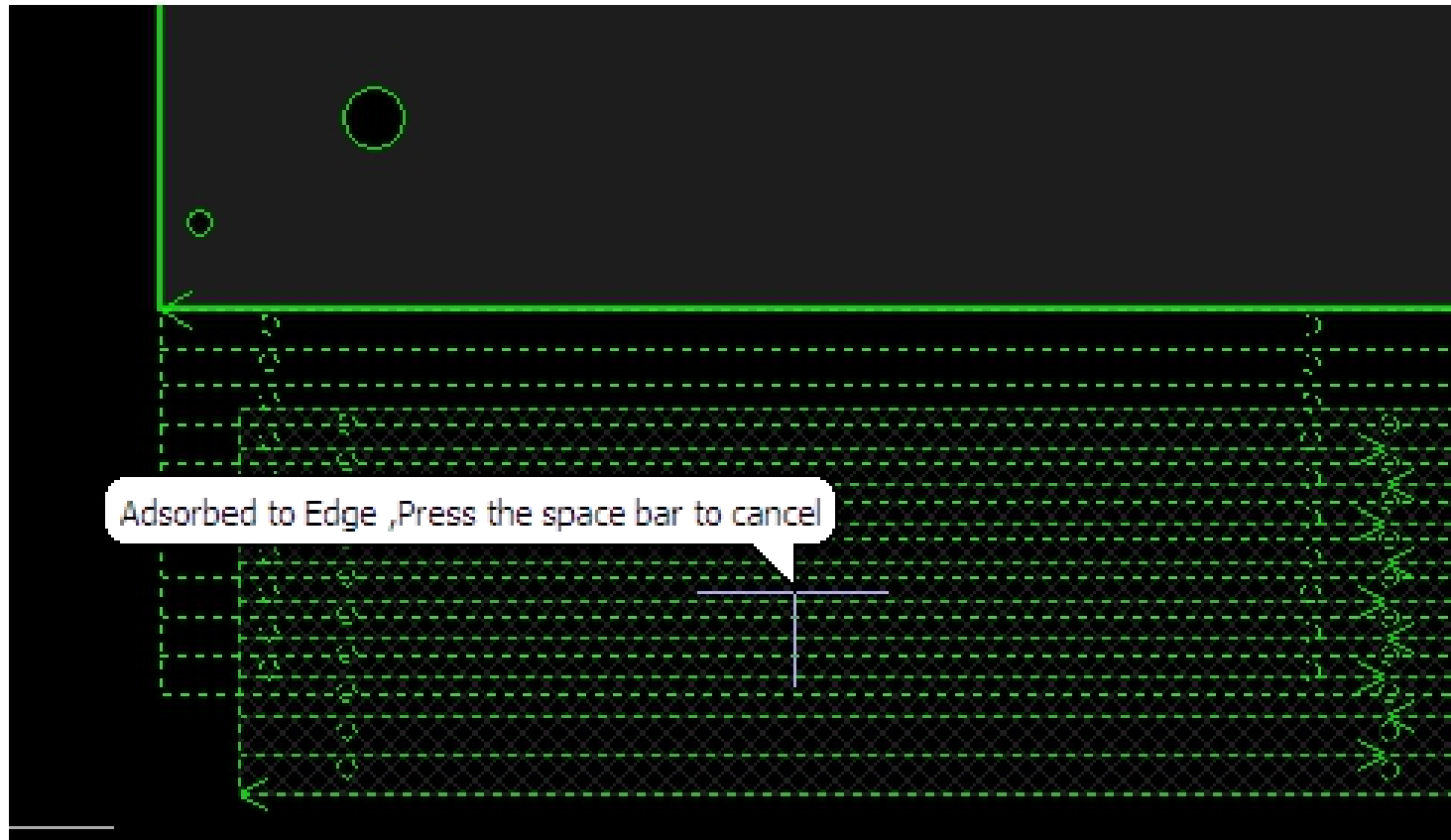
After selecting 10 Part 3 and clicking —Coedge||, the coedge of Part 3 is completed and they become a whole. As shown below. Please note that the thickness of the lines is different. Each Part 3 has a bold outline border before coedge, the whole has a bold outline border after coedge, and the coedged 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, 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.

5.2 Adjustment of Motion Parameters-

Parameter Range

It is recommended that users should first estimate the load status of the system before adjusting the parameters, to facilitate the follow-up parameter setting and determination. The corresponding relationship between the load and inertia ratio of the system are as shown below.

Light Load	Moderate Load	Moderate Load
Inertia ratio < 150%	Inertia ratio 150% - 300%	Inertia ratio above 300%

According to the load status, we can estimate the approximate range of parameters. As shown below (unit $W=10,000 \text{ mm} / \text{s}^3$).

Parameter Name	Default	Light Load	Moderate Load	Moderate Load
Lost Motion Jerk	4W	5W – 20W	2W – 5W	0.5W – 2W
Processing Jerk	2W	3W – 10W	1.5W – 3W	0.5W – 1.5W
Lost Motion Acceleration	1500	2000 – 5000	1200 – 2000	300 – 1200
Processing Acceleration	1200	1500 – 5000	800 – 1500	300 – 800
Turning Jerk	1.5W	1.5W – 4W	1W – 1.5W	0.3W – 1W
Turning Acceleration	600	700 – 1500	400 – 700	150 – 400

Parameter Name	Default	Light Load	Moderate Load	Moderate Load
Speed of 10mm Reference Circle	60	80 – 120	50 – 80	20 – 50

Parameter Determination

Method of determination: You can process a rectangle and require that the size of the rectangle be large enough. Then, you can conduct full acceleration and deceleration, accelerate it to the processing speed and see whether there are waves in the corner. If any, it is necessary to reduce the turning jerk. If not, this parameter can be increased.



Determination of Processing Acceleration

Method of determination: You can process the same rectangle and observe the moment curve of the servo and modify the acceleration and keep the moment curve in the accelerating section not more than 60% generally.

You need to make sure that the settings of the parameter will not cause the vibration of the machine. If mechanical rigidity is poor, a large cutting deformation may be caused due to the setting of large acceleration.

This parameter may affect the cutting accuracy of the small circle.

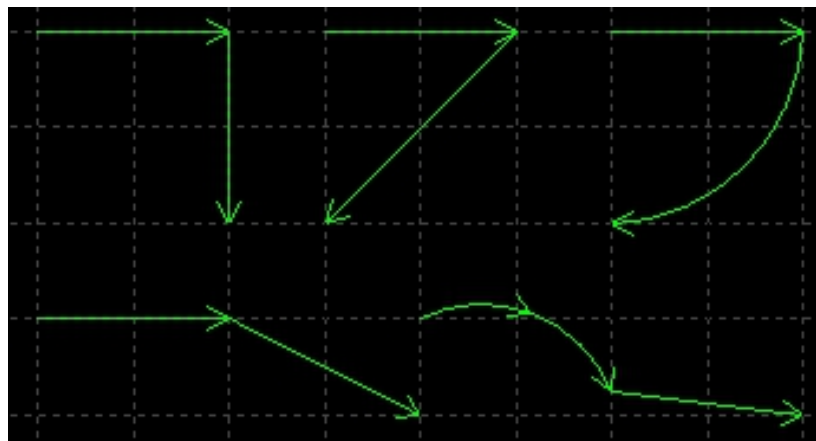
Determination of Turning Acceleration

Turning acceleration only affects the speed of flex point with an angle of greater than 90 degrees. When turning is not greater than 90 degree, the speed in the turning will decelerate to 0, which has no connection with the turning acceleration. The speed of the upper three turnings in the right figure (see the figures in the right picture) are affected by the turning a

Method of determination: After determining the processing acceleration and jerk parameters, you cut a regular hexagon and a regular dodecagon, and reduce the turning acceleration until there are no waves in the corner.

Determination of Turning Jerk

When the track is smoothly connected and the size and direction of curvature changes suddenly, the change of moment may be caused.



Determination of Turning Jerk (Cont'd.)

Therefore, it is necessarily to limit it through **—Turning Jerk||**.

Method of determination: You can look for some instances, such as flat runway and snowflake, and then determine whether there are waves after the curve turns at a corner. Generally, the defaults provided in the **—Approximate Range of Parameters||** can meet the requirements

Determination of the Speed of 10MM Reference Circle

Method of determination: You can draw certain small circles, whose radius are respectively

10mm, 8mm, 5mm, 3mm and others. You can improve the accuracy of circle through modifying **—the Speed of 10mm Reference Circle||**.

If the following phenomena occur during the process of cutting small circles, you shall adjust them according to the corresponding operations.

Phenomenon	Analysis and solutions
Circle Turns into oval	1) The servo response time of X and Y is not consistent with each other; 2) Speed feed forward is not enough.
Deformation in Acceleration Segment and Deceleration segment	Reduce the processing jerk; Reduce the processing acceleration.
Turn into Irregular Polygon	Reduce the speed of 10mm reference circle.
It Could Not be Cut into a Circle no Matter How Low the Speed is	Considerate the mechanical reversal clearance and installation errors.

Settings of Lost Motion Parameters

You can get the lost motion acceleration and lost motion jerk through multiply the processing acceleration and processing jerk by 1.2-2 times directly. You are only required to ensure that there is no machine shock, and the track precision is not demanded.

Integrated Debugging

To improve the precision: To reduce control error by adjusting servo and motion parameters and eliminate the track error caused by mechanical vibration; to reduce the errors of actuators by using thread pitch compensation.

To solve the problem of firing angle: To reduce the acceleration and deceleration time by increasing the jerk and acceleration; to use real-time power adjustment and adjust the power curve according to the technological requirements.

5.3 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 PointI and copy command	Select graphics to be operated
Ctrl + O	Open the file	None
Ctrl + P	Show/hide the graphic direction and lost motion 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 SettingsI	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

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 PointI and copy command	Select graphics to be operated
Ctrl + O	Open the file	None
Ctrl + P	Show/hide the graphic direction and lost motion track	None
Ctrl + V	<u>Paste graphic</u> 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 <u>all</u> of the graphics	None
F4	Check the whole machine range	None
F5	<u>Check the</u> graphics in the zone of selection	Select graphics to be operated
F6	Open the dialogue box —Layer Parameter SettingsII	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

Process Settings-

This chapter introduces the functions related to the process settings provided by the software. Since most of the process parameters are directly related to the material being cut, the laser used, and the air pressure, please set it according to the actual process requirements. All the parameters mentioned here, including the parameters in the picture, are only examples and should not be considered as guiding parameters.

Warning! Inappropriate or incorrect parameters may result in poor cutting or even damage to the machine. Please set it carefully.

Process Settings (Cont'd.)-

1.) Introducing Lead Wires-

◆ Distinguish between internal and external modes

When you open an external file such as IGES, the software automatically distinguishes between the internal and external modules. The software distinguishes the inner and outer molds according to the enclosing relationship, and always uses the outermost layer as the outer membrane, the lower layer of the outer membrane as the inner mold, the inner layer, and the outer layer, and so on.

When the lead is added, the outer film is masculine cut, introduced from the outside, and the inner mold is negatively cut and introduced from the inside. To manually set the cut and cut, select the graph you want to set, then click the "Inside and Out" button on the toolbar.

◆ Automatically Introduce Lead Lines-

Select the graph that needs to set the lead-out line, and then click the "Leader Line" icon on the toolbar to set the parameters for introducing the lead-out line in the pop-up window.

Please note that the automatic introduction of the leader line will search the graph to determine the most suitable lead-in position, so the parameters such as the lead-in position

and type before the graph will be overwritten.

◆ Check the Lead-in Line-

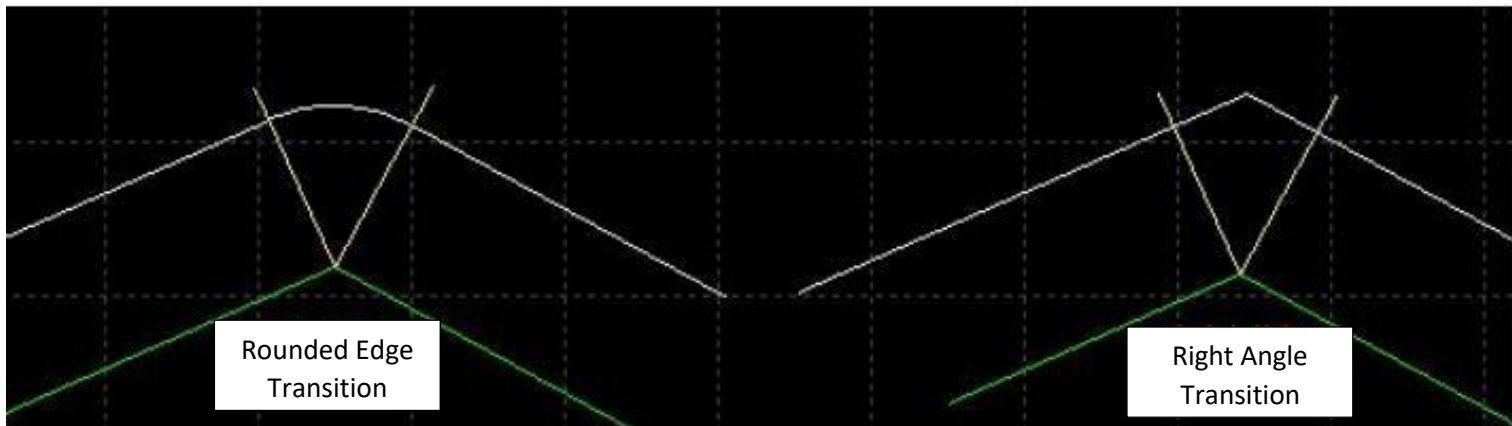
Click the small triangle under the "Cutter Line" button and select "Check Import and Export" to check the legality of the imported lead-out line. This function will shorten the lead with too long length to avoid crossing with other graphics.

◆ Cutting Seam Compensation-

Select the shape you want to compensate and click the Compensation button on the toolbar to perform the kerf compensation. The kerf width should be measured according to the actual cutting result. The compensated trajectory is indicated in white on the drawing board and will be operated with the compensated trajectory during processing; the compensated original image will not be processed, only in the drawing board. Easy to operate and display.

The direction of the kerf compensation can be manually selected, or it can be automatically judged according to the positive cutting and the negative cutting. The male cutting is compensated outward, and the negative cutting is compensated inward.

For kerf compensation, you can choose whether to round or right angle the corner, as shown below:



Process Settings (Cont'd.)-


In the figure, green is the original image, white is the compensated trajectory, and pale

Process Settings (Cont'd.)-

Yellow is the vertical line from the corner of the original image. It can be seen from the figure that the compensation of both sides of the vertical line can ensure that the edge of the slit coincides with the original image, but the corner needs a transition. Usually, the rounded transition ensures that the edge of the kerf remains coincident with the original image during the transition and runs lighter.

To cancel the compensation, select the graphic you want to cancel the compensation, then click the "Clear" button and select "Cancel Compensation".

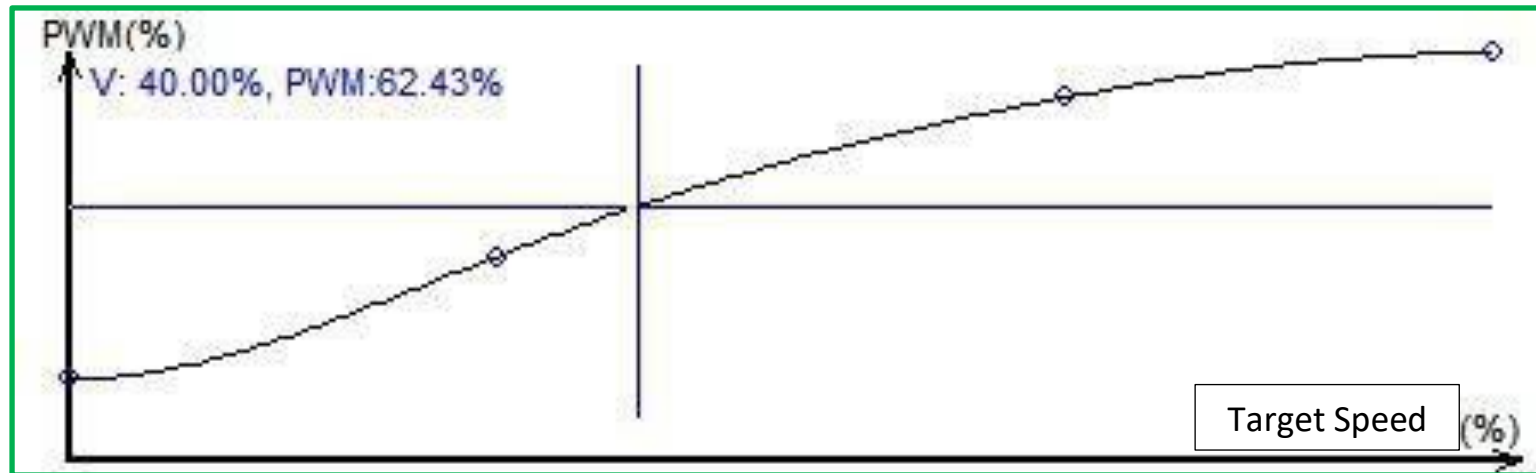
◆ Power Regulation-

If " Dymc Pwr Adj" is selected, the cutting power will change with the speed during the cutting process, and the specific change value is determined by the power curve. The power curve can be dragged and edited with the mouse.

The abscissa of the power graph is the cutting speed, and the ordinate is the cutting power in units of percentage. The table can reflect that when the actual movement to the

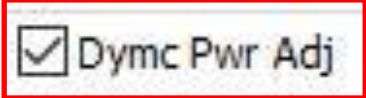
Process Settings (Cont'd.)-

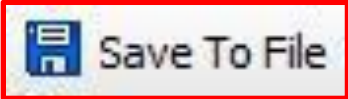
corner is reduced to a few percent of the target speed; the actual power needs to drop to a few percent of the cutting power.

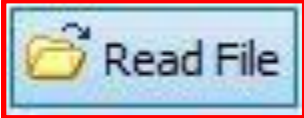


As shown in the figure above, if the laser power is 500W, the cutting speed is 100mm/s, the peak current is 90%, and the cutting power is 80%. When the actual cutting speed drops to 40mm/s, which is the red mark in the above figure, the laser Power is: laser power X peak current (percent) X cutting power (percent) X speed power adjustment (percentage) = 500W X 90% X 80% X 62.43% = 223.75W, but no matter how the power is reduced, it will not be low at a pre-set minimum value, typically 10%, or 50W.

Process Settings (Cont'd.)-

If "  " is not selected, the power will remain unchanged during the cutting process. In the above example, the power during the cutting process is $500W \times 90\% \times 80\% = 360W$, after all the parameters have been edited, the user can save all the parameters in the layer to the material library for further use. **"Click the "**

 **Button** and enter the file name to save it as a material library. It is recommended that the user set the file name with the material characteristics as the name, such as: 2mm carbon steel.

The next time you need to use the material library, click "  " and select the previously saved file. The software will prompt the user to "Do you want to overwrite the current parameters", please click "Yes" system will automatically import the material library parameters, "No" will abandon the read operation.

Process Settings (Cont'd.)-

The control software is a set of software that assists in the design and processing control. All the drawings and parameters can be removed from the machine. After the design is completed, the file can be saved and then copied to the machine for processing.

1.) Mechanical Coordinate System-

The machine coordinate system is uniquely determined by the machine structure and machine parameters. The coordinate system established by "return to the machine origin" is consistent at any time.

Regardless of the mechanical structure used, the software defines the coordinate system to be consistent. All movements are the movement of the laser head relative to the workpiece. The laser head is X forward in the right direction and the Y head is backward in the laser head. That is, the lower left corner of the work piece (steel plate) is the minimum coordinate, and the upper right corner is the maximum coordinate.

The rotation axis forms a difference complement with the Y axis, parallel to the Y axis. When looking at Y+ from the Y- direction, it rotates counterclockwise to forward rotation and clockwise rotation to reverse rotation.

2.) Looking for Zero after an Abnormality Occurs-

◆ Situation One-

If only a peripheral such as a laser or an auxiliary gas is abnormal, the processing is interrupted, and the coordinate system is not shifted. You can click "zero back" directly to return to zero.

◆ Situation Two-

If sudden power failure, servo alarm, etc. will cause the mechanical coordinate system to become an offset abnormality, it is recommended that the user perform the "return to the mechanical origin" to reset the mechanical coordinate system. Then click "Zero" to find the zero point.

3.) Alarm

The software monitors all components during the operation of the machine. Once the alarm is detected, it is immediately displayed in the red title bar and measures such as stopping the movement are taken. Many operations will be disabled until the system alarm is cleared. Please check the machine until the alarm is cleared. The alarm example is shown below:

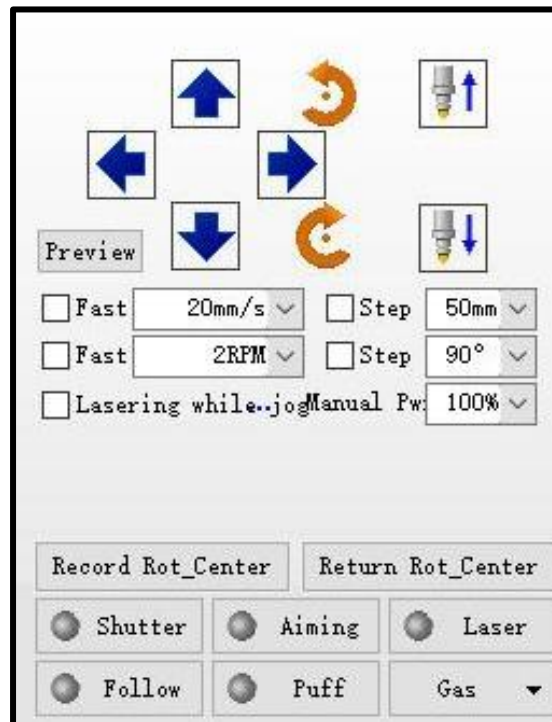


title bar disappears and the information in the **"System Message Window"** is retained. Double-click the System Message Window to open a view of all history to see what happened during system operation.

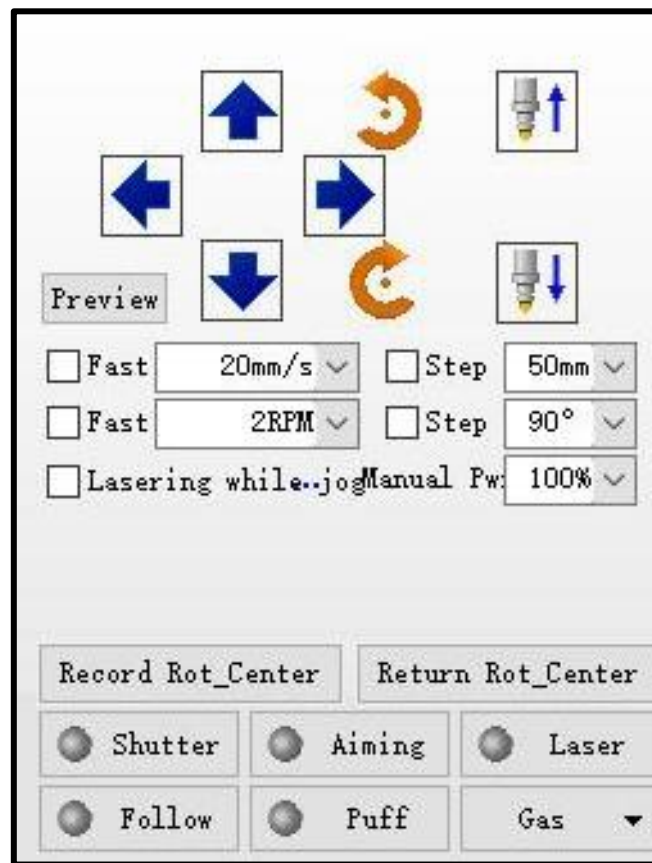
In addition to the alarm, if the software detects other abnormalities, it will be displayed in the **"System Message Window"** in different colors according to the abnormal level, including warnings, reminders, messages, and so on. This information does not cause the machine to stop moving, but it is still recommended that you should pay attention to all kinds of messages displayed by the system in time to take necessary measures as soon as possible.



4.) Manual Test-

The console manual control part of the function is shown below:



4.) Manual Test (Cont'd.)-





Buttons with the "  " icon will change to "  " after the corresponding device is turned on. The "laser" button is pressed to turn on the laser, release to turn off the laser; the other buttons are pressed to switch, release without performing any action, such as "Blowing", press the air, press again to close the air. Depending on the laser, the "gate" may

4.) Manual Test (Cont'd.)-

become "" in a pattern after it is pressed, and this state is read from the laser.

Please note that all button actions require the corresponding component support on the machine. If the machine does not have these components configured, or if the platform parameters are not configured correctly, some of the buttons may not work.

Click "" to record the current position of the machine as the W axis rotation center. Then, when needed, **Click** "" to return to the previously recorded position.

5.) Soft Limit Protection-

To protect the machine tool, the software has built-in soft limit protection, which can be turned on and off through the "" option on the console and is enabled by default.

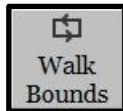
5.) Soft Limit Protection (Cont'd.)-

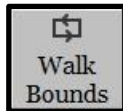
After the soft limit protection is enabled if the system detects that the motion may exceed the travel range, it will prompt “The motion has exceeded the travel range” and no motion command will be issued to prevent possible impact. In this case, check the graphics and machine position and confirm that it is correct.

In addition, the system will monitor the machine coordinates in real time during the movement of the machine. Once the soft limit is exceeded, it will immediately alarm and stop all movements.


Please Note: The soft limit protection depends on the machine coordinate system. If the coordinate system is incorrect, the protection will also be incorrect. Therefore, when the system is abnormally closed, machine parameters are modified, etc., the correct machine coordinate system should be established by “return to origin” operation!

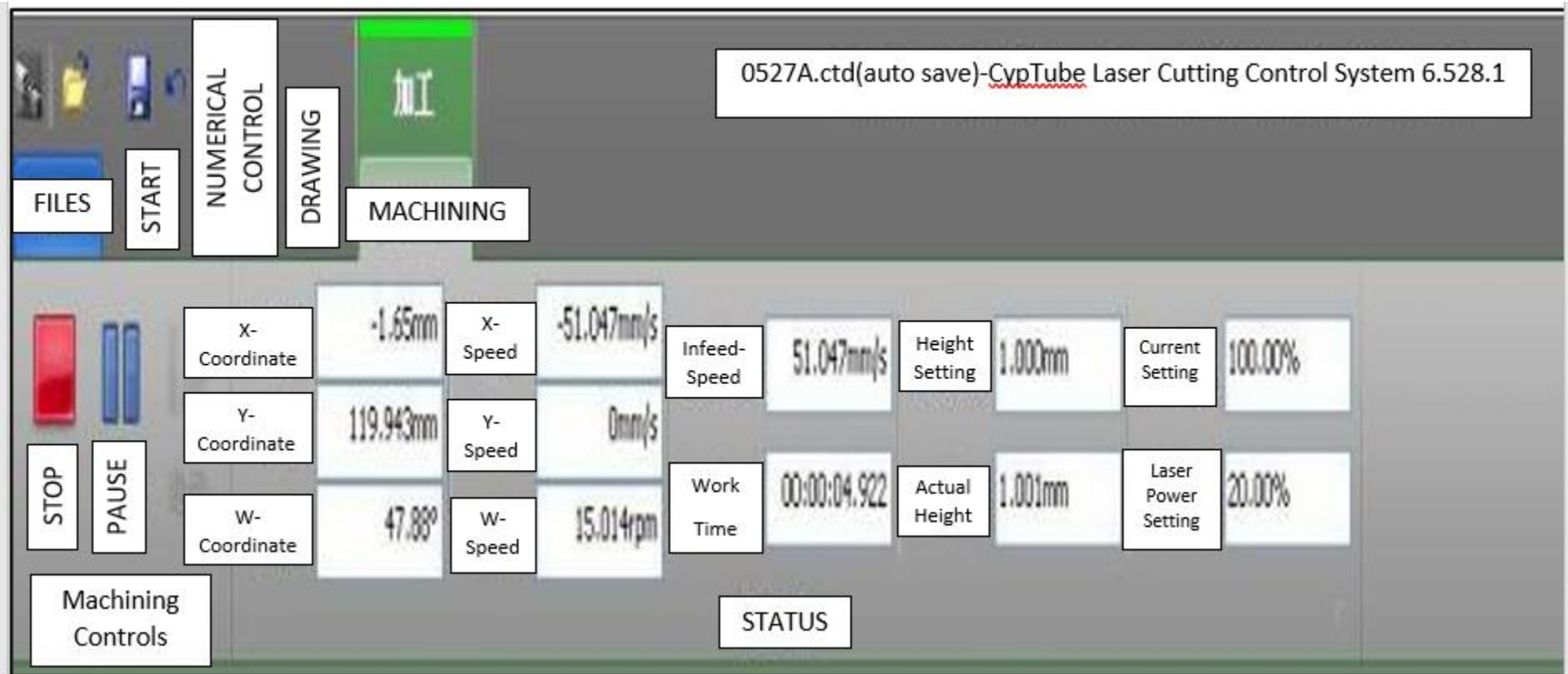
6.) Walking the Border-



“Click on the “  **” Button”** on the console and the laser head will take a rectangle along the frame of the graphic to be machined so that you can determine the approximate size and position required to process the sheet. The speed of the border is set in "Layer Parameter Settings" - "Global Parameters" - "Edge Detection Parameters". Please note that it is important to make sure that the center of rotation has been recorded before taking the border!

7.) Processing and Travel-


“Click the “  ” Button” on the console to start machining. During the processing, the monitoring screen shown in the figure below will be displayed, including coordinates, speed, machining timing and following height.



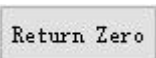
When the above image is displayed, you will not be able to switch to other tabs in the toolbar. This is to prevent the graphics from being modified during processing, but the File menu is still available. To modify the parameters during machining, pause first, then click the Layers button on the toolbar on the right side of the interface.

7.) Processing and Travel (Cont'd.)-




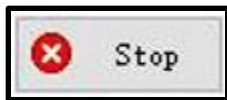


"Click the "  **" Button"** on the console to open the air. The difference between the Travel walks and the actual machining is that the laser is not turned on, the gas is not turned on, and the follow-up can be selected. All the running tracks, including the "pre-perforation" air movement, the speed and acceleration and deceleration processes are the same as the actual machining process, and can also be paused, continued, forwarded, and retracted. The break point memory after stopping is the same as the actual machining, and the parameters can be modified after the pause goes away. Therefore, Travel can be used to perform a comprehensive inspection and simulation of the overall machining process without cutting.


Increments of 1. After a preset Target number, a dialog box will pop up to control the output.



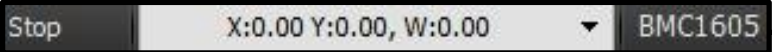
"Click the "  **" Button"** to clear the count. For cycle processing,

"Click the "  **" Button"**.

8.) Stop, Pause and Continue-


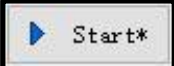
To stop machining, **"Click "**  **" on the toolbar or the "**  **" Button"** on the console. After stopping, the machine will return to zero. If you do not want to return to zero, please cancel the selection of the item on the console. If they want to pause the processing, **"Click the "**  **"Button on the toolbar or the "**  **" Button"** on the console.

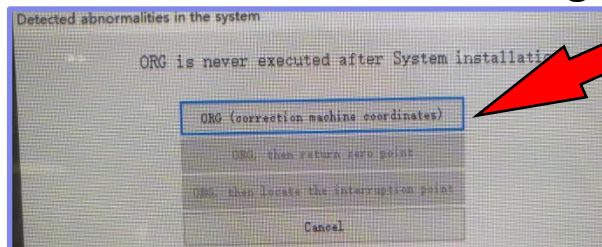
After the pause, you can **“Click the "Layer" Button** on the right toolbar to modify the parameters, or you can operate the manual control section on the console. The functions include laser spotting, switching gas, switch following, etc., but cannot make the machine move. To continue processing, **“Click the "Continue" Button on the toolbar** or the **“ Button** on the console. If the parameter is modified during the pause process, the **“Continue” Button** will be marked with a **“*”**. This means that the system needs to regenerate the machining command. Depending on the size of the file to be processed, **“Clicking “Continue”** may require more time to wait.

During the pause process, you can “Click ”  ” or ”  ” to move the machine backwards or forwards along the machining path. The distance and speed of each movement are set at the console “  .

