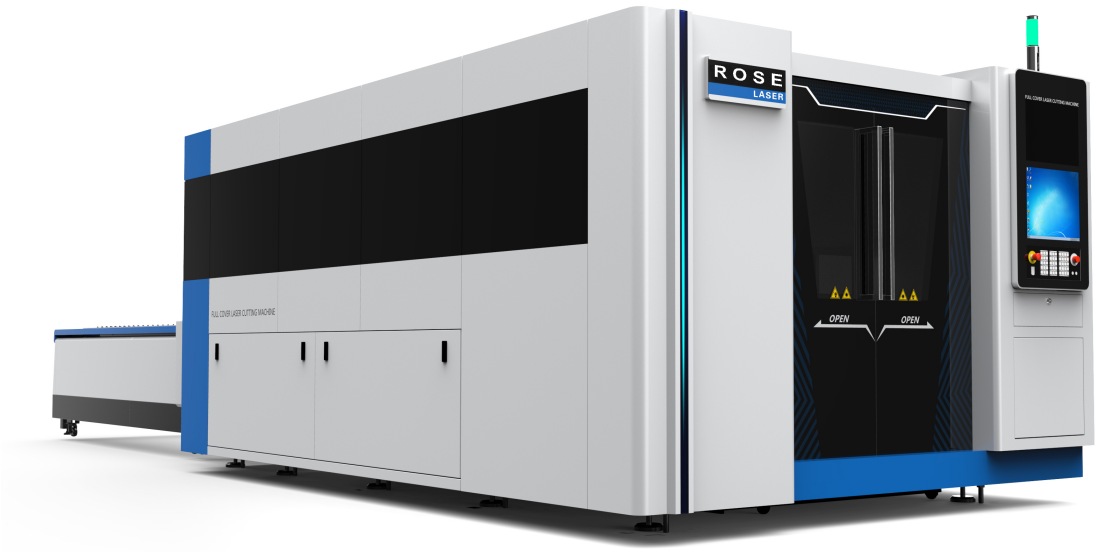
BesCutter Fiber Laser Cutting Machine



User Manual

(Version: V6.15)

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1. Preface

Thank you for purchasing the G series laser cutting machine from Rose Graphix LLC. If this is your first time to use this machine, please read the manual carefully before using the machine. The content labeled **"dangerous"**, **"warning"** and **"attention"** must be pay attention to specially to ensure the safety of your and surrounding personnel, and proper use of this equipment.

"Dangerous": If you do not follow the correct operation, it may immediately lead to serious injury or even life-threatening.

"Warning": If you do not follow the correct operation, it may immediately lead to serious injury or even life-threatening.

"Attention": If you do not follow the correct operation, it may immediately lead to serious injury or damage to the equipment.

2. Product overview

2.1 Summary

Adopting large power, high performance fiber laser with international advanced technology and Cypcut high-grade CNC system, equipped with imported original AC servo motor and some high efficient transmission mechanism, such as, German original gear and rack, imported high-precision linear guide, the G series laser cutting machine is stable and reliable, good dynamic performance, with a strong load capacity performance. Having high speed, high precision, high efficiency, high cost performance, etc, this is high-tech products integrated with laser cutting, precision machinery, numerical control technology and other disciplines. Users must read the manual carefully before the G series laser cutting machine is used. If there is any problem in using process, please contact us in time, we will give you a satisfactory answer in the shortest time.

Please check the manual in accessory box when it is opened. If the manual is not complete, please contact us in time.

2.2 Product characteristics and appearance

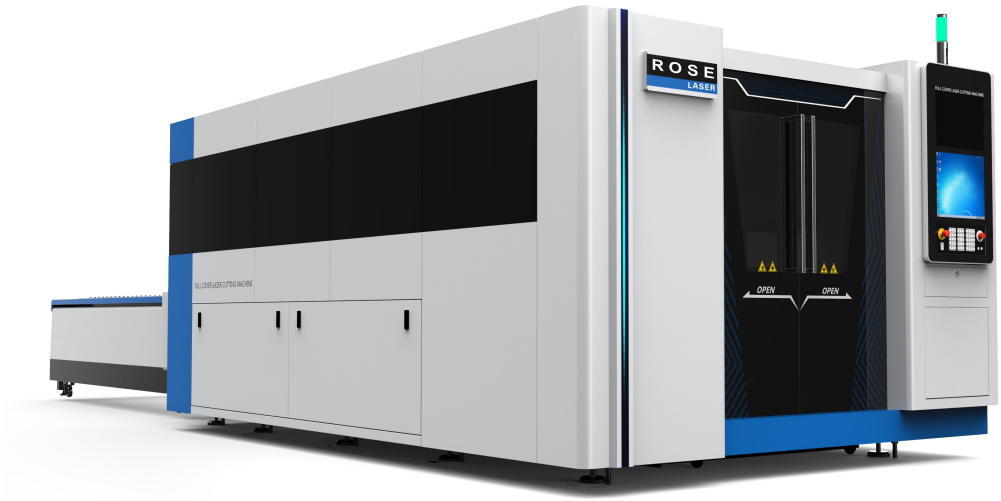


Figure: The machine appearance

Note: All the pictures in this manual are for reference only. (Do not include the products special instructions). The product provided the user shall be prevails

a. Beams cast having double column framework layout and bed welded being large cross section, the machine is high at rigidity, stability and shock resistance.

b. Precision linear guide, gear and rack imported being transmission components, the machine is higher at precision and speed, positioning accuracy is ± 0.03mm/m, and repetitive positioning accuracy is ± 0.02 mm, maximum speed (no-load) is 80m/min.

c. The Cypcut control system is adopted that can satisfy the processing of various kinds of board. The AC servo motor is small inertia and better at dynamic performance.

d. Revolution being reduced by the reducer (its back lash is less than 5 arcmin), the servo motor drives the moving components to assure output power at low speed.

e. The laser and main machine are installed together, which ensures the stability of light path.

f. IPC equipping with CAD/CAM, so it is convenient to drawing and program in cutting, which maximize the conservation of raw materials.

g. Cutting chip falling into the scrap car from funnel, so it is convenient to clean up the chip regularly by operators.

h. Rack and guide way of X axis and Y axis are dustproof that are covered by protection cover to

prolong the service life. Gear and rack of X axis and Y axis are regularly lubricated by central lubrication devices; linear guide way of X axis and Y axis are lubricated by manual regular.

i. Z axis motor is controlled by capacitive sensor to driven cutting head that moves up and down, which ensure the distance between nozzle and the plate cut to be constant to ensure the cutting quality. Drawer-style lens base is adopted in cutting head, so it is extremely convenient to replace or clean the lens. According to the material and thickness of the plate cut, focus position can be adjusted up and down to ensure cutting quality.

j. Travel limit switch are used to control motion stroke in X, Y and Z axis, at the same time, elastic cushion pads are used also at limit position for the movement safety.

k. Closed optical path is adopted to ensure the service life of the lens.

l. Equipped with automatic focusing system, the laser head is prompting and accuracy to move.

m. Components imported are adopted in the gas path system. Three different kinds gas can be filled simultaneously and chosen freely. The pneumatic system is designed to withstanding high pressure and to ensure system stability; the nitrogen pressure may be 3.0 Mpa, in the cutting of stainless steel plate. All these improve the reliability and cutting quality.

n. Operation platform possess elegant appearance, operating the machine is as happy as you do at ATM.

2.3 Main use and scope of application

Using medium - power fiber laser, this series of laser cutting machine is mainly used to cut ordinary carbon steel plate, stainless steel plate, galvanized sheet and other materials. It has the advantages of high precision, high efficiency, and high cost performance and so on.

Note: if the power of the laser chosen is different, the range of the cutting material may be different.

2.4 Environmental conditions

a. Standard power supply: Three-phase five wire, 380V 50Hz

b. Total power of main machine is not greater than15KVA;

c. Power of laser and cooling-water machine is not greater than 5KVA;

d. Power quality: three phase unbalance is less than 2.5%, line voltage fluctuation is less than 5%.

e. The machine must be grounded, grounding pile on machine side and connecting wire, to connect machine to a power wire is also allowed, and the grounding resistance should be less than 4 ohm.

f. Site environment: good ventilation conditions, no dust, no corrosion, and no pollution.

g. Installation foundation: There is no larger vibration source surrounding machine; there is anti vibration groove surrounding.

h. laser working temperature is lower than 20℃.(See the instructions of the laser)

i. Chiller is the special equipment providing circulating cooling water to laser and lenses. Water flow should maintain above 12L/ min; circulating cooling water should be high quality pure water or distilled water.

j. For fire prevention, appropriate fire extinguishers should be configured and fire channel is reserved at processing sites.

k. The distance from machine left side to the workshop wall and the distance from machine backside to the workshop wall should be larger than 1.2m; the distance from laser backside to the workshop wall should be larger than 1.5m. Chillers and air compressor can be placed outdoor, but the distance from the laser should be less than 5M.

l. Control unit, servo unit, display and control panel should avoid being subjected to electromagnetic waves interference, such as electric arc welding and electrical discharge machining machine, which will affect the machine normal work.

2.5 The influence on environment and power requirement

An optical fiber laser generator is used in this machine; waste gas will be generated during cutting, so is necessary to switch on the exhausting device in cutting process.

The fiber laser generator belongs to the fourth category laser products. Light beam emitted, or reflection and diffuse light from mirror may cause damage to the human body (especially the eyes), personnel presence should pay attention to the protection, should also prevent the occurrence of fire.

Being high energy consumption equipment, the laser cutting machine needs total power about: three phase 380V 50Hz, 12KVA (500W continuous type laser and chillers. If laser selected is different, the power needed will be different also).

2.6 Machine structure and working principle

G Series CNC laser cutting machine is mainly composed of the main machine, control systems, laser, chiller and exhaust fan, etc. Except for exhaust fan and chiller, others have there's own manual. This manual mainly introduces the structure of main machine and electrical control system; the rest parts can be referred in their specification.

The main machine is the most important component of the laser cutting machine; it is guarantee to achieve cutting capabilities and assure cutting accuracy. Main machine consists of the bed, laser generator, beam section, Z-axis device, table, auxiliary (protection cover, pneumatic system and cooling system, lubrication system), console, and so on. Details see section 2.6.2.

Electrical control system that consists of CNC systems and low-voltage electrical system is an important part to achieve various type graphics running track.

CypCut CNC system, based on the WINDOWS system operating platform, is used on this machine. Containing 32-bit microprocessor, internet communication interfaces, operation reliable, and the system has characteristics of fast interpolation operation, convenient operation, good dynamic performance, strong load capacity and so on.

The low voltage electrical apparatus control system, located within the cabinet, is interface of the whole electrical control system. All the components used in electrical system are produced by well-known manufacturers, which ensure the machine's stable and responsive in operation. Driving motor is AC servo motor that drive the X-axis (beam), Y-axis (slide), which have good accelerate performance, quick response; maximum position speed is up to 80m / min. Z axis, laser cutting head, being feeding axis, is driven by AC motor to move up and down; cutting head is good at dynamic response and can be servo controlled as well as NC controlled.

Other auxiliary including large and small chiller, air exhaust system, is introduced in detail at section 2.6.2.

2.6.1 The overall structure and working principle, characteristics

The main machine is the most important component of the laser cutting machine; the cutting capabilities and cutting accuracy is achieved by this part. Main machine consist of the bed (X axis), beam (Y axis), Z axis, exchange table (optional), table, gas path, water path and other components, etc.

2.6.2 The structure, function, and working principle of main components or functional units

2.6.2.1 Bed

Being a rectangle frame structure that is welded by high strength steel, bed is annealed to eliminate internal stress after welding and is vibrating treated after roughing. There is also vibration effectiveness after semi-finishing. Because of stress relief more thoroughly, so the bed deformation is small, and the precision is good for a long time.

2.6.2.2 Beam

Beam is cast from high-strength aluminum. After solution treatment and artificial, it is machined to ensure the accuracy and service life. The processing flow include roughing, VSR, semi-finished, VSR, finishing.

Beam is installed on the support rail of bed (there are linear guide rails and flat rail); it can move reciprocating in the X-axis direction. The movement is achieved by rack and pinion transmission, in which 2 racks are fixed on the bed and 2 pinions are driven by 2 serve motor directly to synchronous rotate; pinion translation makes the beam move in the X-axis direction. High-quality linear guides are mounted in beams system. Cutting head, fixing on slide, is driven by servo motor through reducer and move reciprocating in the Y-axis direction. There are the soft limit switches control stroke, and elasticity buffer at limit position to ensure that the system is running security. Retractable organ type shield located between the beams and cross slide ensure the rack and linear rail runs in fully enclosed environment, to unaffected by the external environment.

2.6.2.3 Z-axis device

Z-axis device drives the cutting head to move up or down. Cutting head is located on Z-axis slide, its ball screw is driven by servo motor controlled by CNC system. The travel stroke of Z axis is 120mm; there are limit switch at upper and lower ends to control the Z axis stroke, while there are elastic cushion at both ends to ensure the safety of movement. Ball screws and linear guides adopted are all high-quality products to ensure the transmission accuracy.

Z-axis both can do its individual interpolation motion, being a CNC axis, and can do association motion with X, Y-axis. It can be switched to follow control by changing electronic control to meet the needs of different situations also. Since the Z-axis follow is controlled by the numerical control system, thus relatively moving accuracy is higher, stability is better, so as to ensure the cutting quality. Having sealed and elastic buffer, the cutting head has longer service life.

After the distance from the nozzle to plate surface is detected by the capacitive sensor installed in the cutting head, the signal is fed back to the control system, then the cutting head, driven by Z axis motor, moves up and down to assure the distance between the nozzle to plate unchanged and to ensure effectively cutting quality. There is adjusting device in cutting head, the position of the focus can be adjusted, and according to the material and thickness of the plate cut, thereby good cutting surface can be obtained.

Nozzle is one of wearing; some nozzles having different aperture should be conserved by users to facilitate replacement.

The guides and lead screw lubrication oil nozzle are set up in Z-axis, these nozzle should be regularly oiled.

2.6.2.4 Electrical control

The electrical control system of G series CNC laser cutting machine is mainly composed of numerical control system, servo systems and low-voltage electrical system. CypCut CNC system, which is a PC CNC system based WINDOWS, is adopted by the laser cutting machine. This CNC system has the characteristic with interpolation operation fast, easy to operate; Servo system includes Fuji AC servo motor and driver, reliable, good dynamic performance, with bigger load capability.

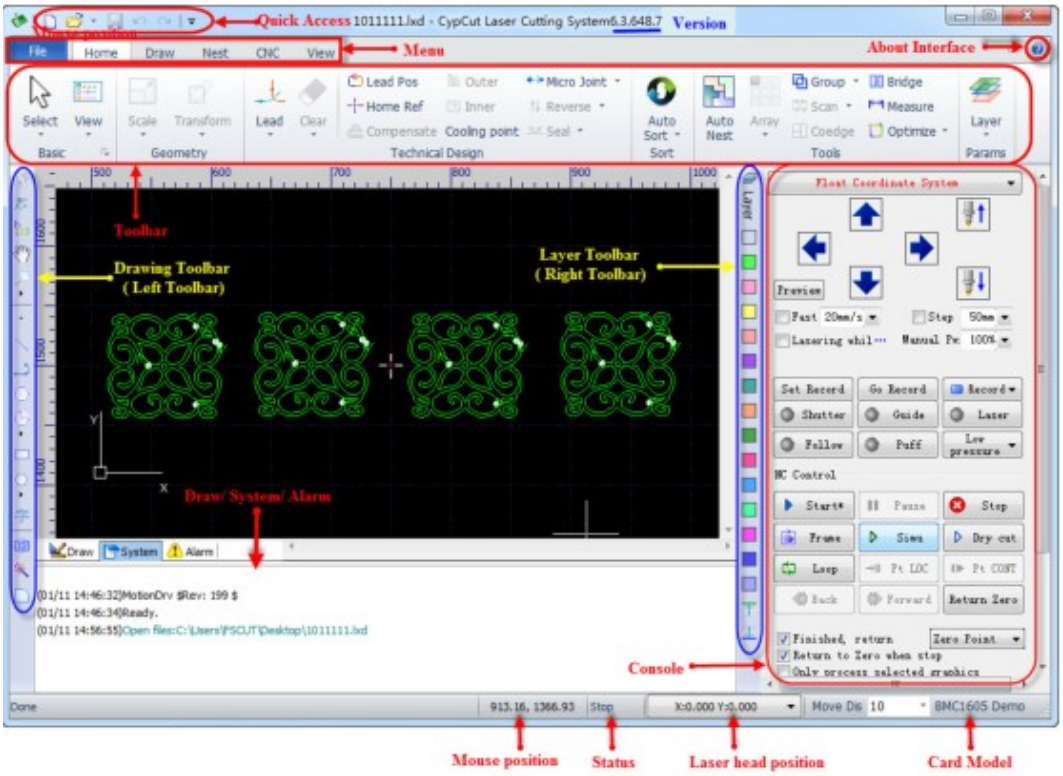


Figure: CNC operator interface

a) Easy to operation

There are six function soft keys and eight operational soft keys in this machine, operational soft keys have different functions in different operation mode, thereby the operating button are reduced and the operation panel is simplified. There are menu display functions in any mode, so operation is intuitive.

The machine has HELP system, the operator, even if who are not familiar with the instructions, can operate machine base on the prompt of the CNC system.

b) Special laser power control function

According to the speed / power function curve set by operator, the optimal laser cutting power can be obtained by adjusting precisely laser power at different speeds when components are acceleration or deceleration.

c) Strong processing function

The machine has a variety of processing and auxiliary function instruction; complex graphics can be obtained by the instruction editor.

d) high-precision machining

Having a good dynamic electromechanical drive performance, the machine is good follow performance and high precision in the process.

e) Graphic display

There is graphic display and dynamic graphics simulate trace display function for parts program edited. processing is more intuitive, easy monitoring and control.