9.) Breakpoint Memory-

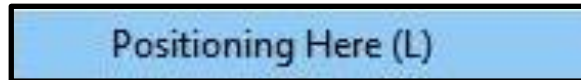
If the machining process stops or the machining is aborted due to an accident, the system will memorize the breakpoint. If the graphic or parameter is not modified, **“Click “Start”** again, the system will ask whether to continue processing from the last stop, as shown below:

The dialog box shown above will only appear when the **Start Button** is in the ”  ” state. If the **“*”** changes to ”  ” in the **Start Button**, **“Clicking the Button”** will start machining directly from the beginning.




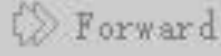
10.) Starting from any Position-

The software supports machining from any specified location, right-clicking where you want to start, and then selecting "Start machining from here." As shown below:



For safety reasons, after selecting "Start Machining from Here", the system will pop up a dialog box asking for confirmation again. After confirming the error, the system will first move to the position you specified first, and then start machining from there. The track before the specified position will not be processed.

If you want to locate the specified position first, but do not start machining, select "Locate here", the system will move to the position you specified, and then enter the pause state.

You can right-click multiple times and select "Locate here" until you are sure. It can also be positioned in a more precise way with the "  Back " and "  Forward " Buttons.

11.) Global Parameters-

Some of the motion control parameters are available in the "**Global Parameters**" **Tab** of the "**Layer Parameter Adjustment**" dialog box. Adjusting these parameters will affect the smoothness of the machine and the processing effect and efficiency.

12.) Parameter Description-

The following table lists some of the parameters of the **“Global Parameters Tab”**.

	The Speed of taking the Border.
Maximum Speed of the rotating shaft during working.	Please calculate the appropriate value according to the maximum speed of your servo motor combined with your reduction ratio. For example: the maximum motor speed is 3000r/min, the reduction ratio is 1:60. Then the maximum rotation axis Speed = $3000/60=50\text{r/min}$ during working.
Empty Shift Speed.	When the motion is idling, the maximum acceleration of each axis is generally set to 1.2~2 times of the working acceleration.
Working Speed.	The maximum acceleration of each axis during trajectory machining is used in conjunction with the working speed.
Turning Acceleration.	The maximum acceleration allowed at the corner of the path during trajectory machining is used to limit the cornering speed greater than 90 degrees. The corner speed of 90 degrees or less is reduced to zero.
10 mm reference Circle Speed.	Used to limit the speed of small arcs and small curvature graphs.

12.) Default Parameter Description-

<u>DEFAULT PARAMETER</u>	
Point injection PWM frequency	PWM frequency used by the laser in manual mode.
Point Peak Current	Peak current used by the laser in manual mode.
Default Pressure	Air Pressure used in Manual Mode (Required with Proportional Valve).
Air Release Delay	Delay time used by the PLC step " Opening Delay " during the piercing process.
First Air Opening Delay	The air-opening delay called by the first hole in the entire drawing process.
Ventilation Delay	Delay in switching different gases during the cutting process.
Directly Follow the Maximum Height	When the height is lower than the set value, direct follow is used; when the value is higher than the set value, follow the set height.

12.) Advance Parameter Description-

ADVANCE PARAMETER	
Curve Fitting Accuracy	Edge Speed.
Maximum Air Movement length that does not lift up short distance	If "Enable short distance is not raised" is checked in the layer parameters, when the air movement length is less than this length, the light is off but not raised. The specific process is determined by the "short-distance light-off process".
Use Leapfrog	The Z-Axis is lifted to half the height, and the X, Y- Axis starts to move empty to achieve the purpose of shortening the movement time of the lost motion.
Enable follow-up when walking	By default, the Z-Axis will not move when it is empty. If it needs to follow when it is empty, the user can select this item.
Disable follow-up during Machining	By default, the Z-Axis is moving during machining. If you do not need to follow during machining, you can select this item.
Unit Selection	By default, the Z-Axis is moving during machining. If you do not need to follow during machining, you can select this item.
	According to the usage habits, the interface will switch.

Appendix-

1.) Square Tube Debugging-

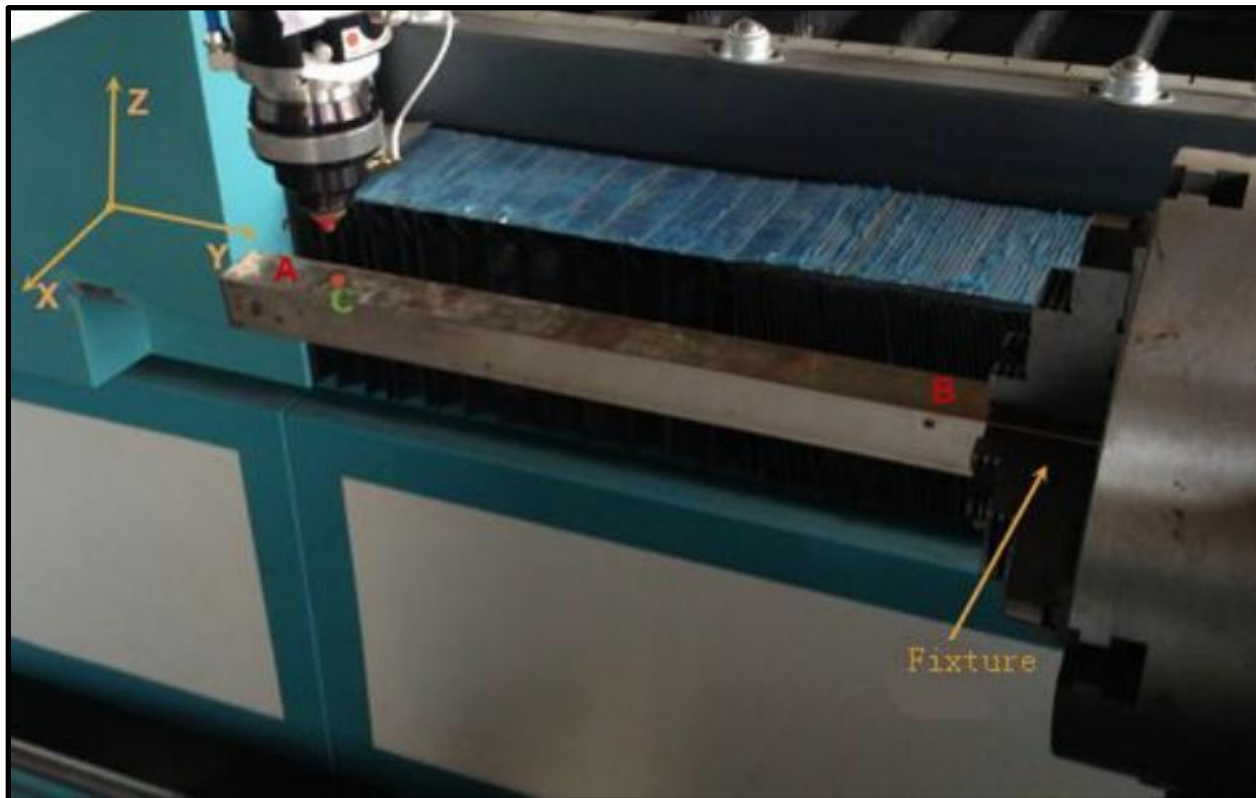
Make sure the tube is placed along the Y-Axis.

- Adjust the Horizontal Direction-

Adjust the height of the ends of the pipe AB at the same horizontal position, debugging steps:

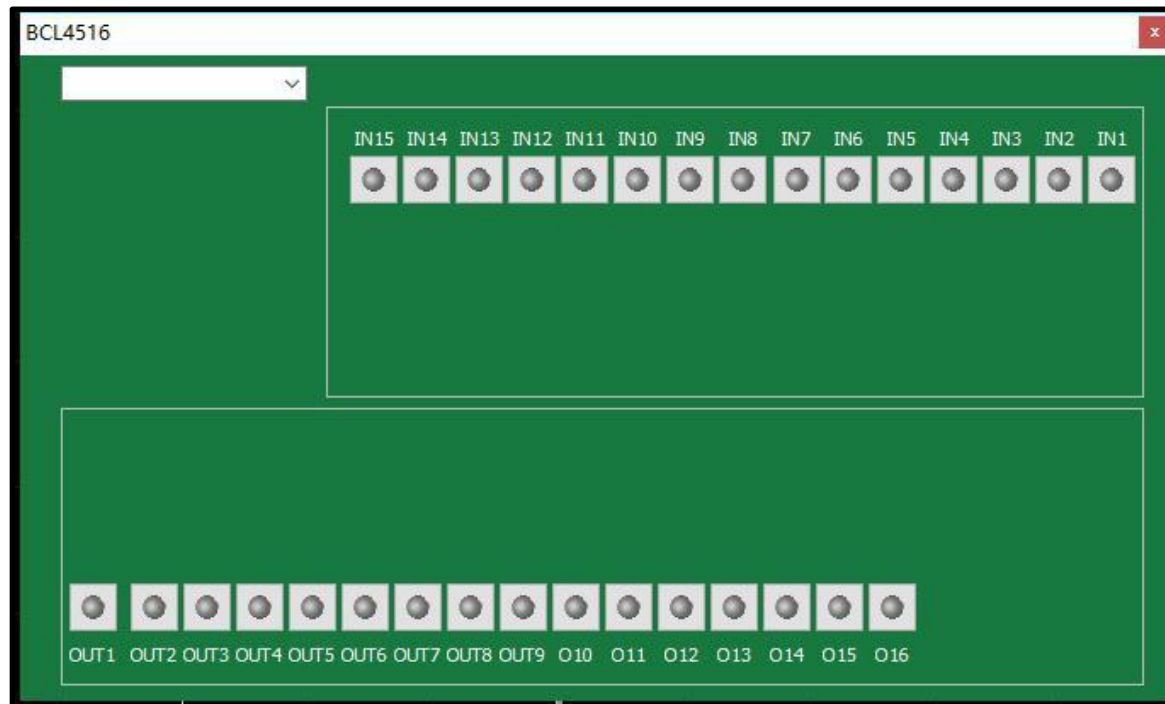
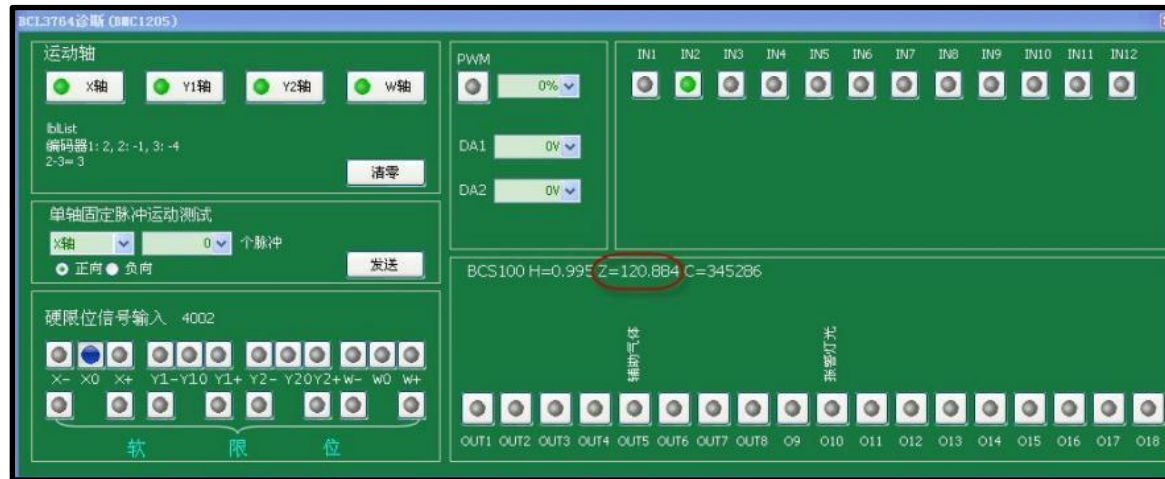
1.) Jog the X and Y-Axis to move the laser head to the center of the tube axis.

“Click “Auto Edge Search”. If the AB Surface is not placed in the horizontal direction (with Tilt Angle), this step can adjust the AB Surface to the horizontal direction as follows shown below:



Appendix (Cont'd.)-

2.) **Open the BCL3764 Diagnostic Interface as shown below:** Jog the Y-Axis, move the laser head to the position near the A end (as shown in Figure 1 away from the end of the fixture), open the follow, record the coordinates of the Z-Axis at this time.



Appendix (Cont'd.)-

Move along the upper surface of the pipe from the low end of the A end to the end B (as shown in Figure 1 near the end of the clamp) and observe the change of the Z-Coordinate of the whole process.

3.) Rotate 180 degrees and repeat step #2.) on the opposite side of the AB side.

4.) Adjust the placement of the pipe according to the following phenomenon.

Fixture placement is not horizontal, If the Z values for steps 2 and 3 are both large to small, then the A end of the tubing is lower than the B end. In this case, it is recommended to raise the clamp to the side near the A end. If the Z values of steps 2 and 3 are from small to large, then the A end of the tube is higher than the B end. In this case, it is recommended to lower the side of the clamp near the A end.

- Pipe placement is not horizontal

If the Z values of steps 2 and 3 are from large to small and the other side is from small to large, then the A end of the tube is lower than the B end. In this case, it is recommended to raise the A end of the pipe. If the Z values of steps 2 and 3 are from small to large and the other side is from large to small, then the A end of the tube is higher than

Appendix (Cont'd.)-

the B ends. In this case, it is recommended to lower the A end of the pipe.

5.) Repeat steps 1 thru 4 until the tube is placed horizontally.

6.) Rotate the tubing by 90° and repeat steps 1-5.

- **Tube Center**

Adjust the tubing parallel to the Y-axis to ensure that the line moving from the A end to the B end is parallel to the Y-axis. Debugging steps:

1.) Jog the laser head to the edge of the sheet, jog from the low end of the A end to the end of the B, check the whole movement process, the red light indicates whether it is close to the edge of the pipe. If the above rules are not met, adjust the placement of the pipe.

2.) Repeat Step #1.) until you move from the A end to the B end, and the **Red Light** indicates that it is always close to the edge of the tube.

3.) Rotate the tubing by 90° and repeat steps #1.)-#2.) above.

4.) After confirming the center of rotation, **"Click "Record Rotation Center"**.

Method 1 + Method 2.

5.) Adjust the horizontal placement of the tubing according to steps #1.)-#5.) of Method #1.).

6.) Adjust the center of the tubing according to steps #1.)-#2.) of Method #2.).

Appendix (Cont'd.)-

- **Empty Walk-**

Import the graphics, take the border, and make sure that the trajectory is correct after the flight is not exceeded.

2.) Hot Key (s)-



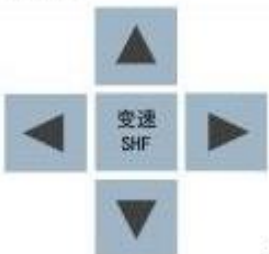
The following table lists the shortcut keys commonly used by the software. Some shortcut keys need to be used under certain circumstances. They have already been introduced in the relevant chapters. They are not listed here.

<u>Hot Key</u>	<u>Effect</u>	<u>Conditions of Use</u>
Ctrl + A	Select all Graphics.	No
Ctrl + O	Open a File.	No
Ctrl + W	Adapt to the Window.	No
Ctrl + X	Cut graphics to the Windows Clipboard.	Select the graphic to operate.
Ctrl + Y	Redo the command that was just revoked.	Have a revoked order.
Ctrl + Z	Undo the order just completed.	Have executed the command.
F3	View all graphics.	No
F4	View the entire machine range.	No
F5	View Graphics in the selection	Select the Graphic to

	area.	Operate.
F6	Open the Layer Parameter Settings Dialog.	No
F7	Show/Hide Machining Path.	No
F8	Delete selected Graphic.	No
DEL	Delete selected Graphic.	Select the graphic to operate.
SPACE	Repeat the previous Command.	One Command can be executed repeatedly.


Operation of Capacitor Heightener-

- The Key:

Keyboard	Function
Functional key	 Achieve the functions prompted by the interface.
Number key Decimal point Backspace key	 : Used for digital input, and mainly for parameter input
Arrow key	 : Used for switching cursor and inching follower, and the key of "SHF" can switch the jog speed.

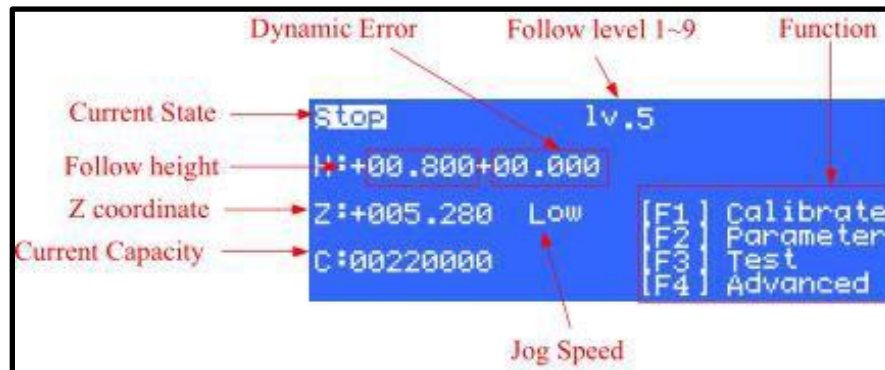
Operation of Capacitor Heightener (Cont'd.)-

The Key (Cont'd.)-

Control key					
	<p> <SHUT>: The cutting head will automatically rise to the stop position while shutting the follower. <FOLLOW>: Open the following function. <FAST> and <SLOW>: Used for adjusting the following gain level. <+0.1> and <-0.1>: Used for adjusting the following height. <STOP>: Immediately stop all movements. <ORG>: Immediately implement the movement to go back to the origin and correct mechanical coordinates. <ENT>: Confirm the current operation. <ESC>: Cancel the operation and go back. </p>				

Operation of Capacitor Heightener (Cont'd.)-

After the **System Power-On Initialization** is completed, it will automatically enter the **[Main Interface]**. As shown below:



The display functions on the main interface include: Status: Displays the motion status of the current slave system.

There are several types of sports:

Stop: The Z axis is at rest.

B.) Slow stop: After receiving the stop command in the motion state, there will be a short slow transition state. After completely stopping, the status becomes "stop"

Operation of Capacitor Heightener (Cont'd.)-

C.) In the air movement: the upward movement in the machining is the air movement of the Z axis. After the **System Power-On Initialization** is completed, it will automatically enter the **[Main Interface]**.

As shown below (Cont'd.):

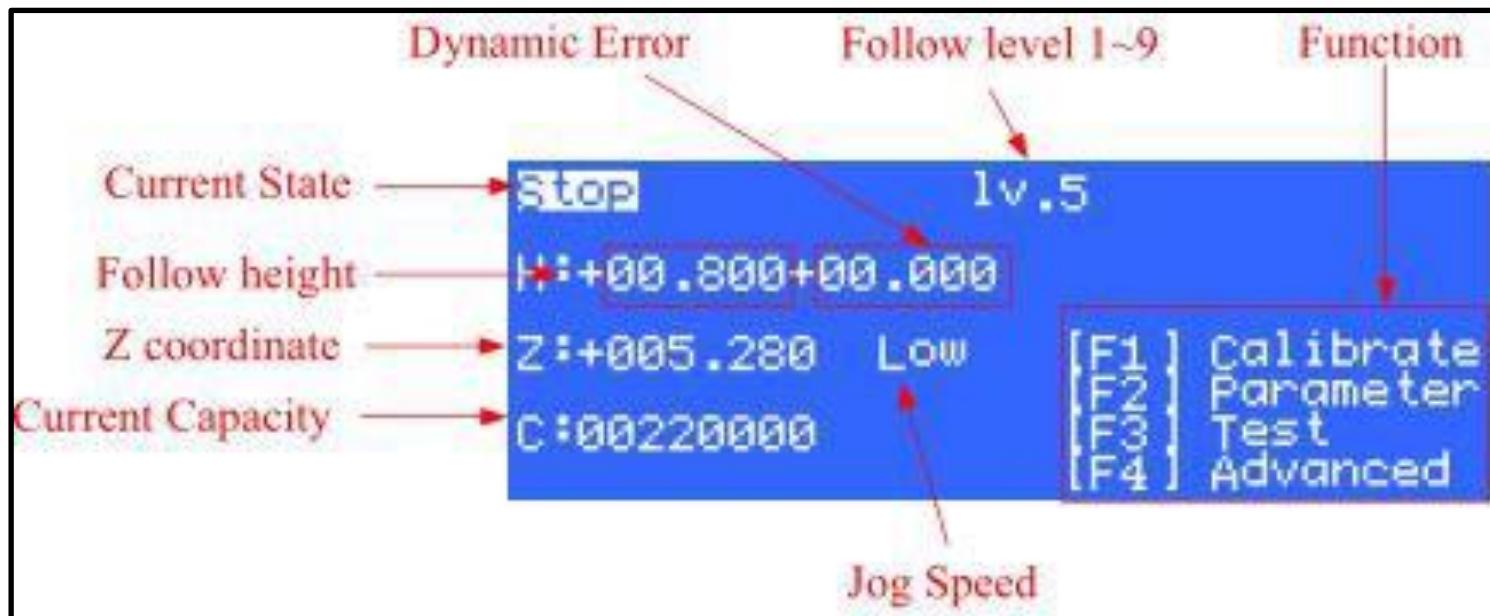
D.) **Following**: When piercing or cutting, the floating head is in the state of following the board being cut.

E.) **Reset**: Return to the Z axis mechanical origin.

F.) **Jog**: Manually jog the Z axis.

G.) **Back to Stop**: the process of closing and lifting to the docking position.

After the **System Power-On Initialization** is completed, it will automatically enter the **[Main Interface]**. As shown below:



Operation of Capacitor Heightener (Cont'd.)-

Follow-Up Gain Level Lv: Follow-up gain level from 1~30, default 17 levels. The larger the number of stages, the smaller the average error of the follow-up, the faster the follow-up action, and the stronger the ability to climb the slope. However, if the gain is too strong, the system will generate self-oscillation. This parameter can be obtained by automatic adjustment.

Set following Height: **Press** <Follow> <Follow> on the main interface to adjust the actual following height in 0.1mm steps. **Press** <Follow On> <Follow Off> to control whether to follow. After the switch is closed, the axis will automatically be lifted to the docking coordinates. After the **System Power-On Initialization** is completed, it will automatically enter the **[Main Interface]**. As shown below (Cont'd.):

(The Default is Z= 0, press <F2> to enter the Parameter Interface, you can also modify the docking coordinates). In addition, in the Ethernet Control Mode, the following height is controlled by CypCut Software.

Operation of Capacitor Heightener (Cont'd.)-

Settings Dynamic Error: In the following state, this value reflects the real-time error during follow-up motion-

Distance between the floating head and the board surface H: Within the capacitance measurement range (**Calibration Range**), the distance between the floating head and the board surface = "set following height" + "dynamic error". When the measurement range is exceeded, the "set following height" + "dynamic error" is always equal to the calibration range.

Current Z-Axis coordinate: After homing, the Z-Axis establishes the mechanical coordinate system. The downward motion coordinates increase.

Current Capacitance Value C: The principle of system sampling is to obtain the distance by measuring the capacitance between the floating head and the plate. The closer the floating head is to the plate, the larger the capacitance value. When the floating head hits the plate, the capacitance will change to zero.

Capacitance Change Value: This value is the difference between the current body capacitance value and the recorded body capacitance after the last floating head calibration. The square brackets indicate that the real-time calibration function is enabled, and the parentheses indicate that the function is not enabled. The real-time calibration function is described in 2.5.8 Advanced Parameters.

Operation of Capacitor Heightener (Cont'd.)-

Capacitance Change Value: This value is the difference between the current body capacitance value and the recorded body capacitance after the last floating head calibration. The square brackets indicate that the real-time calibration function is enabled, and the parentheses indicate that the function is not enabled. The real-time calibration function is described in 2.5.8 Advanced Parameters.

1.) Z-Axis Jog Speed: L jog low speed, H jog high speed. Press the <Shift> button to switch the jog speed position. **“Press the “<↑><↓>” Button”** to perform the jog.

1.) Main interface hidden function Button Function.

<3> View the follow-up parameters (requires the manufacturer password to modify the parameters).

<4> Follow the real-time Error Oscilloscope.

<5> The capacitor monitors the oscilloscope in real time.

<6> Capacitance Calibration Curve Oscilloscope.

<7> Record the current capacitance and use it to observe the historical change data of the capacitor.

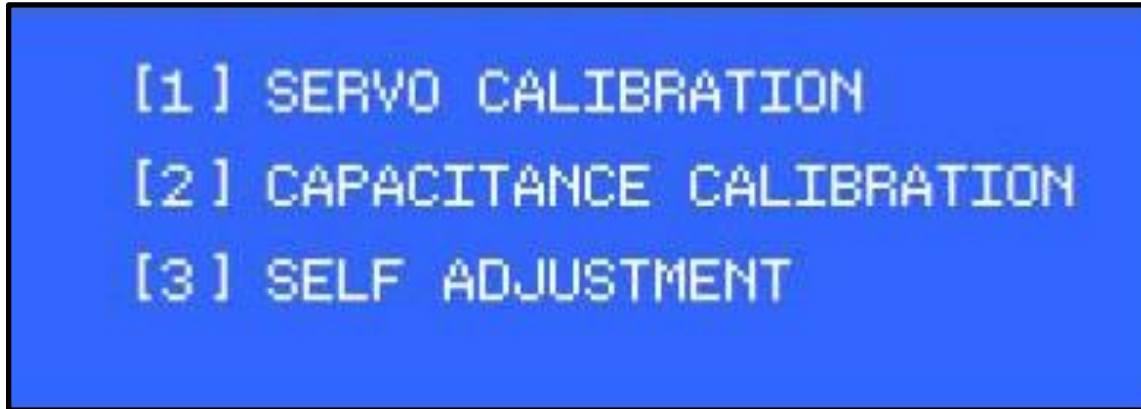
<9> Turns on the follow-up mode of the off board cutting.

<0> Set the current Z-Axis coordinate to 0.

Calibration-

Calibration Interface-

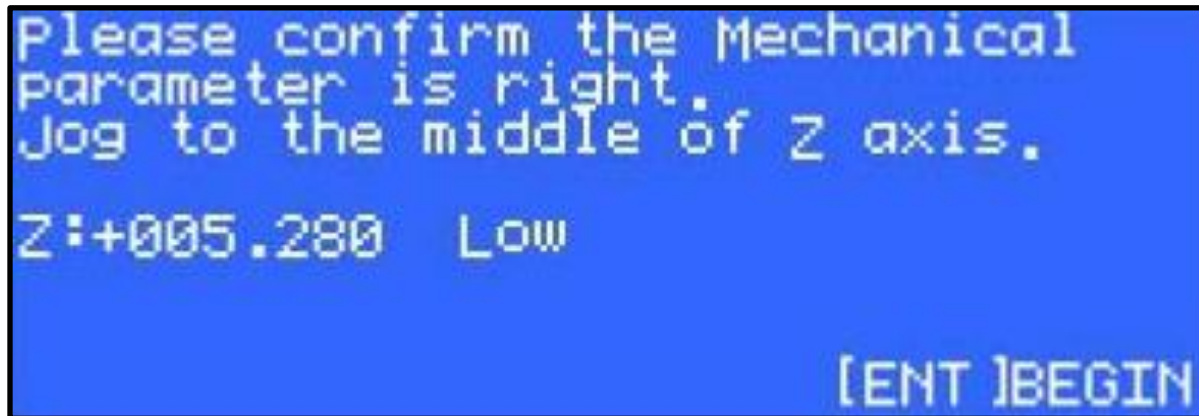
In the main interface, **Press <F1>** to enter the [calibration interface]. As shown below:



When using the BCS100 for the first time, you must first perform Servo Calibration, then perform Floating Head Calibration, and then make automatic adjustments. In subsequent use, if the capacitance changes due to temperature drift and other reasons, only need to do floating head calibration, servo calibration and automatic adjustment can be done.

Calibration-

Servo Calibration: The purpose of servo calibration is to eliminate the zero drift of the servo motor. Press <1> to enter the **[Servo Calibration] Screen**. As shown below:



Please confirm the Mechanical
parameter is right.
Jog to the middle of Z axis.
Z:+005.280 Low
[ENT]BEGIN

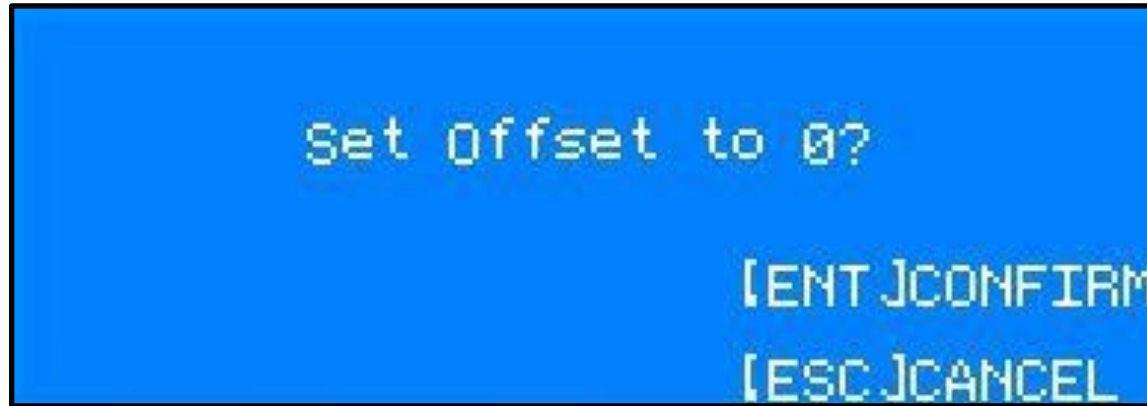
Due to the **Servo Calibration**, the motor will oscillate back and forth in small amplitudes. Therefore, you need to jog to the middle of the stroke to prevent the stroke from exceeding the stroke range. Then Press <ENT> to start the **Calibration**.



Calibrating servo...
Calibrate successful
Offset: +01.200mm/s
[ENT]SAVE

Calibration-

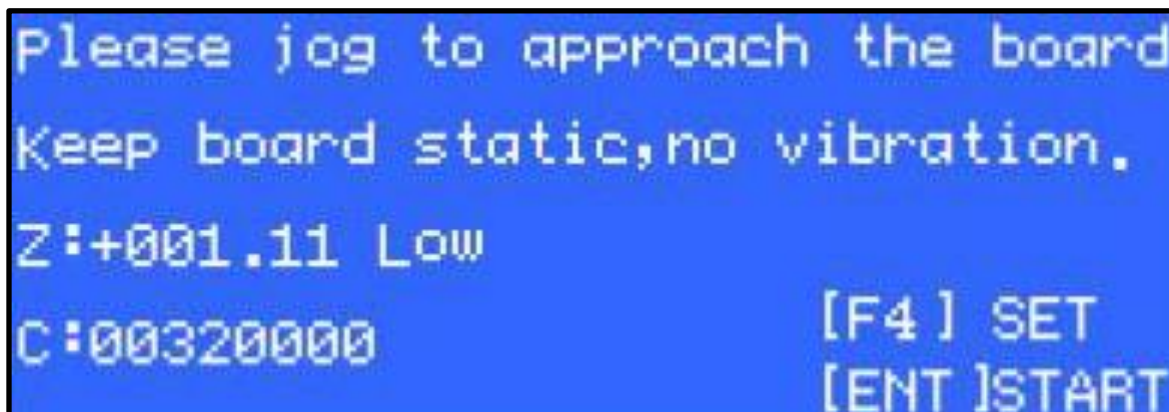
After the system is automatically calibrated, return to the previous interface. If the **Servo Zero Drift Value** is incorrectly calibrated before, **Press <F4>** to clear the clear Zero drift value interface, as shown in the figure below:



Calibration-

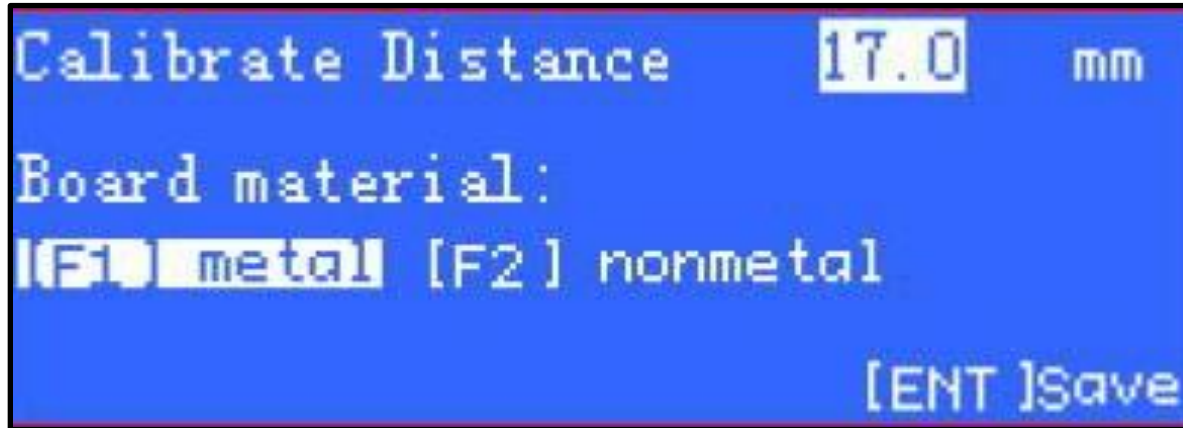
After entering, press <ENT> to confirm the zero-drift value and return to the previous interface after completion.