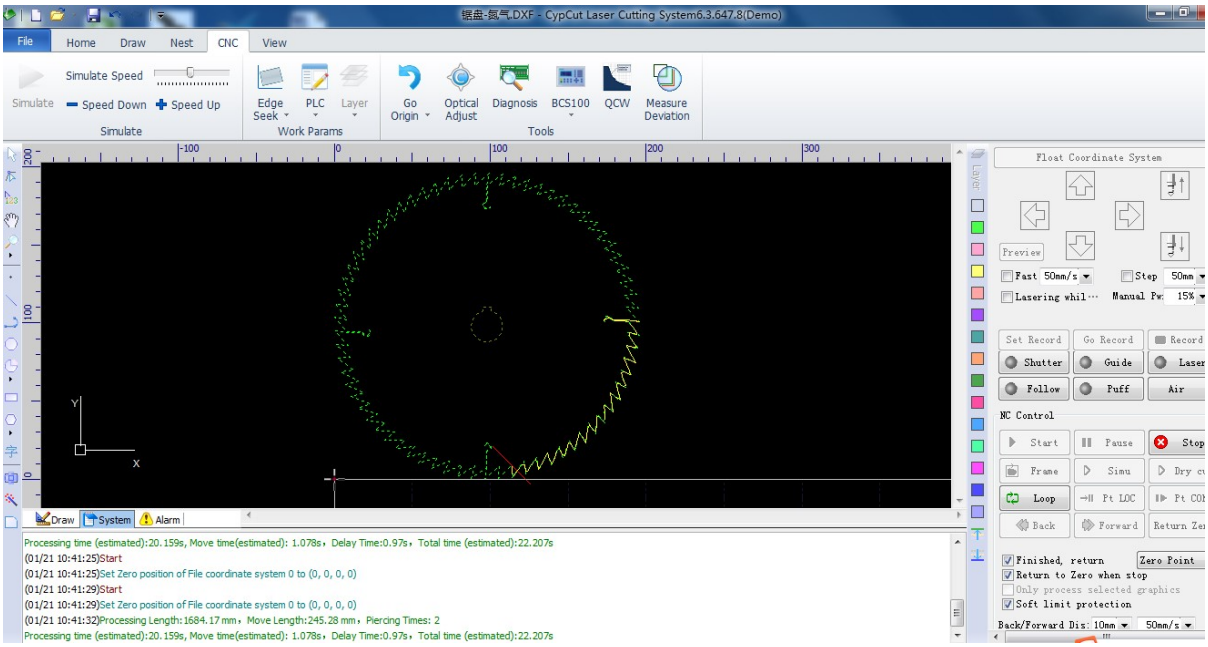


Figure: Graphic display

f) Various alarm functions

Having a self-test alarm system and automatic protection function, this CNC system also can do alarm display and automatic protection for external conditions.

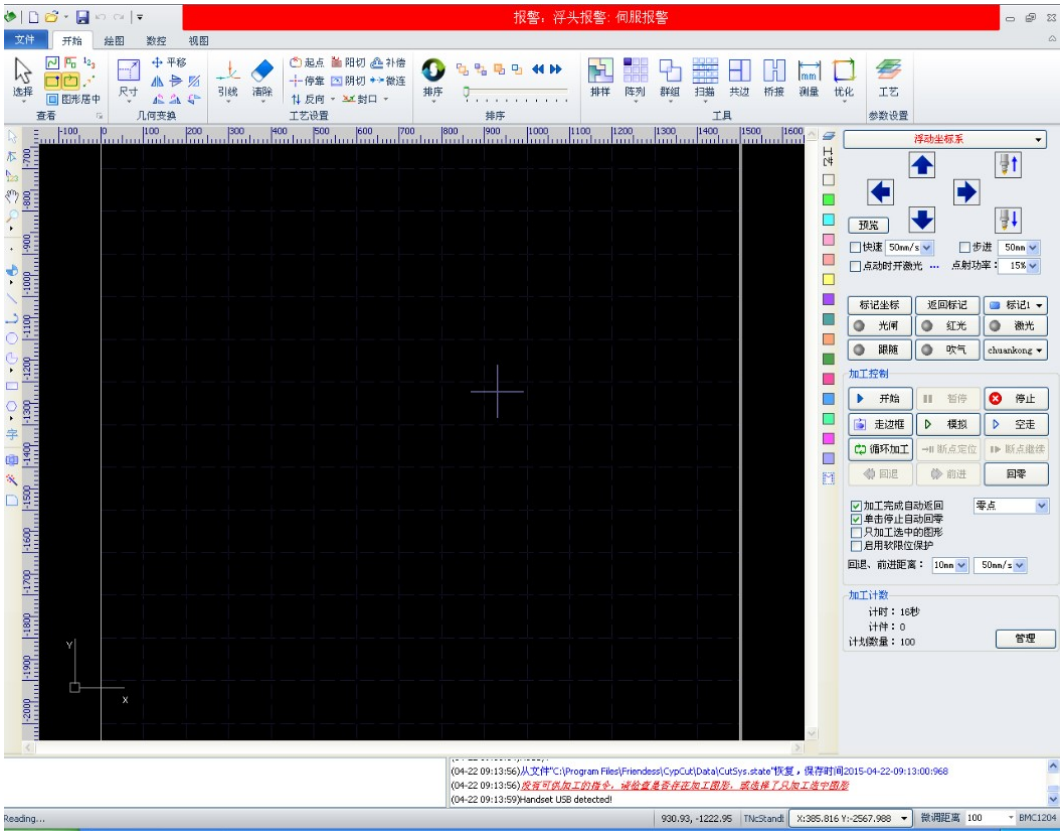


Figure: Alarm functions

g) The electrical control system can be divided into CypCut CNC systems, machine control panel, low voltage electrical systems, motors and machine electrical, according to its mounting position.

h) CypCut CNC system

Belonging to high-end system, CypCut CNC system is special CNC laser system for CNC machine tools. The integrated structure; central control and display are adopted by this system, so the operating unit possesses structure compact and is mounted on the operating table.

The system is PC CNC system WINDOWS-based, hard disk is 60G, the part program memory is 400KB, Internet communication interface, three axes and one spindle can be controlled. A good man-machine interface is provided by display operating unit. Various operational information, keyboard and function keys are all displayed in17-inch TFT LCD color LCD, which is used to input information and operate machine.

i) Height system operator panel

The system operator panel is located in the top right corner of the left electrical control cabinet.

j) Low-voltage electrical system

Low-voltage electrical system, located inside the machine cabinet, is the interface part of the whole electrical control. The power supply, relays, circuit breakers, contactors, servo drive system for electrical control system are all installed in the cabinet inside. The main power switch is located in the left side of the cabinet.

k) Motors and machine electrical

Driving the machine axes, AC servo motor are connected with the corresponding axis, namely X-axis drives beam, Y-axis drives slide and Z-axis drives cutting head. Machine electrical includes the origin switch of each moving axis, pneumatic solenoid valve, pressure switch etc.

2.6.3 Mechanical and electrical contact between each unit structure, fault alarm system

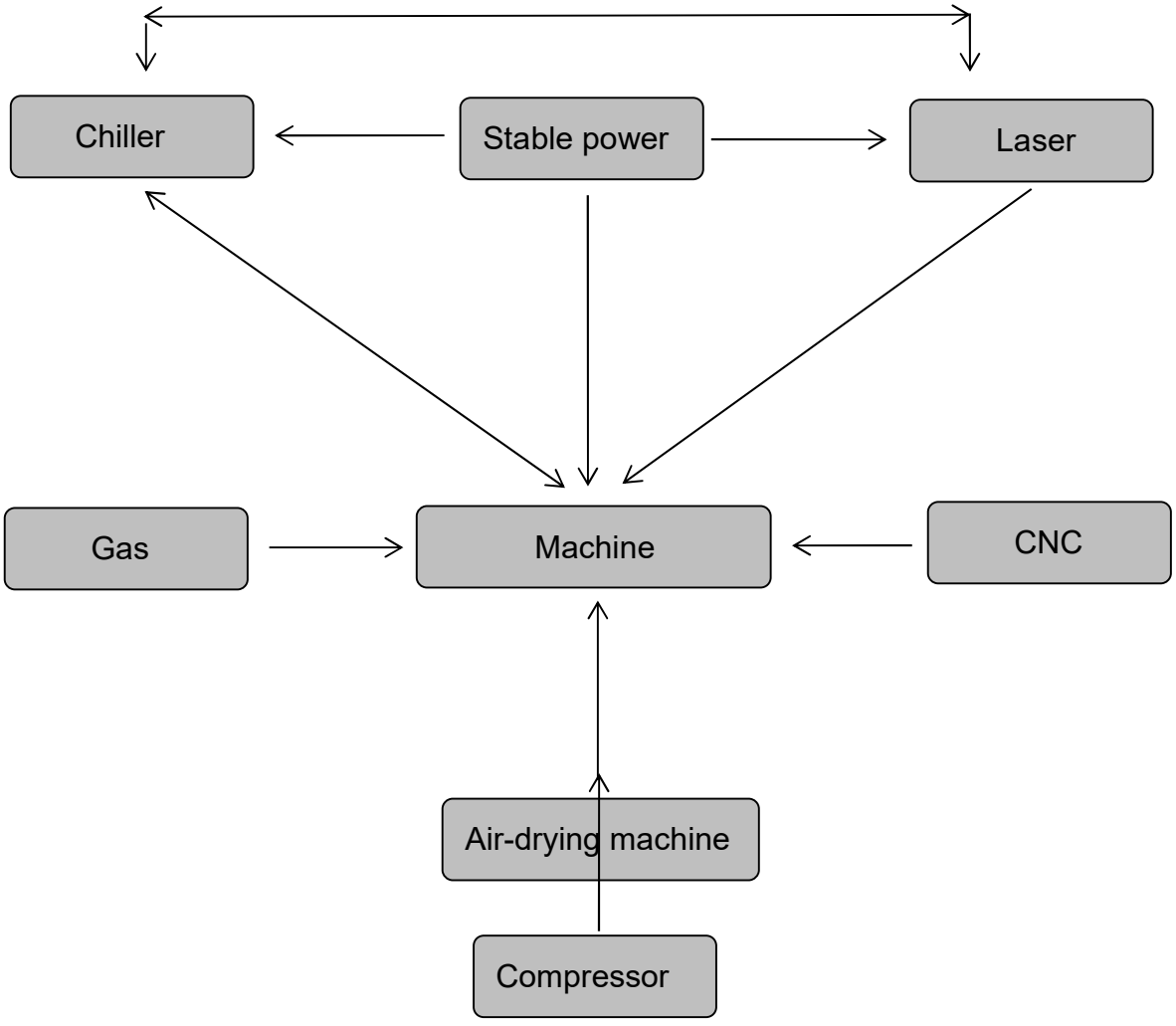


Figure: Unit structure contact diagram

The above figure shows the close relationship between the various components. Stable power provides energy for the chiller, laser and main machine; chiller cools the laser and the main machine; other portions provide effective measures to serve the main machine.

Each electrical circuit is provided over-current protection by the air switch; there are mechanical limit location, electrical soft limit and hard limit protection in each axis. Electrical hardware limit can cut off the power and stop the machine running and alarm; mechanical limit ensure the safety of equipment and operator in case of any accident. The system itself also has a motor overload and over-temperature protection. Alarm list see section 5, 6, and Cypcut alarm system user manual.

2.6.4 The function structure and working principle, operating characteristics of auxiliary devices

2.6.4.1 Gas path system

The gas path in this laser cutting machine is divided two parts, one part supply cutting gas to the cutting head, cutting gas include clean and dry air, high purity oxygen and high purity nitrogen, another part supply the auxiliary gas, being clean and dry compressed air gas for the use of clamping table cylinders.

Entering into the control cabinet through the gas tank and the cold dryer, the gas coming out from the compressor turn into a clean, dry gas by a sophisticated air-handling system and is divided into two parts, one part is the cutting gas, another part is used by gas cylinders. There’s pressure can be adjusted by a corresponding regulating valve.

Cutting gas is included three gases, they are compress air, oxygen and nitrogen, and these three kinds of gas can be selected according to different requirements. Oxygen is mainly used to cut ordinary carbon steel; nitrogen is mainly used to cut stainless steel and alloy steel, compress air is mainly used to cut metal plate that cutting surface quality is not very high. Different cutting gas is used to cut different materials. The pressure sensor is applied in the cutting gas system also, to stop working in time when gas pressure is not high enough to avoid that the part cut is scrapped. Its pressure value can be set by adjusting the screw top on pressure sensor; the pressure value of compressed air and oxygen, being used to cut, can also be adjusted by the process ratio control valves controlled by program.

The function of compressed air in the machine includes the following. 1, drive clamping cylinder and clamp the table to ensure that the table is motionless in cutting process, cutting is smooth. 2, assist feeding. 3, auxiliary cutting, remove dust, clean cutting surface.

2.6.4.2 Water path system

Water path system also consists of two parts, some cooling water coming from the chiller enters the laser to cool the laser through the radiator inside, and than return to chiller; another part is used to cool the optical path and cutting head.

2.6.4.3 Oil lubrication system

The oil lubrication system is composted of automatic pumps and piping. Pump interval is 4 hours (can be changed); pump oil time is 10 seconds (can be changed). When the oil pump's oil level is too low, the pump will alarm, and sound an alarm, to add the oil into pump is needed this moment.

3 Safety instructions and precautions

3.1 Summary

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

3.2 Involved Safety Standards

Laser processing equipment and operations shall comply with following two national standards, GB7247-87 the radiation safety of the laser products, equipment classification, requirements and user's guide, GB10320-88 The electrical safety of laser equipment and facilities.

3.3 Safety warning labels and instructions

See 5.3 operation guide safety, security protection, safety signs and instructions while before machine is used or is using.

3.4 Security warning

Specify security administrator, determine his responsibility, and train safe operation and safety for laser processing operator.

Specify laser safety management area, set up warning signs at entrances and exits in management area, including: power, laser types of laser processing machines, prohibit outsiders entering, eye protection and safety manager names, etc.

The operator of the machine cannot go on duty until he go through specialized training, up to a certain level, and is permitted by the security administrator.

3.5 Laser Safety Notices

Laser is very harmful to the eyes and skin of human; any part of human body can be burned under laser irradiation, avoid exposing any part of your body to the light path of the equipment to avoid damage caused by misuse.

3.5.1 Eyes and skin protection

CO_2, YAG lasers or fiber lasers is usually used in laser processing. Different types of laser, the damage to the human body is different. YAG laser and fiber laser may damage the retina of the eye, as the high wavelength YAG laser and fiber laser are transmittance to the eyes, so the dangers is greater. CO2 laser may burn the eye cornea. These two laser irradiation are likely to cause cataracts and skin burns danger to the eye, therefore, appropriate protective measures mast be adopted when laser is adjusted, according to different laser.

3.5.2 Fire Protection

Oxygen is used generally, and there will be spark splash in cutting process, which is easy to lead to a fire hazard. There are no flammable and explosive materials in work area, appropriate preventive facilities should be equipped also.

3.6 Electrical Safety

Do not touch any switch with wet hands to avoid electric shock. There are some sites affixed lightning signs in the machine, where high-voltage electrical appliances or electrical components are located. Approaching to these sites or repairing, operator should be careful to avoid electric shock. These sides include, servo motor cover, the connecting box behind columns, machine transformer cabinets, electric doors, etc.

Read the machine manual carefully to be familiar with various functions and the operation methods of corresponding keys.

Do not open the electric door casually; prohibit changing unauthorized parameters set already, potentiometers and timers. If these are needed to change, the change must be done by professionals who is trained by the manufacturer and accredited, and parameter values before changing must be record also. if necessary the original state can be restored.

Do not touch the charged components in the electrical cabinet, such as, CNC equipment, servo devices, transformers, fans, and so on, while power is on.

Warning

Do not touch terminals within 5 minutes of power off. Because high voltage will remain between power lines, so do not touch the terminal immediately to avoid electrical shock.

3.7 Material Safety Notices

The focusing lens and other optical instruments are manufactured using chemical vapor deposition method. When the temperature is above the point of combustion, these materials will generate toxic Se vapor that is highly toxic substance. The lens has been coated with radioactive material thorium compound film to improve the transmittance, so lens need to send to the professional manufacturers (or manufacturer) if lens damage, to avoid damage to the environment.

3.8 Machine protective measures

Specify security administrator, determine his responsibility, and train safe operation and safety for laser processing operator.

Specify laser safety management area, set up warning signs at entrances and exits in management area, including: power, laser types of laser processing machines, prohibit outsiders entering, pay attention to eye protection and safety manager names, etc.

When the machine is not used, pull out the switch key, kept it by the designated person to avoid harm caused by misuse. Exhaust smoke gas and waste gas produced in laser processing should be

discharged to outside through the pipe, all cylinders should be placed neatly stable.

3.9 Operator common knowledge

The operator of the machine cannot go on duty until he go through specialized training, up to a certain level, and is permitted by the security administrator.

Operators or personnel near laser should wear appropriate laser safety glasses during working. There will be good indoor lighting at protective region, in order to ensure the convenient operation.

In order to protect the operator, a process chamber or protective screen must be set. There should be security devices to protect laser diffusion and protect the operator in process chamber. The laser shutter should be turn off when process chamber door is opened.

4 Installation and debugging

4.1 Delivery check

4.1.1 Unpacking Caution

Please open the wood box according to the prompts outside of the box, to avoid damage the equipment, if the machine is packed in wood cases. Main machine and other equipment are packed using protective film, it is not allowed to cut protective film using sharp object to avoid that surface is scratched and that electrical line or pipeline is damaged. The damage caused by customers themselves is not covered under warranty.

4.1.2 Check contents

After opening the package, please confirm whether it is the product you buy.

Check whether there is any damage in transport.

Comparing with the list, you check whether the components are complete or not, is there any damage.

In the condition that product model does not agree with contract, the lack of attachment or transport damage is found, etc., please contact us.