2.) **Floating Head Calibration:** The purpose of floating head calibration is to measure the correspondence between capacitance and position between the floating head and the plate. **Press <2>** to enter the **[Floating Head Calibration] Screen**. As shown below:



Calibration-

Press the <F4> key to set the **Calibration Parameters**.



Parameter Name Meaning:

Calibration ranges the distance to be lifted and the corresponding data is recorded. **The default is 25mm.** Tracking Object Sets the material of the tracking object. **Press <ENT>** to save the parameters and return to the previous interface. Before calibrating, first move the floating head to the surface of the board (about 1~5mm from the board surface) and keep the board surface still and do not vibrate. **Press <ENT>** again to start calibration.

Calibration-

The calibration process is done automatically, which takes about a dozen seconds. During the calibration process, the user can **Press the “Stop” Button** to force the calibration to end. When the calibration is completed, there are **2-Indicators**, each of which is represented by the following:

1st Indicator

1a.) “Excellent”

1b.) “Good”

2nd Indicator

2c.) “Medium”

2b.) “Poor”

These are the Four Levels.

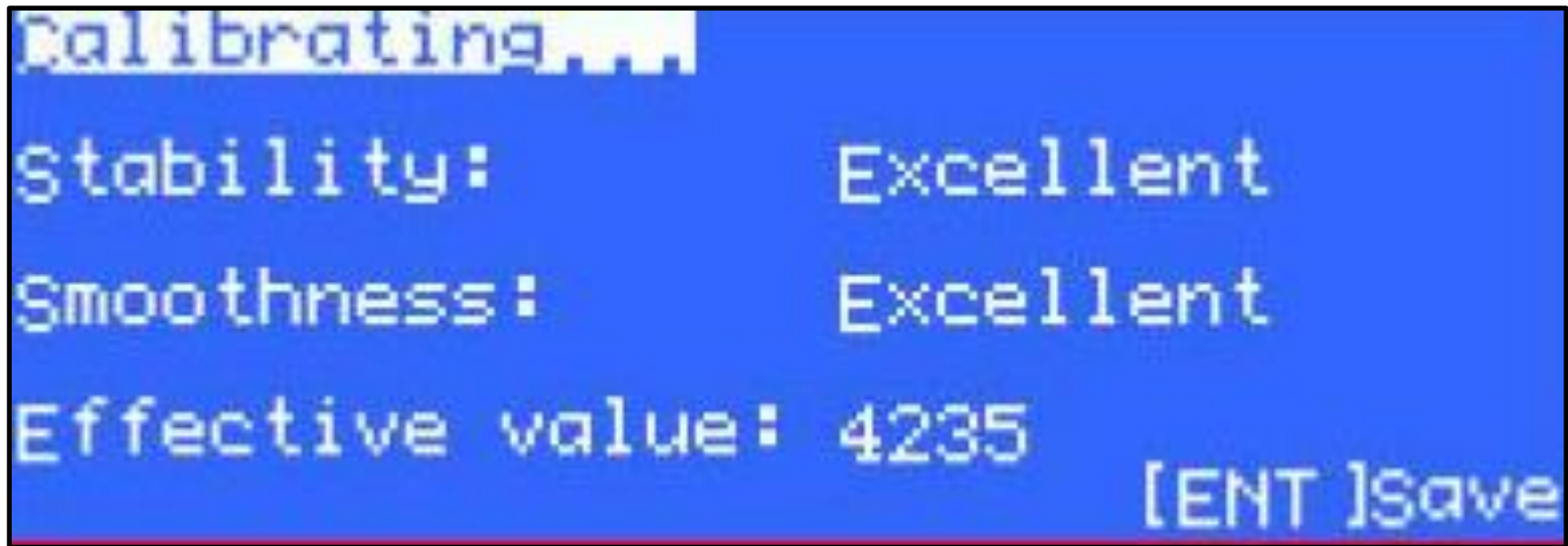
Calibration-

The floating head calibration process is briefly divided into the following steps:

- 1.) The floating head slowly moves downward to detect the touch panel.
- 2.) After hitting the board, move up a distance to detect the stability of the sensor.
- 3.) The floating head moves slowly to detect the touch panel for the second time.
- 4.) After hitting the board, move the set calibration distance upwards to detect the smoothness and characteristic curve of the sensor.

Calibration-

If the above steps are not completed, or the calibration process is terminated abnormally, there may be a problem with the hardware or the cable. A simple way to check if the hardware or connection is normal is to use a metal object to slowly approach the nozzle to see if the capacitance will change. If the capacitance becomes larger until the metal contacts the nozzle and becomes “0”, it means that the hardware and connection are normal, and the calibration can be calibrated. conditions of. The significance of the calibration results is as follows:



```
Calibrating...
Stability:      Excellent
Smoothness:     Excellent
Effective value: 4235
[ENT] Save
```

Calibration-

Reflects the static characteristics of the capacitor. If the indicator is not ideal, it may be plate vibration or external interference. Smoothness: Reflects the dynamics of the capacitance change during calibration. The indicators calibrated by the above two parameters need to be at least “medium”, otherwise the system may not work properly. The ideal situation for these two indicators is “excellent” or “good”. RMS: The value of the capacitor from 0.5mm to infinity. Reflects the measurement range of the nozzle sensing. The larger the measurement range, the better the accuracy and stability of tracking. When you press <ENT> to save the settings, the height-capacitance curve is displayed. The normal curve should be smooth, as shown below:



Calibration-



If the curve is not smooth, there are undulations or burrs, indicating that the result is not ideal and needs to be recalibrated. If the result after repeated calibration is still not satisfactory, the user needs to re-check the hardware installation and connection of the system. In addition, you can also view the calibration curve by **Pressing <6>** on the main interface. Floating head calibration if the calibration fails, various alarms will appear, as listed below:

Calibration Alarm name meaning.

A touch panel detection timeout.

Calibration-

At the time of calibration, the touch panel was not detected for a long time. When this alarm occurs, first confirm the floating head connection before calibration. Near board (usually within 5mm), and secondly, confirm that the sensor is connected and working properly. When the cutting head is close to metal, the capacitance should change significantly.

Leave board detection timeout.

Calibration-

If the first step of the calibration, the nozzle does not touch the board surface, directly lifts, and shows that the departure board detects timeout, then the system may think that the nozzle is always in the collision state. First, confirm that the sensor is connected and working properly.

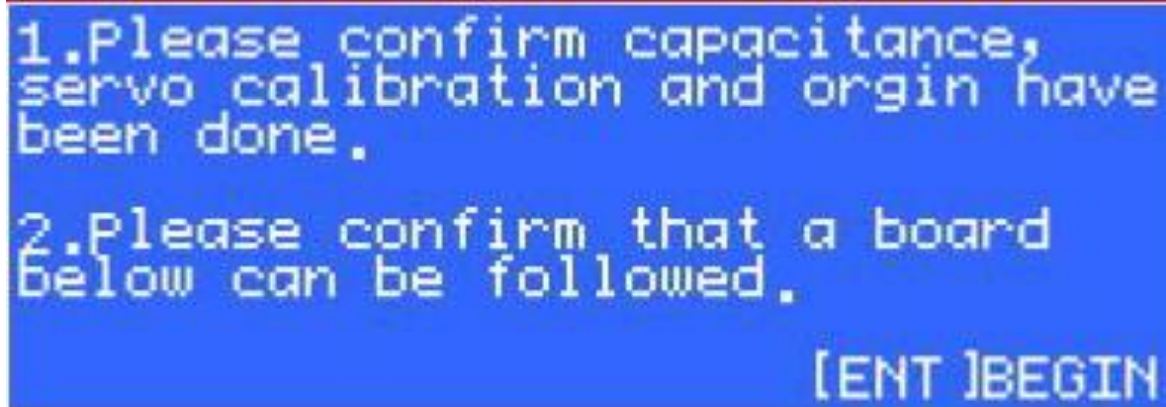
The sampling timeout has been completed but not enough data has been collected. Please recalibrate. Always for the board status see the **"Leave Board Detection Timeout" Alarm**.

d standard timing capacitance change abnormal

When the floating head is close to the board surface, the capacitance does not gradually increase according to the law. Please start the calibration by moving the floating head to within 5mm of the board surface. Or refer to **"Touchpad Detection Timeout"**

Calibration-

1.) **Auto Adjustment Press <3>** to enter the [Auto Adjustment] interface (there is no Automatic Adjustment Function in 3D Mode), as shown below:



```
1.Please confirm capacitance,  
servo calibration and orgin have  
been done.  
  
2.Please confirm that a board  
below can be followed.  
  
[ENT ]BEGIN
```

a Before automatic adjustment, you need to ensure I have done servo calibration.

Calibration-

Once I have returned to the origin, the mechanical coordinates of the Z-Axis are correct. I have done floating head calibration and can follow it normally. There is a board just below the floating head to follow.

Calibration-

The process of automatic adjustment is to fine-tune the position near the position and automatically optimize the internal parameters.

After optimization, as shown below:



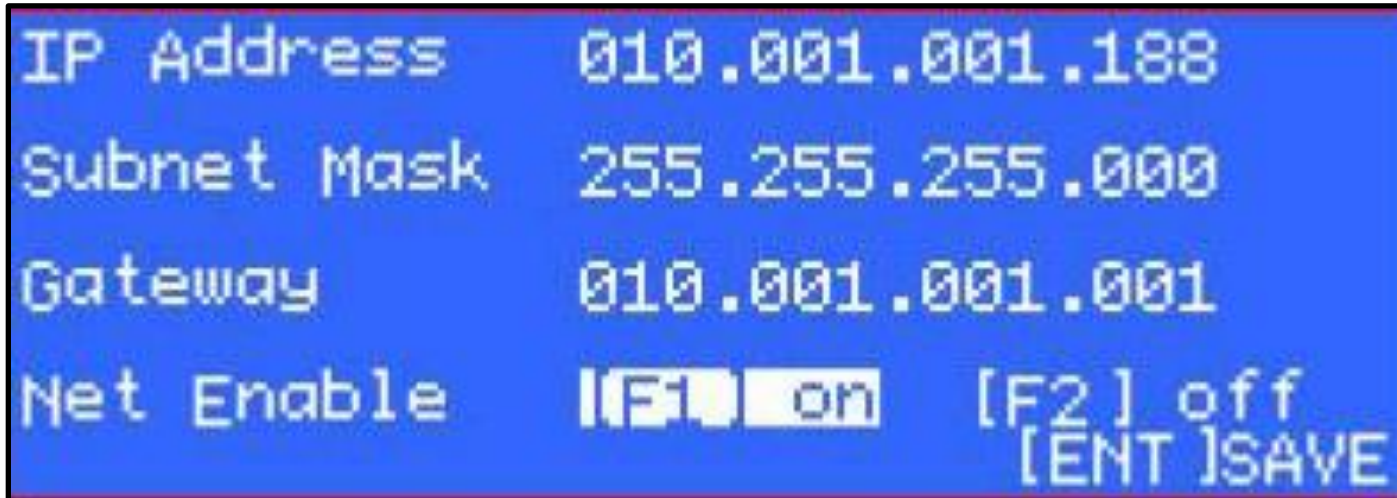
Press <ENT> to save the parameters. The parameters of the automatic adjustment have the following meanings:

Calibration-

Follow-up Gain Level:

The follow-up gain level is from 1 to 30, and the default is 17 levels. The larger the number of stages, the faster the following follow-up actions. If the gain is too large, it will cause following jitter. This parameter is automatically set after automatic adjustment (the main interface can also be modified manually).

Network Settings: Press <6> to enter the [Network Settings] interface, as shown below:

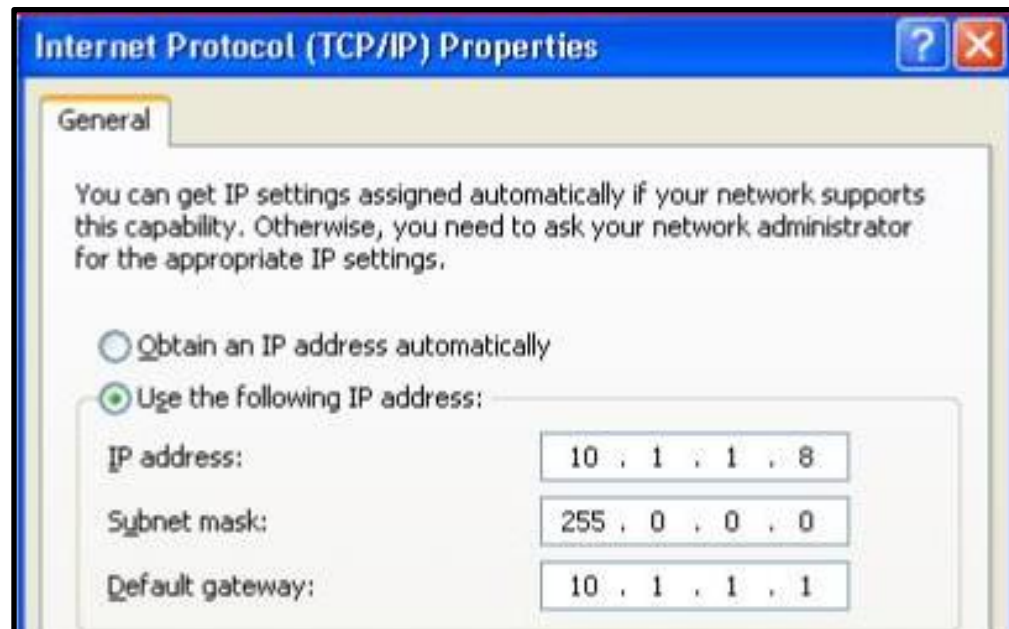


```
IP Address    010.001.001.188
Subnet Mask   255.255.255.000
Gateway       010.001.001.001
Net Enable    [F1] on    [F2] off
               [ENT] SAVE
```

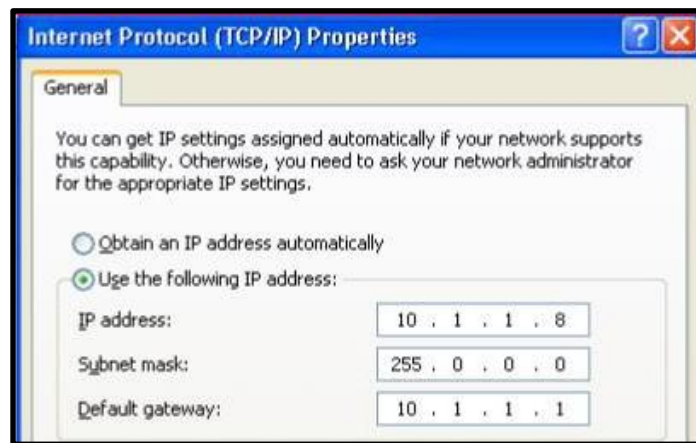
Calibration-

When using our company's CypCut laser cutting software, it can easily realize advanced functions such as lifting any height, frog jump up, segmentation perforation, flight path compensation, etc. through the network. See the description of the CypCut software for details.

Users who do not use the CypCut software should turn off the network function, otherwise the boot process will be slower. When connecting to a network, it is recommended to connect the PC and BCS100 through a crossover cable. The IP address of the PC side should be set in the same network segment as the BCS100 (10.1.1.xxx, which cannot be duplicated with the BCS100). The gateway also needs to be set on this network segment, and the last digit is 1, such as 10.1.1.1. As follows:



Calibration-



Note: 1.) When the computer uses other network devices at the same time, such as IPG Fiber Laser (network connection method), each network connection must be set to a different network segment. For example, set to: 10.1.2.x, 192.168.1.x. 2. After the computer's network card resets the IP, it must be re-disabled - enable the network card. Make the NIC's IP settings take effect.

Cutting Head Debugging Method and Common Sense-

The debugging of the machine tool needs to be carried out by professionals. It must be strictly implemented in accordance with the relevant regulations. Please understand the performance of the machine and read the relevant random technical data before commissioning. Correct debugging is the basis for ensuring the normal operation of the machine. If there is any ambiguity, please contact our company in time. We will give you a satisfactory answer in the fastest time.

Note: This debugging method includes the debugging method after the machine is powered on.

The Fiber Laser of the machine is free of optical path debugging, but the operating fiber must be placed strictly in each axis of the towline, and the bending radius must be greater than 200mm. The motion radius is prohibited to be less than 200mm and the fixed radius is less than 100mm.

Cutting Head Debugging Method and Common Sense-

The fiber is slowly unscrewed from the fiber frame, and the fiber length is required along the machine fiber inlet and each axis towline measurement.

Make sure that the water pipe connections are normal and leak-free before starting the machine!

The **QBH Head (QBH-Quartz Block Head)** must be cleaned before QBH insertion.

If there is foreign matter, clean it as follows:

Use a special microscope assembly to observe the **QBH Head**, use special compressed air or professional cleaning agent (ethylene propanol) and cleaning tool fiber special cotton swab, special lens paper to clean the dirt such as QBH Head dust!

- It must be ensured that the QBH head is clean and free of contamination before it can be inserted into the cutting head expansion tube!
- Adjust the cutting head lens coaxial and focus, then try to cut! Repeatedly adjust to the best position!

Installation of optical fibers requires that trained personnel install fiber optics, and non-professionals are prohibited from plugging and unplugging QBH!

Cutting Head Debugging Method and Common Sense-

Note on the use of Lenses:

1.) The surface of the optical lens such as focusing mirror, protective mirror and QBH head should not be touched directly by hand, which may cause scratch or corrosion of the mirror surface.

2.) If there is oil or dust on the mirror surface, it will seriously affect the use of the lens, and the lens should be cleaned in time.

3.) It is strictly forbidden to use water, detergent, or other cleaning on the surface of the optical lens. The surface of the lens is coated with a special film that can damage the surface of the lens if used.

4.) Do not place the lens in a dark, damp place, as this will age the lens surface.

5.) The surface of the lens must be clean, such as dust, dirt, or moisture, which is easy to absorb the laser to cause damage to the lens coating; lightly affects the quality of the laser beam, and the laser beam cannot pass or reflect.

Cutting Head Debugging Method and Common Sense-

Note on the use of Lenses (Cont'd.):

6.) When installing or replacing the mirror or focusing mirror, do not use too much pressure, otherwise it will cause deformation of the lens and affect the quality of the beam.

How to Install or Replace Optical Lenses:

1.) Pay attention to the installation of optical lenses: wear clean clothing, use soap or detergent to clean your hands, and wear light and clean white gloves; do not touch any part of the hand with the lens; take the lens from the side of the lens Do not touch the surface of the lens coating directly.

How to Install or Replace Optical Lenses (Cont'd.):

2.) When assembling the lens, do not blow the lens against the lens; the lens should be placed on a clean table, and a few lens professional papers should be placed underneath. Care should be taken when taking the lens to prevent bumps and falls, and it is not allowed to exert any force on the coated surface of the lens; the lens holder for mounting the lens should be clean and clean the dust and dirt in the lens holder with a clean air spray gun. Then, gently place the lens into the lens holder.

3.) When the lens is mounted to the lens holder, do not use too much force to fix the lens to avoid deformation of the lens, thus affecting the quality of the beam.

Steps to Clean the Lens:

Different lens cleaning methods are different. For example: the specific steps of the focusing mirror or collimating mirror are as follows:

1.) Steps of cleaning the lens with lens paper: Use a clean air spray gun to blow off the dust on the surface of the lens; use alcohol or lens paper to clean the surface of the lens. The smooth surface of the lens should be placed flat on the surface of the lens. Use 3 drops of high-purity alcohol or high-purity acetone, slowly pull out the lens paper horizontally in the direction of the operator, repeat the above operation several times

Cutting Head Debugging Method and Common Sense-

Steps to Clean the Lens (Cont'd.):

until the mirror surface is clean, and it is forbidden to apply pressure on the lens paper to prevent scratches, such as the mirror is dirty. You can fold the lens paper in 2 or 3 times. Repeat the above steps until the mirror is clean. Do not use a dry lens paper to pull directly on the mirror.

2.) Steps to clean the lens with a cotton swab: first blow off the dust on the mirror with a spray gun; then use a clean cotton swab to remove the dirt; use a new cotton swab dipped with high-purity alcohol or acetone to move the lens from the center of the lens and scrub the lens. After each week of cleaning, change another clean cotton swab and repeat the above operation until the lens is clean. Take the cleaned lens to a well-lit area. If the lens is well reflected, the lens is clean. If the reflection is not good, continue to clean the lens; place the lens on the lens holder according to the method described above. It is forbidden to use a used cotton swab for operation.

2a.) **Storage of Optical Lenses-**

- The optical lens is properly stored to keep the quality of the lens intact.
- The storage environment temperature is 10~30°C. Do not put the lens into the freezer or similar environment. Otherwise, it will condense and frost when it is taken out, which will easily damage the lens. The temperature of the storage environment should not exceed 30 °C, otherwise it will affect the coating on the lens surface.
- Keep the lens in the box, the lens should be placed in a non-vibrating environment, otherwise it will easily cause deformation of the lens, thus affecting the performance of the lens.

Cutting Head Debugging Method and Common Sense-

Fiber Access and Removal Methods:

- **QBH (Quartz Block Head) Plug Insertion Operation Sequence-**

- 1.) Remove the dust cover at the top of the chuck-

Align the red mark on the plug with the red mark above the QBH chuck and lower it to the bottom.

According to the marking procedure on the QBH collet nut, first turn the nut to the left, then lift it, then turn it to the left to complete the fixed locking procedure.

2.) QBH plug removal operation sequence

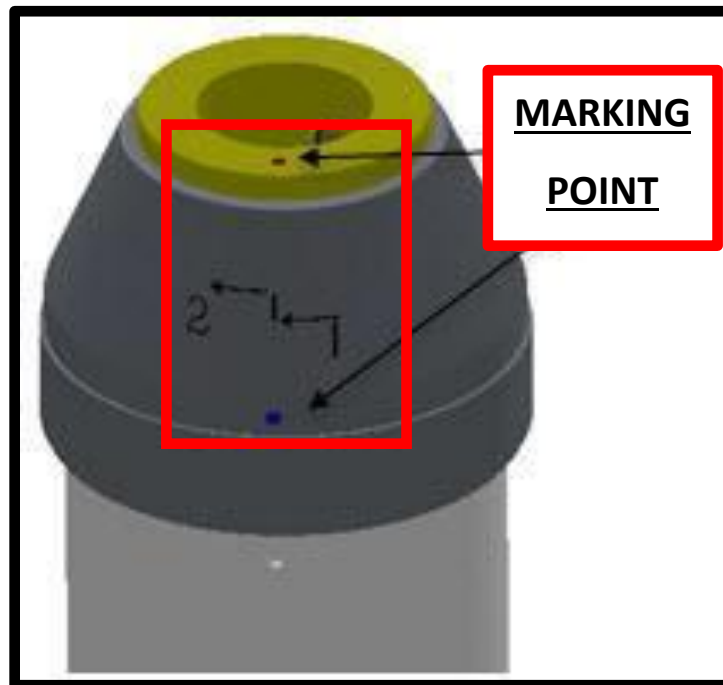
The QBH plug is removed and installed in the opposite order. The QBH collet nut is rotated to the right, then pressed down, and then rotated right. The plug is in a free state and can be removed from the QBH chuck.

After removing the QBH plug, be sure to cover the dust cover to prevent dust from entering.

Cutting Head Debugging Method and Common Sense-

Fiber Access and Removal Methods:

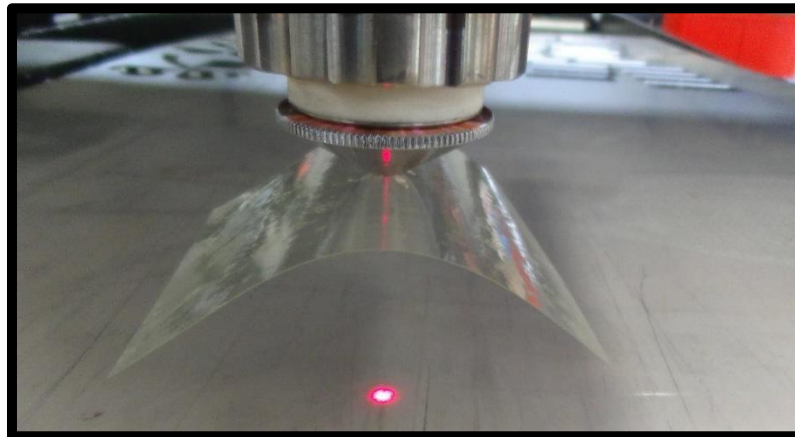
- QBH (Quartz Block Head) Plug Insertion Operation Sequence-



- **Focusing Method of focusing Mirror:** The focusing mechanism of the focusing mirror adopts the precision screw pulling focusing box to realize Z-axis focusing, which has good self-locking performance and fine focusing function. Focusing module is electric focusing, focusing lens can be moved vertically according to the type of laser head.

Fiber Access and Removal Methods:

- **QBH (Quartz Block Head) Plug Insertion Operation Sequence-**
- **The Function of Nozzle and the Adjustment of its Center:** The design of nozzle and the condition of jet flow directly affect the quality of cutting, and the manufacturing precision of nozzle is closely related to the quality of cutting. The main functions of the nozzle are preventing cutting weld stains and other debris bounce up into the cutting head damage focus lens. The nozzle can change the condition of gas exhalation, control the area and size of gas diffusion, and thus affect the cutting quality. Adjust the nozzle to pass the laser through the center of the nozzle by sticking transparent tape on the nozzle first when dimming, pressing the "tap" button on the handle will appear "⊙" on the tape. If not in the center of the nozzle by adjusting the two knobs above the cutting head, make the point of light hit at the center of the nozzle.



Cutting Head Debugging Method and Common Sense-

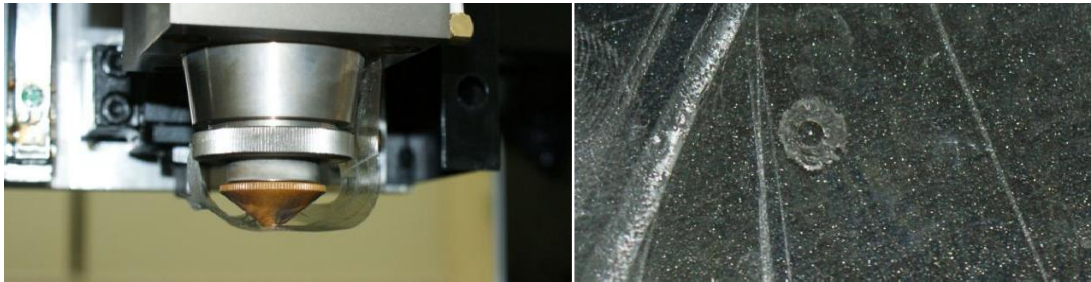
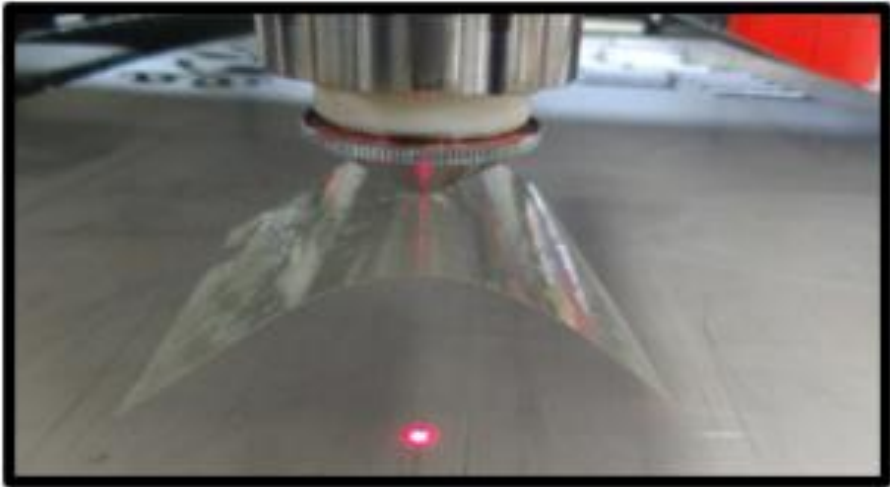


Figure 1
up

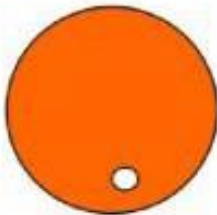


Figure 2
down



Figure 3
left

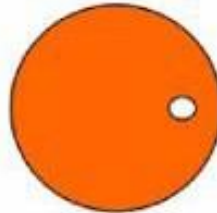
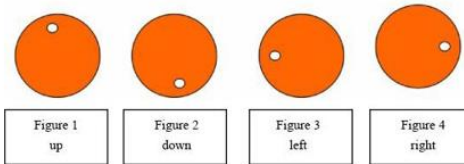
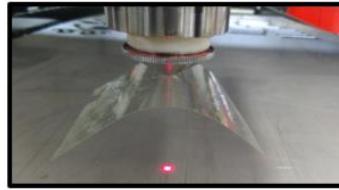


Figure 4
right

Cutting Head Debugging Method and Common Sense-



1.) Move the nozzle to about the cutting height.

2.) Coat the end face of the nozzle with printing mud, and then paste the transparent tape on the end face.

Note: In the toolbox have transparent tape.

Cutting Head Debugging Method and Common Sense-

3.) Adjust the laser output power by 20W ~ 100W. After laser source light stops, take off the transparent tape and take care not to rotate its relative position. If the position of the nozzle is too different from the laser center, it will not be able to hit the center hole on the transparent tape. Because the laser center is fixed, it is necessary to change the center of the focus mirror by adjusting the adjusting screw on the handle of the lens cavity to make it correspond to the laser center. Repeat the above until the laser hole on the transparent tape coincides with the center of the nozzle, thus confirming that the laser center coincides with the nozzle center.

- Effect of different axes between the center of the nozzle and the center of the laser on the cutting quality.
- The cutting edge is affected, and when the cutting gas is blown, the amount of gas is not uniform, so that the cutting edge is easy to appear stain on one side, and other side do not have, or the surrounding quality of the part section is not consistent, and sometimes the cutting section cannot be cut normally.

Cutting Head Debugging Method and Common Sense-

- The quality of the sharp corner is affected. When cutting a workpiece with a sharp angle or a small angle, it is easy to produce a partial melting phenomenon, and when the thick plate is cut, it may not be cut.
- It affects the perforation, is not stable at the time of the perforation, the time is not easy to control, the penetration of the thick plate can cause the over-melting condition, and the penetrating condition is not easy to master, and the perforation effect on the thin plate is small.

In conclusion, the concentricity of the center of the nozzle and the laser is one of the most important factors that cause the quality of the cutting, especially when the workpiece is thicker. Therefore, the concentricity of the center of the nozzle and the laser must be adjusted to achieve a better cutting cross-section.

Cutting Head Debugging Method and Common Sense-

Note: When the nozzle is deformed or there is a solution stain on the nozzle, the effect of the nozzle on the cutting quality is as described above. Therefore, the nozzle shall be placed with care, and shall not be damaged to avoid deformation; the surface of the nozzle shall be cleaned in time. The quality of the nozzle has a high precision requirement during manufacture, and the method is required to be correct at the time of installation. If the conditions are to be changed during cutting due to poor quality of the nozzle, the nozzle shall be replaced in time.

Selection of Nozzle Aperture-

The difference in nozzle aperture is shown in the following 4-1 form:

Nozzle Aperture	Gas Flow Rate	Melt Removal Capacity
Small	Fast	Strength
Big	Slow	Week

Selection of Nozzle Aperture-

The difference in Nozzle Aperture is shown in the following 4-1 Form:

Nozzle Aperture	Gas Flow Rate	Melt Removal Capacity
Small	Fast	Strength
Big	Slow	Week

Form 4-1:

Table of relationship between Aperture and Auxiliary Gas Velocity-

The aperture of the nozzle has $\phi 1.5\text{mm}$ 、 $\phi 2.0\text{mm}$ 、 $\phi 2.5\text{mm}$ 、 $\phi 3.0\text{mm}$ etc. three-dimensional cutting of the general thin plate using the thickness of 1.2 mm and the thickness of 1.5 mm it is enough. The different between both is :

1.) Material thickness less than 2mm: use $\phi 1.2\text{mm}$, the cutting surface will be thinner; use $\phi 1.5\text{ mm}$, the cutting surface will be thicker.

Form 4-1:

Table of relationship between Aperture and Auxiliary Gas Velocity (Cont'd.)-

2.) Material thickness more than 2mm: because the cutting power is high, the relative heat dissipation time is longer, and the relative cutting time is also increased. With a gas diffusion area of $\phi 1.2\text{ mm}$ and a small gas diffusion area, it is less stable in use. With a diameter of $\phi 1.5\text{ mm}$, the gas diffusion area is large, and the gas flow rate is slow, so the cutting time is more stable.

In conclusion, the size of the nozzle aperture has a serious effect on the cutting quality and the perforation quality. At present, the laser three-dimensional cutting uses a nozzle with a $\phi 1.2$ mm and $\phi 1.5$ mm.

The larger the diameter of the nozzle, the more the protection of the opposing lens is, as the spark of the melt at the time of the cutting is splashed, and the probability of the upward impact is large, so that the life of the lens is also shorter.

Beam Focus Adjustment-

In the laser cutting process, the relative position of the focal point of the beam and the surface of the cutting plate has a great influence on the quality of the cutting, and the correct adjustment of the focus position is very important. The laser cutting machine is provided with a height automatic follow adjusting device, and when the height of the plate is changed, the numerical control system can automatically adjust the height of the nozzle and the plate surface to be constant, and the position of the focus is ensured to be stable.

Beam Focus Adjustment (Cont'd.)-

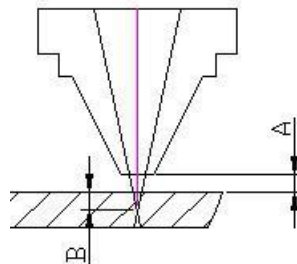
Manual Adjustment Method: adjust the laser cutting head lower adjustment nut, so that the focus position to meet the cutting needs, provided that the position of zero focus is found. During the cutting process, the height adjustment of the operator panel can also be manually adjusted according to the situation to change the cutting height slightly. It takes enough experienced operators to adjust the height during the cutting process.

Beam Focus Adjustment-

Automatically adjust the focus: equipped with the automatic focus cutting head equipment, can automatically adjust the focus position according to the parameters, the advantage is that it can improve the processing efficiency, can make up for the change of focus position caused by the change of optical path. Can improve the product yield.

A Method of finding 0- Focus-

Place a flat stainless-steel plate on the table, draw a straight-line cut height setting of 1 mm, and then set the focus in turn 0. 1.-1-2-3 1 2 3, the focus of the laser is output laser on the stainless-steel plate in turn, the burn-out trace is present, and the thinnest line of the burn-in is the 0-focus of the laser.



A Method of finding 0- Focus (Cont'd.)-

- Description of the Relationship between the position of Focus and the Cutting Material & Section.

The following table lists the laser cutting focus in different positions when cutting different plates, the impact on the perforating and cutting sections of the sheet, and the selection of the focus position when cutting plates of different materials and thickness:

<u>Name and Focus Location:</u>	<u>Cutting Material and Section Characteristic:</u>
<u>Zero Focus:</u> The Laser Focus is on the upper surface of the cutting work piece	Use in Sheet Cutting. Focus on the Upper Surface of the work piece, the Upper Surface Cut Smooth, the Lower Surface is not smooth.
<u>Positive Focus:</u> Laser Focus on cut sheet surface.	The use of Carbon Steel and other Materials. The focus is on the surface, so the range of smooth surface is larger, the slotting is wider than the zero focal length, the gas flow rate is larger and the piercing time is longer than the zero focal length.

Process Parameter Debugging Method-

- **Laser Cutting Principle-**

Laser cutting is performed by focusing fiber laser cutting, transmitting through optical fiber, high degree of flexibility, fast speed, less failure point, low maintenance cost, convenient maintenance, high photoelectric conversion rate, and great cost performance advantage in system matching. Mainly used for cutting metal sheets within 20mm. The laser beam is not easily absorbed by the highly reflective material, and the cutting effect on the highly reflective material is not ideal, and the non-metallic material cannot be cut.

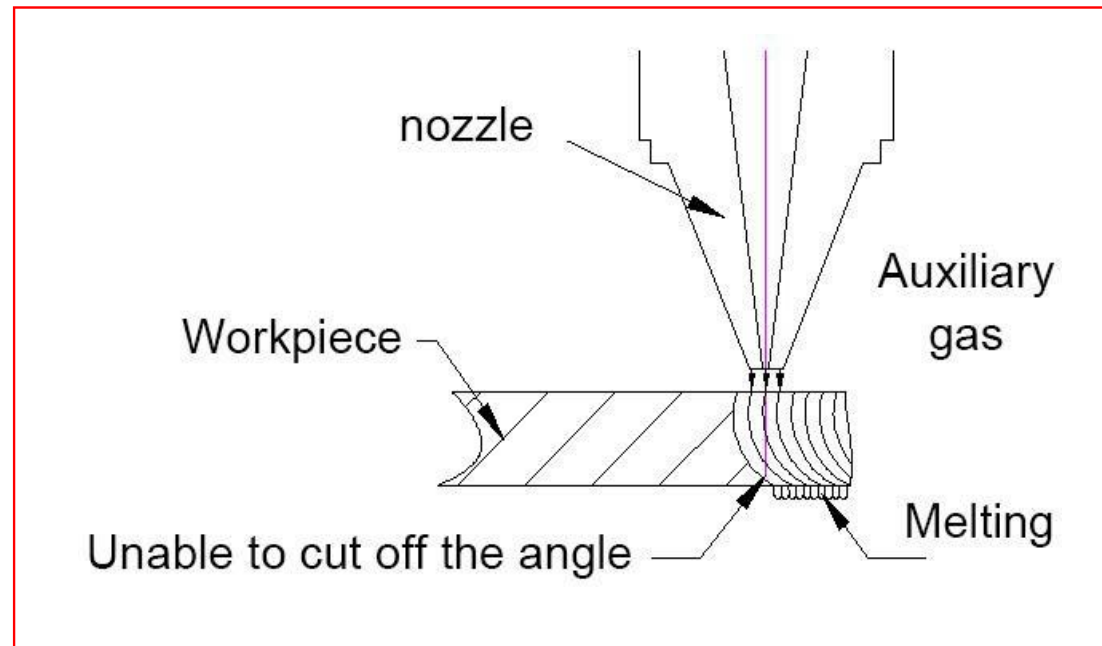
- **Main Process Control of Fiber Laser Cutting-**

1.) **Cutting Power:** When laser cutting, the choice of laser power has an influence on the cutting quality. The cutting power needs to be determined according to the material of the cutting plate and the thickness of the plate. If the power is too large or too small, a good cutting section cannot be obtained. When laser cutting, the laser power is too small, which will make it impossible to cut.

Main Process Control of Fiber Laser Cutting (Cont'd.)-

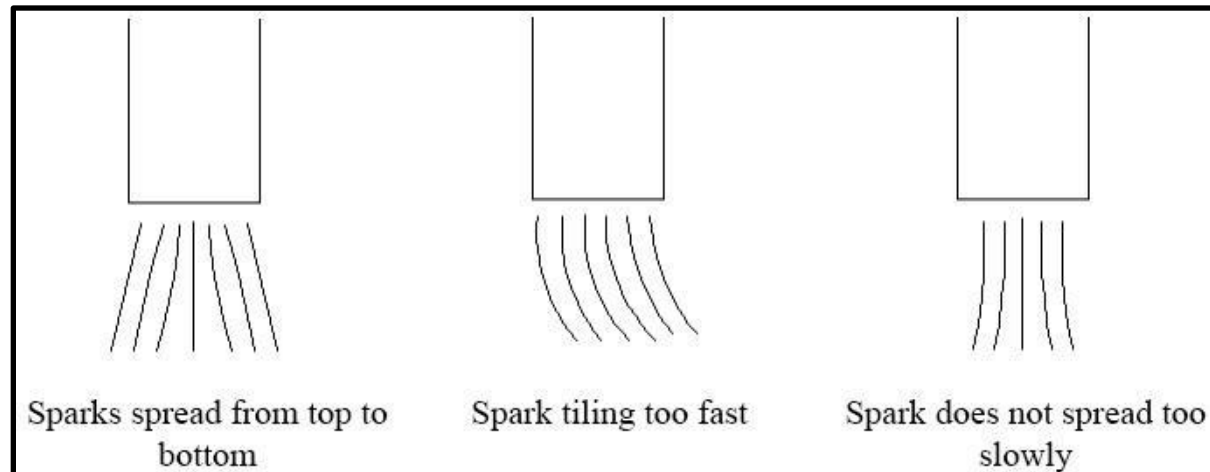
When the laser power setting is too large, the entire cutting surface is melted, the slit is too large, and good cutting quality is not obtained. When the laser power setting is insufficient, cutting cracks are generated, and tumor defects are generated on the cut section. Proper laser power setting, combined with proper cutting gas and pressure, results in good cut quality without cracking.

2.) **Cutting Speed:** The effect of too fast speed on the cutting quality may result in the inability to cut and sparks. Some areas can be cut, but some areas cannot be cut. Causes the entire cutting section to be thicker, but no cracks are produced. Speed is too fast, causing the plate could not be cut off in time, the cut section showed a diagonal stripe road, and the lower part produced a melt, as shown in the figure below.



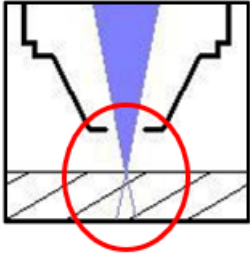
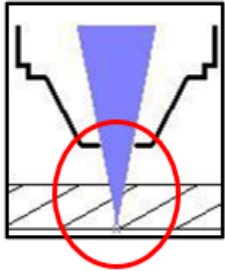
Main Process Control of Fiber Laser Cutting (Cont'd.)-

How to judge the Cutting Speed by the Cutting Spark: Generally, the cutting spark spread from the top to the bottom, if the spark tilts, the speed is too fast; If the spark spread a little or not spread, condensed together, then speed is too slow. As shown in the figure below, the cutting speed is appropriate. The cutting surface presents a relatively smooth line, and the lower part is free from melting.



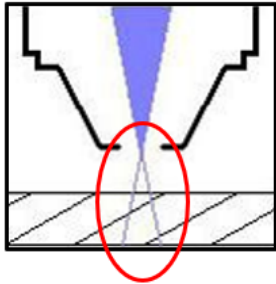
3.) **Cutting Height:** The cutting height has little influence on the cutting quality of the workpiece. Set it too low, the slag removal ability of the auxiliary air pressure is strong, but it is easy to reverse slag to the protective lens and damage the protective lens. Too high, poor slag removal ability need to increase air pressure, gas consumption increase. Generally, the cutting height should be set between 0.5 and 1.5. There is a small amount of bead-like slag below the cutting workpiece, and the cutting section grain is good.

4.) **Focus Point:** The position of the focus point has an important effect on laser cutting, how to choose the focus, and the effect of the focus on plate punching and cutting section. Nitrogen cutting stainless steel general negative focus; Oxygen - cut carbon steel plates are generally in positive focus. Nitrogen cutting stainless steel general negative focus; Oxygen - cut carbon steel plates are generally in positive focus.

<u>Name and Location on Focus</u>	<u>Cutting Material and Section Features</u>
<p>Zero Focal Length: The laser focus is on the cutting surface of the workpiece.</p> 	<p>Suitable for Thin Carbon Steel under 1 mm, etc. The focus is on the workpiece surface, the upper surface is cut smooth, the lower surface is not smooth.</p>
<p>Negative Focal Length: The laser focus is below the surface of the cutting part.</p> 	<p>Nitrogen Cutting Stainless Steel cutting method; The focus is below the plate surface, so the smooth surface has a wide range, the cutting slot is wider than the zero focal length slot, the cutting gas flow is larger, and the punching time is longer than the zero focal length slot.</p>

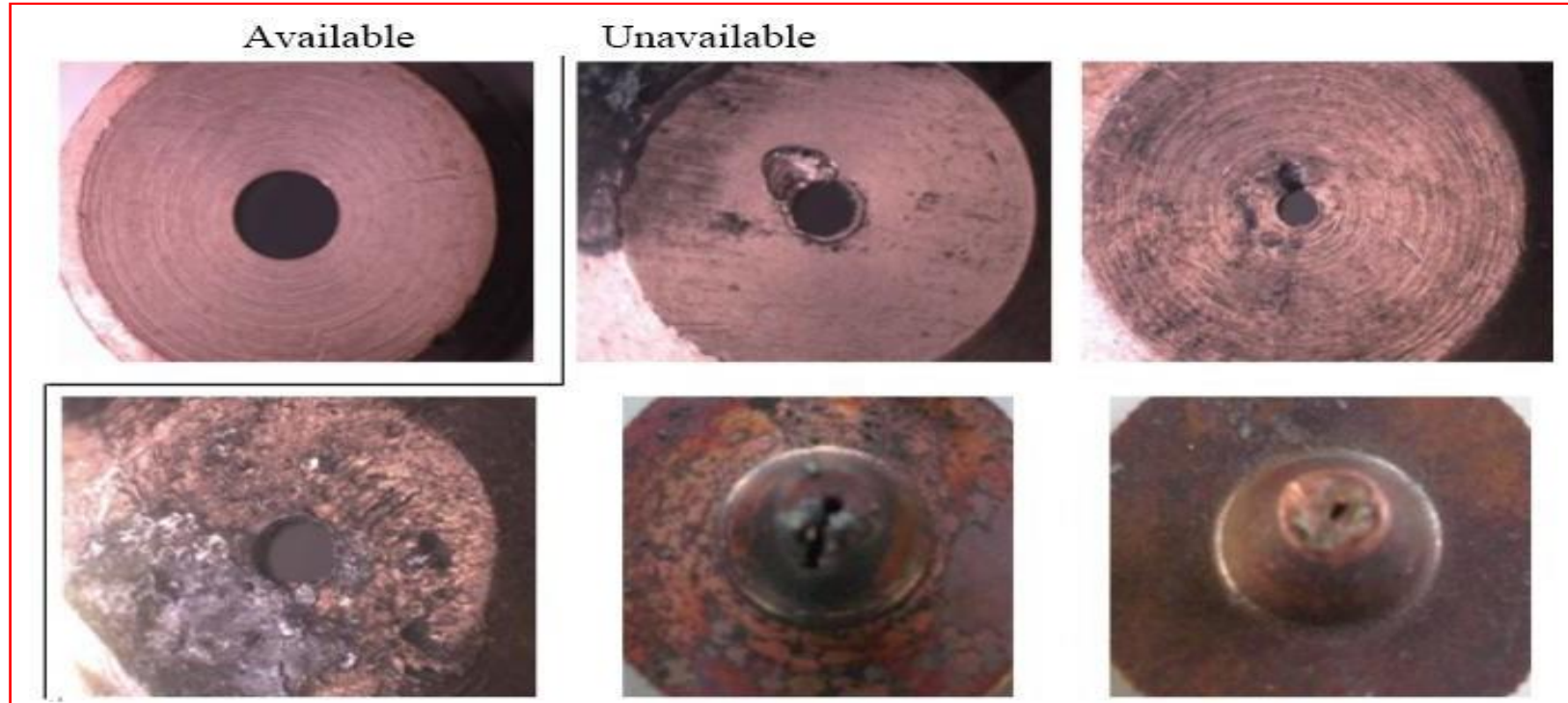
Main Process Control of Fiber Laser Cutting (Cont'd.)-

4.) Focus Point (Cont'd.):

Name and Location on Focus	Cutting Material and Section Features
Focal Length: The laser focus is above the cutting surface. 	Oxygen used for cutting Carbon Steel; Blackened surface, rough surface.

5.) Nozzle: The nozzle commonly used aperture is Φ 1.0, 1.5, Φ 2.0 Φ 2.5 two kinds. Aperture size difference is cutting thin plate: use Φ 1.5 nozzle, cut surface will be fine. Use Φ 2 nozzle, cut surface coarser, corner place easy to melt. When cutting thick plate: because of high cutting power, relatively longer cooling time, relative cutting time also increases. Use Φ 1.5 nozzle, gas diffusion area is small, so is not so stable when using. With above Φ 2 nozzle, gas diffusion area is large, the gas flow velocity is slow, so, the cutting is stable. Nozzle is divided into double layer nozzle and single layer nozzle : oxygen cutting carbon steel nozzle choice: generally, uses double nozzle, generally use single layer nozzle within 3 mm thickness; 3-12 mm generally adopts double Φ 2.0; Nitrogen cutting stainless steel nozzle selection: generally, use single-layer nozzle, use single-layer Φ 1.5 below 2mm thickness, use single-layer 2.0 above 2mm thickness. The size of the nozzle aperture has an absolute influence on the cutting

quality and the perforation quality. The larger the nozzle aperture is, the poorer the relative protection of the focusing lens will be. Because there is a large probability of the molten spark flying during cutting and the upward bounce, the shorter the life of the lens will be. At the same time, the quality of the nozzle is also an important factor affecting the cutting quality. The shape of the nozzle is shown in the figure below.




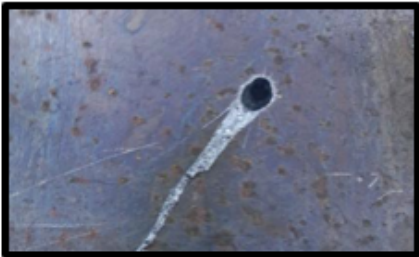

6.) Air Pressure: The main function of cutting gas is cooling and protection. Oxygen can help to burn and dissipate heat, blow off the melt generated by cutting, prevent the cutting melt from rebounding into the nozzle, protect the focusing lens and protect the mirror. The effect of cutting gas and pressure on the quality of the cut: the cutting gas helps to cool the heat and combustion, blow off the melt, and obtain a better-quality cut section. When the pressure of the cutting gas is insufficient, the following effects are caused: the melting occurs during cutting; the cutting speed cannot be increased, and the production efficiency is affected. When the pressure of the cutting gas is too high, the influence on the cutting quality: when the pressure is high, the airflow is too large, the cutting surface is rough, and the slit is wide; when the airflow is too large, the cut section is partially melted and cannot be formed well. The influence of the pressure of the cutting gas on the perforation. When the gas pressure is too low, the laser does not easily penetrate the cutting plate, and the drilling time increases, resulting in low productivity. When the gas pressure is too high, the penetration point is melted, and a blast hole is formed to form a large melting point, thereby affecting the quality of the cutting. When laser drilling, generally, a higher gas pressure is applied to the punching of the thin plate member, and a lower gas pressure is applied to the punching of the thick plate member. Oxygen cuts ordinary carbon steel. The thicker the material, the lower the pressure of the cutting gas. Nitrogen cut stainless steel, the thicker the material, the higher the gas pressure, the cutting gas pressure is always above the high-pressure state of 1.2mpa.

7.) Lead In-line: A line connecting the punching position to the contour of the workpiece. The lead-in line is also called the lead-in line. The benefit of adding a lead-in: when the hole is blasted, the resulting workpiece scrap is reduced. The quality of the first cut surface can be improved. It can improve the appearance of the knife edge. It is easier to start the knife when cutting stainless steel. Stainless steel lead set requirements 2mm stainless steel can use straight lead; 2mm or more generally adopts straight line 3-5mm plus R0.2-R0.8 around small arc; carbon steel generally adopts straight line 3-5mm plus R0.5— The arc of R3 is introduced, and the thicker the plate, the larger the R value. Oxygen cutting thick steel carbon steel 5mm or more, cut small holes, it is recommended not to add.

8.) Perforation Direct Cutting: Generally applicable to carbon steel plate below 1.2mm, stainless steel perforation, small perforation aperture. Segmented perforation: generally applicable to carbon steel plates of 3mm or less and stainless-steel perforations of 1.5mm or more. Progressive perforation: generally applicable to carbon steel plate of 3mm or more, perforation of 2mm-3mm stainless steel, fast perforation speed, large perforation aperture ($\Phi 2$ - $\Phi 3$ mm), perforation height > 3mm, pressure < 2bar. According to the actual situation. Three-stage perforation: generally applicable to carbon thick steel plate more than 6mm, stainless steel more than 5mm. Thick carbon steel sheets have a long time for ordinary perforation and are easy to explode. The purity of oxygen is at least 99.5%. The lens, protective mirror and nozzle have good

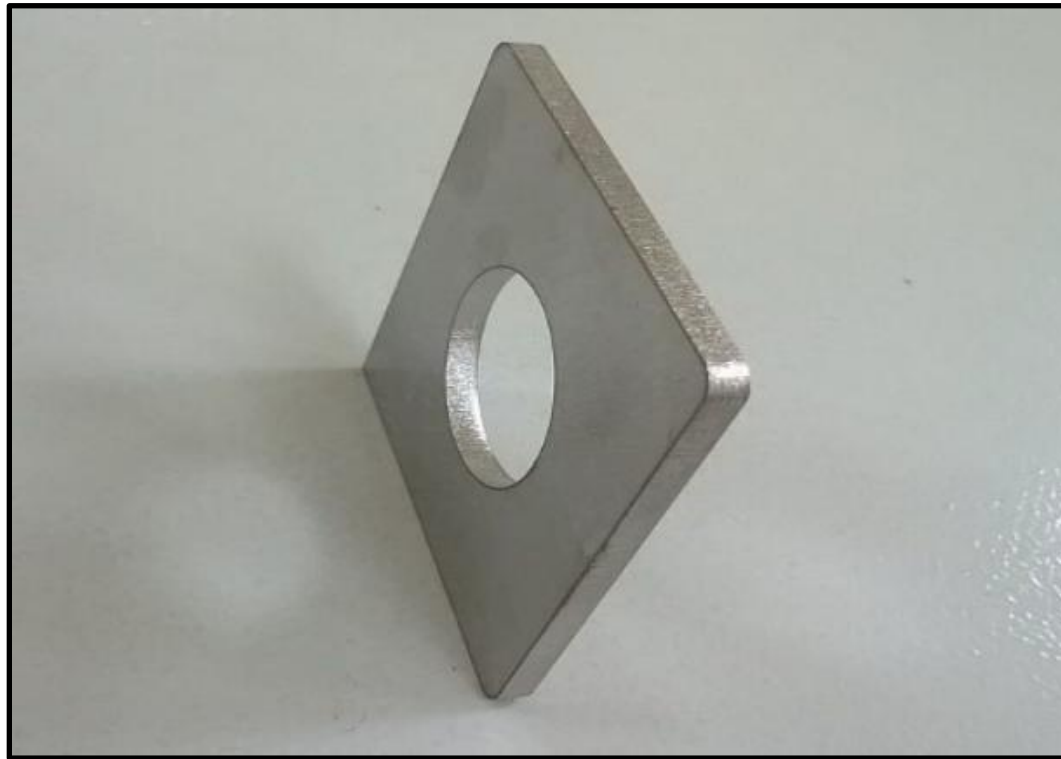
Main Process Control of Fiber Laser Cutting (Cont'd.)-

8.) Perforation Direct Cutting: (Cont'd.)- materials. The laser mode is free of distortion and wastes time, and the collision alarm is prone to occur. After the progressive perforation is used, the piercing time is greatly shortened, and the blasting rate is lowered.

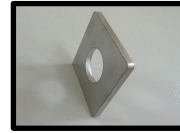
<u>Problem</u>	<u>Possible Reason-Root Cause</u>	<u>Solution</u>
Punch at the beginning of the punch. 	1.) The duty cycle is too high. 2.) Punching power is too large. 3.) Too much pressure. 4.) The focus is wrong. 5.) Punching is wrong.	1.) Reduce power by 10% each time. 2.) Reduce the duty cycle, 1% - 2% each time. 3.) Reduce the air pressure, change the focus every 0.1bar, check the punching mode every 0.1-0.2mm, whether it is continuous wave drilling, etc.
Hole in the process of hole. 	1.) The Duty Cycle is too low. 2.) Low Power. 3.) The Focus is wrong. 4.) Low Air Pressure.	1.) Reduce Speed. 2.) Check the amount of defocus. 3.) Increase Power, 5%-10% each time. 4.) Increase Air Pressure, 0.1-0.2bar each time.
End of punching, blasting before cutting starts. 	1.) Insufficient Punching Time, Low Punching Power.	1.) Increase the Punch Time, 0.5sec each time. 2.) Increase the Punching Power, 5% each time. 3.) Increase Duty Cycle, 1% - 2% each time. 4.) Use slow speed.

Main Process Control of Fiber Laser Cutting (Cont'd.)-

9.) In the process of production and processing, before the mass production, there must be a process of trial cutting, called **“Testing Knife”**. Through the test knife, the process parameters required for sheet cutting can be adjusted, but the test knife and the whole board cutting process will be slightly different and needs attention. Test knife: first select a circle to cut, the main purpose is check whether the parameters can be cut normally, whether the cutting section is qualified, know the deviation between the actual size and the size after cutting, to compensate the size in mass production, and try to Select the most complex contour in the machining pattern to test the knife.



Precautions for mass production after Test Knives:



- 1.) Pay attention to the limit of the machine tool. The plate should not be too close to the edge, pay attention to the starting position of the cutting head.
- 2.) Pay attention to whether the direction of the graphic is consistent with the direction of the plate when cutting, and the dimensional deviation when testing the tool should be compensated to the figure of mass production.
- 3.) It is best to simulate the program once before cutting to ensure the correctness of the program.
- 4.) The speed in mass production is 80% of the speed at which the knife is tested.
- 5.) The first part to be cut during mass production must be measured to ensure that it is safe to be inspected and, if necessary, sampled during the cutting process.
- 6.) See if the parts are turned over during mass production, it is easy to hit the cutting head, and an alarm is generated. It is necessary to suspend the cutting. Otherwise, collision will occur easily, and the plate will be moved. The solution is to set the micro-connection to the cutting workpiece. The laser head needs to be recalibrated.
- 7.) Before cutting, manually check whether the blowing is normal. During the cutting process, pay more attention to the use of gas to prevent the lack of gas in the middle, resulting in scrapped parts.
- 8.) During the cutting process, the operator is not allowed to leave the console to avoid an emergency.

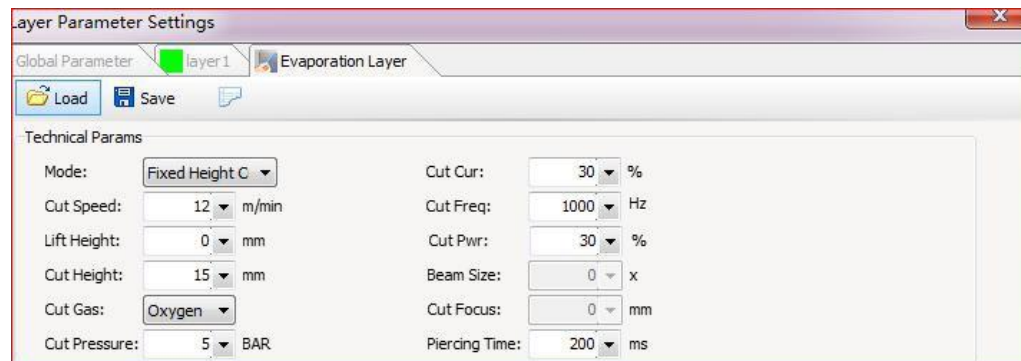
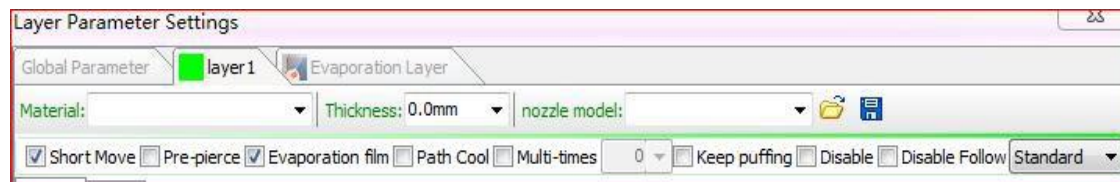
Precautions for mass production after Test Knives (Cont'd.):

9.) The starting point is set at the lower right of the part to reduce the error caused by the deformation during the cutting process.

10.) The part is at least 10mm from the edge of the board.

11.) **With Film Cutting**: with the film side up, if there are films on both sides, the lower surface film must be torn off, otherwise the slag will be slag; according to the film condition, if the film is firmly attached, it can be cut normally; if the film is not attached In case of hard work, it is necessary to use a snoring to remove the film and then cut it (recommended: high-viscosity, viscosity 120, black and white film with a thickness of 0.05 mm or less);

12.) **De-Filming**: The cutting path is marked first and then cut. Simply put, the same path is repeatedly cut twice, once with a small power marking, the film is cut off, and the metal is cut again with high power. The height of the film can be adjusted by adjusting the degree of cut in the film removal parameter, and the wider the height, the smaller the probability that the film is blown up.



13.) Overview of different Material Methods-

- **Carbon Steel Cutting Process:** This material will get better results when cut with oxygen. When oxygen is used as the processing gas, the cutting edge is slightly oxidized. For plates up to 1 mm thick, high pressure cutting can be performed using nitrogen as a process gas. In this case, the cutting edge will not be oxidized. A plate having a thickness of 10 mm or more and oiling the surface of the workpiece during processing can obtain a good effect.
- **Stainless Steel Cutting Process:** oxygen can be used in the case of acceptable cutting end oxidation; high pressure nitrogen is used to obtain the edge without oxidation and burr, no need to deal with it. Coating the oil film on the surface of the board can get better perforation without sacrificing processing quality. As shown in the figure, a stainless-steel piece cut with high-pressure nitrogen has small burrs under the workpiece to increase the nitrogen pressure.
- **Aluminum Cutting Process:** despite the high reflectivity and thermal conductivity, aluminum with a thickness of 6mm or less can be cut, depending on the alloy type and laser capability. When cut with oxygen, the cutting surface is rough and hard. When nitrogen is used, the cutting surface is smooth. Pure aluminum is very difficult to cut because of its high purity.
- **Brass and Copper Cutting Process:** both materials have high reflectivity and very good thermal conductivity. Brass can be cut with nitrogen; copper can be cut, and the process gas must be oxygen.
- Special process with film cutting.

13.) Overview of different Material Methods (Cont'd.)-

a.) With the film facing up, if there are film on both sides, the lower surface film must be torn off, or hang slag; according to the plate film, if the film is firmly attached, it can be cut normally; if the film is not firmly attached, it must be used Cutting after removing the film (recommended: high viscosity, black and white film with a viscosity of 120 and a thickness of 0.05 mm or less).

b.) **De-filming:** The cutting path is first marked and then cut. Simply speaking, the same path is repeatedly cut twice, once with a small power marking, the film is cut off, and the metal is cut at a high power again. The width of the film can be adjusted by adjusting the degree of cut in the film removal parameter, and the wider the width, the smaller the probability that the film is blown up.

- **Special Process Layered Cutting:**

The contours of each workpiece are not the same, some are easy to cut, but some are more difficult to cut, such as small holes, sharp corners and so on. To ensure the cutting quality and cutting efficiency of the whole workpiece, we adopted the layered cutting method, so that we can adopt different process parameters to control the cutting of different contours, which can not only ensure the cutting quality of the difficult contour but also improve the cutting efficiency of the easy contour. Layered cutting is mainly divided into continuous wave cutting layer and pulse cutting layer.

13.) Overview of different Material Methods (Cont'd.)-

Pulse Cutting Features: Low heat input, small deformation of the workpiece, slow cutting speed, high pressure, and rougher cutting section than continuous wave cutting.

Applications: Sharp corners, small contours, irregular lines (especially the lines broken up by the spline) and precision parts requiring less thermal deformation.

Carbon Steel does not use pulse cutting more than 4 mm, stainless steel does not exceed 3mm, aluminum alloy generally does not use pulse cutting.

Maintenance-

Review-

To ensure the normal use of the laser cutting machine, the equipment must be routinely maintained and maintained. Because the whole machine tool is made up of high-precision parts, it must be taken care of in the daily maintenance process, strictly in accordance with the operating procedures of each part, and maintained by a special person, and must not be barbaric to avoid damage to components.