4.2 Installation methods and precautions

4.2.1 Lifting and transportation machines

a. Equipped with lifting holes, the machine can be hoisted. lifting hole location shown as below:

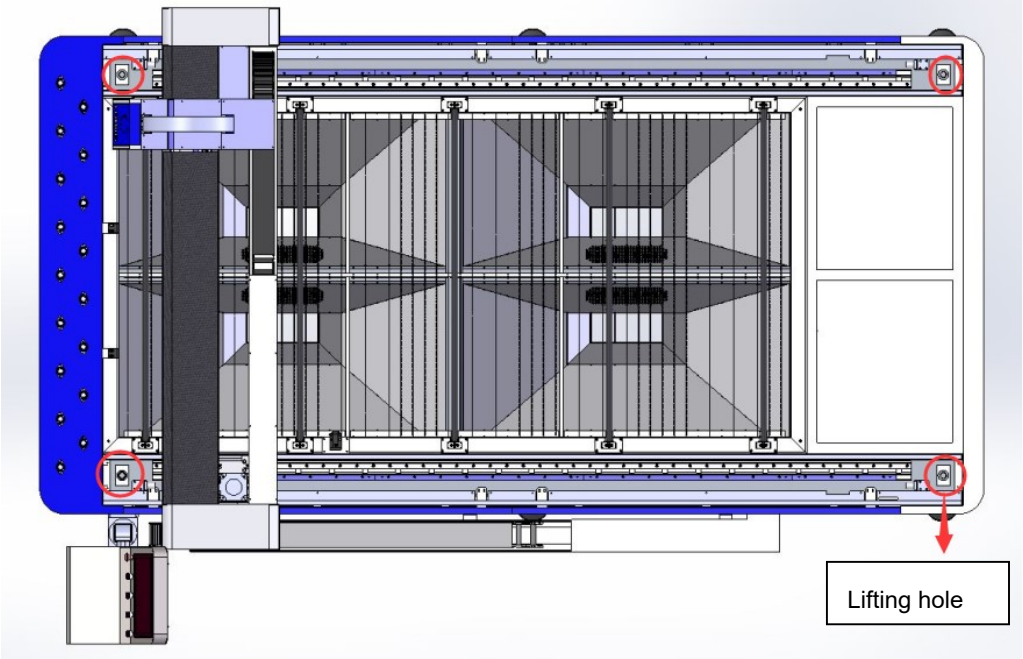


Figure: Lifting hole

b. the machines can also be transported by forklift, truck bits shown as below:

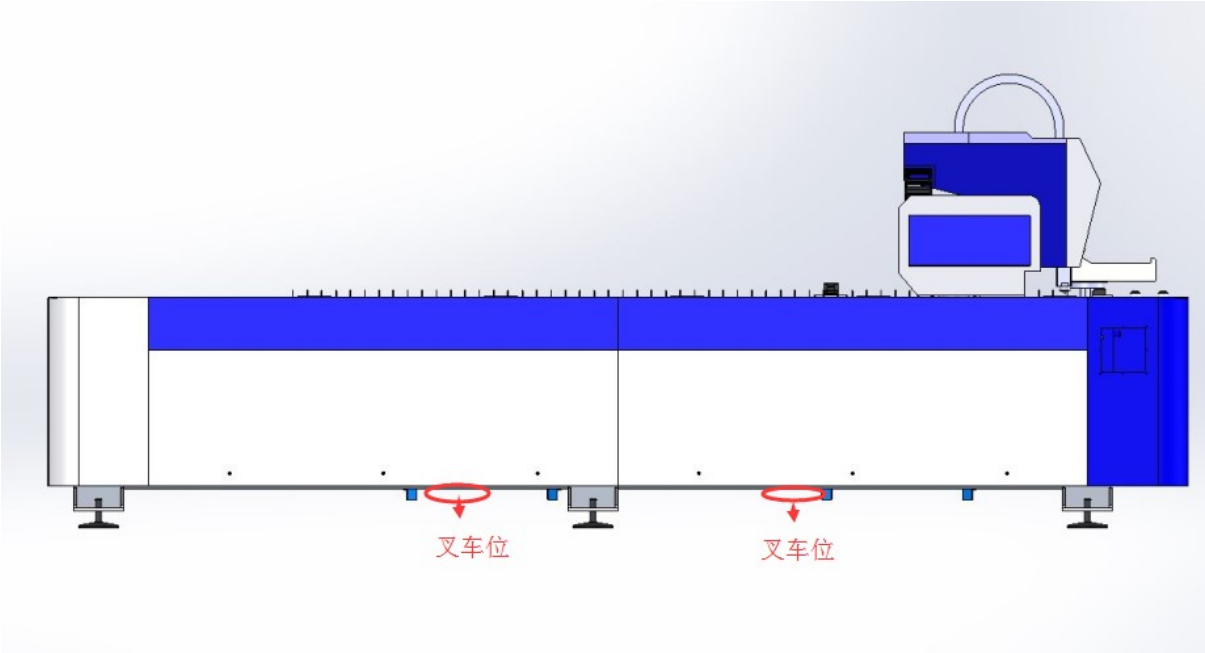


Figure: forklift bit

Note: When using forklifts, forklift fork into the side of the machine is not a tank located on the side chain, the chain of tanks into the

side of the fork is not allowed, to avoid damage to tanks, chain and internal optical fiber cables.

4.2.2 Chiller installation

--- Flow: Min 3.5L / min, maximum 13L / min.

--- Cooling capacity: 14483Btu / h.

--- Water pressure difference between inlet and outlet: Minimum 3kgf / cm^2.

--- Temperature controlling capacity: ± 10 ° or less.

--- Cooling water: high quality, pure water distilled or deionized water.

--- Valves and pipes: all the valves material is stainless steel and pipe are high-pressure hose; galvanized material is not allowed to use, pipe joint are fixed using stainless steel clamp.

--- External laser water pipes is the pressure rubber pipe, plastic (PVC) pipe, its internal diameter being 6mm, external diameter being more than 8mm. Stainless steel, and brass pipe are also available. If the chiller pipe length is more than 10 meters, to increase the pipe diameter is needed to assure the pressure difference lasers needed. For different lasers, connecting pipe dimensions are also differences.

--- Cooling water pipes of optical path: PU pipe pressure being not less than 6kgf / cm2, pay attention to the sealing in pipe joints.

--- Filter hole diameter is 100um, so it is better for pipe material to be transparent plastic, the filter used between the chiller and laser must be the standards filter requested by manufacturers.

a. Mounting conditions

Chiller should be placed firmly and it is not too near from the wall, the installation space must be larger enough to ventilate to improve chiller cooling.

b. Machine check

Check whether the Joint in water path system loose, check whether the filter device in chiller filtration are tightened.

c. Installation method

Connect water pipeline to the corresponding connector of the unit, and note the direction of inlet and outlet, connect the inlet and outlet of chiller to the inlet and outlet of laser respectively based on the signs of chiller. Make sure pipes are connected correctly and there is no garbage and foreign matter outer pipe. As shown below:

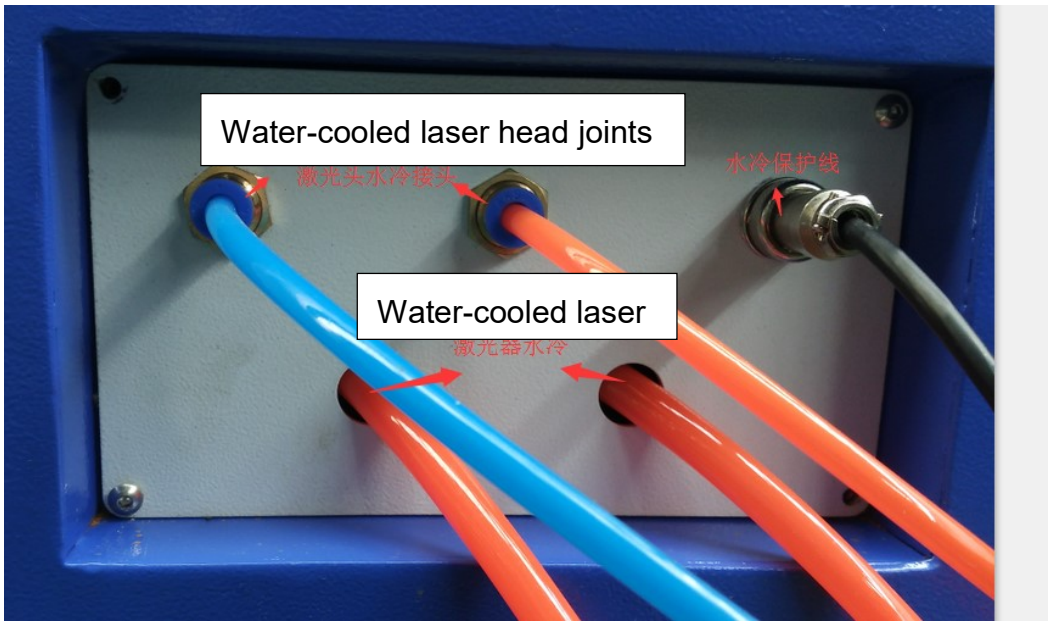


Figure: water inlet and outlet

d. Water quality standards

Open the inlet valve, add water to the tank, water level should be at the appropriate height marked to prevent water overflow from the tank. Tap water are not generally allowed to use, high-quality pure water, distilled or deionized water can be used, otherwise water scale will be produced in chiller refrigerator and laser radiator to cause component damage. Prohibit adding any corrosive liquids.

e. Debug the machine

Put on power, check and sure that the single-phase three-wire electrical are connected correctly within the unit, turn on the chiller and wait for water temperature inside the chiller to rise suitable temperature.

f. starting step

Before booting, make sure pipes of chiller are connected correctly, and then start the machine and check whether there is leaking pipe joints.

g. Note:

(1) When the water temperature reaches the control temperature, chiller will control automatically constant temperature, and water pump still run now.

(2) The laser cannot be started until that the cooling water temperature, pressure difference between inlet and outlet reached the required value of the laser.

(3) When environment temperature is below 0 ℃, the cooling water may be freeze, which can damage the laser. Now, users can add 30% ethanol to water and freezing point of cooling water will be lower than -10 ℃.

4.2.3 Assist gas connection

Prepare N_2 or O_2 and compressed air to be used. First check nameplate on the special cylinders and assure whether it meets the requirements, such as, purity and pressure requirements of N_2 or O_2. Secondly, connect the gas in cylinders with the machine correctly, and open gradually the cylinder valve. A water separator between oil-free air compressors and refrigerant dryer is needed. There is a nitrogen pressure reducing valve and an oxygen pressure reducing valve, which is standard parts. Its inlet connects with gas source and outlet connects with the machine. As shown below:

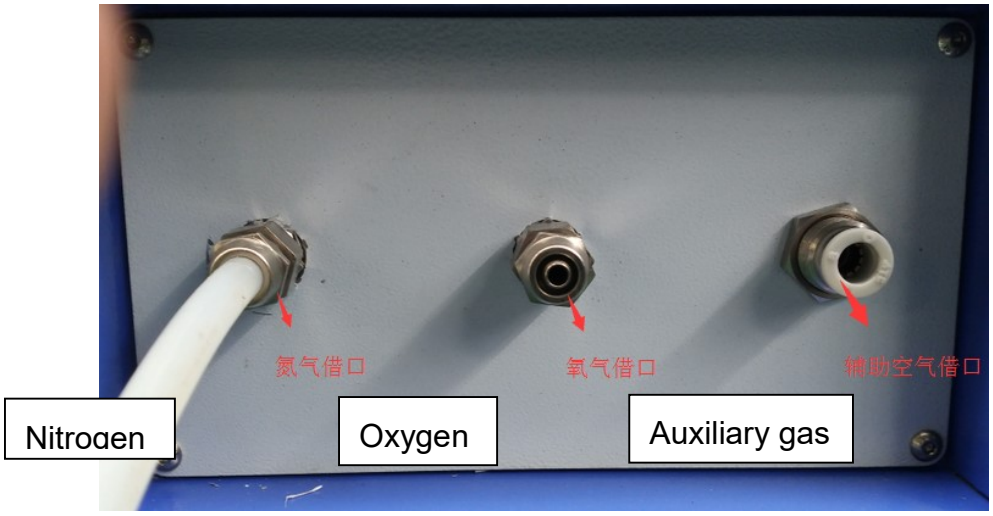


Figure: gas in

4.2.4 Install dust removal device

Dust blower connector as shown below:

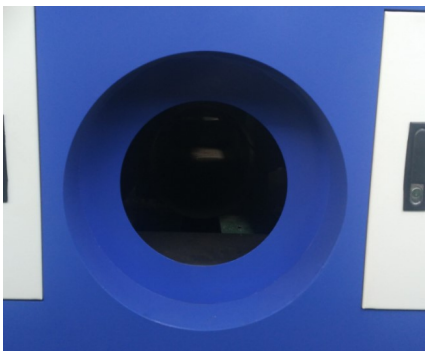


Figure: dust blower connector

4.2.5 Electrical connection

a. Inspect whether the air switch of main power and the scram button of all independent power is sensitive.

b. Inspect whether the laser power wiring is correct, the workshop 380VAC power supply should be connected to the air swatch terminal QF0 (entrance) of main power.

c. Inspect that the air switch of main power and independent power (such as main machine, laser machines, air compressors, etc.) must meet the capacity indicated.

d. Power wire, ground zero wire of the machine diameter is not less than the required diameter.

e. Inspect whether the power cord ground wire is connected correctly.

f. Inspect whether all strong electric wire terminals (especially the power transformer input and output points) is reliable, firm, whether all plugs and flapper are connected firmly.

Caveat
Power cord ground must be grounded, otherwise the signals inside machine cabinet will be disrupted and cause dangerous encountering leakage.

4.3 Debugging methods and related instructions

Debugging machine must be done by professionals and comply with the relevant provisions. To understand the machine performance and read the relevant technical information is needed before debugging. Right debugging is the basis to assure the machine working correctly, if there is something unclear please contact us, we will be in the shortest time, give you a satisfactory answer.

Note: This debugging method includes how to debug machine after it is powered on online normal, how to debug online power electric line, please refer to section 4.2.5 on the machine.

4.3.1 Adjustment of the laser and optical path adjustment

a. Installation Notes:

1) Please read the manual carefully before using the product, if you have any questions please contact Rose Graphix LLC staff;

2) Use the original power wire, and ensure that the laser shell and the earth are conducted, detects whether laser shell and the earth (PE yellow and green line) is effective conducted using multimeter before power is on.

3) Each control wire and voltage of laser must satisfy the technical requirements of products, otherwise, will result in happen unrecoverable damage. Please inspect whether the voltage signal meets requirements before laser is online working.

4) Pay attention to protect optical fiber and output end and do not bend the fiber during fiber is embedded process. This part belongs to vulnerable; please pay attention to protect.

5) When the laser is assembled or disassembled, the lens dust prevention in fiber output end must be done, please clean the lens based on the specification, if there is dust on lens. (a. ethanol, a purity of more than 99.9%;. b. clean Cotton, do not use ordinary cotton swabs, cotton is easy to fall, resulting in lens secondary pollution).

6) Start order: chiller (guaranteed to work normally and the water temperature is suitable, about 25 ℃) - the laser power - control software start - gas line work - control system is working properly - ready laser light - security Protection - cutting system working.

7) Shutdown order: turn off the machine control system - turn off the laser control signal – turn off laser power - stop chiller.

8) Other considerations: during laser operation, please assure that water, gas system and electric circuit are working normally, otherwise, please put off power and check the cause of the malfunction.

9) Please record the fault time, fault phenomenon, system operation state, and then troubleshoot the fault cause, if any failure happens during laser working process. If you have any questions please contact BesCutter staff.

b. Coaxiality adjustment between nozzle hole and laser beam

The step to adjust the coaxality between nozzle hole and laser beam is as follows:

1) Paint inkpad (usually, the red is good) at the outlet end face of nozzle, bond the adhesive film at the outlet end face of nozzle. This is showed as the follow drawing.

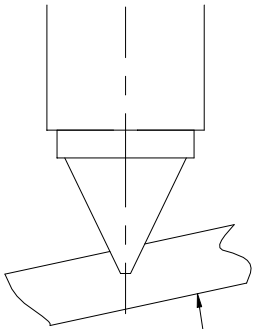


Figure: Coaxial adjustment Step 1

2) Punch hole manually using power from 10 to 20 watts.

3) Remove the adhesive film, pay attention to its direction in order to compare with the nozzle.

4) As a normal situation, there will be a black dot left on adhesive film that is formed by laser burning. If the deviation between nozzle hole and laser beam center is too large, there will be no black dot on adhesive film. (The laser beam is emitted to the wall of nozzle).

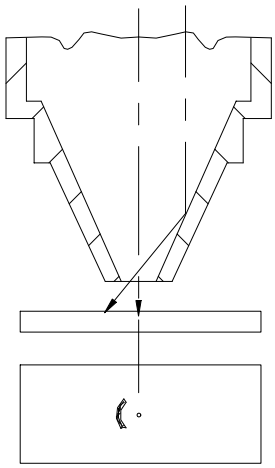


Figure: deviation between nozzle and laser center is too large

If the black dot is large or small sometimes, inspect whether the conditions are consistent or not, and whether the focusing lens is loosened.

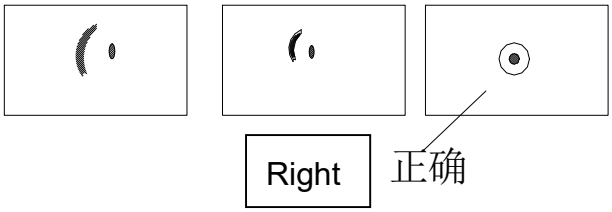


Figure: Focus Lens is loosened

According to the deviation direction from the nozzle hole to the black dot, adjust the nozzle position.

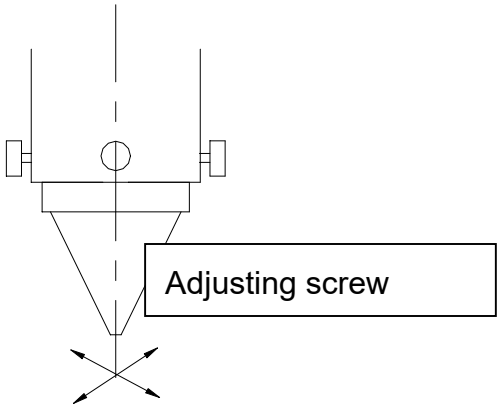


Figure: Adjustable nozzle position, coaxial with the laser beam

5) Nozzle diameter

Nozzle aperture size has a crucial influence on cutting and perforation quality.