General Guidelines-

Professional lubrication with the most suitable lubricant is the premise of maintaining the quality of machine tools. This avoids running failures and their consequences. In this sense, the following considerations should be noted.

Before Putting into Operation: Before the machine is put into operation, the machine must be carefully lubricated according to the lubrication instructions. If the machine has not been used for a long time (e.g., ocean transport), the lubrication of the entire machine must be checked.

General Guidelines (Cont'd.)-

Lubrication Precautions: Machine tool lubrication according to the lubrication diagram and the description of the lubrication diagram. I suggest you also pay attention to the following points:

- Do not open the refueling and discharge ports for more than the specified time and keep them clean.
- Use only non-fibrous wipes for scrubbing oil grooves and lubrication points, do not use waste wool, do not use kerosene and gasoline, and use a lean liquid spindle oil ("Spray Lubricant").
- Synthetic lubricants are not allowed to be mixed with mineral oils or synthetic oils from other manufacturers. This is true even for synthetic oils of the same characteristics produced by other manufacturers.

Waste Oil can only be discharged when the machine is warm. Special attention must be paid to the innocent treatment of used oil.

Cleaning Precautions: The entire equipment must be thoroughly cleaned at specified intervals. Obvious dirt can be scrubbed or removed with an industrial vacuum cleaner.

Safety Tip: When performing maintenance work, the machine must be turned off by the main switch to turn it off.

Safety regulations must be strictly observed to avoid accidents.

General Guidelines (Cont'd.)-

The Maintenance Items that the user should keep are as follows:

- Acetone: a purity of 99.5%, water less than 0.3%, a bottle of 500ml capacity.
- Absorbent cotton: 5 packs.
- Alcohol: 500ml, purity 99.5% or more.
- Lens paper: 5 copies.
- Blowing Ball: (1) one.
- Dropper Needle: (1) one (Medical).
- Plexiglass: 200mm × 300mm × 20mm or
7.875 In. x 11.81 In. x .787 In.
- Ink slab; (**Red**): (1) one piece.
- Cotton Swabs: two packs.
- Multimeter: (1) one.

Daily Maintenance and Maintenance of Peripheral Equipment-

For routine maintenance of peripheral equipment such as chillers, voltage regulators, and lasers source, please take the corresponding instruction manual as reference. The following is only brief description.

The main function of the high-power chiller is to cool the laser source so that the laser is in a constant temperature working condition, thus good and regular maintenance is the key to ensure the normal operation of the machine; And the circulating water of the chiller requires the use of distilled water. However, due to the water quality problem, certain impurities such as minerals and dust still exist in the circulating water, and the dust in the environment may also enter the circulating water in some operation steps, and the deposition of these impurities may cause Blockage of water system and cutting machine components (such as metal filters, heat exchanger heads in the cutting machine), which seriously affect the cutting effect and even burn out the optical components. Dust and other debris in the environment accumulate on the radiator and water pump of the chiller, resulting in poor heat dissipation of the radiator and the pump, resulting in poor cooling, burning of the compressor, and burning of the pump. This will directly affect the cutting effect; therefore, cold water, the daily maintenance of the machine is particularly important; the daily maintenance of all types of chillers must be carried out in strict accordance with the respective chiller maintenance instructions (See Attached Table Below), for Facilities holding a Quality Systems Certification,(Example: ISO/QS9000 etc.) incorporate maintenance instructions to Preventive Maintenance Program.

CWFL-2000 DUAL TEMPERATURE & ONE PUMP INDUSTRIAL CHILLER		
Maintenance Period	Maintenance Content	Maintenance Target
Daily	1.) Check if the chiller temperature setting is normal, (Set Temperature 20±1°C).	Ensure that the cooling water supplied to the
	2.) Check whether the chiller waterway seal, water temperature and water pressure meet the requirements.	Ensure that the equipment
	3.) The working environment of the chiller is kept dry, clean and ventilated.	Conducive to the good operation of the chiller.
Monthly	1.) Use neutral detergent or high-quality soap to remove dirt from the surface of the chiller. Do not use benzene, acid, milling, steel brush, hot water, etc.	Ensure the surface of the chiller is clean.
	2.) Check if the condenser is blocked by dirt. Please use compressed air or a brush to remove the dust from the condenser.	Ensure the normal operation of the condenser.
	3. Cleaning the Air Filter: a.) Open the panel of the air filter of the machine assembly, pull up the air filter and pull it out; b.) The dust on the filter net can be removed by using a vacuum cleaner, an air spray gun and a brush. After the cleaning is completed, if the filter is wet, shake it and dry it before putting it back. c.) Cleaning time: once every two weeks, if the dirt is serious, please wash it regularly.	Prevents poor cooling, pumps and compressors burns out which caused by poor heat dissipation.
	4.) Check the water quality of the tank and follow up	Good water quality ensures
	5.) Check if the chiller pipeline any leakage or not.	Ensure that the chiller has
Every 3 Months	1. Check electrical components (such as switches, terminals, etc.) and wipe then clean with a dry cloth.	Ensure that the surface of the electrical part of the chiller is clean and
	2.) Replace the circulating water (Distilled Water), and clean the water tank and metal filter; if equipped with ROFIN laser, the cooling water can be replaced with cooling water after adding anti-corrosion inhibitor for half a year. If equipped with PRC laser, propylene glycol is added to the cooling water. The cooling water can be replaced once every six months.	Make sure the laser running properly.

Daily Maintenance and Maintenance of Peripheral Equipment (Cont'd.)-

★★★ Note:

Requirements for Long-Term Suspension:

- a.) Place the chiller and water pipe away from dust.
- b.) Pull the power cord away from the socket and wipe the power cord clean.
- c.) Cleaning the unit body: When cleaning the inside of the unit, do not let water splash on the electronic parts.
- d.) Completely remove water.

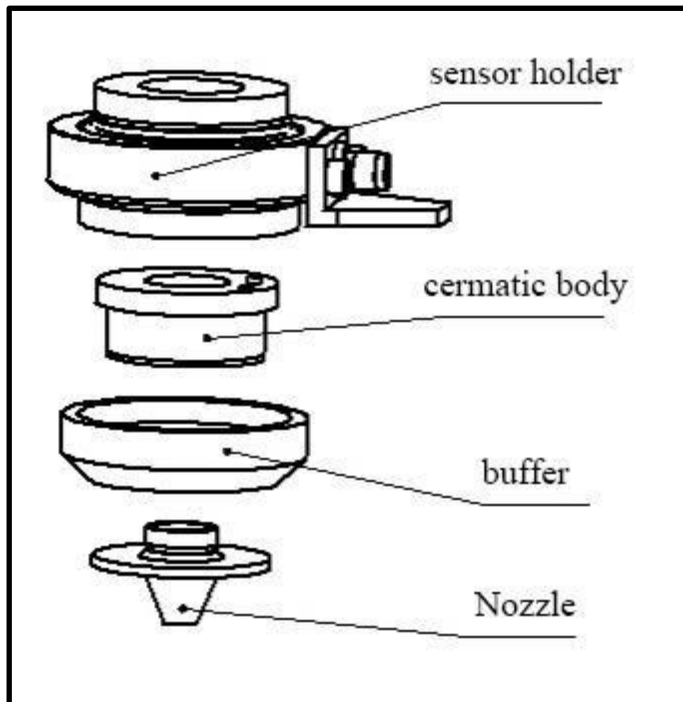
The Maintenance of Laser Source and Laser Cutting Head-

- **Laser Source-** is the core equipment in laser cutting machine. It provides cutting light source for laser cutting machine. To ensure your laser cutting machine to work normally with high quality, while ensuring reliable operation of your laser source and extending the service life of laser source, remind you Check and maintain your laser regularly.

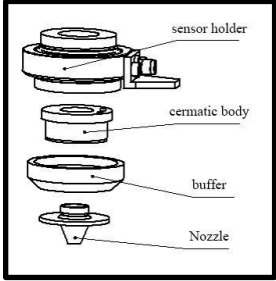
Fiber lasers can basically be maintenance-free. Mainly need to take care of the observation of cooling water and cooling air conditioning is normal, whether the voltage is normal! If there is an abnormal alarm, contact Laguna Tools Customer Service immediately @ 1-800-234-1976!

Laser Cutting Head Maintenance-

Protection Lens Maintenance (See Illustration Below)



Laser Cutting Head Maintenance (Cont'd.)-



The protection lens is in the lower part of the centering mold and is susceptible to dust pollution. It is recommended to clean it every week.

- Removal of the Protection Lens Box-

Hold the drawer of the protection mirror box with your thumb and index finger, slowly pull out the protection mirror box, and then seal the drawer with adhesive tape to prevent dust from contaminating the focusing lens.

- Protection Mirror Box Installation-

The protective lens is a flat mirror that can be placed directly into the mirror box. The procedure in which the lenses are mounted is reversed as when the lenses are removed. Press the lock button on the drawer with your finger and insert it into the drawer. When the lock button pops up, the assembly is completed.

Laser Cutting Head Maintenance (Cont'd.)-

Lens Cleaning-

Prepare Tools:

Dust gloves / finger cots, long fiber cotton wool, isopropyl alcohol, rubber gas blowing.

B, cleaning method:

- 1.) The left thumb and index finger with a finger cot.
- 2.) Spray isopropyl alcohol onto the cotton wool stick.
- 3.) Gently pinch the side edge of the protective lens with your left thumb and forefinger.

Note: The fingertips should not touch the surface of the lens to avoid leaving marks.

4.) The lens facing the eyes, the right hand with a cotton wool stick, from bottom to top or from left to right, gently wipe the lens in a single direction, (do not wipe back and forth to avoid secondary pollution of the lens), and blow with rubber gas the surface of the lens. Both sides must be cleaned. After cleaning, re-confirm that there are no residues: detergent, cotton wool, foreign matter, and impurities.

The cleaned lens should not be exposed to the air, installed as soon as possible or temporarily stored in a clean, sealed container.

Laser Cutting Head Maintenance (Cont'd.)-

Replacement of the Bottom Kit-

- 1.) Unscrew the mechanical part of the sensor and remove it.
- 2.) Replace the new bottom kit and tighten.
- 3.) Adjust the bottom kit to the right position.

Nozzle Replacement-

Unscrew the nozzle by hand, as shown in Figure 9. Replace with a new nozzle and retighten it with the appropriate force.

Calibrate the floating capacitor again after replacement.

Replacement of Ceramic Body-

- 1.) Remove the short cable, remove the mechanical part of the cutting head, and remove the nozzle.
- 2.) Then unscrew the fastening nut of the ceramic body and take out the ceramic body, as shown in the figure 9.
- 3.) Install the new ceramic body, it need aligned that two positioning posts on the mechanical part of laser head.
- 4.) Firmly lock the compression nut and reassemble it on the connector.

Laser Cutting Head Maintenance (Cont'd.)-

- **Optical System Checking and Cleaning-**

Precautions-

To ensure the lens used normally, the optical lens (protect mirror, focus lens, collimating mirror, etc.) should be checked in time. Do not touch the surface of the lens directly with hand during the check, otherwise the mirror surface will be easily scratched. If there is oil or dust on the mirror, please clean it.

1.) Optical lenses are strictly prohibited from being cleaned with water, detergent, etc. The surface of the lens is coated with a special film, it will damage the surface of the lens if cleaned with water, detergent etc.

2.) Do not place the lens in a dark, damp place, as this will age the surface of the lens.

3.) The surface of the lens is stained with dust, dirt, or water vapor, which easily absorbs the laser to damage the lens coating; it will affect the quality of the laser beam, if damaged lightly, there will be no laser beam, if damaged seriously.

4.) When the lens has little damage, it should be sent to the supplier to repair in time. Try not to use the damaged lens, otherwise it will accelerate the damage to the lens which can be repaired before.

Laser Cutting Head Maintenance (Cont'd.)-

Precautions (Cont'd.)-

5.) When installing or replacing the mirror or focusing lens, do not use too much pressure, otherwise it will cause deformation of the lens and affect the quality of the beam.

Method of Installing or Replacing an Optical Lens-

1.) Before installing the optical lens, wear cleanly, clean the hands with soap or detergent, and wear white clean and thin gloves; do not touch the lens with any part of the hand; when taking the lens, wear gloves and Take the side of the lens and do not touch the lens coating surface directly.

2.) When assembling the lens, do not blow the lens by mouth; the lens should be placed on the clean table steadily, and a few lens papers should be placed under neath. Care should be taken when taking the lens to prevent bumps and falls, and no force should be applied to the coated surface of the lens; the lens holder for the lens should be cleaned, and the dust and dirt in the lens holder should be cleaned with a clean air spray gun. Then, remove the lens and gently put it into the lens holder.

3.) When mounting the lens to the lens holder, do not use too much force to fix the lens to avoid deformation of the lens, thus affecting the quality of the beam.

Method of Installing or Replacing an Optical Lens (Cont'd.)-

4.) Precautions when replacing the optical lens: Be careful when removing the lens from the box to prevent the lens from being damaged; do not apply any pressure to the lens before the wrapping paper is opened; When take the mirror and focus lens from the box, wear clean gloves and take it from the side of the lens; when removing the wrapping paper on the lens, avoid dust and other objects falling on the lens; after removing the lens, use a spray gun to remove dust from the mirror, and then put the lens on the special paper for the optical lens; Clean the dust and dirt on the lens support frame and the fixing frame, and no other objects are dropped on the lens during assembly; when the lens is mounted on the lens holder, do not use excessive force to avoid deformation of the lens; After assembly, clean the dust and foreign matter on the lens with a clean air spray gun.

Procedure of Clean the Lens-

Different lenses have different cleaning methods. When the mirror is flat and has no lens holder, use lens paper clean it, for example-Cleaning the reflection mirror; When the mirror is curved or with a mirror holder, use a cotton swab to clean, such as cleaning the focus lens.

Procedure of Clean the Lens (Cont'd.)-

1.) Steps to clean the lens with lens paper: Use a clean air spray gun to blow off the dust on the lens surface; use alcohol or lens paper to clean the surface of the lens. Never use a dry lens paper to pull directly on the mirror surface. Instead, flatten the lens paper to the surface of the lens, drop 2-3 drops of high-purity alcohol or high-purity acetone, and slowly pull out the lens paper horizontally to the direction of the operator. Repeat the above operation several times until the mirror surface is clean; if the mirror surface is very dirty, fold the lens paper 2-3 times, repeat the above steps until the mirror is clean.

2.) Steps to clean the lens with a cotton swab: first blow off the dust on the mirror with a spray gun; then use a clean cotton swab to remove the dirt; Move a new cotton swab dipped with high-purity alcohol or acetone from the center of the lens to the edge of lens making a circular motion. Scrub the lens, after each circle of cleaning, change another clean cotton swab and repeat the above operation until the lens is clean. Never use the used cotton swab to operate it; clean the lens with a clean cloth and remove the residue on the mirror. Be careful not to scratch the mirror surface; take the cleaned lens to a place with sufficient light. If the reflection of the lens is good, it indicates that the lens is clean. If the reflection of the lens is not good, continue to clean the lens; Put the cleaned lens on the lens holder in accordance with the method described above.

Procedure of Clean the Lens (Cont'd.)-

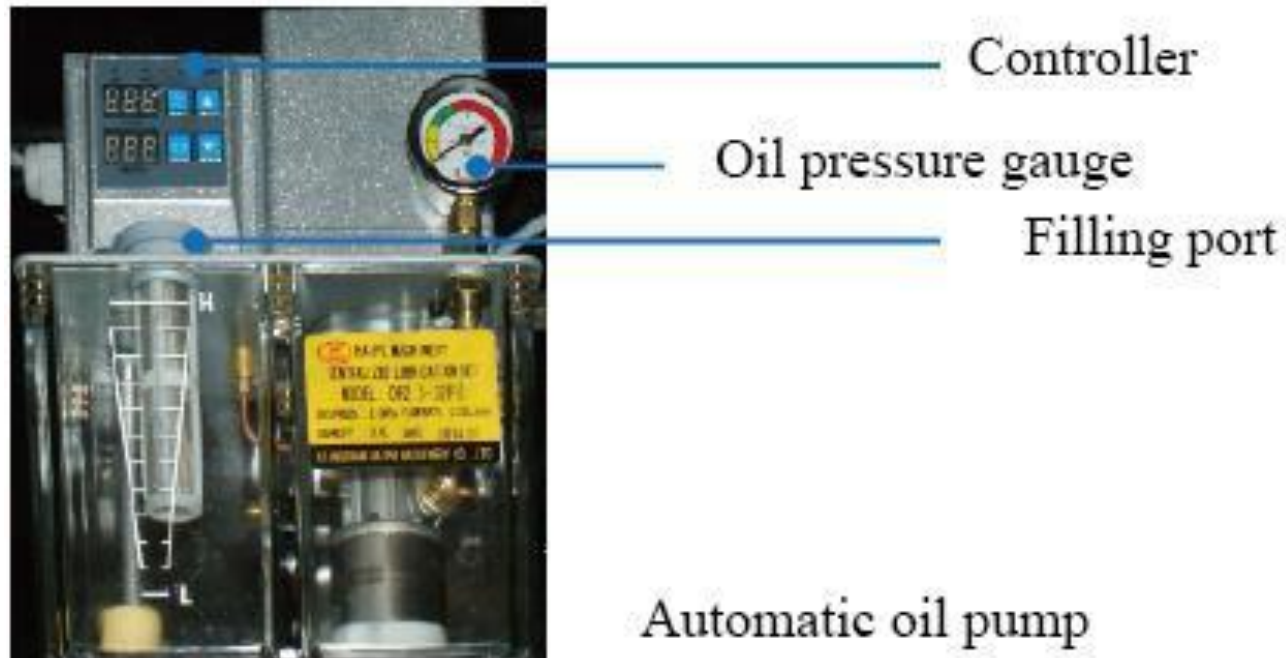
Storage of Optical Lenses-

- 1.) The optical lens is stored properly to keep the lens quality in a good condition.
- 2.) The storage environment temperature is 10~30°C. Do not put the lens into the freezer or similar environment. Otherwise, it will condense and frost when it is taken out, which will easily damage the lens. The temperature of the storage environment is not more than 30°C, otherwise it will affect the coating on the lens surface.
- 3.) Keep the lens in the box, the lens should be placed in a non-vibrating environment, otherwise it will easily cause deformation of the lens, thus affecting the performance of the lens.
 - **Maintenance during Long-term Storage:** When the machine is not used for a long time, please apply butter on the moving parts of the machine and wrap the anti-embroidered paper. Check other parts regularly to see whether there is any rust and rust-proofing treatment of rusted parts.(if the condition can be added with a dust cover), and regularly clean and check the machine.
 - **Linear Slide and Rack and Gear Maintenance:** because the different lubricant types used in the two rails, the equipment also adopts two different lubrication methods. The guide rail adopts the electric automatic refueling pump to refuel automatically . When the automatic oil pump is too low, the system will alarm automatically, you need to join the Great Wall heavy-duty vehicle gear 90GL-5 lubricating oil at the oil filling port and reset after the oil filling is completed. The rack needs to add oil to the machine body

Linear Slide and Rack and Gear Maintenance (Cont'd.):

- days. The oil used is Mobil 00# lithium grease. If the linear slide is not properly lubricated, the friction of the rolling portion will increase, and long-term use will become the main reason for shortening the life.

The linear slide and sprocket chain grease is a lithium-based grease. It is recommended to use the Tsutsui lithium grease MP-3:



- **Machine Cleaning and Maintenance-**

Mainly maintenance is the transmission part of the machine body and the cleaning of work surface.

1.) It is necessary to clean the work surface and the dust and debris on the worktable every day.

2.) The dust and debris on the track dust cover must be cleaned every day to prevent the dust cover from being scratched and shorten its service life.

- **Water Tank Cleaning and Maintenance-**

The main function of the water tank is to protect the laser and the cutting head by controlling the water temperature to ensure the normal operation of the laser equipment. It is an important accessory and must be cleaned and maintained.

1.) It is necessary to clean the filter every day to ensure that the ventilation and heat dissipation are good, to ensure the water temperature is normal. "As shown below"

2.) The temperature of the water tank is generally maintained at 22°C to 28°C (in summer the high temperature can be set to 28-35°C, the low temperature can be set to 26-29°C, pay attention to the temperature difference between the equipment temperature and the external environment temperature cannot be greater than 5°C, please adjust in summer Otherwise it will have a serious impact on the device). "As shown below":

- **Water Tank Cleaning and Maintenance-**

2.) The temperature of the water tank-



3.) Change the water every week (**Note:** Be sure to use distilled water, recommend Watson's distilled water), wash the water tank before changing the distilled water every time, recycle the dirty water in the equipment once with new distilled water, and then inject distilled water again.

- **Cleaning and Maintenance of the Electric Cabinet:**

1.) The filter of the electrical cabinet is cleaned weekly and can be cleaned with compressed air or water. Replace filter if it is dirty.



Cleaning and Maintenance of the Electric Cabinet (Cont'd.):

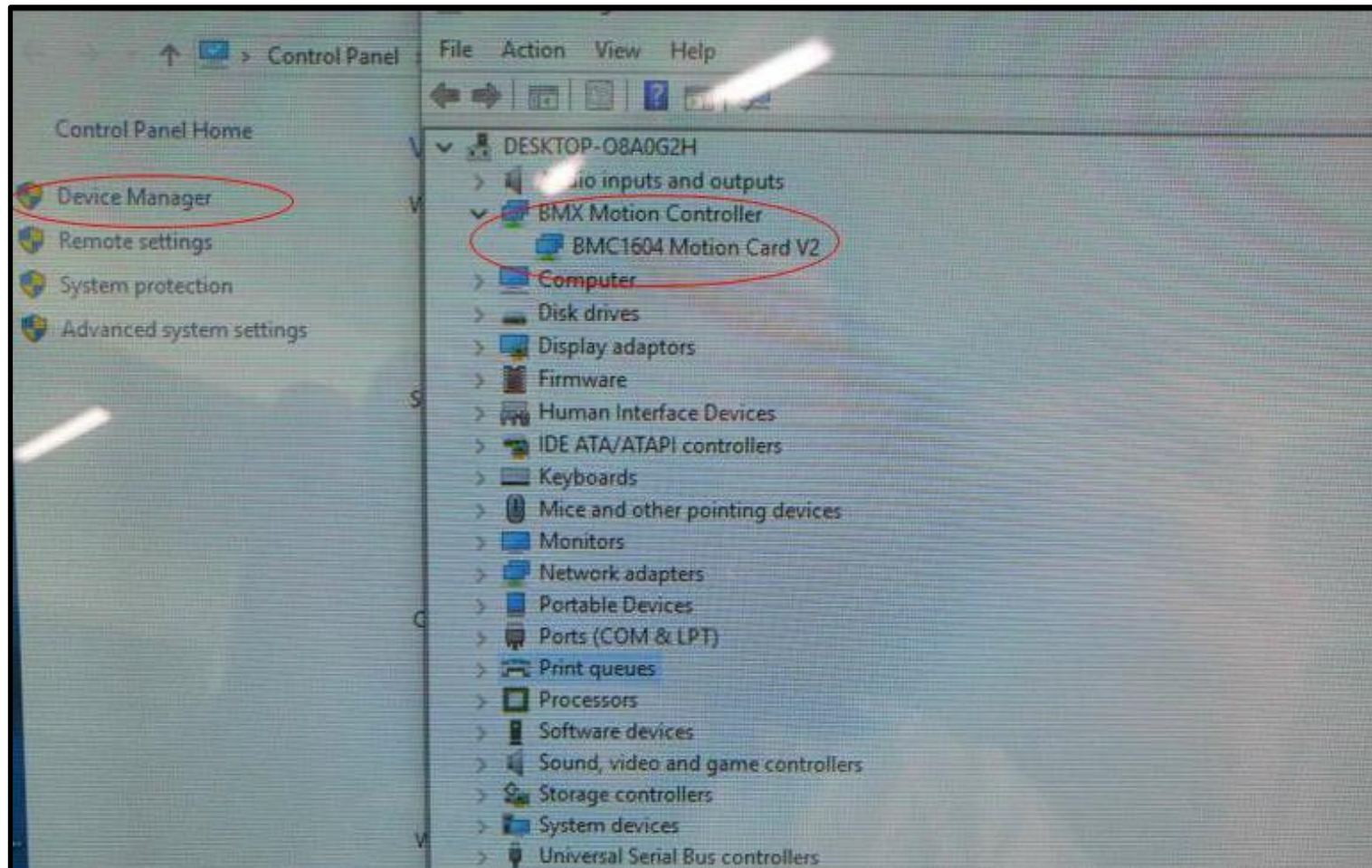
2.) The electric cabinet will be cleaned once every three months. If the environment is bad, the dust will be cleaned once a month. When the dust is cleaned , all the power supplies must be powered off, and then the doors on both sides of the power supply cabinet are opened. Do not touch the electronic components inside the cabinet directly. Clean the dust in the cabinet with a vacuum cleaner (do not use compressed air).

3.) Clean the computer host every six months. (If environment is bad every 3 months need clean once) You need to clean the computer host, remove the fixing strip, and remove the cover. The motion control card and memory module can be removed and cleaned. Please use a clean and dry cloth to do this.

Common Fault Analysis-

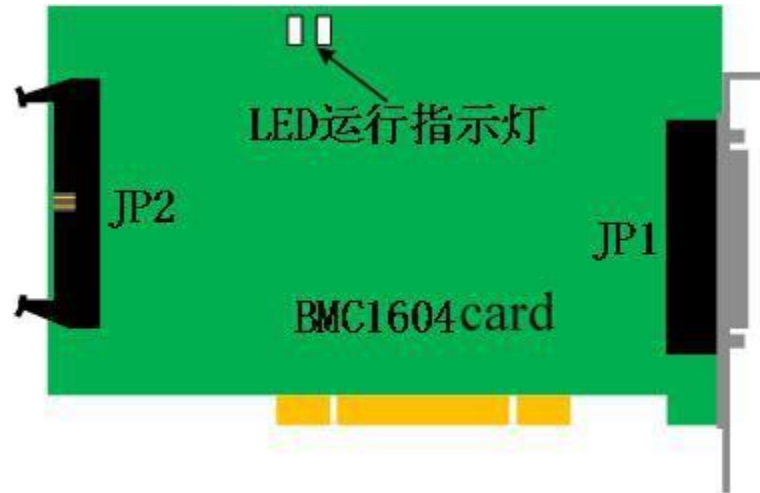
Software enters the Demo Interface Failure-

Check if the device manager finds the Cypcut Electronic Motion Control Card and checks if the control card driver is installed.




Software enters the Demo Interface Failure-

If the motion control card is not found in the device manager, please check the 2 small lights (LED7, LED8) on the top of the control card to flash. If it does not flash alternately, the control card may be faulty and can be upgraded or sent back for repair.



Check the interface to see if the system has expired.

S/N:	Licence Not Found
Available Times:	2010-01-01 ~ 2010-01-01
Registered Coc	<input type="text"/>
 Register	

Software enters the Demo Interface Failure (Cont'd.)-

160X series control card, CypCut software requires 6.3.702.x version and above version to support 60X series control card, check whether the serial number has multiple repeated codes such as ZZZZZ, re-plug the control card to see if the serial number changes, and then re-encrypt and decrypt after the change.

LICENSE

SERIAL # : ZZZZZ-ZZZZZ-A118P RTC:20170701 19

EXPIRATION DATE:

注册码: [Empty Field]

REGISTRATION CODE

PCI CONNECTION FAILED, MIGHT BE STARTUP ERROR, OR PLEASE CHECK CONTROL CARD MOUNT.

REGISTER

External Dongle, check if the RTC time behind the serial number is the current time. If the time is wrong, the dongle may be damaged.

S/N: Licence Not Found

Available Times: 2010-01-01 ~ 2010-01-01

Registered Code | [Empty Field]

Register

The laser source does not have light-

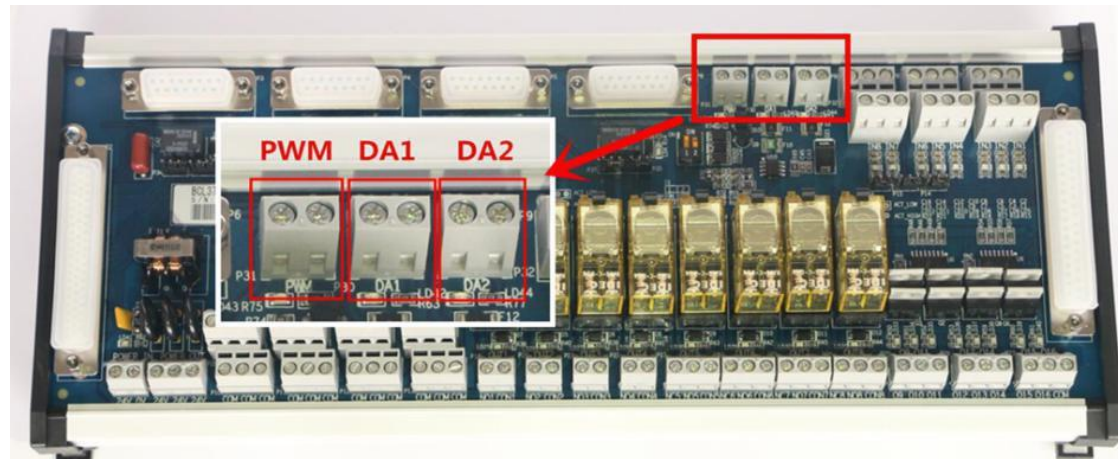
If the laser shutter not open?

Check if the output signal of the PWM (up to 4.1V or 22V when the duty ratio is set to 100%) and DA (0~10V) is normal on the terminal board.

Relying on the communication-controlled laser, you need to check the configuration of the network / COM port, whether it is connected.

Check whether the external control module of the laser is faulty. The internal control can emit light. It does not mean that the external control module is normal.

The laser monitoring software is used to detect whether the laser receives control commands, such as DA and PWM signals.



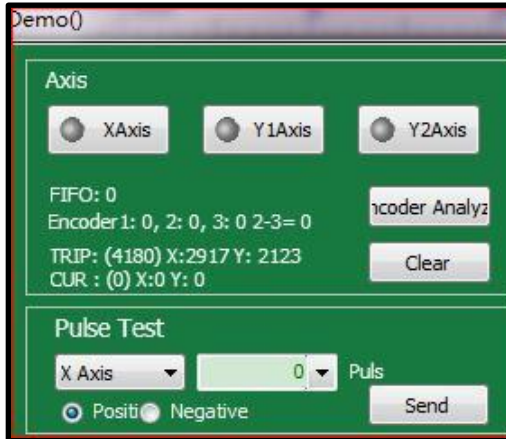
The Light of Scanning and Cutting Out is not normal, Light leakage-

Send a pulse in the diagnosis window to check whether the encoder feedback is normal. If the direction is wrong, reverse the direction of the encoder in the platform configuration tool. If the number is incorrect, modify the servo feedback pulse and other related parameters.

Check the accuracy of the error measurement is not high enough, the servo stiffness setting is too low

Sort the graph when generating the scan line, it is recommended to use the "Local Shortest Move" strategy

If the light leakage is from IPG laser, the PWM signal is set to 5V, and other lasers check whether the servo interferes with the board.



Check Encoder Pulse

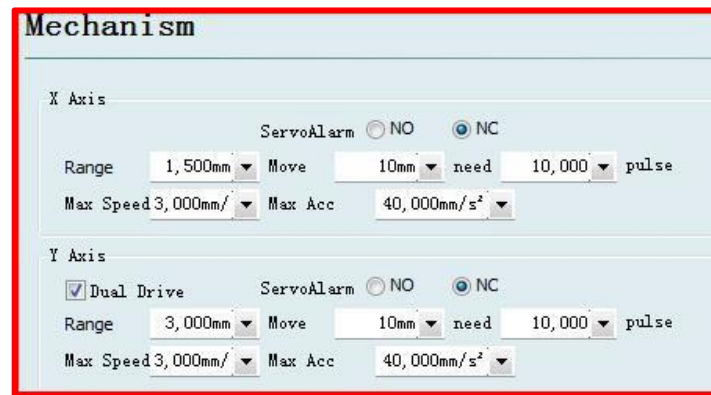
The Light of Scanning and Cutting Out is not normal, Light leakage (Cont'd.)-



Encoder Reverse

The Cutting Process is not the right size-

Check if the size drawn on the original drawing is correct. The deviation of the size is about 10 filaments. You can add the appropriate slit compensation. If the scale becomes larger or smaller, adjust the pulse equivalent in the servo and platform configuration tool.