If the nozzle aperture diameter is too large, melting slag formed in cutting may pass through the nozzle aperture and contaminate lenses. The larger aperture is, the greater the chance contaminated is, and lens protection gets weaker, which will reduce lens life.

4.3.2 Adjustment of independent capacitive sensors

BCS100 independent capacitor height regulator

4.3.2.1 Introduction of capacitor height regulator

a. Introduction

BCS100 independent capacitor height regulator (here in after referred to as the BCS100) adopt a closed-loop method to control the capacitance follower head. That is a high-performance adjustable capacitance device. Having similar control model like other products, in addition, BCS100 also provides a unique ethernet communication (TCP / IP protocol) interface, which can be combined with the our company's CypCut laser cutting software to achieve a height automatic tracking, segmentation perforation, perforation progressive , look for edge cutting, leapfrog elevation, elevation of the cutting

head arbitrarily set, light path compensation function. The response speed is greatly improved. In the servo control, due using speed position dual-loop algorithm, BCS100 is better at speed and accuracy performance than similar products at home and abroad.

b. Performance overview

1) Sampling rate is 1000 times per second.

2) Static measurement accuracy is 0.001 mm, dynamic response accuracy is 0.05 mm.

3) The range of height servo controlling is 0-10 mm.

4) The maximum follow speed depends on the servo motor rotation rate and lead screw pitch. For example, pitch is 5 mm and servo motor rotation rate is 3000 rev / min, the maximum follower speed is up to 375 mm / sec.

5) Having strong anti-interference ability, the signal does not decay even if signal transmission cable length is more than 100 meters.

6) Support network communication, U disk upgrade online.

7) It can suitable for any cutting head and nozzle, capacitance parameter self-adaption.

8) Alarm when nozzle touches plate or follows beyond the plate edge.

9) Supports edge detection and edge searching automatically.

10) One key calibration process, operation is fast, simple and convenient.

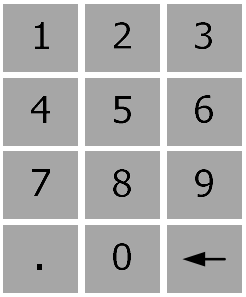
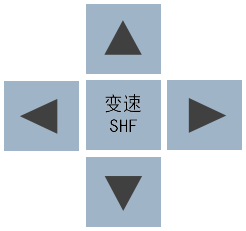
11) Support leapfrog elevation, segmented perforations, elevation height arbitrarily set.

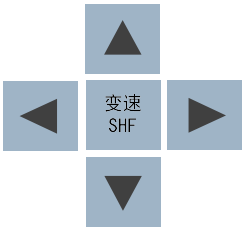
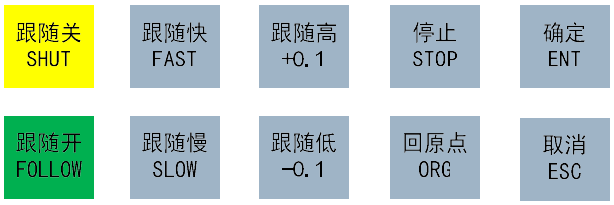
12) Supports the oscilloscope function, detect the changes of capacity and height in real-time.

4.3.2.2 Operating Instructions

A.Key Description

Keyboard category	functions
Functional Key	F1 F2 F3 F4 According to the prompts in interface

Number key Decimal point Backspace	 They are used to input number, mainly for parameters.
Direction keys	 For switching the cursor and jog the cutting head, “SHF” key is used to switch the jog speed.

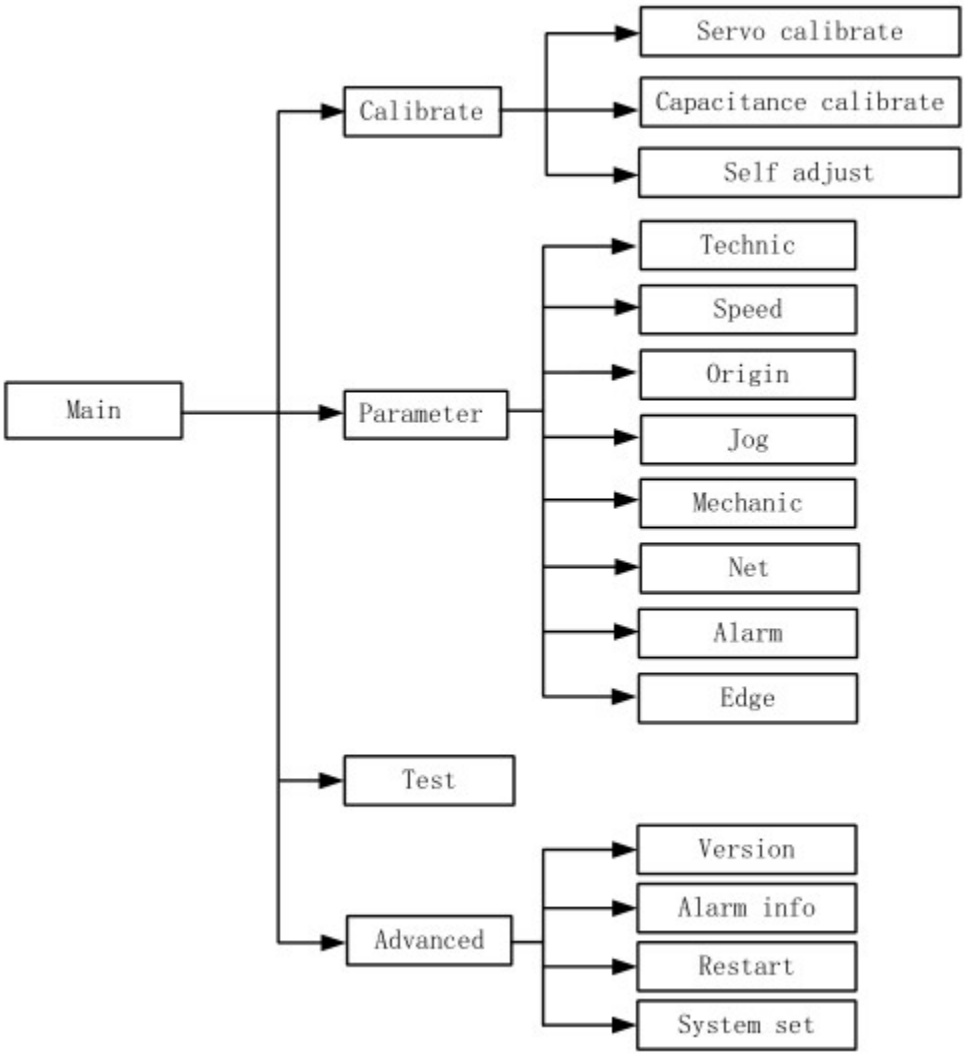
Direction keys	 For switching the cursor and jog the cutting head, “SHF” key is used to switch the jog speed.
Control keys	 Press down the “FOLLOW” key manual, head will follow; Press down the “SHUT” key. the cutting head will move up automatically then stop at the dock. “Fast and slow”: Used to adjust speed grade set by follow movement in real time. “Follow high and low”: Used to adjust follow height in real time. “Stop”: Stop all the movement automatically.

B.

	“ORG” go back to original point immediately and correct mechanical coordinate. “ENT”: Confirm the current operation. “ESC”: Cancel operation or back.

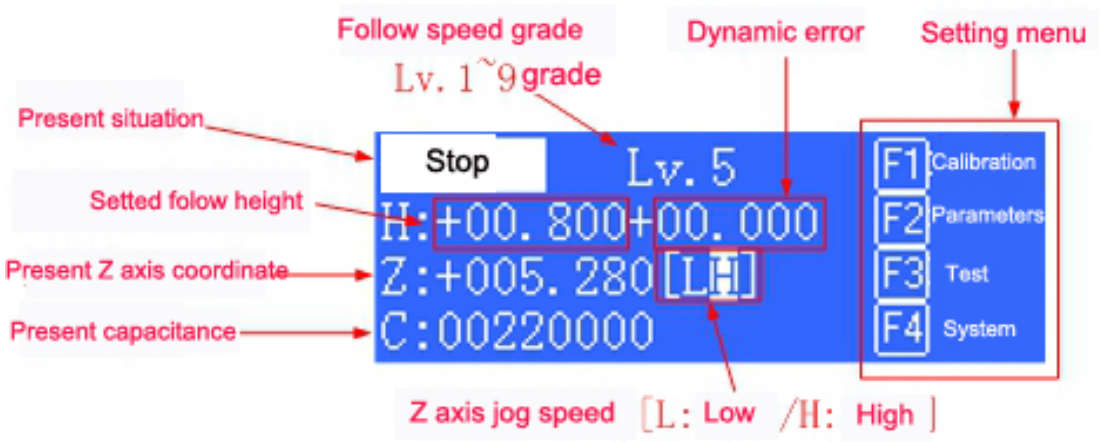
System functional hierarchical diagram

The functional hierarchy of BCS100 is as shown below:



C. Main interface

After the initialization of the power supply, the system will automatic enter the main interface as the following drawing:



Display functions on main interface include following:

Current state: Show the moving state of current follow system, the moving state includes the following types:

a) Stop: Z axis is in a stationary state.

b) In suspension: after the stop instruction is received in moving state, there will be a very short suspension transition state. After the Z axis is totally stopped, the state will be “Stop”.

c) Idle running: the upward movement in processing is idle running.

d) In following: While perforation or cutting, the cutting head is following the plate being cut.

e) In resetting: the cutting head go back to the mechanical original point of Z axis.

f) Jogging: Jog Z axis manually

g) Return to the dock: Press down the “SHUT” key, cutting head move up to the dock.

Follow gain grade Lv: Follow gain grades are from 1to 30, default is 15th grade. The bigger the grade is, the smaller follow-up average deviation is, the faster the follow speed is, climbing ability is stronger on going uphill. If the gain is too strong, there will be self-oscillation in system. This parameter can be obtained from automatic adjustment.

Follow height Set: Pressing “Follow high” or “Follow low”, you can adjust the actual follow height by 0.1mm step. Besides, you can also adjust the follow height by pressing “F2” to enter parameter interface. Pressing “FOLLOW” or “SHUT”, you can control whether the cutting head follow presently. After the follow is turn off, the axis can move to the stop coordinate automatically (default is the place Z=0), press “F2” to enter parameter interface, the stop coordinate can be changed in this interface also).

In addition, in the internet control mode, the follow height is set by Cypcut software.

Dynamic error: In the follow state, this data reflects the current error while cutting head is follow-up.

Distance between nozzle and plate: Within the scope of capacitance measurement (demarcate scope), the distance between the nozzle and plate = “follow height set” + “dynamic error”. When over the measurement range, “follow height set ”+”Dynamic error”=Calibration range.

Present Z axis coordinate: After cutting head return back to the ORG, mechanical coordinate system of Z axis is built, the coordinate is getting larger when Z axis moves downward.

Present capacitance C: measure the capacitance between cutting head and polar plate to get the distance, which is sampling principle of this system.

The shorter the distance between cutting head and the plate is, the bigger the capacitance is, if the nozzle touch the plate, the capacitance will be 0.

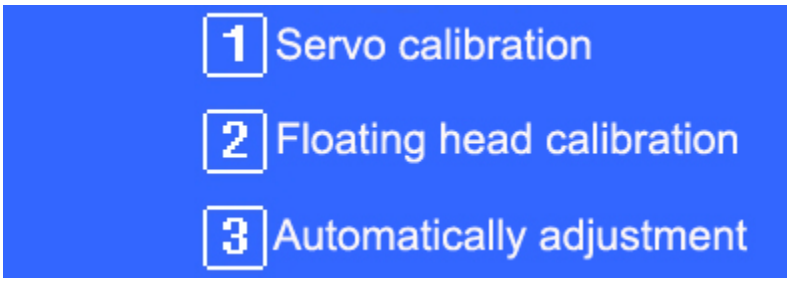
Z axis jog speed: L: Low H: High. You can change the gears of point speed by pressing the button “Change speed” . Press <↑><↓> button to carry out jogging.

The conceal functions of the main interface:

Button	Function
<3>	Check follow-up parameters (Needing manufacturer code, if you change parameters)
<4>	Follow-up real time error oscilloscope
<5>	Capacitance real time monitoring oscilloscope
<6>	Capacitance calibration curve oscilloscope
<7>	Record present capacitance used to observe temperature drift
<8>	Simulate input 1 signal, begin to follow up
<9>	Open edge searching cutting follow-up
<0>	Set the present Z axis coordinate to 0

D. Calibration interface

In the main interface, press the button <F1> to enter calibration interface, like the following picture:

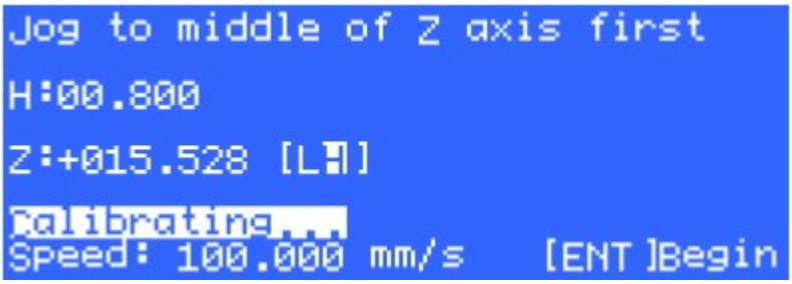


If the BS100 is used first time, servo calibration must be done first, and then floating head calibration is done, automatically adjustment is done last. When BS100 is used again later, if there is temperature drift, the floating calibration is just needed, the servo calibration and automatically adjustment is not needed.

Servo calibration

The aim of servo calibration is to remove the servo motor's zero drift. Press button <1> can enter "Servo calibration" interface.

Like the following picture:

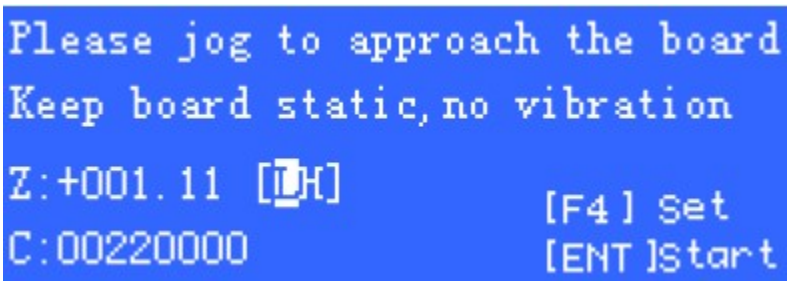


During servo calibration, the cutting head will swing back and forth with small amplitude, so it is required to first jog the cutting head to the mid-travel, and to prevent from exceeding the travel range while swing. And then press <ENT> to begin calibration.

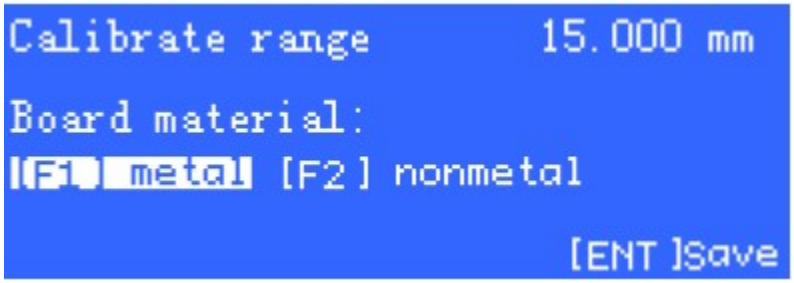
The system will return to the previous interface after the automatic calibration is completed.

Capacitance calibration

The purpose of follow calibration is to measure the corresponding relationship of capacitance and position between the follower and plate. Press <2> to enter the interface of<follower calibration>, as shown below.



If no setting has been conducted before, press <F4> to set calibrated parameters.



Parameter name	Meaning
Calibration scope	Record the capacitance data in the range when do calibration, default is 15mm. When Z axis trip is too short, the data can be set lower. When the speed is larger than 250mm/s, the calibration range need to enlarge to make the floating head has enough distance to reduce speed.
Capacitance When nozzle touch plate	When the materials, such as, acrylic and plastic that has less calibration change, is calibrated. User should set the capacitance. When nozzle touch plate before do calibration. In calibration interface, make the floating head touch the plate surface slightly, press “[F1] present”, set the present capacitance to touch plate capacitance.
Intelligent touch plate detection	After this function is used, a method of intelligent to identify capacitance changing tendency is adopted to check whether the floating head touch the plate when do calibration. Using this method, user can calibrate nonmetal without setting the touch plate capacitance. In the occasion with larger disturb (like the DIF is larger than 30), please close this function. Otherwise, the phenomenon maybe appears that the floating head do not touch the plate but move up.

Press <ENT> to save the parameters and return to the previous interface.

Before calibration, first jog to move the floating head close to the plate (distance to plate is larger than 1mm), and keep the plate still without vibration. Then press <ENT> to begin calibration.

The calibration process can be completed automatically within a dozen seconds. Users can press the <Stop>button to forcibly terminate the calibration during calibration. After the calibration is complete, there are two standards, and four grades of “excellent”, “good”, “not good” and “poor” are respectively set for each standard. The automatic calibration steps are as below:

(1) Float head moves down slowly and checks whether the nozzle touch the plate.

(2) After nozzle touch the plate, float head moves up some distance to check the stability of sensor.

(3) Float head moves down slowly second time and checks whether the nozzle touch the plate.

(4) After nozzle touch the plate, float head moves up for the calibration range to check the smoothness and characteristic of sensor.

If above steps are not executed, and there is alarm after calibration, it may be a problem with hardware or connection lines. There is an easy way to check the hardware or connection lines. Check whether the capacitance changes by touching the nozzle using metal. If the capacitance changes very small or zero, it should be considered that sensor connection or working is abnormal. In addition, considered safe and static electricity factor, is not recommended to touch the nozzle by hand when system is powered.

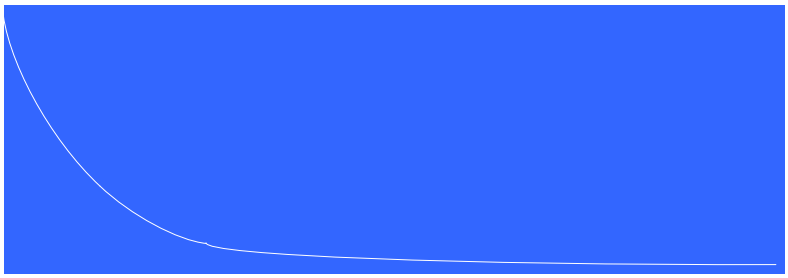
The result of calibration has the following significance

Stability reflects the static characteristics of the capacitance. If the parameter demarcate is not ideal, the plate vibration or strong external interference may be the reason.

Smoothness reflects the dynamic characteristics of the changes in capacitance during calibration.

The above two parameter at least should be “medium”, otherwise the system may not be used normally. The two parameter should be “excellent” or “good”, which are relatively ideal conditions.

After pressing <ENT> to save the calibration results, capacitance-distance curve will be displayed. Normal curve should be smooth, as shown below:



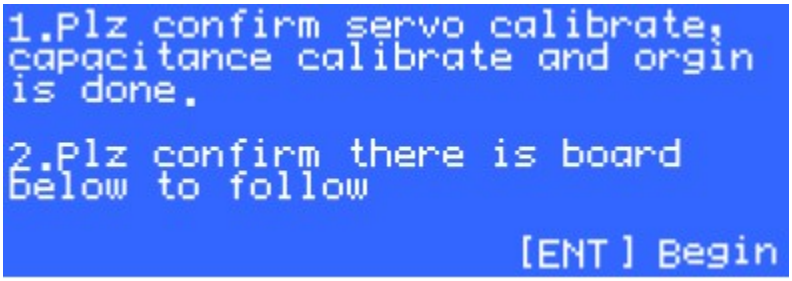
If the curve is not smooth with mutation or a sharp angle, the results are not ideal and re-calibration is required. If the results are still not ideal after repeated calibration, users should reexamine the hardware installation and wiring of the system. In addition, users can view the calibrated curve after pressing button<6> on the main interface.

If calibrate failed, alarm is as shown below:

Calibration alarm name	Meaning
Timeout to detect touching plate	The nozzle has touched the plate for time, but it can not be detected. If this alarm appears, firstly, confirm that the nozzle is near to the plate before calibration (distance is less than 5mm).Secondly, confirm that the sensor connection and work is normal. If the Z axis does not move down when doing calibration, the reason may be that the analog quantity's resolution ratio is not large enough, the speed gain parameters is needed to change.
Timeout to detect leave plate	In the 1st step of calibrate, if the nozzle do not touch the plate but it move up directly and leave plate detection overtime is shown. Now system considered that nozzle is always contact with plate. Firstly, confirm the sensor connection and work is well. Secondly, check whether touch plate capacitance parameters are set correctly. If the plate material is metal, the touch plate capacitance is set to be 0.
Sampling overtime	Full travel has been completed, but less data are collected. Please recalibrate.
Always in touching plate situation	Refer to " Timeout to detect leave plate " alarm
Abnormal change of capacitance when calibration	When the calibration is begun, jog the head to the plate, the distance between nozzle and plate is less than 5mm.

Automatically adjustment:

Press <3> to enter "automatically adjustment" interface, like the following picture:



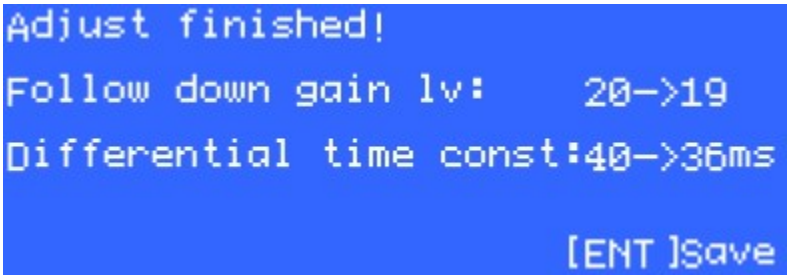
Before adjustment, following should be confirmed.

Servo calibration has been done.

just come back to the origin point and the coordinate system is correct.

Floating head calibration has just be done. There is a plate to be followed below the head.

The process of automatic adjustment is that the cutting head follows the plate repeatedly and automatically to optimize the internal parameters. The optimization result is as shown below:

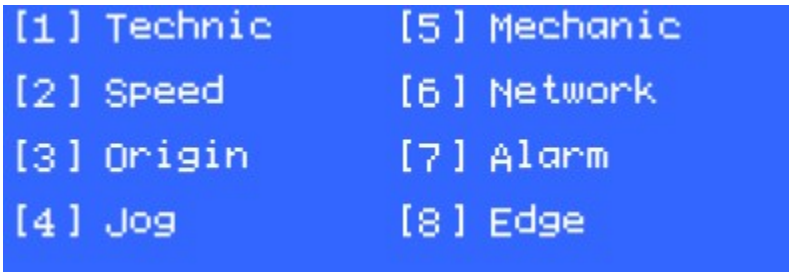


Press <ENT> to save the parameters. The meaning is as shown below:

Parameter	Meaning
moving down gain level	These include the 1~30 levels, the default is level 15. The larger gain level is, the faster head follows down. Too larger gain level will result in large deceleration. This parameter can be only set automatically after automatically adjustment is finished. And follow level parameter is also set after automatically adjustment is finished .(it can also be manually set in main interface)
Differential time constant	The default value is 40. This parameter is different for different machines. The less the parameter is, the greater the head impact is, when the head follows, and less time is cost. This parameter can be got by self adjustment.

e. Parameter Interface

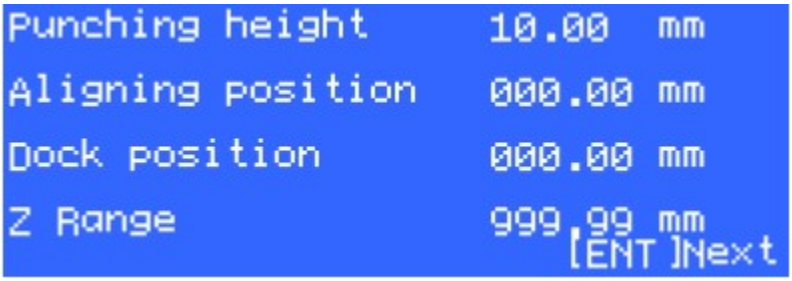
In the main interface, press <F2> to enter <parameter interface>, as shown below:



The above parameters must set correctly by users, especially, “mechanical parameters” should be set correctly, and otherwise the system cannot work normally. This machine has been set in factory; so these parameters do not needed to set again by customers.

Technical Parameters

Press <1> to enter the interface of <technical parameters>, and the first page is as shown below:



The descriptions of parameters are as shown below:

Parameter	Description
Perforation height	Set up the distance between the nozzle and the plate when perforation is done.
Coordinate in motion	Set up a coordinate. In the main interface press ＜←＞, ＜→＞, the cutting head can move to this coordinate.
Dock Coordinate	Set up a stop position of the cutting head, after the whole processing program is completed.
Z –axis travel	Set the travel of the Z axis. The cutting head is over the stroke, processing is immediately stopped, and the "beyond Z travel" alarm is issued.

When the cursor selects the parameter of “stopping coordinate” or “Z-axis travel”, there will be a specified [F1] menu on right. And press [F1] to set the current parameters by jog mode now.

Press <ENT> for the following page, and continue to set process parameters. The second page is

as shown below:

These parameters are mainly used in IO control mode. These parameters are invalid in Ethernet control mode. The descriptions of the parameters are as shown below:

Parameter	Description
IN1 following mode	When the input port 1 is effective, one of the following mode of direct following, perforation-delay-following, or progressive perforation is adopted
Perforation delay	Delay time, perforation is done.
Progressive speed	Set the speed that nozzle follows progressive from the perforation height to the cutting height.

When the nozzle drops to the perforation position, output port 4 will give a 200ms of effective signal. When the nozzle drops to the cutting height, output port 1 will give a constant effective signal.

Speed Parameters

Press <2> to enter the interface of “speed parameters”, as shown below:

The descriptions of parameters are as shown below:

Parameter	Description
Idle running speed	It refers to the moving speed of the cutting head upward or downward. The idle running speed is set to assure that the speed of the servo motor is close to its rated speed, which is recommended to improve efficiency and ensure the running stability of the system. In addition, when the setting speed is larger, the calibration range needs to be properly increased; there should be enough deceleration areas to avoid the collision when the cutting head follow down. If the speed is more than 250mm/s, the calibration range should not be less than 15mm.
Acceleration	Set the acceleration of cutting head following or idle running movement.

Please re-execute self adjustment after the speed parameters be modified.

Origin Parameters

Press <3> to enter the interface of <Origin parameters>, as shown below:

The descriptions of parameters are as shown below:

Parameter	Description
Whether it is reset after power on	Whether it is reset automatically after power on is set. Please set this option to be 'yes', after the debug is completed.
Return to dock position after reset	Whether it return to the dock position after the resetting is set.
Return speed	Fast moving speed to return original point is set.
Return distance	The distance that it moves back after the original switch is touched is set.

Jog Parameters

Press <4> to enter the interface of <jog parameters>, as shown below:

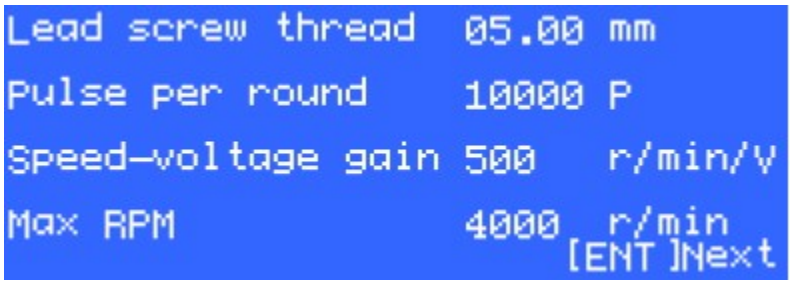
The descriptions of parameters are as shown below:

Parameter	Description
Jog low speed	Jog L grade speed is set
Jog high speed	Jog H grade speed is set
Soft limit protection	Whether the soft limit is enabled for jog moving is set. If the soft limit is enabled, it is not allowed for cutting head to jog to negative coordinates or to low than the following height, which can avoid the collision between the nozzle and the limit switch or plate. The soft limit protection function is only effective on the main interface.

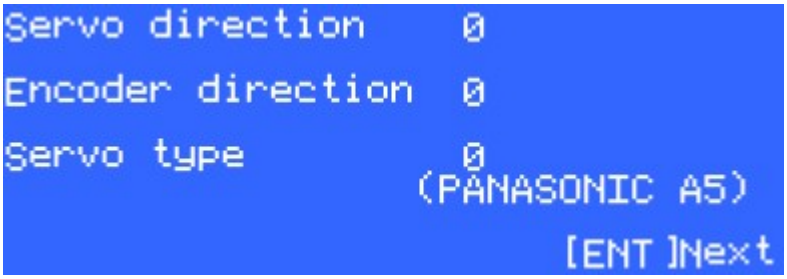
Only on the interface of<test>, the jog function is controlled by open-loop. When encoder signal is abnormal, the jog function will not be affected on the functional testing interface.

Mechanical Parameters

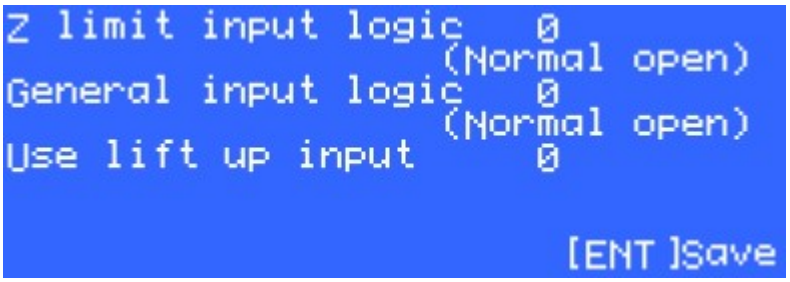
Press <5> to enter the interface of <mechanical parameters>, and Page 1 is as shown below:



Press <ENT>, Page 2 is as shown below:



Press <ENT> again, Page 3 is as shown below:



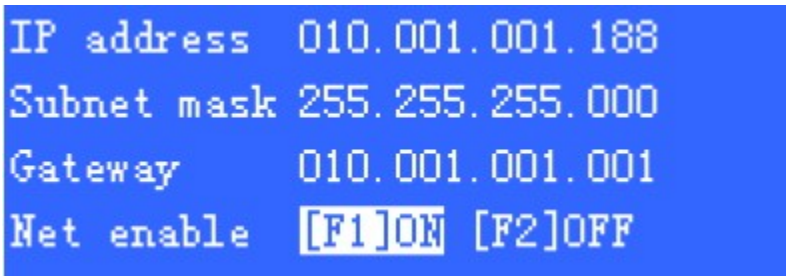
The descriptions of parameters are as shown below:

Parameter	Description
Lead screw pitch	Set the Z axis travel for each rotation of the transmission mechanism used. Taking the lead screw for example, the Z axis travel is the pitch of the lead screw. In theory, the greater the pitch of the screw, the faster the Z axis runs. It is recommended for ball screw with pitch 5 to be used.
Pulse number per rotation	Set the pulses number fed by the encoder for per revolution of the servo motor. It needs to be consistent with the parameters in the drive.
Speed gain	Set actual speed corresponding to each volt. It needs to be consistent with the parameters set in the drive; the recommended value is 500 rpm per volt.
Maximum rotation rate	According to the characteristics of motor and load, set the allowable rotation rate limit of the servo motor, In general, the maximum rotation rate is not more than 4500 rpm.
Servo direction	Set the rotation direction of the servo, the default is 0.
Encoder direction	Set the feedback direction of the encoder pulse, the default is 0

Servo type	0 represent the Panasonic A5 series servo; 1 represent the yaskawa Σ-V series servo or Delta ASDA series servo; 2 represent the Teco JSDEP series servo; For different servo, the principle of zero speed clamping, the logic of the input and output signals and the system control parameters are different.
Limit input logic	Set the logic of the limit input port (IN5~6) (0: often opens / 1: often closed).
General input logic	Set the logic of the general input port (IN1~4) (0: often opens / 1: often closed).
Enable lift-up signal	Whether the input port IN3 is used as a separate interface for lift-up signal is set. If it is set to be 0, and IN1 is valid, the following motion is opened, and if IN1 is invalid, then the following motion is closed. If it is set to be 1, after IN1 is invalid, only the IN3 is set as valid, cutting head can lift up.(When network communication is used, the parameter is ignored)

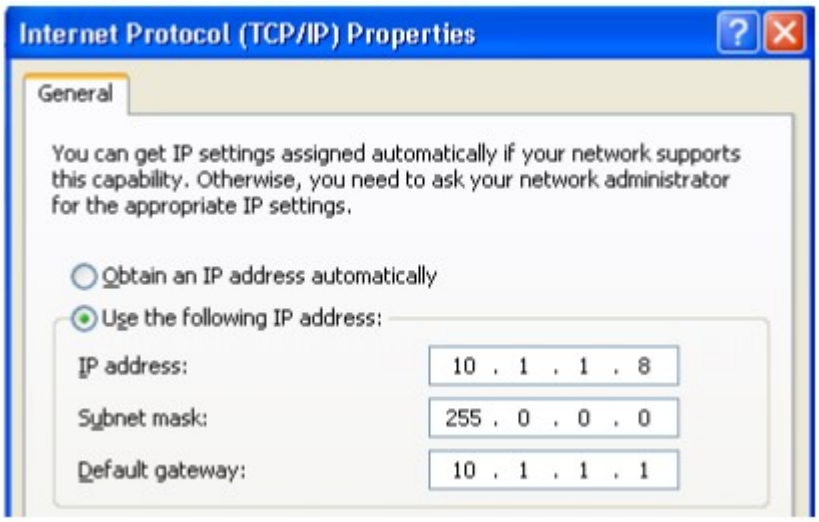
Network Settings

Press <6> to enter the interface of <network settings>, as shown below:



CypCut laser cutting software of our company is used; to rise up to any height, leapfrog, segmented perforation; flying light path compensation and other advanced functions can be easily achieved by the network. See the manual for CypCut software for details. If CypCut software is not used, please shut down the network, otherwise it will need more time to start-up machine.

When network is connected, it is recommended to directly connect PC and BCS100 by crossed wire. IP address of PC should be in the same network segment with BCS100 (10.1.1.xxx, which cannot be same to BCS100). The gateway should be set in the same network segment, and the last number should be 1, such as 10.1.1.1. As shown below:

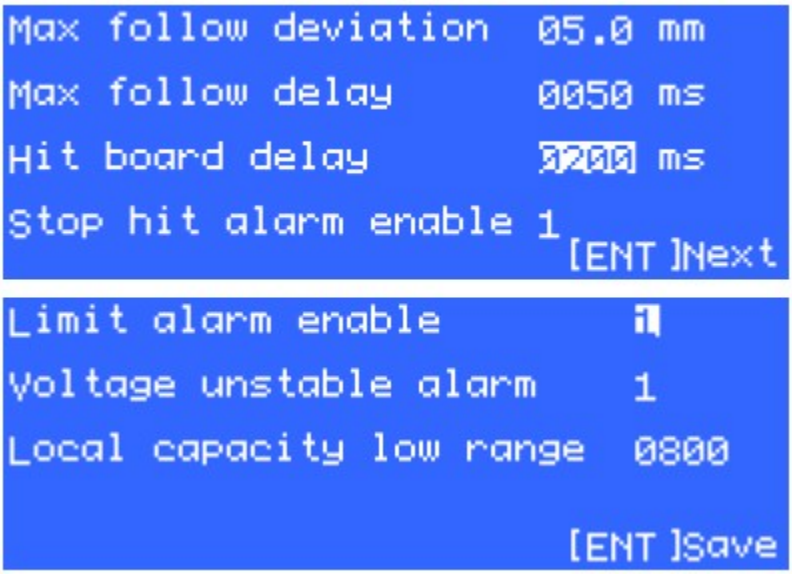


Note: 1.When the computer is connected to other network equipments concurrently, such as IPG fiber laser (network connection mode), and each equipment must be set in different network segments. For example, the equipments can be respectively set to be 10.1.2.x and192.168.1.x.

2. After the IP of network card is reset, please re-prohibit enabled network card again, so as to make the IP settings of the network card to take effect.