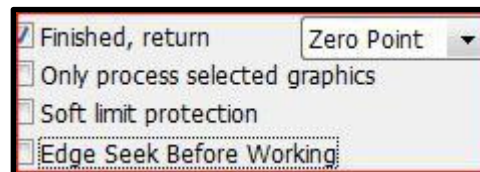


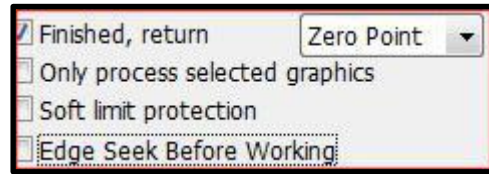
Cutting Deviation-

- Check if the servo motor is correctly equipped with a regenerative resistor.
- Check whether the trajectory of the cut part is deformed. If the distance of the empty movement changes and the closed pattern of the cutting is normal, check whether there is looseness between the servo and the reducer.
- In the above case, the null acceleration and low pass filtering frequency are set to be low or the same as the cutting portion, which can be temporarily solved.

Cannot perform Breakpoint Positioning after Power Failure or Restart-

If you check the option "only process selected graph", the processing breakpoint memory function will not be available.





In the process of using, the power should be returned to the origin at least once.

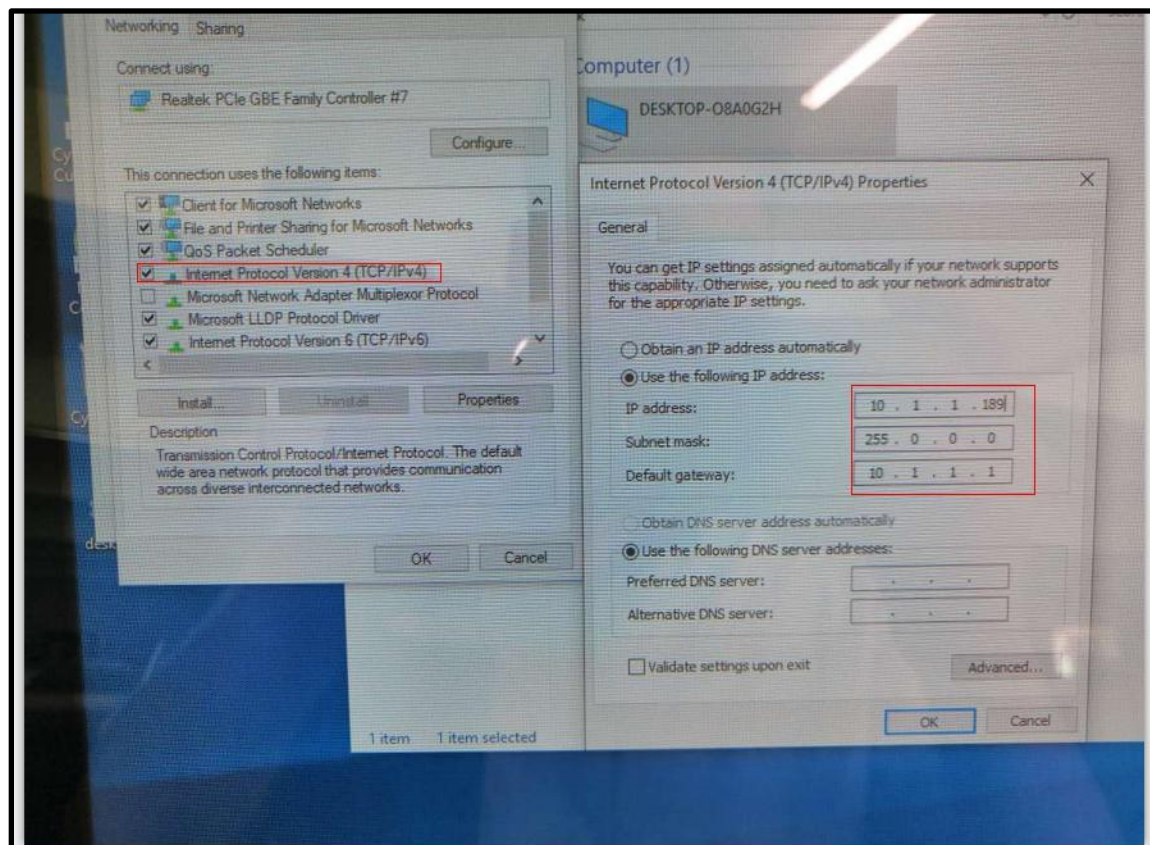
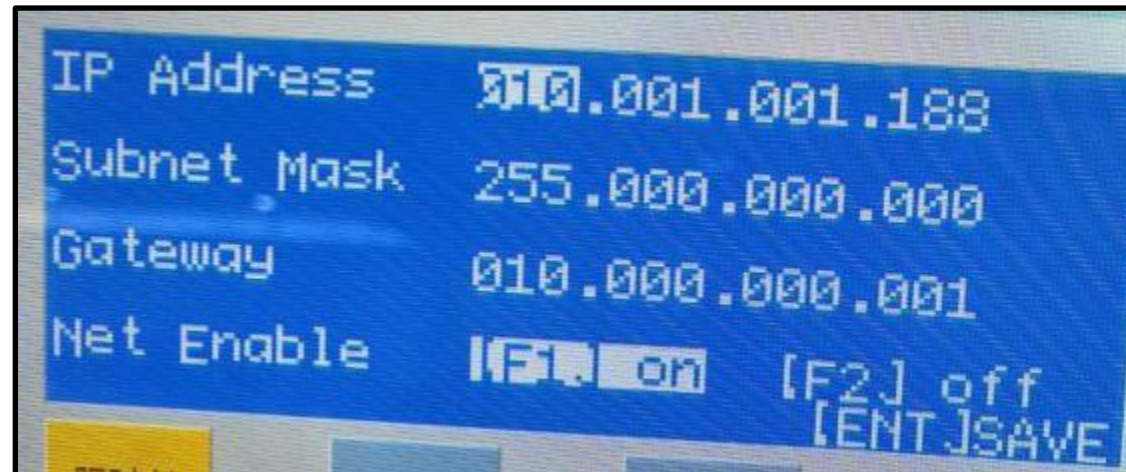
- The state of power failure must be machining (this function is invalid if the frame is moved or moved).
- The file autosave.lxd is not damaged.
- The basic information of the machine tool has not been changed (such as pulse equivalent, origin direction, etc.).
- The processing time must be more than 30 seconds.

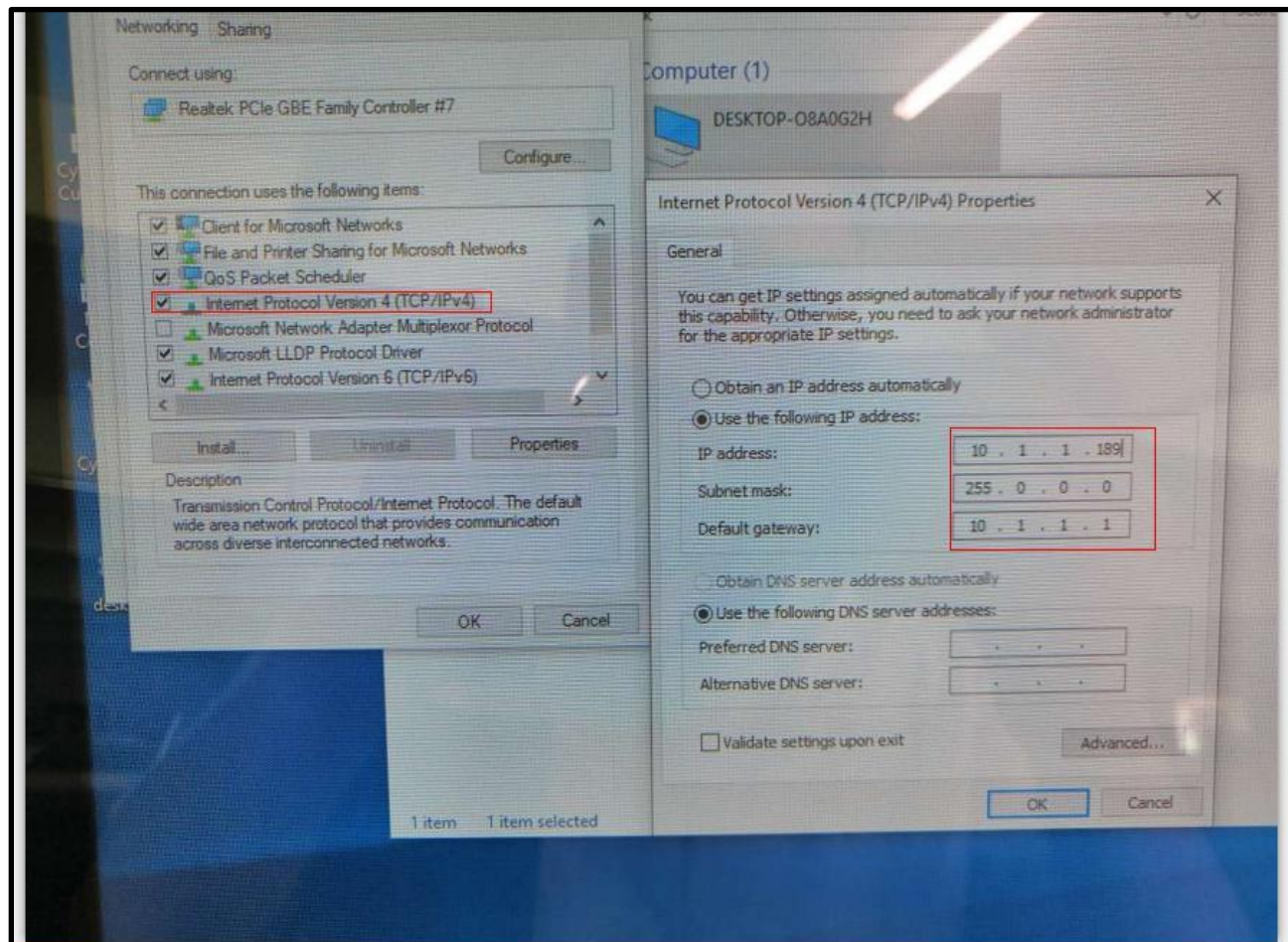
Height Adjuster Network Timeout-

Check that the IP address of the tuner in the platform configuration tool is the same as that in the network parameters of the tuner itself.

The screenshot shows a web-based interface titled "Follower". At the top, there are three radio buttons: "BCS100" (which is selected), "BCS100 Demo", and "IO". Below these, the interface is split into two main sections. The left section, titled "Network Config:", contains an "IP Addr:" label followed by a text input field containing "10.1.1.188". Below this input field are three buttons: "Test connection", "Set IP", and a larger button labeled "Set IP". The right section, titled "BCS100 Upgrade:", contains two buttons: "Select Firmware" and "Upgrade". At the bottom of the "Network Config:" section, there is a text area displaying the following information: "This computer installed 3 netcards:", "Network Card Name: 无线网络连接", "MAC : 10-0B-A9-C3-F3-7C", "IP : 192.168.4.23", "Network Card Name: 本地连接", "MAC : E4-11-5B-4C-D9-FB", "IP : 169.254.200.123", "Network Card Name: Bluetooth 网络连接", "MAC : 40-2C-F4-12-FA-6A", and "IP : 169.254.106.184".

Check whether the IPv4 address of the computer network card is consistent with the first three segments and the adjuster, and the last segment is inconsistent.





If the problem is not solved, please replace the network card.

Homing is not normal-

Check whether the Z trust number is enabled in the parameter of the platform configuration tool back to the origin, and the 15-core servo wire is not welded or falsely welded with the relevant encoder signal wire.

Return Org

☐ Soft limit☐ Prompt go Org at start☐ Prompt go Org in warning

X ORG direction: ☒ Neg ☐ PosY ORG direction: ☒ Neg ☐ Pos

ORG signal: ☒ Org ☐ LimitLimit logic:

Z-Phase signal: ☒ Enable

High Speed: X rollback dis:

Low Speed: Y rollback dis:

Check the origin or limit signal is always valid.

Limit Signal0000

X-

X0

X+

Y1-Y10

Y1+

Y2-

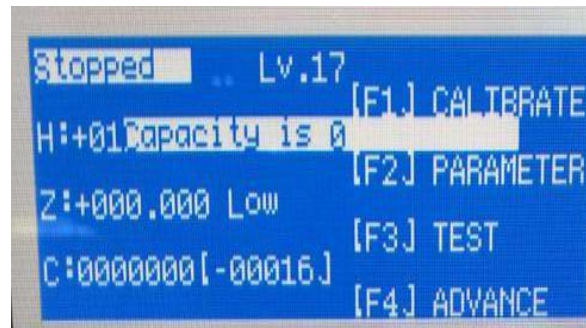
Y20Y2+

SoftLimit

Axis movement is not normal-

Check whether the 15-core wire and the 62-core wire are connected normally. No need to replace the board card. Exclude whether the board card damages the servo and whether the parameters are set incorrectly. 10 this alarm is sent by the software to the height regulator, but the height regulator does not execute the instructions sent by the software within a certain period or does not respond after receiving the corresponding instructions from the height regulator. Check if there is any abnormal condition that affects the normal operation of the height regulator. Check whether the level of the height regulator is too low. It is recommended that the level of the v2.0 version should be upgraded to v1224 or above, and the level of the 3.0 version should be upgraded to 3180 or above. If frequent occurrence can check whether the network connection is normal, or after changing the network card, the test prompt "the height regulator did not complete (follow) instruction within the specified time" failure.

The capacitance has always changed to 0-

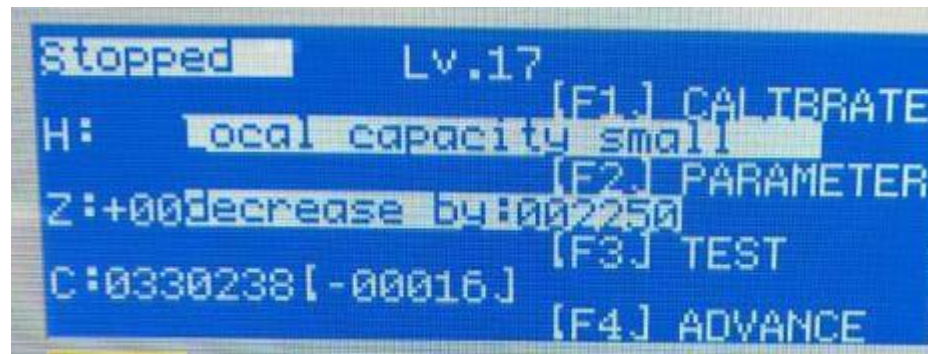


If it is still “0”, replace the standard SPC-140 RF Cable of BCS100 height regulator, check whether the capacitor is restored, and the recovery will be normal. Replace the amplifier and check if the capacitance is restored.

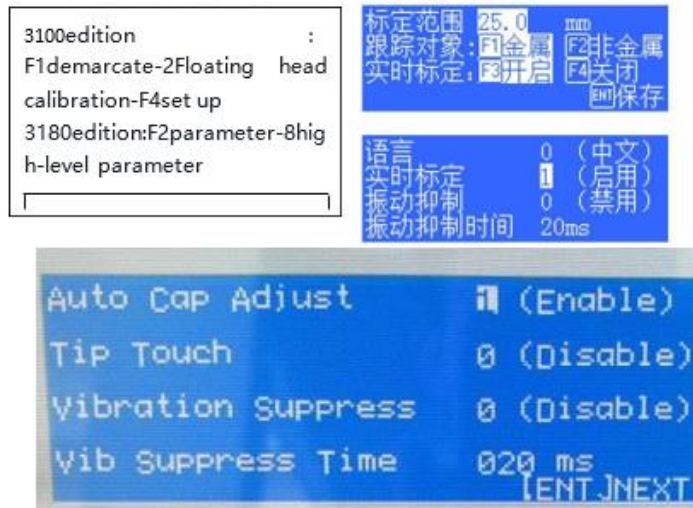
The Body Capacitance Becomes Smaller-

Touch the nozzle and observe whether the capacitance changes to 0. If it does not change to 0, check whether the ceramic ring and nozzle of the cutting head are installed. Once the cutting head is processed, the alarm will be given to "the capacitance of the body decreases".

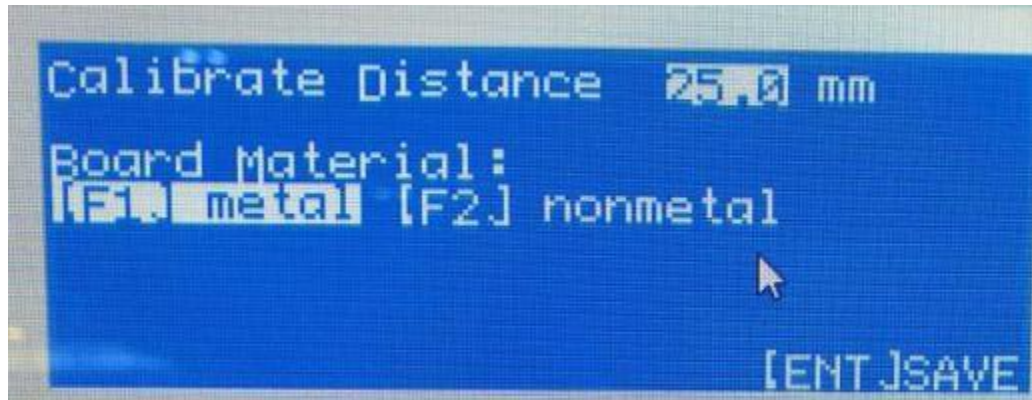
When the ambient temperature decreases, the capacitance induction of the amplifier and the cutting head itself will decrease, and the floating head needs to be calibrated again. When the calibration function is on, the parking point should be set above 30mm of the plate surface.



How to turn on real-time calibration

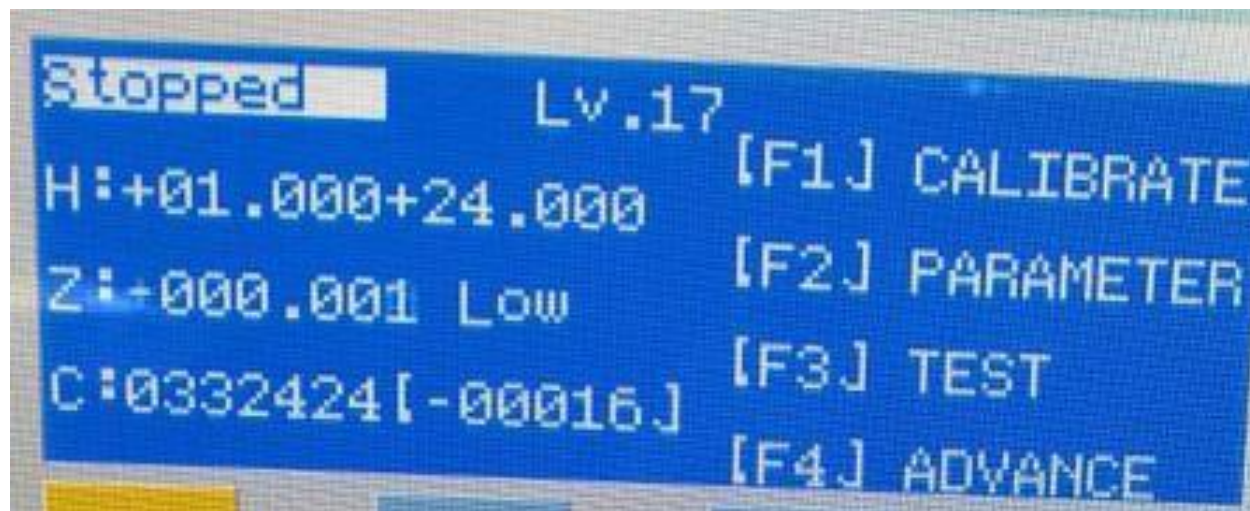


The Body Capacitance Becomes Smaller (Cont'd.)-



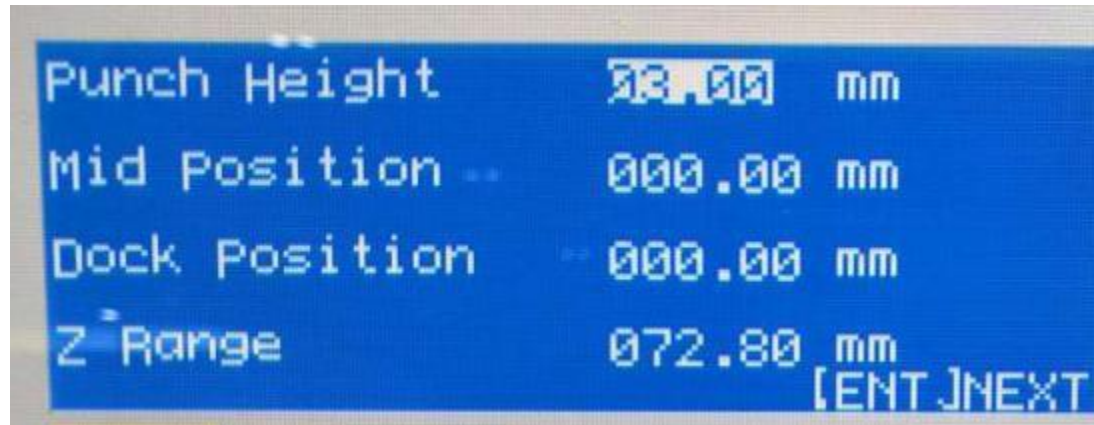
The Laser Head Direct Touch Board-

The floating head calibration is performed again, whether the real-time calibration is started when the docking coordinate is set too low. (the criterion is that the switch will be followed immediately after the calibration, and the value in square brackets shall not exceed 300 after the "C" value of the capacitor is checked).



Capacitance frequent Alarm during Processing-

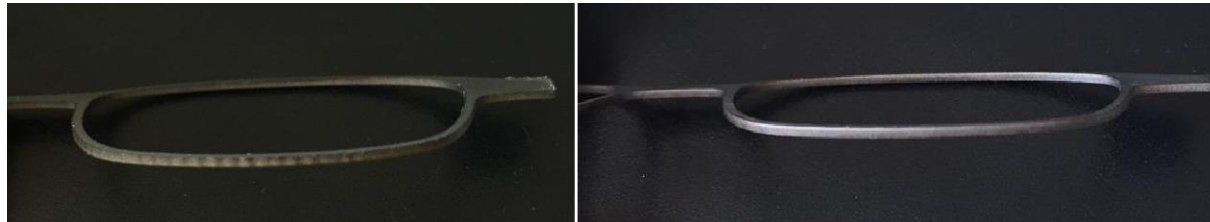
Check the block F2-7 alarm parameters of the touch panel alarm delay if abnormal, can be appropriately increase the touch panel cut hole or delay.



Check whether the cutting head sensor head is not properly installed and whether there is light deviation.

Cutting Thin Plate, Thick Plate Edge Jitter-

Turn on the vibration suppression function in the advanced parameters of the height regulator F2 -- 8. The recommended setting of vibration suppression time is between 10 and 50ms. The higher the value is, the more obvious the suppression effect will be.

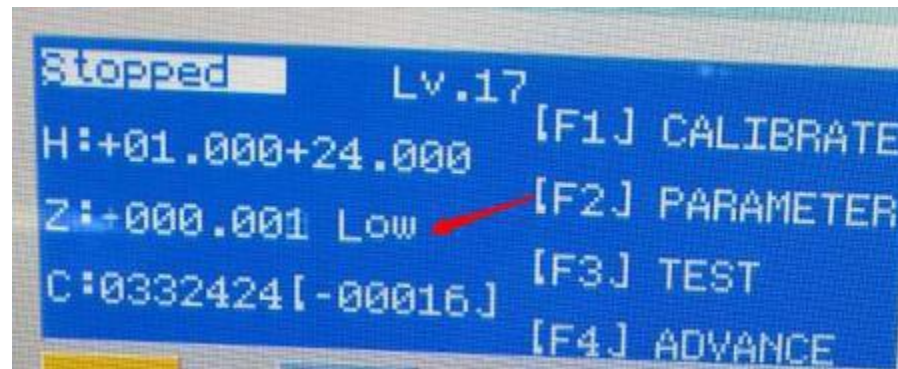


Following the cutting process is getting higher and higher-

Check the cutting head is hot or not, and check whether the lens has stains. Cutting laser head is hot will affect the capacitance collection of the induction.

The lifting height is getting lower and lower during the cutting process-

After the lifting stops, check whether the value of the height adjuster's Z coordinate is 0. If the value is 0, there is skidding between the z-axis motor and the coupling and check the mechanical problems.



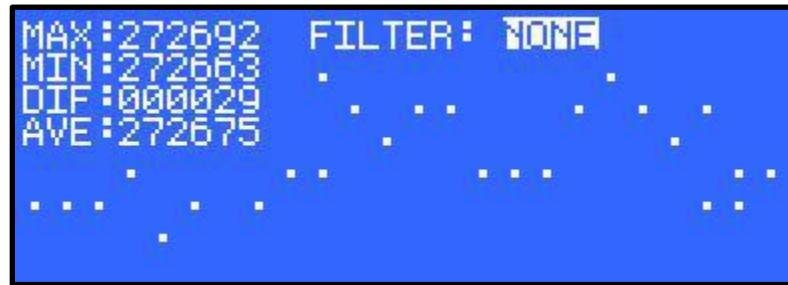
Floating head calibration cannot be marked-

Move the cutting head close to the sheet and click the number 5 key on the main interface of the height adjuster to observe the DIF value. If the value is above 30, power off the servo, laser, transformer, and other powerful power successively and observe the DIF value. If it is judged that a strong current causes the DIF value to increase, it is necessary to check whether the strong current is well grounded and whether there is leakage, and try to

Floating head calibration cannot be marked (Cont'd.)-

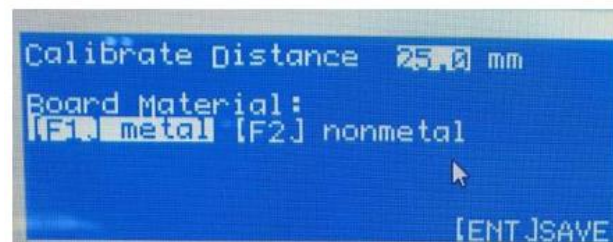
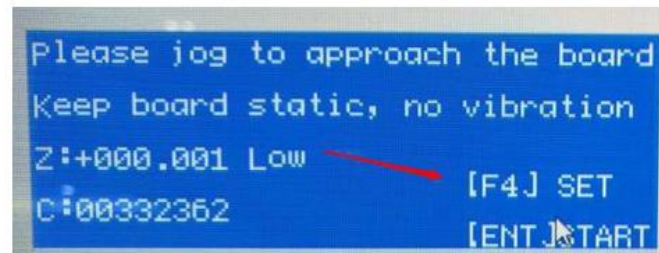
use single-terminal grounding for this equipment.

If the DIF is still large even after all the strong electricity has been turned off, check whether all the four core wires are on, measure whether the enclosure of the amplifier and the bed of the machine are on, and if the conductivity is not good, reduce the impedance by adding grounding wires at both ends.



When the piercing height is greater than 3mm, the piercing process is not performed-

Direct cutting is normal. When the perforation height is more than 3mm, it only follows the follow-up action and does not continue. Check whether the calibration range in F4 setting in the height adjuster floating head calibration interface is set to 3mm and modify it to 25mm.



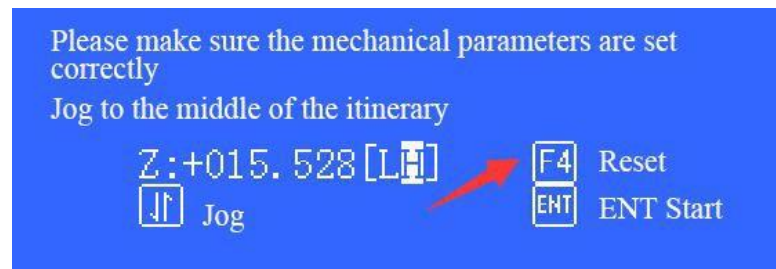
Servo overload alarm after the height adjuster returns to the origin

Check the upper limit for failure.

Check whether the upper limit position is too close to the top of the screw rod and whether the speed to the origin is too fast.

The up and down movement of the height adjuster moves in one direction-

Check whether the servo zero drift is too big, and then do the servo calibration again after clearing the zero drift in the servo calibration interface.



Adjuster Floating Head Calibration Failed-

If the alarm indicates that the upper limit is valid, the height adjuster shall be returned to the origin and then the floating head calibration shall be carried out again. The alarm indicates that the capacitance is abnormal. Touch the nozzle by hand to check whether the capacitance changes to 0 or not. If the capacitance does not change to 0, check whether there is something wrong with the internal induction head of the cutting head.

The alarm indicates that the capacitor is always in the state of collision plate, then check

Adjuster Floating Head Calibration Failed (Cont'd.)-

whether the capacitor is 0, eliminate the problem so that the capacitor can be normally induced and then re-calibrate the float head.

Height Adjuster prompts to follow the Error too Large Alarm-

This alarm refers to that during the following process of the height regulator, the acquisition capacitance changes violently (such as plate shaking, more anti-slag, insufficient air pressure of cutting gas, etc.), which leads to a large deviation between the actual following height and the target following height, thus generating an alarm.

The height adjuster prompts the encoder to be unresponsive-

The encoder does not respond to send motion instructions for the height regulator, and the motor does not move.

Check whether the servo driver parameters are set correctly (check whether it is running in speed mode) on the 15-core wire (wiring definition is different from the XY axis, which is in analog quantity control mode). Whether the servo driver parameters are set correctly (check whether it is running in speed mode).

Encoder Abnormal Motion-

The height regulator does not send motion instructions, but the motor is in motion, it is necessary to check whether there is zero drift in the motor, or the motor falls due to gravity when the servo is not enabled.

Cutting Process Problem-

- **Problem of Cutting and Perforation-**

Any hot cutting technique, except in a few cases where it can start cutting at the edge of the plate, generally requires a small hole to be punched through the plate. In the past, the punching head of laser stamping composite machine was used to punch out a hole, and then a laser start cut from the hole. There are two basic methods for laser cutting machine without stamping device:

Blasting Perforation-The material is irradiated by a continuous laser beam to form a pit in the center, and then the melting material is quickly removed by a stream of oxygen to form a hole in the molten material. The size of the general hole is related to the thickness of the plate, and the average diameter of blasting perforation is half of the thickness of the plate, so the hole diameter of the blasting perforation of the thicker plate is larger and not round, which is not suitable for the high precision parts, and can only be used for waste materials. In addition, the oxygen pressure used for perforation is the same as that used for cutting, the splash is larger.

Pulse Perforation-Each pulsed laser only produces small jets of fine particles, which are gradually deepened, so the time perforation of thick plate needs a few seconds. Once the perforation is complete, the auxiliary gas is replaced with oxygen for cutting. In this way, the diameter of perforation is smaller. and the quality of perforation is better than that of blasting. The laser source in used not only should have higher output power; It is more

Cutting Process Problem (Cont'd.)-

important is the time and space characteristics of the beam, so the general transverse flow laser cannot meet the requirements of laser cutting. In addition, a reliable air path control system is required for pulse perforation to realize the control of gas type, gas pressure switch and perforation time. In the case of pulse perforation, the transition technology from pulse perforation at rest to constant continuous cutting should be paid attention to obtain high quality incisions. In theory, the cutting conditions of the acceleration section usually can be changed, such as focal length, nozzle position, gas pressure, etc., but in fact, it is difficult to change the above conditions due to too short time. It is practical to change the average power of laser in industrial production. change the pulse width; Change the pulse frequency and Change the pulse width and frequency at the same time.

Analysis of deformation of cutting small holes (Small Diameter and Thick Plate)-

- Because the machine (only for high-power laser cutting machine) does not use blasting and perforation when making small holes, but by pulse perforation (soft piercing), which makes the laser energy concentrated in a small area. The non-processed area is also burnt, causing deformation of the hole, and affecting the processing quality. At this time, we should change the pulse perforation (soft piercing) method to the blasting perforation (normal piercing) method in the processing program. For the smaller power laser cutting machine, the method is opposite. In the small hole processing, pulse perforation should be adopted to obtain a better surface finish.

Solution for Burr of Workpiece when Laser Cutting Low Carbon Steel-

According to the work and design principle of laser cutting, the following reasons are the main reasons for the burrs of the work piece: the upper and lower positions of the laser focus are not correct, the focus position test needs to be done, and the offset is adjusted according to the focus; The output power of the laser is not enough. It is necessary to check whether the work of the laser generator is normal. If it is normal, observe whether the output value of the laser control button is correct and adjust it; if the line speed of cutting is too slow, the line speed needs to be increased during operation control; if the purity of the cutting gas is not good, it is necessary to provide high-quality cutting working gas; If the laser focus is offset, the focus position test needs to be performed, and the offset is adjusted according to the focus; If the instability of the machine running time is too long, and the shutdown is required at this time, Restart.

Analysis of Burrs on workpieces when Laser-Cutting Stainless-Steel and Aluminum-Zinc Plates-

When the above problem happens, first consider the factors of burr when cutting carbon steel, but it is not simple to speed up the cutting speed, because the plate may not be cut when the speed is increased. This is especially the case when processing aluminum-zinc plate. At this time, should considering other factors of the machine, such as the replacement of the nozzle and the unstable movement of the guide rail.


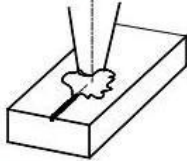




Analysis of Laser Incompletely cut through State-

After analysis, it can be found that the following cases are the main reasons of processing instability: the size of laser head nozzle does not match the processing plate thickness; the laser cutting line speed is too fast, the operation control is required to reduce the line speed; the nozzle sensing is not allowed. To the laser focus position error is too large, need to re-detect the nozzle sensing data, especially when cutting aluminum is most likely to appear.

Solution to Abnormal Sparks when Cutting Low Carbon Steel-




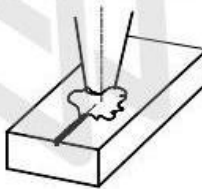
This condition will affect the quality of the cut section finish of the part. At this time, if other parameters are normal, the following should be considered: the loss of the laser head nozzle NOZZEL should be replaced in time. In the case of no new nozzle replacement, the working gas pressure should be increased; the thread at the joint between the nozzle and the laser head is loose. At this point, the cutting should be paused immediately, the laser head connection status should be checked, and the thread should be re-threaded.

Summary of Cutting Process Defects-

Phenomenon	Reason	Solve
<p>only have burrs on the bottom of cutting edge</p> 	nozzle center not good, nozzle is deformed	adjust the center of nozzle, change nozzle
<p>have blue plasma gas come out, and can not cut through the metal plate.</p> 	connect the false gas, speed too high, power too low	use correct gas, decrease speed and increase power
<p>cutting edge is irregular</p> 	gas pressure is too high, nozzle break, nozzle d is too big	decrease gas pressure, change nozzle
<p>no burrs, cutting route turn to right, the bottom of cutting edge become thin</p> 	speed too high	decrease speed
<p>there is corrosive pit on the cutting surface</p> 	gas pressure too high, speed too low, focus too high, material has rust, impurity or too hot of material.	decrease gas pressure, increase speed, decrease focus, use good material
<p>rough cutting edge</p> 	focus is too low, gas pressure is too high, speed too low, material is too hot.	cutting stainless steel by N2

Summary of Cutting Process Defects (Cont'd.)-

Cutting stainless with Nitrogen

Phenomenon	Reason	Solve
<p>there is irregular burrs on the two sides of cutting edge bottom</p> 	focus is too low, speed is too high	increase the focus position and decrease the cutting speed
<p>there is long burrs on the two sides of cutting edge</p> 	speed is too low, focus is too high, gas pressure is too low, and material is too hot.	increase speed, decrease focus, increase gas pressure and cooling material
<p>only on the two sides of the cutting edge, there is long burrs</p> 	nozzle is not in the center, focus is too high, and has pressure and speed is too low	adjust nozzle, decrease the focus position, increase gas pressure and speed
<p>yellow color on the cutting edge</p>	there is O ₂ in N ₂	use high purity n ₂
<p>produce plasma gas, can not cut trough</p> 	speed too high, power and focus is too low	decrease cutting speed, increase power and focus position
<p>Bestrahlungsunterbrechung</p>	speed is too high, power and focus position is too low	decrease speed, increase power, increase focus position
<p>rough cutting edge</p>	nozzle break, lens being polluted	change nozzle, clean or change lens

Maintenance Service-

- 1.) During the warranty, there is some parts is broken, and need back to factory to repair, the buyer should pay for the transportation fee to factory. After testing in factory and found, the broken part is broken as itself quality problems(not man-made reason, not use environment reason), the factory will repair it for free or send the buyer a new one for free. At the same time, the factory will undertake the transportation fee to the buyer's company.
- 2.) The back part should be test in Laguna Tools factory firstly, after testing and repairing by Laguna Tools after sale service department, then return it to the buyer.
- 3.) During the warranty period, if the part is broken not as the products itself quality problems, the buyer should pay for the transportation fee to turn back the buyer's company.
- 4.) During the warranty period, the buyer should pay for the transportation fee to repair the part.
- 5.) The spare parts do not have warranty, such as reflective lens, focus lens, protect lens, collimating lens, laser head, ceramic ring, nozzle etc..

Maintenance Service (Cont'd.)-

6.) The peripheral devices should be maintaining according to the devices' manufacturer and at the help of Laguna Tools, the devices have one year warranty. The warranty will be started to calculate from the date of production such as water chiller, exhaust fan, pimp, air compressor, industry computer etc.

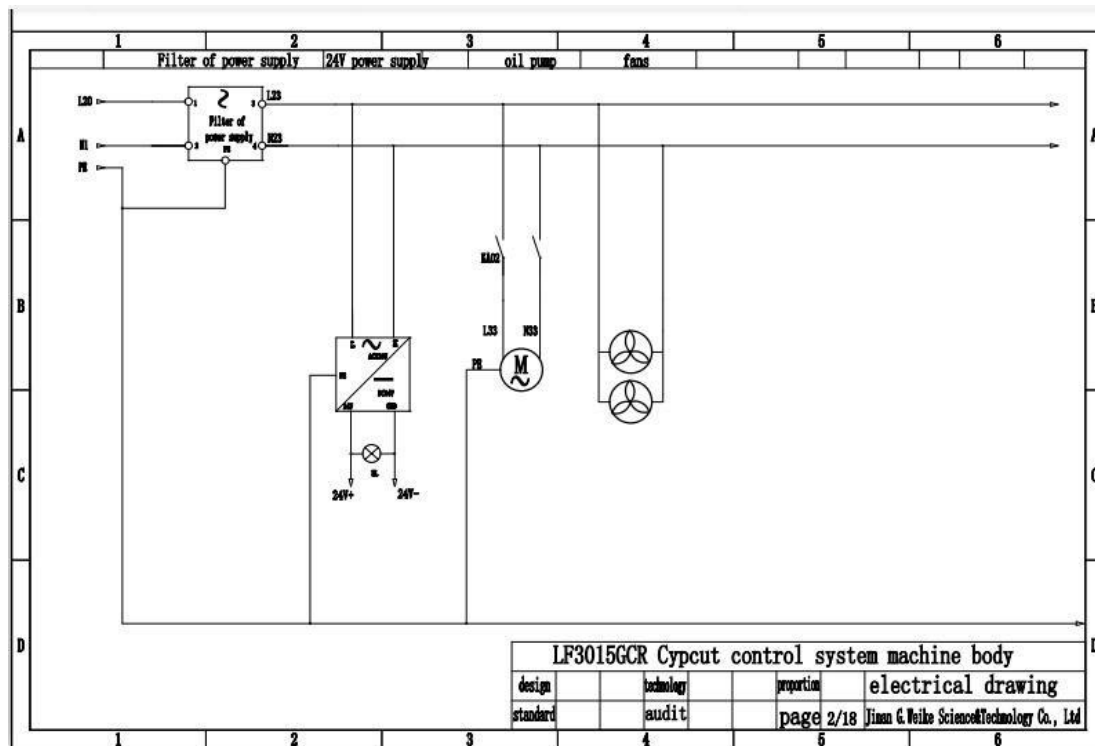
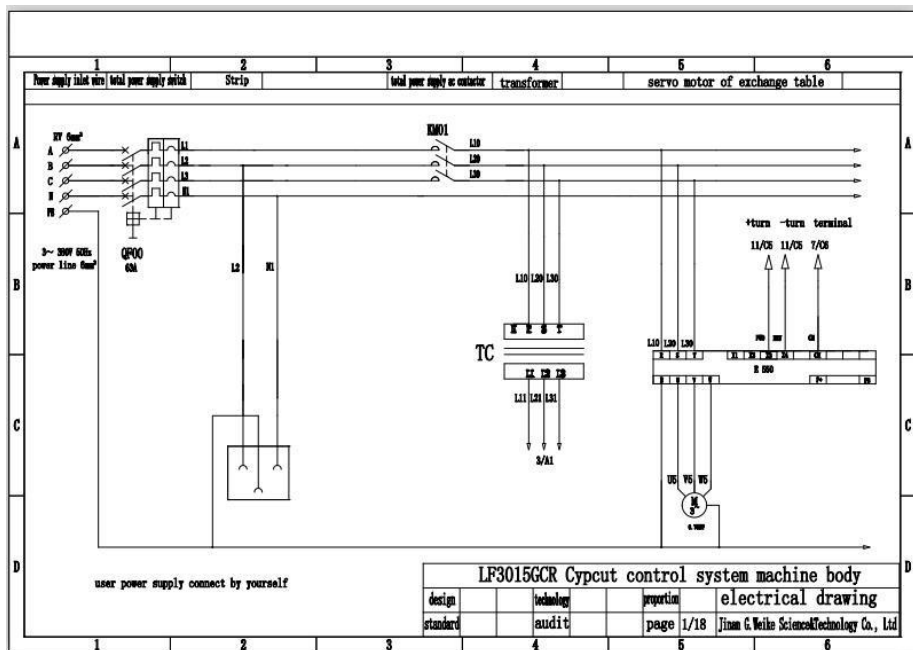
Raycus 3300W切割参数

材料种类 Material	厚度 Thickness	气体种类 Assisted Gas	速度(m/min) Max.Speed
碳钢 Carbon steel	1.0	氮气 Nitrogen	29.0-35.0
	2.0		5.0-6.2
	3.0		3.6-4.5
	4.0		3.0-4.0
	5.0		2.5-3.0
	6.0		2.3-2.6
	8.0		1.5-2.0
	10.0	氧气 Oxygen	1.2-1.5
	12.0		1.0-1.2
	14.0		0.7-1.1
	16.0		0.5-0.7
	20.0		0.2-0.4
不锈钢 Stainless steel	1.0		30.0-36.0
	2.0		10.0-15.0
	3.0		7.0-9.0
	4.0		4.0-6.0
	5.0	氮气 Nitrogen	2.3-2.7
	6.0		1.8-2.1
	8.0		1.0-1.2
黄铜 Brass	1.0		20.0-28.0
	2.0		7.0-12.0
	3.0		5.0-6.5
	4.0		1.8-2.2
	5.0		1.0-1.5
	6.0		0.8-1.2
	8.0		0.3-0.4
紫铜 Copper	1.0		20.0-30.0
	2.0	氧气 Oxygen	7.0-9.0
	3.0		2.0-3.0
	4.0		0.8-1.2
铝合金 Aluminum	1.0		25.0-36.0
	2.0		10.0-18.0
	3.0		5.0-6.0
	4.0	氮气 Nitrogen	3.0-3.6
	5.0		2.0-2.4
	6.0		1.0-1.5
	8.0		0.5-0.7
	10.0		0.3-0.4

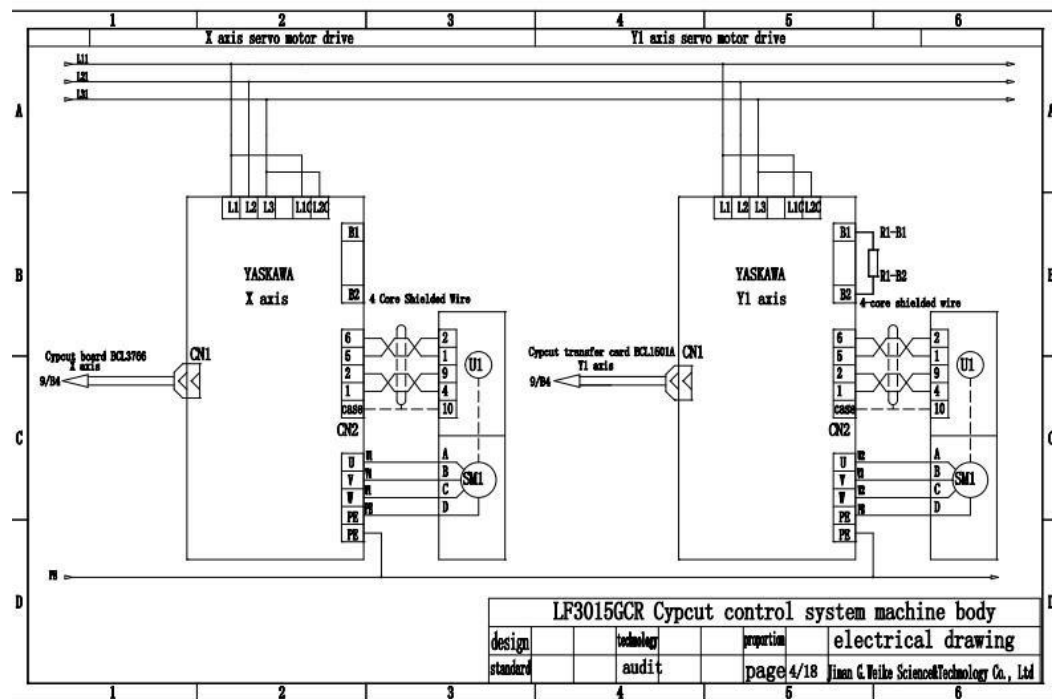
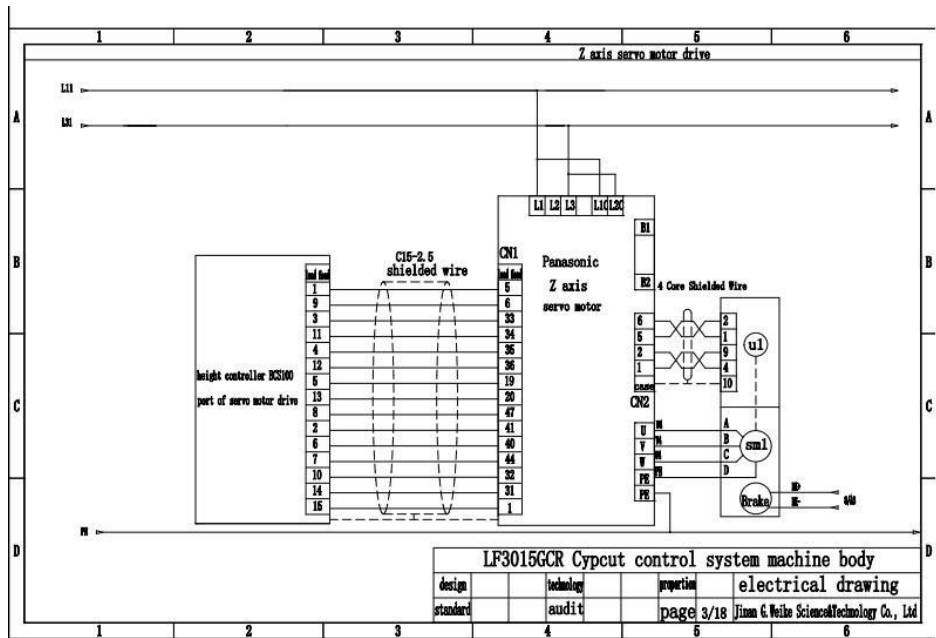
Raycus 1000W切割参数

材料种类 Material	厚度 Thickness	气体种类 Assisted Gas	速度(m/min) Max.Speed
碳钢 Carbon steel	0.8	氮气 Nitrogen	24.0-30.0
	2.0		5.0-6.0
	3.0		2.5-3.3
	4.0		2.0-3.0
	5.0	氧气 Oxygen	1.4-1.8
	6.0		1.2-1.5
	8.0		0.9-1.2
不锈钢 Stainless steel	10.0		0.6-0.8
	12.0		0.4-0.6
	0.5		40.0-50.0
	0.8		25.0-30.0
	1.2		12.0-15.0
	2.0	氮气 Nitrogen	4.5-5.5
	3.0		2.0-2.8
黄铜 Brass	4.0		1.0-1.5
	5.0		0.4-0.6
	6.0		0.2-0.4
	1.0		14.0-18.0
	1.5		5.0-7.0
紫铜 Copper	2.0		3.0-4.0
	1.0		7.0-8.0
	1.5	氧气 Oxygen	1.2-1.5
铝合金 Aluminum	1.0		25.0-30.0
	2.0		6.0-7.0

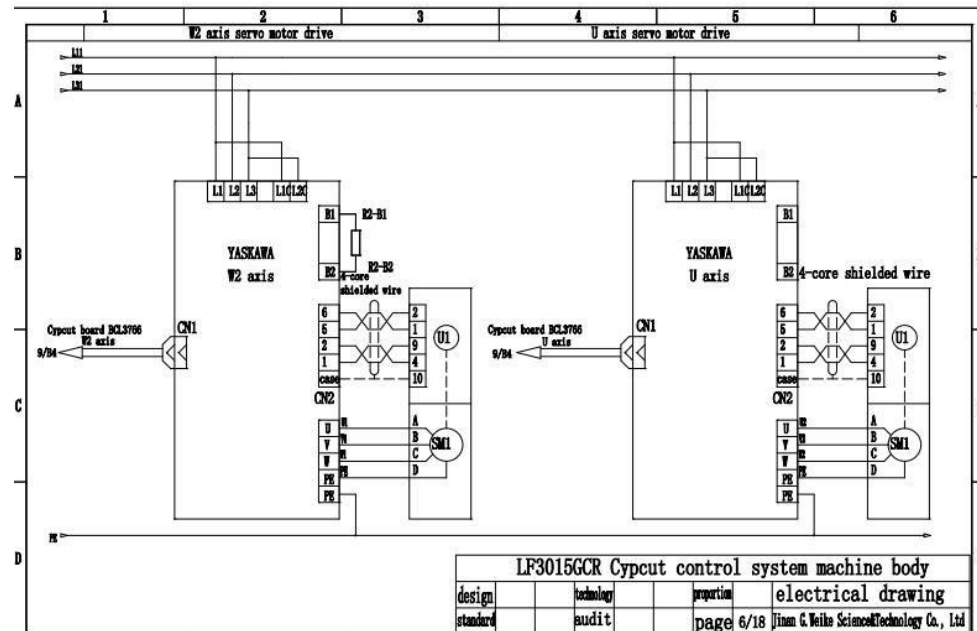
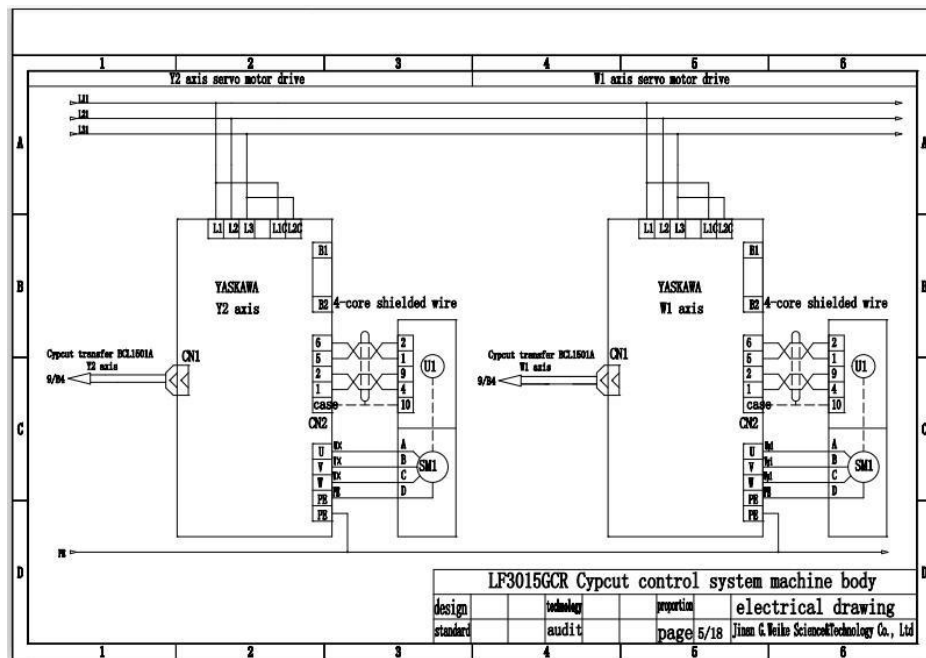
Attachment: Circuit Diagram(s)-



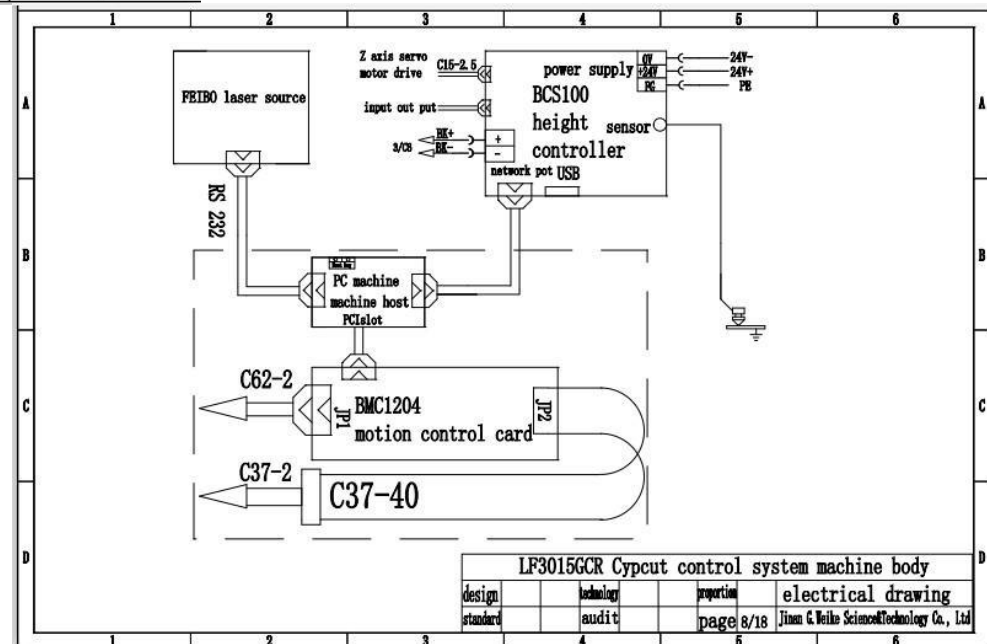
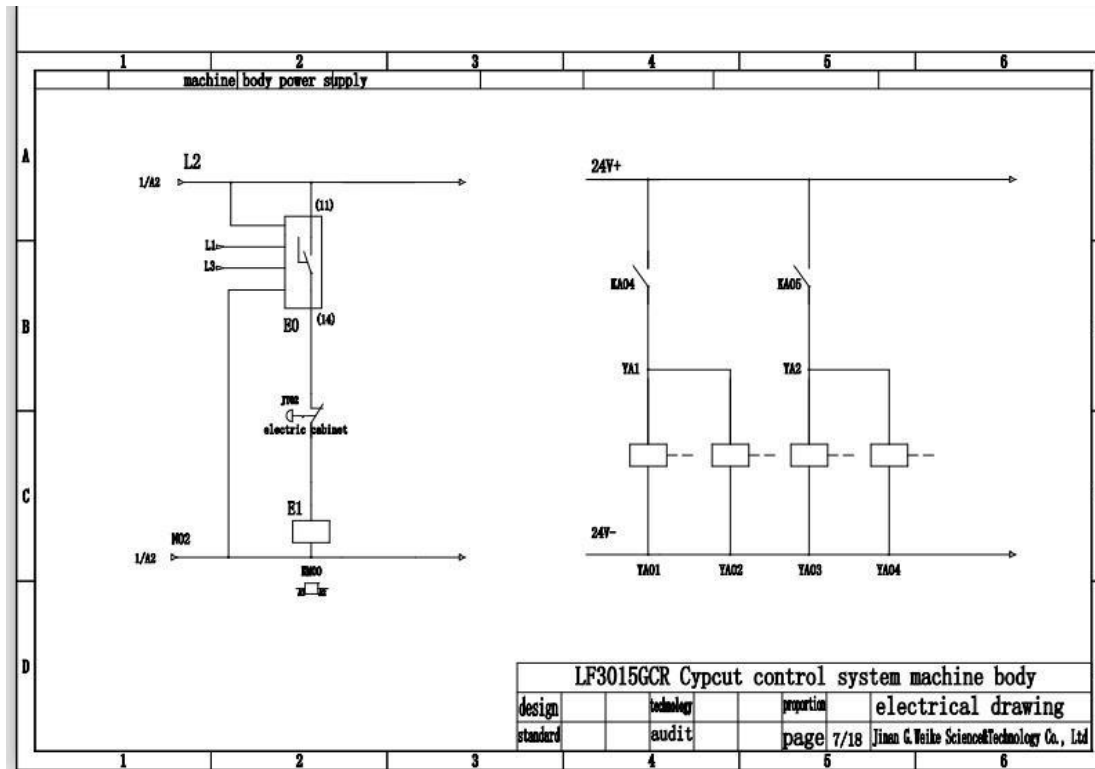
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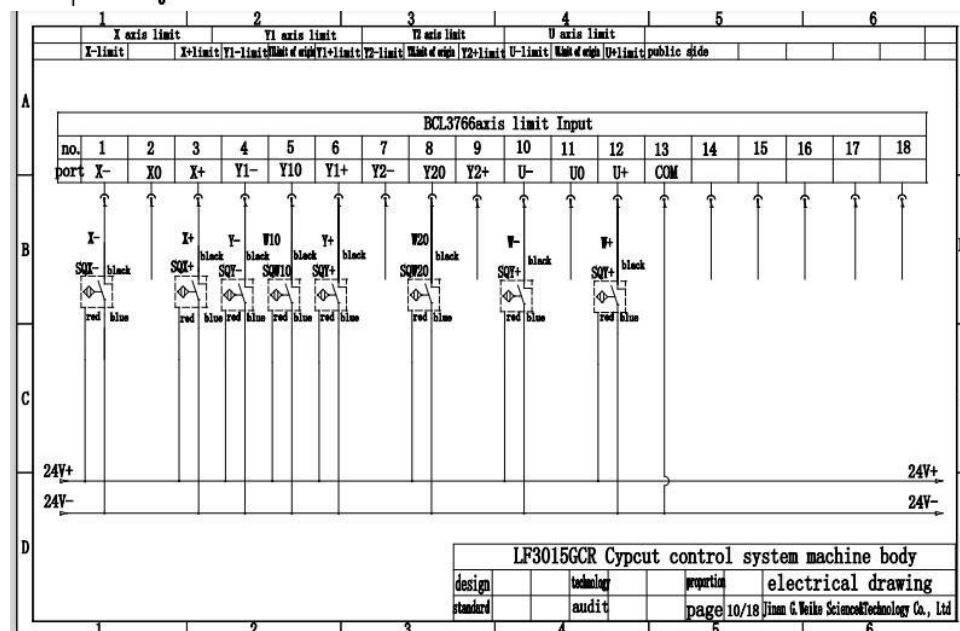
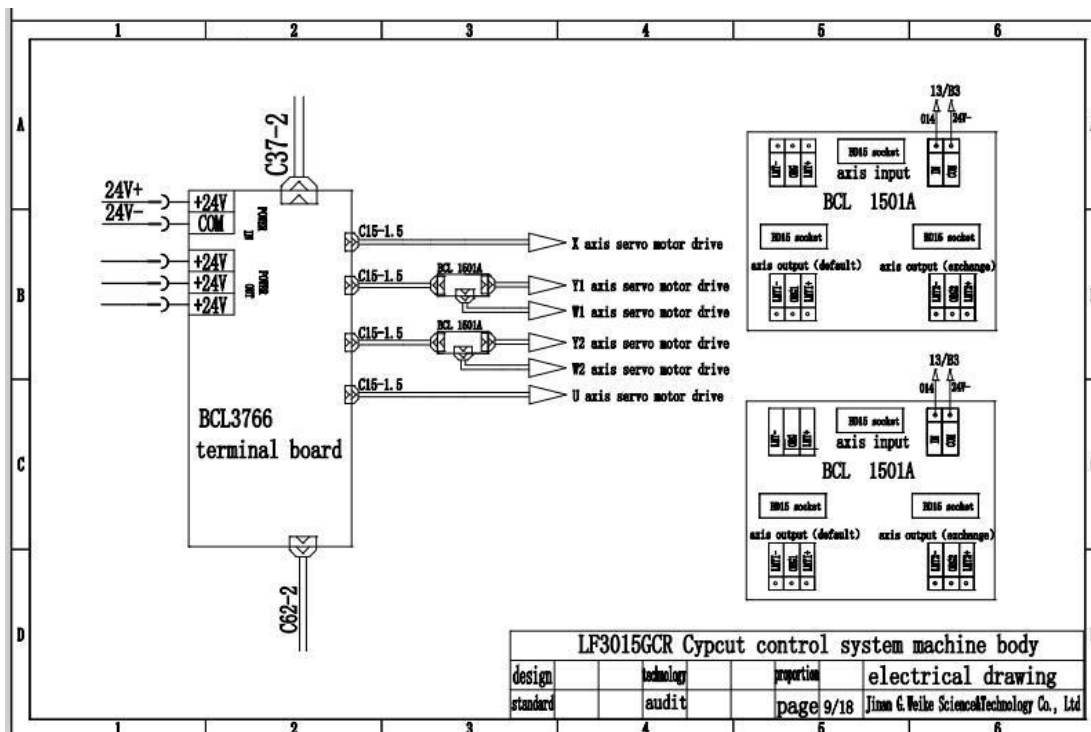
Attachment: Circuit Diagram(s)-