Alarm Settings

Press <7> to enter the interface of <alarm settings>, as shown below:



Parameter	Description
Alarm delay time when nozzle touch the plate	When the contact time between the nozzle and the plate reaches this value, The floating head will automatically lift, and alarm signal is output.
Following error alarm	That is the maximum following error allowed by BCS100. During the cutting head follows, because that the cutting head moves beyond the boundary of plate or vibration of plate, following error exceeding an alarm value set, at this point, the controller produces an excessive alarm for the following error.
Following delay time	Set the filtering time following error alarm. The longer the time is set, the slower the reaction is, the stronger the ability to filter out interference.
Limit alarm enabling	If this parameter is set to 1, upper and lower limit alarm function opens. When the upper / lower limit is touched, the cutting head is automatically lifted and the alarm signal is sent. If this parameter is set to 0, this function is closed.

Edge searching Settings

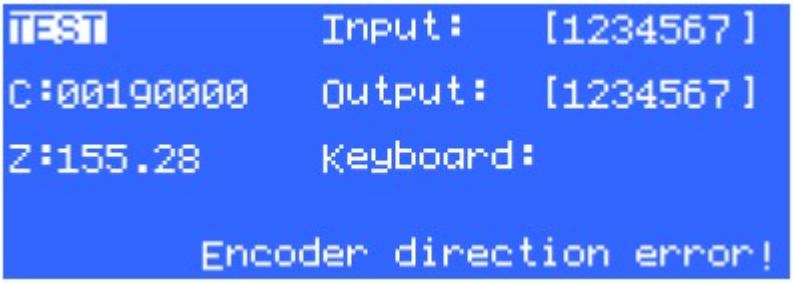
Press <8> to enter the interface of <edge settings>, as shown below:

Parameter	Description
Forward saturation velocity	The maximum forward velocity when the boundary is left. Limit this parameter to avoid a large downward movement of the nozzle.
Sensitive height entering	The H is detected to be less than the sensitive height entering the

the boundary	boundary, floating head follow is opened.
Sensitive height exiting the boundary	H height detected is larger than exiting the boundary sensitive height during Delay time exiting the boundary, the cutting head following is Closed.
Delay time exiting the boundary	
Finding edge height	Set the first descending Z coordinate, open the finding edge cutting.

F. Test Interface

On the main interface, press <F3> to enter the interface of <functional test>, as shown below:



In the interface, the keys, state of input and output ports and whether the motor rotation direction is correct can be tested. After the first installation is completed, users must enter the interface to jog and determine whether the rotation direction of motor and the director of encoder signal are correct. If the rotation direction of motor is incorrect, the “servo direction” parameters in “mechanical parameters” should be modified. And then open-loop jog is done to determine whether the direction of encoder signal is correct. If it is prompted that the direction of encoder is incorrect, the “encoder direction” parameters in “mechanical parameters” need to modify.

The input and output ports of the interface are defined as below:

Input port	Definition	Output port	Definition
IN1	Follow to the cutting height	Out1	Follow in place signal
IN2	Follow to the perforation height	Out2	Follower error signal
IN3	Lift-up signal	Out3	Alarm output signal

IN4	Stop signal	Out4	Perforation in place signal
IN5	Negative limit	Out5	Eliminate the servo alarm (servo signal)
IN6	Positive limit	Out6	Servo enabled (servo signal)
IN7	Servo alarm (servo signal)	Out7	Zero speed clamping (servo signal)

Press←→button, you can switch the analog input /output port , press the numeric keys , simulation of the opening/closing the corresponding input/output port .

g. Interface of advanced settings

On the main interface, press <F4> to enter the interface of <advanced settings>, as shown below:

Product Information

Press <1> to enter the interface of <product information>, as shown below:

Users can view the following on this interface:

Information	Description
Version	Version number of BCS100 program, such as, V500, (plane) means that it can be used for plane cutting。(Three dimensional) means that it can be used for 3D cutting by using mechanical hand.
ID number	Global unique sequence number of BCS100. such as, 201111180100
Expiration	The rest of the time for BCS100, such as 30 days，or unlimited.

When the service time of BCS100 expires, alarm information (service time expires) will be displayed in the main interface, and key functions cannot be implemented, such as following. Users can press [F1] to register and enter <registration interface>, and then continue to use the height controller after inputting the correct registration code.

Alarm Information

Press <2> to enter the interface of <alarm information>, as shown below:

In this interface, the previous alarm events are displayed in a list. The most recent 9 alarm events can be recorded by the system. Users can clear the alarm list after pressing <F1>. The fifth chapters can be referred to the meaning of each alarm.

Restart

Users can press <3> to restart BCS100 controller. This operation is equivalent to that the system is powered down and then powered on. Users can first insert USB disk to BCS100 when they want to upgrade the firmware, and complete the upgrade with restart function, which can avoid the trouble to power down and then power on the system.

System Settings

Users can press <4> for system settings, and then enter the interface of <system settings> after inputting the password of 61259023.

Parameter	Meaning
Application	0: plane cutting, 1:3D cutting
Language	0: Chinese version. 1:English version
User configuration character	Specific user custom-made function
Parameter encryption	0: no parameter Encryption, 1: Parameter encryption. If need to modify parameter, need to input the password. Password :11111111

Configuration file

Press <5> to enter configuration file interface, is as shown below:

The function of configuration file includes:

1) download the boot screen and parameters designed to BCS100

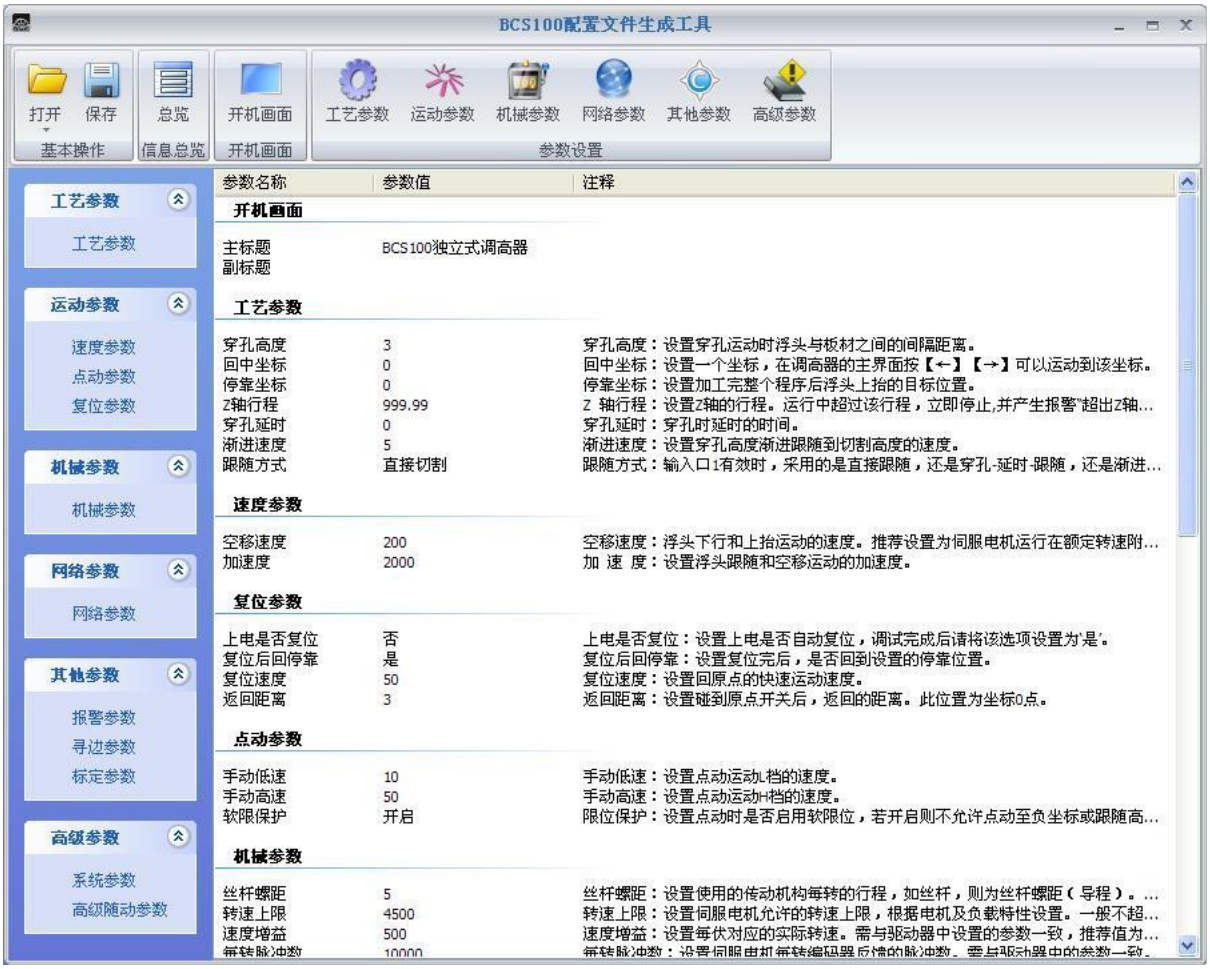
2) quickly installed, batch download the parameters to download to different devices by U disk.

3) save and backup parameter debugging.

The forma of configuration file is xxx.CFG. Import configuration file, copy the CFG file to the root directory of U disk and make sure that is only 1 configuration file suffix .CFG in U disk. When the configuration file is exported to the U disk, the generated file name is EXPORT.CFG, If there is this file in the U disk, the file will be overwritten. Remove the boot screen function can delete the boot screen

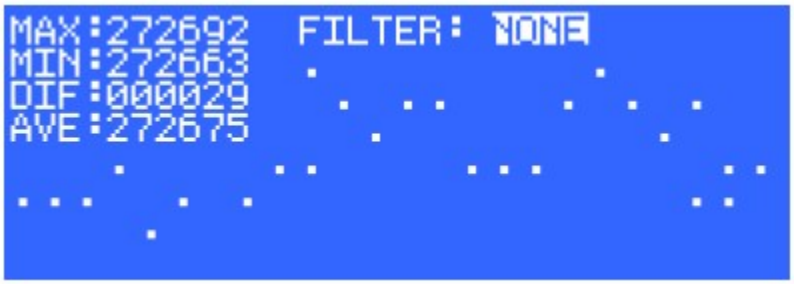
current formulated, restore the factory default boot screen.

Users can make configuration file on the computer (design boot screen, setting the parameters of BCS100), using the configuration file generation tool on PC side. As shown below:



h. Oscilloscope

Oscilloscope function is one of the unique functions of BCS100. Press <5> on the main interface can enter the interface of <capacitance oscilloscope>. The principle of the oscilloscope is to display capacitance value C in real time. It also displays the maximum value (MAX), minimum value (MIN), difference between the MAX and MIN (DIF) and average value (AVE) of the measured capacitance. As shown below:

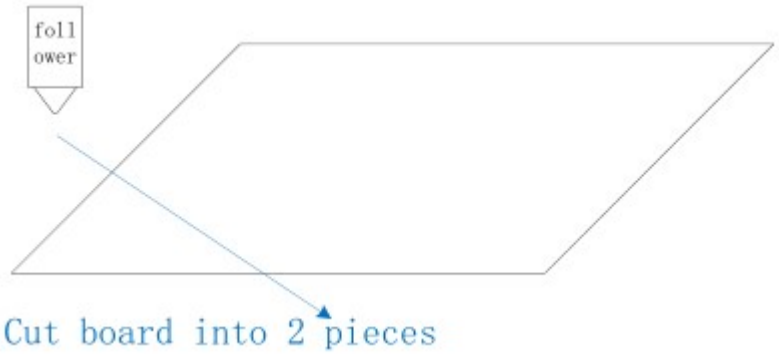


Please observe the changes of capacitance while keeping the cutting head and plate stationary. The greater DIF value is, the greater the interference is, or the more unstable the capacitance is. Users can determine the interference size in reference with the values below:

DIF value	Interference size
0~10	No
10~20	Tiny
20~30	Less
30~50	General
>50	Larger

I. Edge searching Cutting Function

As shown below:



Edge searching cutting function is widely used for corner, blanking and oddment cutting. This function supports the situation that the cutting head enters from the boundary, and then it leave the border again. This function is effective only when CypCut software is used.

Before cutting, the cutting head needs to follow to the position near the cut-in point of board, and the position is set as the “edge searching height”. The edge searching cutting function needs to be

enabled in CypCut software.

In the practical operation, first the cutting head move down to the edge searching height, and then conduct cutting movement. The system will immediately enable the functions for following when it detects that the distance between the follower and the board is smaller than “incoming edge sensitivity” parameter. The system will immediately move up to the edge finding height when the follower cuts out of the edge of the board and the following deviation of follower is greater than “cut out check” parameter and last more than “cut out delay”.

When this function is used, the following need to note:

Please sure that the “Edge searching height” has been set before the first cutting.

Ensure that the difference of Z-axis coordinate value at each cut-in point is less then 5mm, so as to avoid the case that some cut-in points are not sensed, while others are sensed too early when the cutting income edge.

Cutting in the edge, if the head followers early, the “in edge sensitive parameters” should be reduced. If the head followers later or failure to follower, the “in edge sensitive parameters” should be increased.

If the board has larger flatness error and the cutting speed is higher, the “out edge sensitive parameters” should be appropriately increased.

Under these circumstances, such as, greater interference of capacitor sampling, larger sparks, having vibration, the “cut edge delay “parameter should be appropriately increased.

Adjust the "positive saturation velocity" to reduce moving distance when nozzle leaves the edge. This parameter set is not too small; otherwise it will affect the response speed to follow.

When the edge searching function is opened and Sensitive conditions are met for cut out, users need to lift the follower to the edge searching height and continue cutting.

J. The instructions of input and output port control

BCS100 is controlled by Ethernet and it can be controlled by the input and output ports (The following is called IO port). When Ethernet is used, the connection line of the IO port does not need to be connected.

When BCS100 is controlled by the input and output ports, the function of the input port is defined as follows.

input port	function
IN1	Follow to the cutting position
IN2	Follow to the perforation position
IN3	Move up fast
IN4	Emergency signal

Output port is defined as follows.

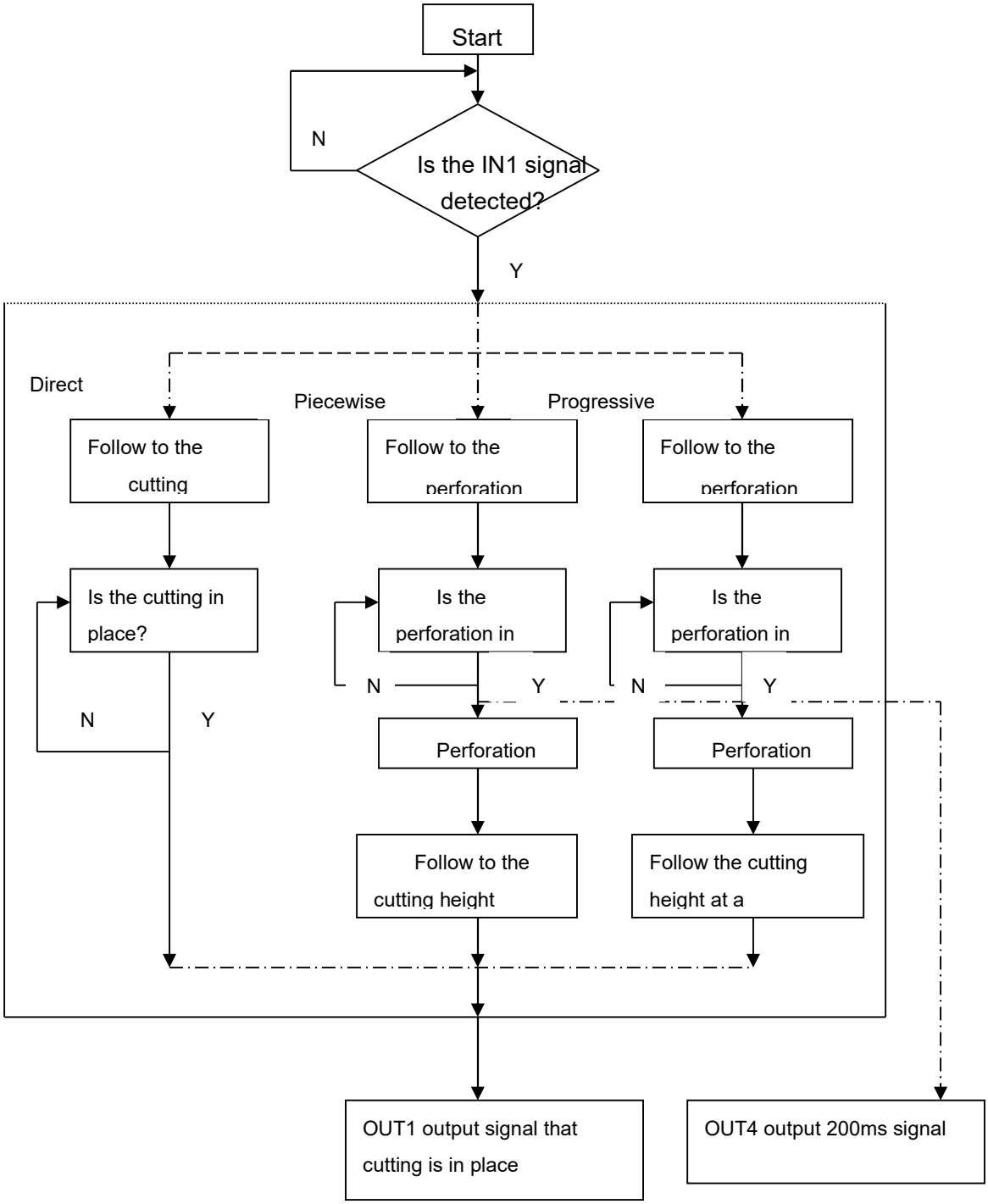
output port	function
OUT1	Follow to the cutting position signal in place (continuous signal)
OUT 2	undefined
OUT 3	Alarm signal (at least 200ms)
OUT 4	Follow to the perforation position signal in place (200ms)

There is a "lift up signal parameters" in the interface of the mechanical parameters. When the selection is 0, the lifting signal is not enabled, and the IN3 function is invalid at this time. Open IN2, the nozzle follows to the perforation position. Shut down IN2, there is no movement. Open IN1, the series of following action is opened (Direct following, piecewise perforation, progressive perforation can be set in the process parameters). Turn off IN1, cutting head move back dock.