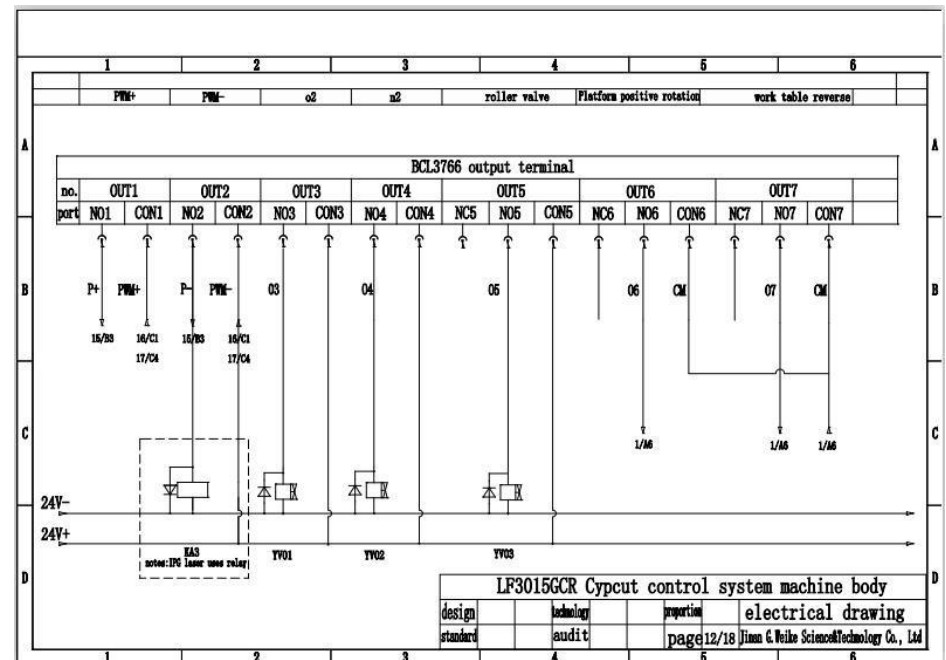
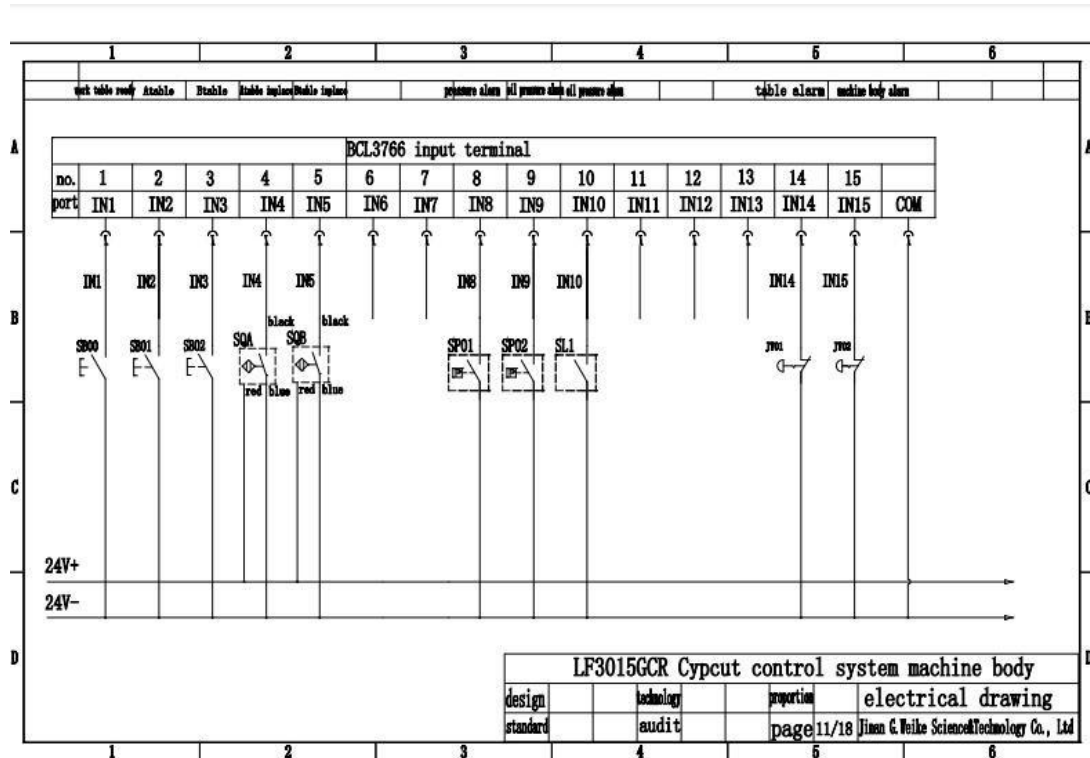
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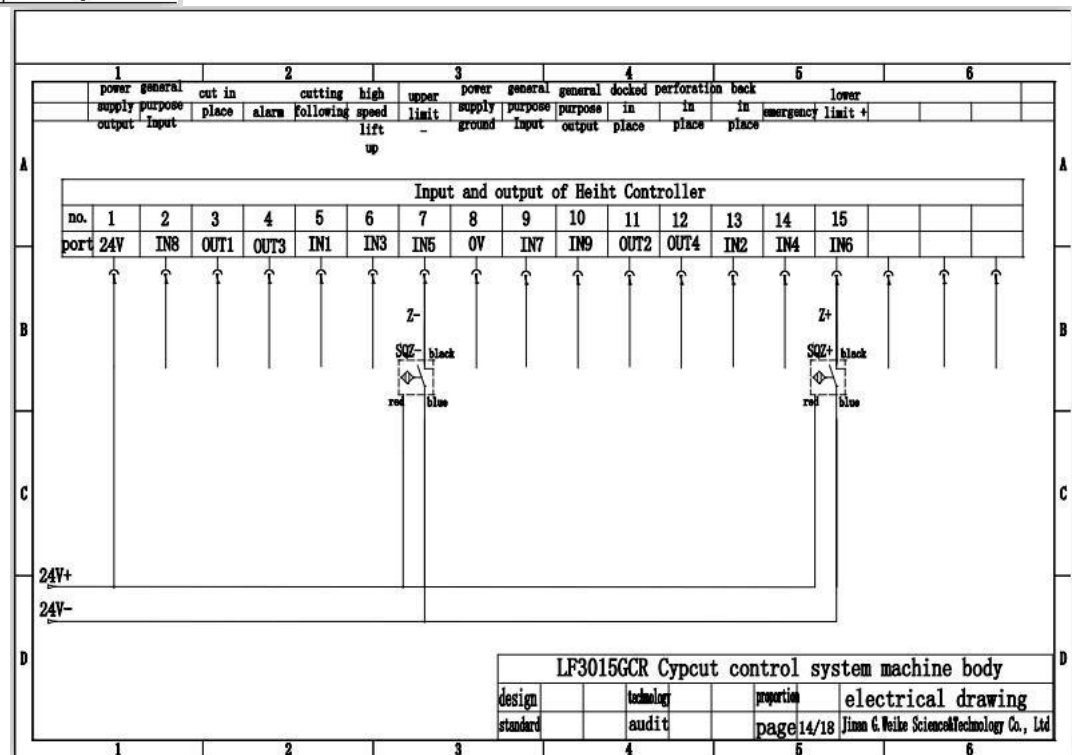
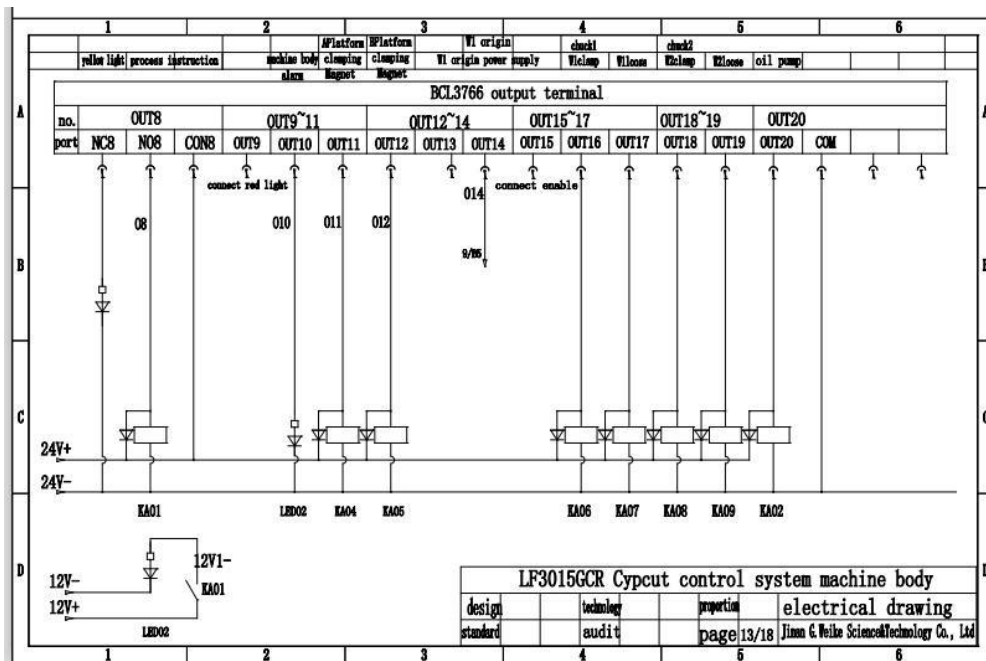
Attachment: Circuit Diagram(s)-



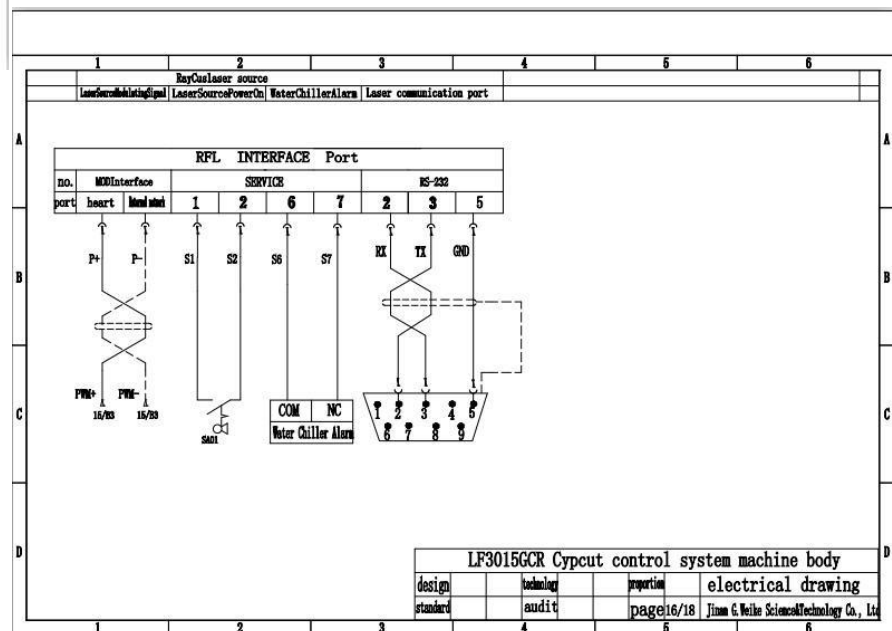
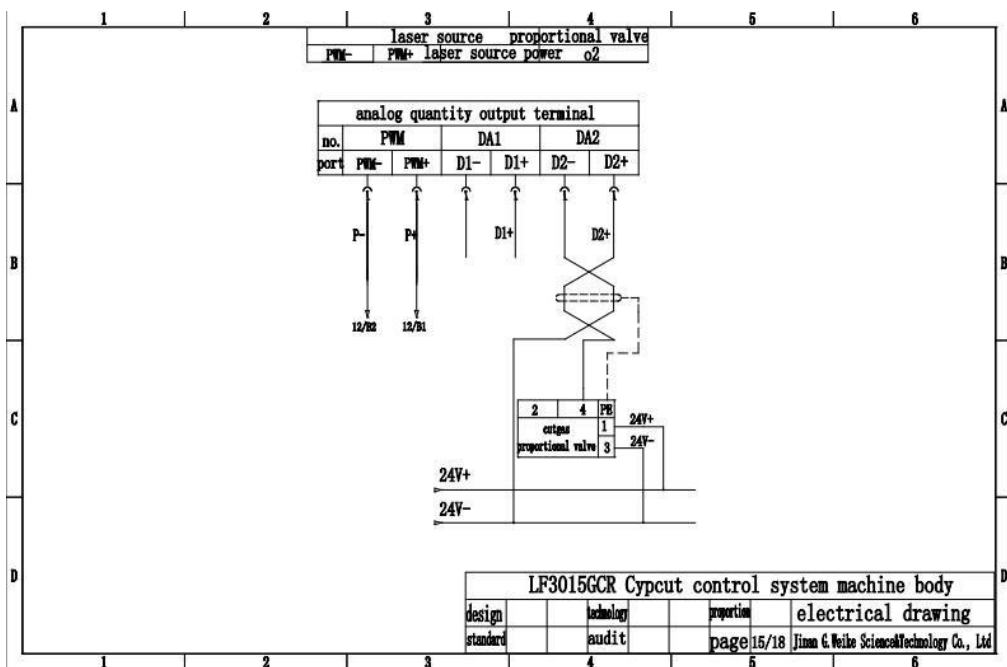
Attachment: Circuit Diagram(s)-



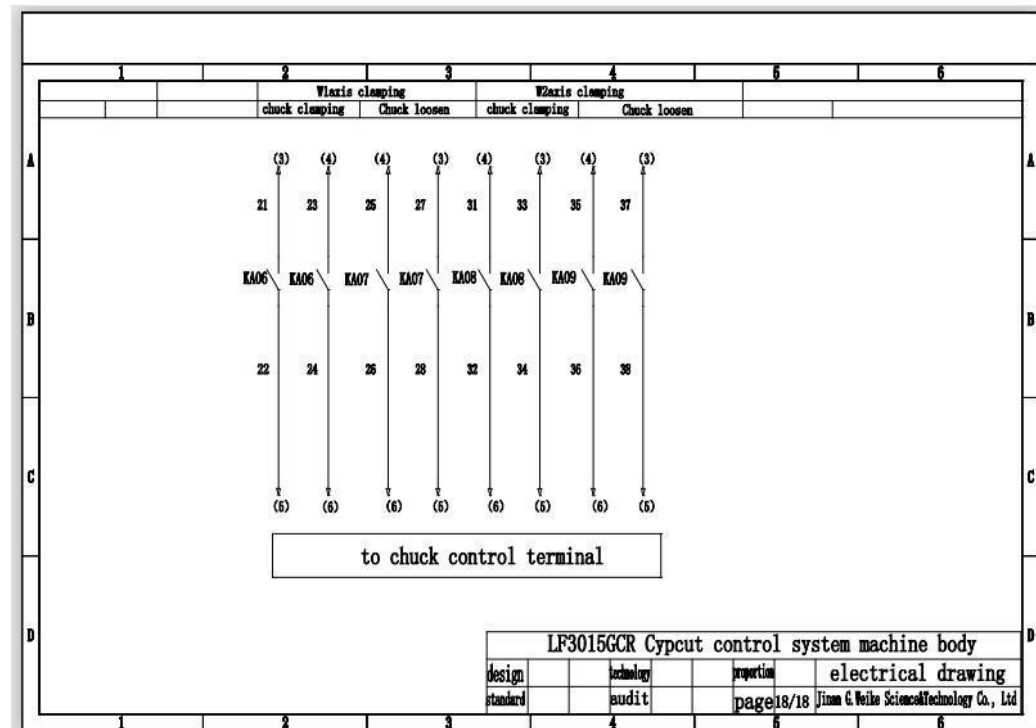
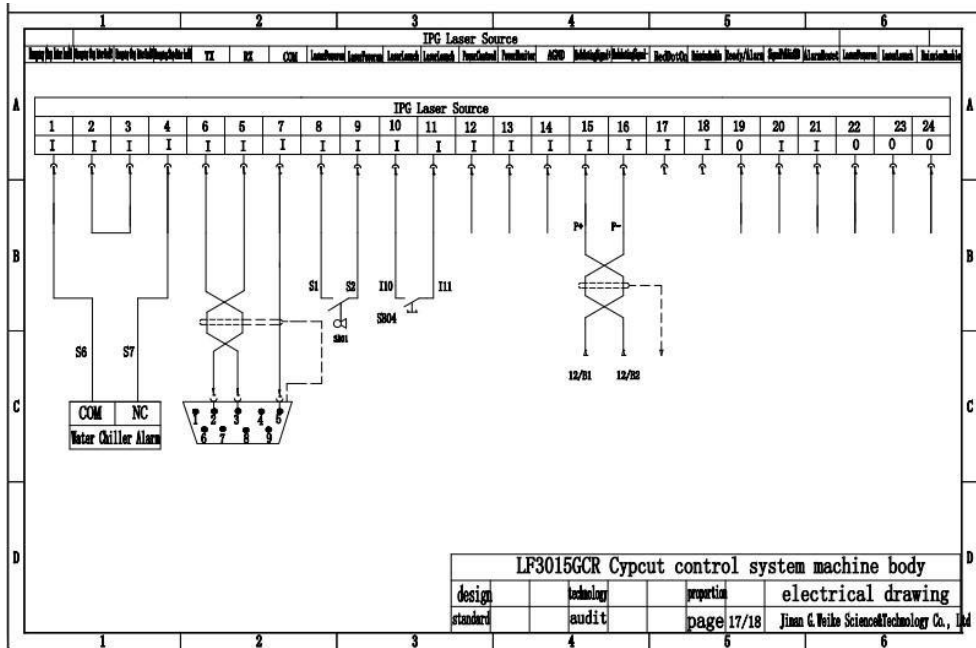
Attachment: Circuit Diagram(s)-



Attachment: Circuit Diagram(s)-



Attachment: Circuit Diagram(s)-



Delivery Protocol-

- | | | | | | |
|---|------|---|-----------|--|-----------------|
| Date: 12/02/2020 | | BILL OF LADING | | Bill of Lading Number : 145787446 | |
| SHIP FROM | | | | | |
| Name: _____ | | Carrier Name: <u>Estes Express</u> | | | |
| Address: _____ | | SCAC: <u>EXLA</u> | | | |
| City/State/Zip: _____ | | Pro number: _____ | | | |
| | | FOB: <input type="checkbox"/> | | | |
| SHIP TO | | | | | |
| Name: _____ | | | | | |
| Address: _____ | | | | | |
| City/State/Zip: _____ | | FOB: <input type="checkbox"/> | | | |
| FREIGHT CHARGES BILL TO | | | | | |
| Name: _____ | | Freight Charge Terms: (freight charges are prepaid by Worldwide Express unless indicated otherwise) | | | |
| Address: _____ | | <input type="checkbox"/> Master Bill of Lading:
with attached underlying Bill Of Lading | | | |
| City/State/Zip: _____ | | WWE Number: W70969351 | | | |
| SPECIAL INSTRUCTIONS: For assistance, please call 833-8WE-SHIP
Handling Instructions: RMACR11096
Pickup Instructions:
Delivery Instructions: RMACR11096
Pickup Service(s): Liftgate Pickup, Residential Pickup | | | | | |
| REFERENCE NUMBER INFORMATION | | | | | |
| REFERENCE | | # PKGS | REFERENCE | | # PKGS |
| | | | | | |
| | | | | | |
| | | | | | Total # of Pkgs |
| CARRIER INFORMATION | | | | | |
| HANDLING UNITS | | PIECES | | COMMODITY DESCRIPTION | |
| QTY | TYPE | QTY | TYPE | WEIGHT | H M X |
| 1 | PLT | | | 365 | |
| 1 | | | | 385 | |
| | | | | Grand Total | |
| | | | | machine, 48(L) x 48(W) x (H) DO NOT STACK | |
| | | | | LTL ONLY | |
| | | | | NMFC# | CLASS |
| | | | | 77.5 | |
| Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of property as follows: The agreed or declared value of the property is specifically stated by the shipper to be not exceeding _____ | | | | | |
| Note: Liability limitation for loss or damage in this shipment may be applicable. See 49 U.S.C. 514706(c)(1)(A) and (B).
RECEIVED, subject to individually determined rates or contracts that have been agreed upon in writing between the carrier and Worldwide Express Operations, LLC is registered motor carrier broker, pursuant to 49 USC 14501(b) and all applicable state and federal regulations. | | | | | |
| SHIPPERS LIABILITY / DATE:
This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation. | | | | COD Amount: \$ <u>5</u>
Remit Address: _____
Acceptable Forms of Payment:
Bank Certified Check <input type="checkbox"/>
Customer Check <input type="checkbox"/>
Personal Check <input type="checkbox"/>
Money Order <input type="checkbox"/> | |
| CARRIER SIGNATURE / PICKUP DATE:
Carrier acknowledges receipt of packages and required placards. Carrier certifies emergency response information was made available and for carrier has DOT emergency response guidebook or equivalent documentation in vehicle. Property described above is received in good order, except as noted. | | | | | |
| Trailer Loaded: <input type="checkbox"/> By Shipper
<input type="checkbox"/> By Driver | | | | Freight Counted: <input type="checkbox"/> By Shipper
<input type="checkbox"/> By Driver/said to contain
<input type="checkbox"/> By Driver/Pieces | |
| (Signature) _____ | | | | (Date) _____ | |

SPECIAL INSTRUCTIONS: For assistance, please call 833-8WE-SHIP
Handling Instructions: RMACR11096
Pickup Instructions:
Delivery Instructions: RMACR11096
Pickup Service(s): Liftgate Pickup, Residential Pickup

Dealer Machinery Warranty-

Dealer Machinery Warranty

New woodworking machines sold by Laguna Tools carry a two-year warranty effective from the date of dealer invoice to customer/end-user. Machines sold through dealers must be registered with Laguna Tools within 30 days of purchase to be covered by this warranty. Laguna Tools guarantees all new machine sold to be free of manufacturers' defective workmanship, parts and materials. We will repair or replace, without charge, any parts determined by Laguna Tools, Inc. to be a manufacturer's defect. We require that the defective item/part be returned to Laguna Tools with the complaint. The end-user must request an RMA (return material authorization) number from Customer Service and include the (RMA) number with any and all returned parts/components requesting warranty coverage.* Any machines returned to Laguna Tools must be returned with packaging in the same manner in which it was received. If a part or blade is being returned it must have adequate packaging to ensure no damage is received during shipping. In the event the item/part is determined to be damaged due to lack of maintenance, cleaning or misuse/abuse, the customer will be responsible for the cost to replace the item/part, plus all related shipping charges. This limited warranty does not apply to natural disasters, acts of terrorism, normal wear and tear, product failure due to lack of maintenance or cleaning, damage caused by accident, neglect, lack of or inadequate dust collection, misuse/abuse or damage caused where repair or alterations have been made or attempted by others.

****NOTE: Issuing an RMA number is for referencing materials and issues, it does NOT indicate warranty acceptance/conformity.**

Laguna Tools Warranty-

CNC Limited Warranty

New CNC machines sold by Laguna Tools carry a one-year warranty effective from the date of shipping. Laguna Tools guarantees all new machine sold to be free of manufacturers' defective workmanship, parts, and materials. We will repair or replace without charge, any parts determined by Laguna Tools, Inc. to be a manufacturer's defect. We require that the defective item/part be determined to be damaged due to lack of maintenance, cleaning or misuse/abuse, the customer will be responsible for the cost to replace the item/part, plus all related shipping charges. This limited warranty does not apply to natural disasters, acts of terrorism, normal wear and tear, product failure due to lack of maintenance or cleaning, damage caused by accident, neglect, lack of or inadequate dust collection, misuse/abuse or damage caused where repair or alterations have been made or attempted by others.

Laguna Tools, Inc. is not responsible for additional tools or modifications sold or performed (other than from/by Laguna Tools, Inc.) on any Laguna Tools, Inc. woodworking machine. Warranty maybe voided upon the addition of such described tools and/or modifications, determined on a case-by-case basis. Software purchased through Laguna Tools, Inc., is not covered under this warranty and all technical support must be managed through the software provider. Normal user alignment, adjustment, tuning, and machine settings are not covered by this warranty. It is the responsibility of the user to understand basic woodworking machinery settings and procedures and to properly maintain the equipment in accordance with the standards provided by the manufacturer.

Parts under warranty are shipped at Laguna Tools, Inc.'s cost either by common carrier, FEDEX ground service or a similar method. Technical support to install replacement parts is primarily provided by phone, fax, e-mail, or Laguna Tools Customer Support Website. The labor required to install replacement parts is the responsibility of the user. Laguna Tools is not responsible for damage or loss caused by a freight company or other circumstances not in our control. All claims for loss or damaged goods must be notified to Laguna Tools within twenty-four hours of delivery.

Please contact our Customer Service Department for more information. Only NEW machines sold to the original owner are covered by this warranty. For warranty repair information, call 1-800-332-4094. Copyright 2013 Laguna Tools, Inc. *Warning – no portion of these materials may be reproduced without written approval from Laguna Tools, Inc.**

WARRANTY & REGISTRATION

THANK YOU!

Welcome to the Laguna Tools® group of discriminating woodworkers. We understand that you have a choice of where to purchase your machines and appreciate the confidence you have in the Laguna Tools® brand.

Through hands-on experience, Laguna Tools® is constantly working hard to make innovative, precision products. Products that inspire you to create works of art, are a joy to operate, and encourage your best work.

Laguna Tools®
Imagination, Innovation, and Invention at Work

WARRANTY & REGISTRATION

Every product sold is warranted to be free of manufacturers' defective workmanship, parts, and materials. For any questions about this product, the intended use or what it was designed for, customer service, or replacement parts, please contact our customer service department:

Laguna Tools® Customer Service
2072 Alton Parkway, Irvine, California 92606, USA
1-800-332-4049
customerservice@lagunatools.com
www.lagunatools.com/why/customer-service/
8AM. to 5PM PST, Monday through Friday

For warranty claims or to report damage upon receiving – please reach out to our warranty department:

Laguna Tools® Warranty Service
2072 Alton Parkway, Irvine, California 92606, USA
1-949-474-1200
customerservice@lagunatools.com
www.lagunatools.com/policies/warranty
8AM to 5PM PST, Monday through Friday

REGISTRATION

To prevent voiding this warranty, all products sold must be registered within thirty (30) days of receiving the product. Registering the product will enable the original purchaser to receive notifications about important product changes, receive customer service, and be able to file a warranty claim against defective workmanship, parts, or materials.

WHO IS COVERED

The applicable warranty covers only the initial purchaser of the product from the date of receiving the product. To file such claims, the original purchaser must present the original receipt as proof of purchase.

WHAT IS COVERED

The warranty covers any defects in the workmanship of all parts and materials that make up the machine unless otherwise specified. Any part, determined by Laguna Tools®, to have a defect will be repaired or replaced (and shipped), without charge. The defective item/part must be returned to Laguna Tools® with the complaint and proof of purchase in the original packaging that it was received in. In the event the item/part is determined to be not covered by this warranty, the customer will be responsible for the cost to replace the item/part and all related shipping charges.

REGISTER HERE!



<https://lagunatools.com/policies/warranty/>

WARRANTY LIMITATIONS

This limited warranty does not apply to natural disasters, acts of terrorism, normal wear and tear, product failure due to lack of maintenance or cleaning, damage caused by accident, neglect, or lack-of inadequate dust collection. The warranty may be voided against proof of misuse/abuse, damage caused where repair or alterations have been made or attempted by others, using the product for purposes other than those described as intended use (unless with consent by Laguna Tools®), modification to the product, or use with an accessory that was not designed for the product. It is the responsibility of the user to understand basic woodworking machinery settings and procedures and to properly maintain the equipment in accordance with the standards provided in this manual.

LENGTH OF WARRANTY

All new machines and optional accessories sold through an authorized dealer carry a two-year warranty effective the date of receiving the product. Machines sold for either commercial or industrial use have a one-year warranty. Wearable parts like throat plates, bandsaw guides, etc., have a ninety-day warranty.

Table A-1 Warranty Lengths

2 Year – New Machines Sold Through an Authorized Dealer

2 Year – Accessories Sold as Machine Options (excluding blades)

1 Year – Machines Sold for Commercial or Industrial Use

1 Year – Blades and Accessories outside of Machine Options

90 Days – Wearable Parts

Aside from being free of defects upon receiving, consumable parts, like cutters and abrasives, are not covered by this warranty unless otherwise stated by Laguna Tools®. These parts are designed to be used at the expense of the operator and are available for replacement or inventory purchase. The determination of a consumable part will be made on a case-by-case basis by Laguna Tools®.

SHIPPING DAMAGE

Laguna Tools® is not responsible for damage or loss caused by a freight company or other circumstances not in the direct control of Laguna Tools®. All shipping-related claims for loss or damage goods must be made to Laguna Tools within twenty-four hours of delivery.

HOW TO RECEIVE SUPPORT

To file a warranty-claim please contact the warranty department at 1-949-474-1200. To receive customer service or technical support please contact the customer service department at 1-800-332-4094. Parts, under warranty, are shipped at the expense of Laguna Tools® either by common carrier, FedEx ground services or similar method. Technical support to install replacement parts is primarily provided by phone, fax, email, or the Laguna Tools Customer Support Website.

LAGUNA

Modifications Allowed or Sold.

Laguna Tools, Inc. is not responsible for additional tools or modifications sold or performed (other than from/by Laguna Tools, Inc.) on any Laguna Tools, Inc. woodworking machine. Warranty maybe voided upon the addition of such described tools and/or modifications, determined on a case-by-case basis. Normal user alignment, adjustment, tuning, and machine settings are not covered by this warranty. It is the responsibility of the user to understand basic woodworking machinery settings and procedures and to properly maintain the equipment in accordance with the standards provided by the manufacturer. Parts, under warranty, are shipped at Laguna Tools, Inc.'s cost either by common carrier, FEDEX ground service or a similar method. Technical support to install replacement parts is primarily provided by phone, fax, e-mail, or Laguna Tools Customer Support Website. The labor required to install replacement parts is the responsibility of the user. Laguna Tools is not responsible for damage or loss caused by a freight company or other circumstances not in our control. All claims for loss or damaged goods must be notified to Laguna Tools within twenty-four hours of delivery. Please contact our Customer Service Department for more information. Only new machines sold to the original owner are covered by this warranty. **For warranty repair information, call 1-800-332-4094.**

Laguna Tools Packaging/RMA Procedures-

Dealer Machinery Warranty

****Any machines returned to Laguna Tools must be returned with packaging in the same way it was received. If a part or blade is being returned it must have adequate packaging to ensure no damage is received during shipping. In the event the item/part is determined to be damaged due to lack of maintenance, cleaning or misuse/abuse, the customer will be responsible for the cost to replace the item/part, plus all related shipping charges.**

We require that the defective item/part be returned to Laguna Tools with the complaint. The end-user must request an **RMA (Return Material Authorization) Number** from Customer Service and include the (RMA) number with all returned parts/components requesting warranty coverage.

Laguna Tools Packaging/Laguna Tools RMA Example-

RMA #
RTN. AUTH. #
CR10979

12/1/2020Return Authorization - NetSuite (Laguna Tools, Inc)

Return Authorization

CR10979

PENDING RECEIPT

EditBackReceiveClose

Actions

CUSTOMER

DATE

CURRENCY

SUBSIDIARY

DEPARTMENT
Sales

LOCATION
Laguna Texas Demo / Returns

SALES REP

PARTNER

LEAD SOURCE

PO #
PO-961

MEMO

CREATED FROM

SALES EFFECTIVE DATE

EST. EXTENDED COST

EST. GROSS PROFIT

EST. GROSS PROFIT PERCENT

PROMISE DATE

☐ DEPOSIT RECEIVED

☐ ACCOUNTING APPROVAL

COMMENTS

RETURN REASON
Manufacturers Warranty Defect

SHIP IMMEDIATE

SPLIT SHIP

☐ REVISED INVOICE

ORDER HOLD REASON

Summary

SUBTOTAL

DISCOUNT

GST/HST

PST

TOTAL

SHIPPING COMMENTS

ItemsPromotionsAddressMessagesHistoryWorkflowCustomPartnersSales TeamAdditional InformationOzLINKPacejetSPS

EXCHANGE RATE

RATE

DISCOUNT

ITEM	RETURNED	REFUNDED	QUANTITY	UNITS	INVENTORY DETAIL	DESCRIPTION	PRICE LEVEL	UNIT PRICE	AMOUNT	TAX CODE	TAX RATE	PST	OPTIONS	GIFT CERTIFICATE	CLOSED	DROP SHIPMENT	COI EST TYI
																	Item De Co

EditBackReceiveClose

Actions

Date: 12/02/2020

SHIP FROM

Name:

Address:

City/State/Zip:

FOB:

SHIP TO

Name:

Address:

City/State/Zip:

FOB:

FREIGHT CHARGES BILL TO

Name:

Address:

City/State/Zip:

Bill of Lading Number : 145787446

Carrier Name: Estes Express

SCAC: EXLA

Pro number:

Freight Charge Terms: (freight charges are prepaid by Worldwide Express unless indicated otherwise)

Master Bill of Lading: with attached underlying Bill Of Lading

WWE Number: W709699351

SPECIAL INSTRUCTIONS: For assistance, please call 833-8WE-SHIP

Handling Instructions: RMACR11096

Pickup Instructions:

Delivery Instructions: RMACR11096

Pickup Service(s): Liftgate Pickup, Residential Pickup

SPECIAL INSTRUCTIONS: For assistance, please call 833-8WE-SHIP

Handling Instructions: RMACR11096

Pickup Instructions:

Delivery Instructions: RMACR11096

Pickup Service(s): Liftgate Pickup, Residential Pickup

REFERENCE NUMBER INFORMATION

REFERENCE	# PKGS	REFERENCE	# PKGS	Total # of Pkgs

CARRIER INFORMATION

HANDLING UNITS		PIECES		WEIGHT	H.M. X	COMMODITY DESCRIPTION Commodities requiring special or additional care or attention in handling or stowing must be so marked and packaged to ensure safe transportation with ordinary care. See section 2(a) of NMFC Item 350.	LTL ONLY	
QTY	TYPE	QTY	TYPE				NMFC#	CLASS
1	PLT			385		machine, 48(L) x 48(W) x (H) DO NOT STACK		77.5
1				385		Grand Total		

Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of property as follows: The agreed or declared value of the property is specifically stated by the shipper to be not exceeding _____ per _____

Note: Liability limitation for loss or damage in this shipment may be applicable. See 49 U.S.C. B14706(c)(1)(A) and (B)

COO Amount: \$

Fee Terms: 3rd Party WWE

Remit Address:

Acceptable Forms of Payment:

Bank Certified Check

Customer Check

Personal Check

Money Order

RECEIVED, subject to individually determined rates or contracts that have been agreed upon in writing between the carrier and Worldwide Express Operations, LLC, a registered motor carrier broker, pursuant to 49 USC 14101(b) and all applicable state and federal regulations.

SHIPPERS SIGNATURE / DATE

This is to certify that the above-named materials are properly classified, described, packaged marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

Trailer Loaded:

By Shipper

By Driver

Freight Counted:

By Shipper

By Driver/pallet said to contain

By Driver/Pieces

CARRIER SIGNATURE / PICKUP DATE

Carrier acknowledges receipt of packages and required placards. Carrier certifies emergency response information was made available and for carrier has DOT emergency response guidebook or equivalent documentation in vehicle. Property described above is received in good order, except as noted.

(Signature)

(Date)

Manual Revision Record

[illegible]