When the “lift signal - enabled” is set to 1, the IN1 is closed at this time, and the cutting head will not be back dock. Only when the IN3 is opened, the cutting head will return to the dock.

Take the simplest way of control as an example

The “lift signal - enabled” is set to 0, an external PLC gives a signal to the IN1 of BCS100, the execution flow of BCS100 is as follows:

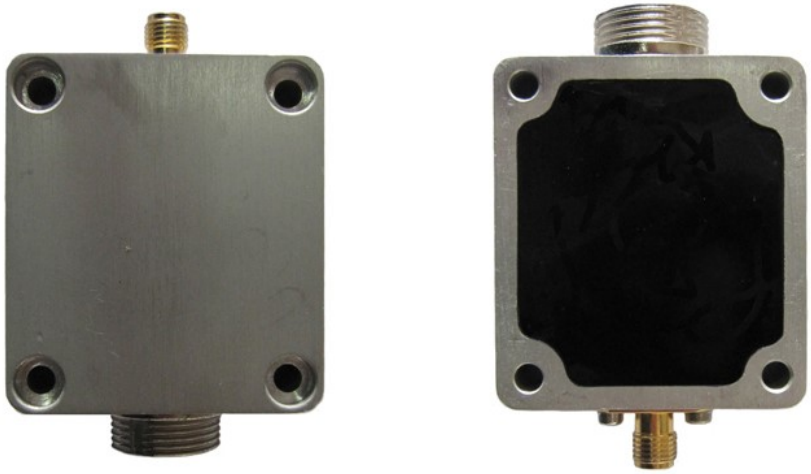


The process of direct cutting / segmental perforation / progressive perforation is determined by the setting of process parameters. The control process of the input and output ports can be simulated in the test interface.

k. Preamplifier

The capacitance signal of the cutting head is sampled, amplified and converted into a digital signal by the preamplifier unique designed. The digital signals can be transmitted in a long distance, even if the transmission cable length is 100 meters, there is no parasitic capacitance, so it can ensure that the signal is not attenuated and the stability is strong.

The appearance of preamplifier is as shown below.



Pay attention to the following when sensors are used.

(1) please use dry, pure auxiliary gases in cutting. If the gas contains impurities, such as water, oil, and so on, there will be a mutation in the work gap; even sensor work is out of order.

(2) The stain on the sensor needs to be cleaned up using a clean, dry cotton cloth. Liquid is not allowed to be used to clean cutting head and ceramic body. The sensor should be correctly assembled again after it is cleaned.

(3) Nozzle, ceramic body, cable can be changed at any time. Nozzle can be replaced for arbitrary shape and model, but a capacitor calibration of floating head must be done again, after it is replaced.

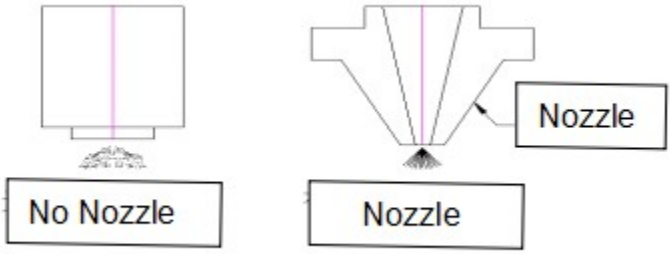
4.3.3 Function and regulation of the nozzle

4.3.3.1Nozzle

The shape of the nozzle and jet flow state directly affects the cutting quality. Its precision also has closer relationship with cutting quality. The main functions of the nozzle are follows.

Avoid that cutting slag and other debris enter cutting head and damage focus lens.

The nozzle can change the cutting gas injection state, control the area and size of gas diffusion, which affect the cutting quality. Below is the shape difference of gas spurted having nozzle and without nozzle.



4.3.3.2The effect of nozzle on cutting quality and the choice of the nozzle hole

Relationship between nozzle position accuracy and cutting quality:

The influence of concentricity between the nozzle hole and laser center on the cutting quality:

The deviation between the nozzle hole and laser center may result in that gas volume ejected is not uniform in working, maybe there is slag in one side of kerf, and there is no slag on another side of kerf, so it affects the cutting kerf quality. The influence is small for the plate thickness is less than 3 mm, but the influence is more serious for the plate thickness is over 3mm, sometimes normal cutting can not be carried out even.

It affect sharp angle cutting, there will be partial melting phenomenon when the part with sharp angle is cut, and even the sharp angle can not be cut in thick plate.

Affect the perforation quality, there will be super fusion in perforation for the stability and uncertain time. The condition of perforation is not easy to master. It has less influence on the sheet.

To sum up, the concentricity between the nozzle hole and laser center is one of the important factors that influence cutting quality. Especially when a thicker plate is cut, the influence is much greater. In order to obtain better cutting kerf, concentricity between the nozzle hole and laser center must be adjusted well.

Note: as described above, nozzle deformation and slag in outlet will influence cutting quality,

therefore, the nozzle should be carefully preserved to avoid deformation by bumping; the slag stuck in outlet should be clear in time. Having high manufacturing accuracy, the nozzle should be installed correctly. If the cutting parameter needs to change for nozzle poor quality, the nozzle should be changed timely.

The selection of the nozzle aperture

The nozzle aperture and performance see the table below

The nozzle aperture	gas flow velocity	removal ability to melt
Small	fast	better
big	slow	weak

Table: aperture and auxiliary gas velocity relational tables

The aperture of nozzle is separately Φ1.0mm, Φ1.5mm, Φ2.0mm and Φ2.5mm, and the nozzle, its aperture being Φ1.5mm and Φ2mm, are often used.

The nozzle its aperture being Φ1.5mm is used to cut sheet that thickness is less 3mm, cutting surface is fine. If nozzle (Φ2mm) is used, cutting surface is rough and there will be slag in corner.

When the plate, thickness being more than 3mm, is cut, power consumption is larger; relatively long cooling time is needed. If nozzle aperture Φ1.5mm is used, gas diffusion area is small; this nozzle can be used basically but unstable. The nozzle aperture Φ2mm is often used in this situation, gas diffusion area is large, the gas flow velocity is slow, and so the cutting is stable.

The nozzle, aperture being Φ2.5mm, is only used to cut thick board that thickness is more than 10mm.

To sum up, the nozzle aperture has serious influence on cutting quality, perforation quality. At present, the nozzle, its aperture being Φ1.5mm or Φ2mm, is most commonly used.

The larger nozzle aperture is, the poorer the protection effect of lens, for the slag formed by melt has much chance to bounce up, which will reduce the lens life.

4.3.4 Beam focus adjustment

4.3.4.1 Introduction

In cutting process, the relative position of the beam focus on the board surface cut has a great influence on the cutting quality, so it is very important to adjust the focus position properly. Generally,

user can determine the optimal position of focus by trial method, in which, laser focus position is directly adjusted by rotating nut to get good cutting effect.

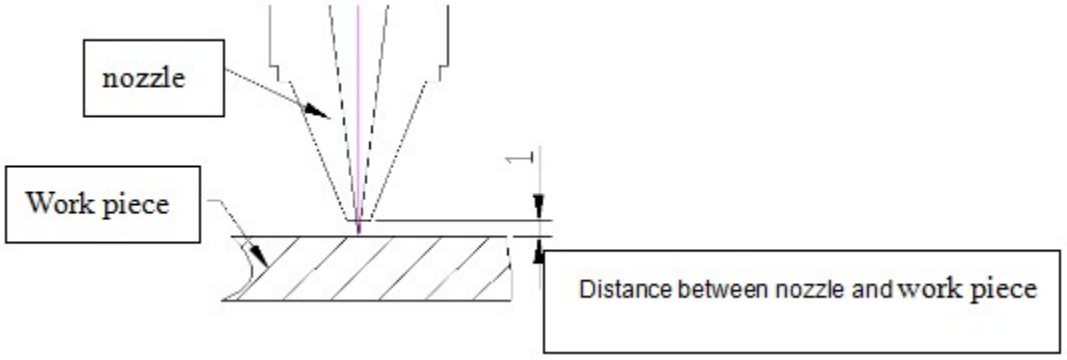
4.3.4.2The position of focus and the relationship between the cutting section and the position of focus

The following table shows the effect of focus position to perforation and cutting surface, focus location choice please see the table below.

Table: the relationship between focus and cutting material

Name and focus position	Material and cutting surface
Zero focal length. The focus is on the surface of the plate.	used to cut such as SPC, SPH, SS41 upper surface is smooth, under surface is not smooth
Positive focal length. The focus is between the upper and lower surfaces	Used to cut carbon steel, aluminum, etc. For focal is located under the cutting surface, smooth surface area is larger, and the kerf is wider than the zero focal length cutting. Needing large gas flow, the perforation takes more time than zero focal length cutting.
Negative focal length. The laser focus is on lower surface of the workpiece.	Used to cut carbon stainless steel plate. Use high pressure nitrogen to blow slag protect cutting section when stainless steel is cut, the kerf will increase with the increasing of board thickness.

4.3.5 Set the distance between nozzle and plate



After the sensor box is adjusted, follow-up distance between nozzle and the plate should be determined according to the system technological parameter, please refer to the process parameters table.

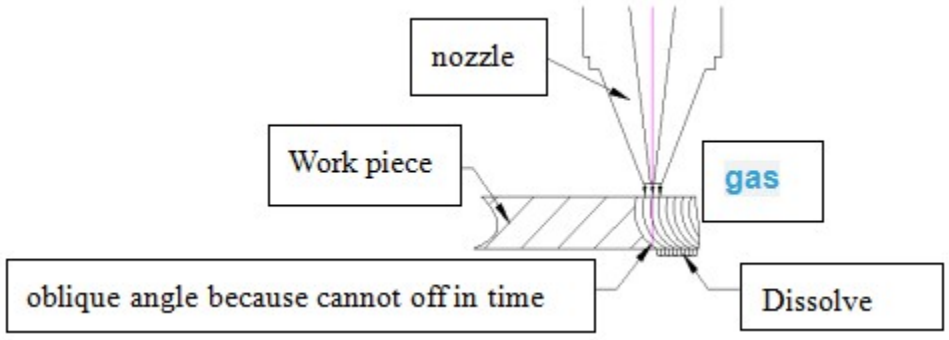
4.3.6 The selection of laser cutting speed

Determine the cutting speed according to the cutting material and thickness. Appropriate cutting speed, can not only increase the cutting efficiency, but also improve cutting quality. Here is the influence of different cutting speed on cutting quality.

The influence of larger feed speed on cutting quality:

A large number of sparks appear on the surface, but the plate can not be completely cut through; the cutting surface is much rough with slag.

As shown, because cutting feed speed is too larger, the board cannot be cut off, the cutting cross section is inclined to strip, and the lower part of the slag is produced.



The influence of slow feed speed to the cutting quality:

There will be a melting phenomenon; cutting section is much rough;

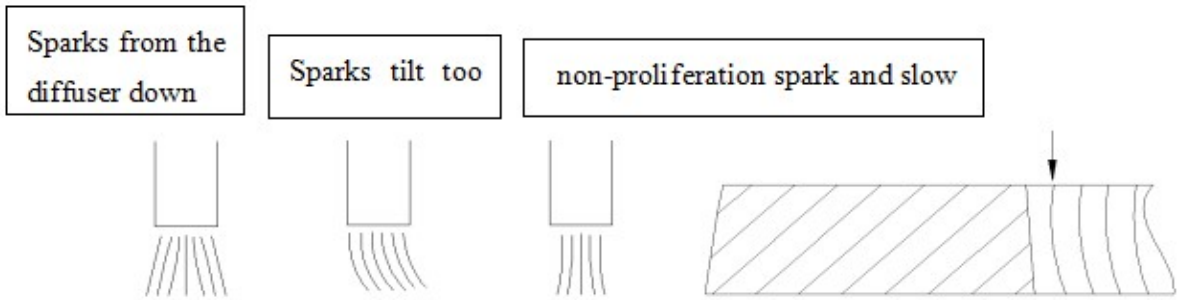
The kerf will be wider, happen a large area of melting in smaller rounded corners or sharp corners,

which can not get the ideal cutting result;

Reduce production capacity.

The selection of cutting feed speed:

Judge whether the cutting feed speed is large or small according to of the cutting spark. Generally cutting spark splashes in the direction from the top down in the vertical plane. If the spark direction is inclining, which means the feed speed is too large; if the spark splashes non-proliferation and less, which means the feed speed is too small. Choose appropriate cutting speed, please refer to below figure. If cutting speed is appropriate, the surface cut is smooth, and there is no slag generated on the bottom.



cutting sparks shape and position

4.3.7 The selection of cutting gas and pressure

Select the different cutting gas according to different material cut plate. The choice of cutting gas and pressure has a great influence on the cutting quality. The main effect of cutting gas include: combustion and heat dissipation blows away the cutting melt slag timely to prevent cutting slag rebound upward into the nozzle and to protect the focusing lens.

1. The influence of cutting gas and pressure on cutting quality

Cutting gas help to heat dissipation and combustion, blew the slag, so cutting surface is good at quality.

a. If cutting gas pressure is insufficient, which may cause the following effects on cutting quality, there is melt slag produced and cutting efficiency reduction.

b. If cutting gas pressure is too high, cutting surface is rough, and kerf is wider; at the same time, there will be partial melting in the cutting section, so cutting surface is not good at quality.

2. The influence of cutting gas pressure on perforation

a. If gas pressure is too low, the laser is not easy to penetrate the plate, and punching time increase, reduces productivity.

b. If the gas pressure is too high; there will be melting at penetration point to form a larger melting area, which reduces the cutting quality also.

Higher gas pressure is generally adopted, when drill hole in the sheet. But lower gas pressure is adopted, when drill hole in the thicker plate.

When ordinary carbon steel is cut, the larger of the plate thick is, the lower cutting gas pressure is relatively, but when stainless steel is cut with nitrogen, the larger of the plate thick is, the higher cutting gas pressure is relatively, and the pressure is always in high pressure state.

In a word, the cutting gas and its pressure must chosen according to actual condition, different cutting parameters can be chosen according to the specific situation.

4.3.8 The influence of cutting power on cut quality

Laser power has some influence on cutting quality. Choose laser power based on the material and the thickness of plate cut. If the laser power is too big or too small, to get a good cutting surface is difficult also.

a. If the laser power is too small, cutting can not be done.

b. If the laser power is too large, there will be a large area of melting in cutting surface, and the kerf will get much wider. To get a good cutting surface is very difficult.

c. If laser power set is insufficient, there will be much slag and scar will be produced on cutting surface, so to set the appropriate laser power and coordinate with cutting gas and pressure is the base to obtain a good cutting quality without slap.

4.4 Acceptance test items, method and judgment after installation and debugging

According to the acceptance of 《equipment acceptance certificate》.

5 Using and operating

5.1 Summarize

The correct operation is the effective measures to guarantee the normal work of the machine and personal safety. Before the machine is used formally, please master relevant operating methods and understand running status of all the machine parts. Please prepare and check strictly coherence content according to follow request, before the machine is used.

5.2 Prepare and check before use

a. Check whether the power supply is connected properly.

b. Check whether the oil level of machine lubrication is in normal height, otherwise the lubricating oil is added to the normal level.

c. Check the concentricity between laser and nozzle to ensure that the laser beam emanates from the nozzle center.

d. Check whether nozzle meets cutting process requirement; otherwise, replace a appropriate nozzle.

e. Check whether the auxiliary gas is normal connected, gas normal access, and ensures that gas pressure is adjusted to the normal range.

5.3 Security and safety protection, safety signs and instructions during use.

Which means "notice", do not follow the correct operation, may cause personal injury or damage to equipment.

Means the laser beam pass, do not from through the beam of light, otherwise it will cause burns to human body and even life-threatening.

Means there is a risk of high voltage power supply, don't close to high voltage. Otherwise it will cause electric shock to human body, and even life threatening.

Attention；

a. For anyone, to align his eyes to see the laser (including the red light) injection direction is not allowed at any time

b. Once the mechanical light brake is opened, there are no person and non-working objects in the laser irradiation range.

c. Operators should wear protective glasses, during the running of machine operators are strictly prohibited to leave.

d. If the machine is abnormal in use process, should press the scram switch immediately.

e. It is necessary to check the cooling water temperature and the working gas pressure regularly.

f. The operator must have the operation license, abide by rules of safe operation, no- operator is strictly forbidden to operate the machine.

g. The laser equipped by the machine belongs to the forth kind of laser products. Fiber laser is not visible; the injection beam diffuse may cause damage to the human body (especially the eyes). Persons present also should pay attention to protection and prevent fires.

h. The exhaust gas produced when laser cutting harm to the person; please make sure that the dust removing device work properly.

i. Keep the equipment clean and tidy, add lubricating oil according to the regulations, and assure the reasonable lubrication. Comply with the shift system, and manage tools and accessories, shall not be lost; Find fault, stop the machine immediately and check, if themselves can't handle, they shall notify promptly the maintenance.

j. To prevent shock damage, it is not allowed for non-professional maintenance personnel to check and repair the machine electrical control system.

5.4 Operation instruction

5.4.1 Quickstart

5.4.1.1 Function introduction

- Supports AI, DXF, PLT, Gerber and other graphic data formats, and accept the international standard G code generated by Mater Cam, Type3, Wentai and other software.
- When DXF and other external files are opened / imported, optimization is conducted automatically, including: to remove repetitive lines, to merger connected lines, to remove tiny graphics as well as automatically distinguish inside and outside dies and conduct sorting. Each function above can be custom, and each function can also be carried out manually.
- Supports common editing and typesetting functions, including: zooming in and zooming out, rotation, alignment, copying, combination, smoothness and connection and so on.
- Set Introduction and lead line, slotted compensation, micro connection, bridge connection, matching cut, lead seal gap and so on. What you see is what you get.
- Distinguish automatically 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.
- Support curve splitting, merge, 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 particular browsing capabilities of processing order, to check the processing order in a more interactive way than that of imitation.
- To support poly punching and incremental punching, pre-punching. To support the settings of separate laser power, frequency, laser form, type of gas, air pressure and following height for punching process and cutting process.
- To support the speed capacity control and set separate lead velocity.
- With Powerful material library functions, to keep all processing parameters so that it can be provided again for the same material.
- With processing break point memory, to trace the break point forwards and backwards; to process some graphics.

- To be able to be positioned to any point in the process of stop or temporary stop; to start processing from any position.
- The same set of software supports round pipe cutting and plane cutting, and the way of programming is exactly the same; to support intersecting line cutting.
- To support Cover cut, auto seek edge, cutter starting and cutter lifting[1].
- With powerful expansion capacity, as much as 15 PLC process edit and more than 30 programmable process.
- Programmable input and output outlet, programmable alarm input[2]
- To support the remote control of the system through wireless teach box and Ethernet[3].

5.4.1.2 Obtaining and Installing the Software

You can contact the supplier or customer service staff to obtain the software installation program.

Before installing the software, please check whether your system meets the following minimum requirements.

- The operating system should be above Windows 2000.
- CPU with basic frequency above 1.0G
- The memory should be 512Mb at least.
- The VGA monitor should be more than 15 inches with a resolution of more than 1024*768. And it would be better to use 32-bit true color display.
- There should be two USB interfaces at least.

If your operating system is vista-based (including Windows Vista, Windows 7, Windows 8, Windows 2008 Server), please run the system as an administrator as much as possible in order to avoid the possible errors.

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

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

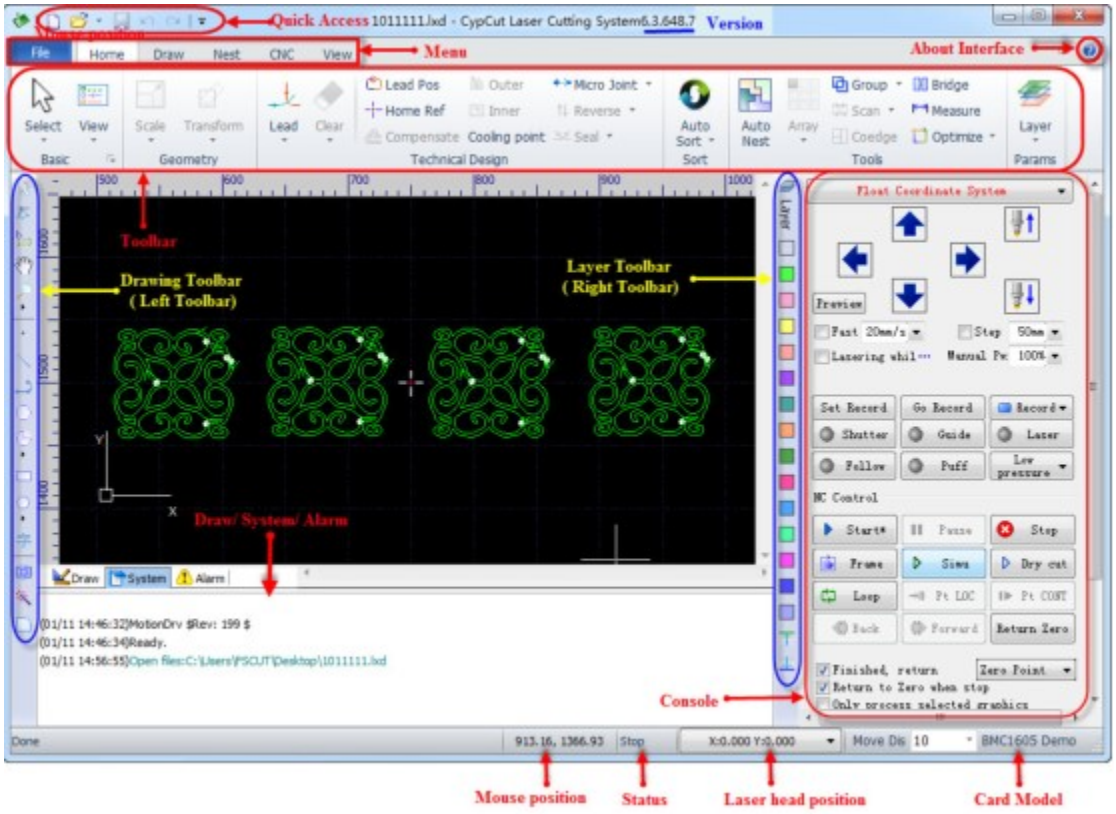
5.4.1.3 Starting to use

A. Desktop Shortcut

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

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

B. User Interface



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

Above the interface from top to bottom one by one are Title Bar, Menu Bar and Toolbar. The toolbar is arranged with very obvious large icons in grouping and most of the common functions can be found here. The menu bar includes the menu “File” and five toolbar menus, namely “Home”, “Draw”,

“Nest”, “CNC” and “View”, and toolbar display can be switched through selecting these five menus. There is a toolbar called “Quick Access Bar” at the left of the title bar, which can be used for fast creating, opening and saving a file; besides, undo and redo commands can also be finished quickly here.

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

At the right of the drawing area is “Process Toolbar”, which is called directly “Right Toolbar” in the following introduction. It includes a “Layer” button and seventeen color square buttons. “Layer” dialog box can be opened by clicking the “Layer” button, and then most of the parameters can be set. each of the seventeen color square buttons corresponds to a layer, and when a graph is selected, the selected graph can be moved to the specified layer by clicking these buttons, when no graphs are selected, it means to set the default layer for the next drawing by clicking these buttons. The first white square indicates a special layer. When “un-exported Layer” is displayed, the graph on this layer will be shown in white and it cannot be processed. The last two layers are layers of first processing and last processing.

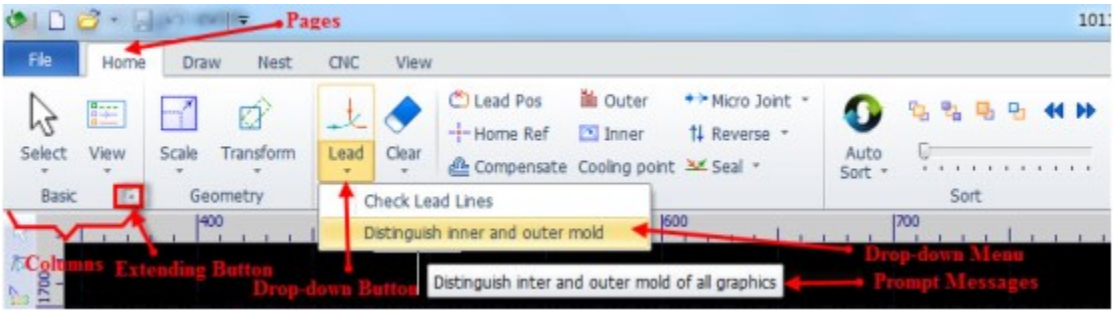
There are three scrolling displayed ribbon text windows below the interface. The left one is “Draw Window”. The related prompting messages of all the draw instructions or input message will be shown here. The middle one is “System Window”, and other system messages will be displayed here except drawing.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

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

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

C. Toolbar

The toolbar of CypCut uses a style called Ribbon. It puts the common functions by column and area, and also applies many large-size buttons for easy operation. The photo below will help you to understand this new toolbar:



The whole toolbar is divided into five “pages”, which can be selected by the five menus “Home”, “Draw”, “Nest”, “CNC” and “View”. When selecting each menu, the pages related to the selected contents will appear. Furthermore, the page “Being Processed” will appear during processing and it cannot be switched to other pages before stopping.

The toolbar of each page will be arranged again in multiple “Columns” according to the functions, such as “Base operation” and “Geometric transformation” and so on. The first buttons of the general columns are all in large size, and there is a small button“ ” at the lower right corners of some columns, which is called “Extending Button”, and a related dialog box can be opened by clicking this button.

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

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

D. 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:

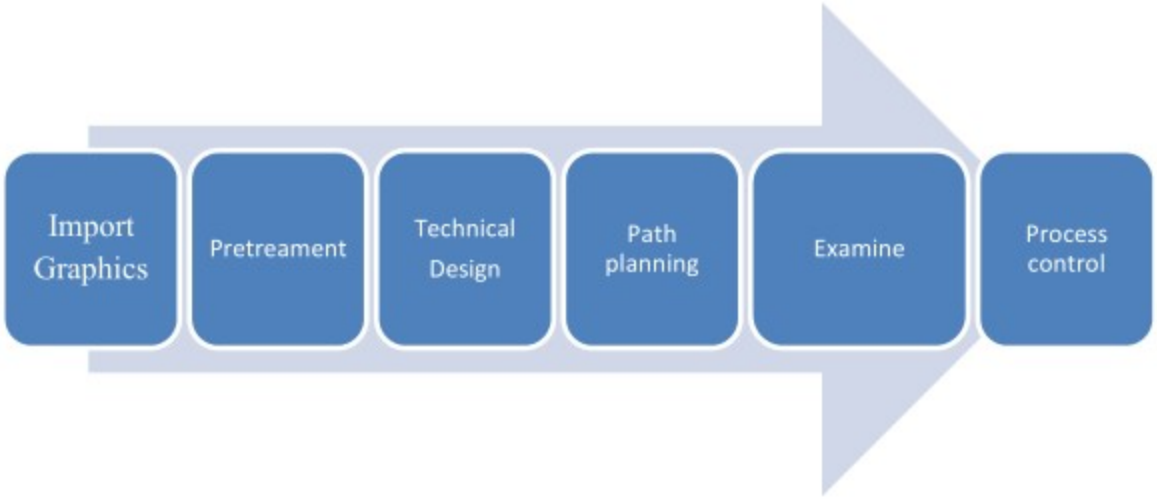
Please note that at the right of the menu the recently used files are listed. While the files saved by CypCut are marked with the icon“ ” , and in this way it is convenient for you to find the designed documents of last time.

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 “Backup Params” is used by users to backup all parameters as a compressed file; and the menu "BCS100 monitor" is used to monitor and display the interface of BCS100 Height controller in the software; while the menu “Diagnosis” is used for program diagnosis and monitoring.

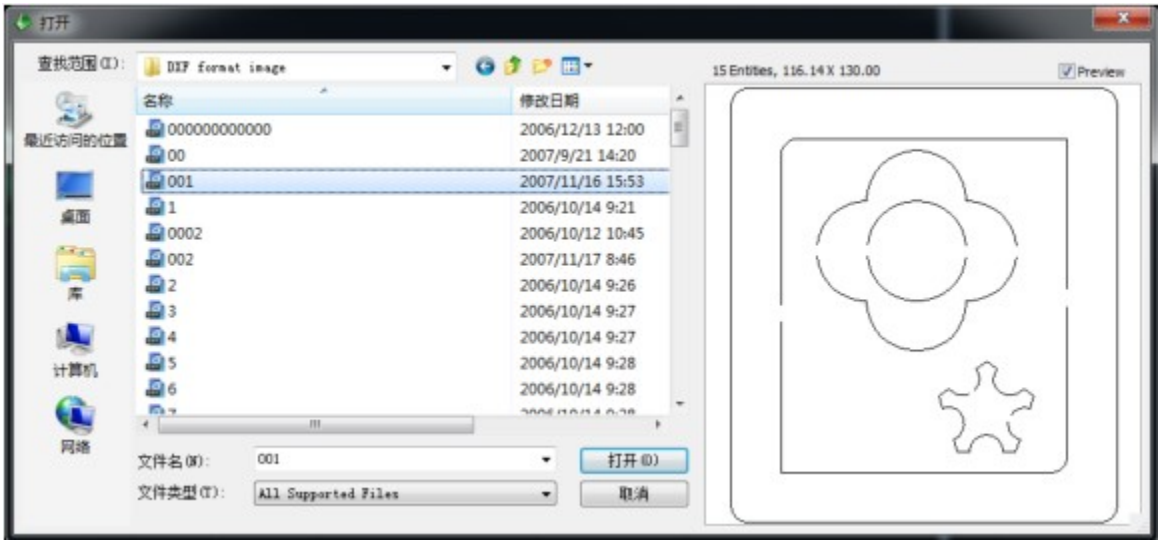
You can see the detailed version information of CypCut software by clicking “About” at the lower right corner.

5.4.2 Operation Process



5.4.2.1 Import Graphics

After clicking the button of opening files “ ” in the quick launch bar at the upper left corner of the interface, the dialog box of opening files will be popped, and then you can choose the graphic you need to open. There is a quick preview window at the right of the opening file dialogue box, and it can help you to find quickly the file you need.



If you hope to draw a part on the spot through CypCut software, please click the create button “ ”and then draw pictures with the buttons of the drawing toolbar at the left. See the details in related chapters.

5.4.2.2 Preprocessing

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

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

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

5.4.2.3 Technical Design

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

” can be used to set lead lines, and the button “ 

” is used to set lead seal over, lead seal gap or lead seal parameters. The button “ Compensate ” is used for cutting compensation; the button“ Micro Joint ” can insert micro joint of not cutting into the graphics; the button “ Reverse ” can reverse a single graph; and the button " Cooling point " is for setting a cooling point in the 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 manually.

You can press Ctrl+A to select all the graphics as quick start tutorial, then click the button “Lead” and set the parameters of the lead lines, and then click OK. In this way the software can search suitable positions to add the lead automatically according to your settings. You can conduct the Lead Lines Check by clicking the small triangle below the button “Lead” and selecting “Check lead lines”. When select “Distinguish inner and outer mold”, lead can be automatically optimized according to inter and outer mold.

You can set detailed cutting technical parameters by clicking the button “ 

” in the toolbar at the right. The dialog box “Layer Parameter Settings” contains almost all the parameters related to the cutting effect.

5.4.2.4 Lead Planning

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

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

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

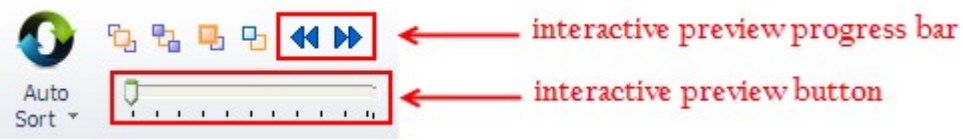
You can conduct automatic sorting for the graphics within the group by selecting a “Group” and then clicking the right key with selecting “Group Sort”.

5.4.2.5 Inspection before Processing

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

by clicking the interactive preview button.

在实际切割之前，可以对加工轨迹进行检查。单击各对齐按钮可将图形进行相应对齐，拖动如下图所示的交互式预览进度条（绘图菜单栏下），可以快速查看图形加工次序，单击交互式预览按钮，可以逐个查看图形加工次序。

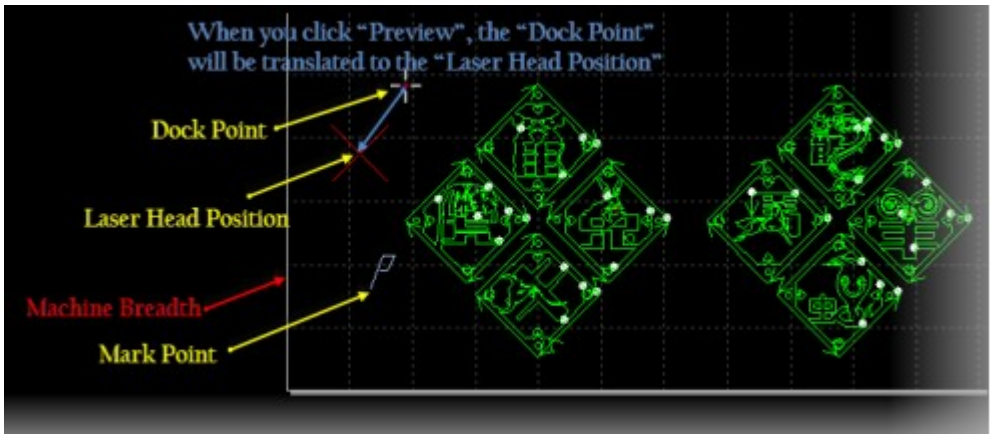


You can simulate process by clicking the button “ Simu ” on the console, and you can adjust the speed of the simulation processing through the function “simulation speed” on the page“ CNC ”.

5.4.2.6 Actual Processing

Please note that this step must be done on the actual machine with the support of dongle and the control card.

Before formal processing, you need to match the graphics on the screen with the machine. You can find the relative positional relationship between the upcoming processing graphics and the machine breadth on the screen by clicking the left button “ Preview ” above the “Console”. This corresponding relationship is calculated in accordance with the dock point markers on the screen and the position matches of the machine laser head. Some common coordinate markers on the screen are shown in the photo below. When you click “Preview”, the “Dock Point” will be moved to the “Laser Head Position” and visually parallel move occurs in the graphics on the whole.



If the “Laser Head Position” shown by the red cross cursor does not match the actual laser head position of the machine, please check whether the position of the machine origin is correct, and it can be corrected through “Numerical Control”—“Go Origin”. After previewing, if you find that the graphics are outside the machine breadth wholly or partially, it means that it may exceed the range of travel during processing.

You can change the relative relationship between the graphics and the dock points by clicking the button “ 

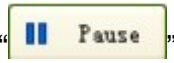
” under “Home” menu. For example, if the laser head is at the lower left corner of the upcoming processing work-piece, you can set the lower left corner as the dock point and so forth.

If there is no error on the screen after checking, you can click the button “ 

” on the “Console”, and the software will control the machine to go around the outer frame of the upcoming processing graphics so that you can check whether the working positions are correct. You can also click the button “ 

”, and the machine will run completely without laser along the graphics which will be processed so that you can check more carefully whether there may be any impropriety in the processing.

Finally please click the button “ 

” to start the formal processing, and you can click the button“ 

” to suspend the processing. During the suspension, you can control the laser head to go up and down manually, and switch the laser, gas and so on manually, besides, you can also trace back along the working route through the buttons “ 

”. You can continue to work by clicking the button “ 

”.

You can click the button “ 

” to stop the processing and the laser head can automatically return to the corresponding point according to your setting. As long as you do not change graphics or start new processing, when click the button “ 

”, the system will allow you to locate to the position you stopped last time; when click the button “ 

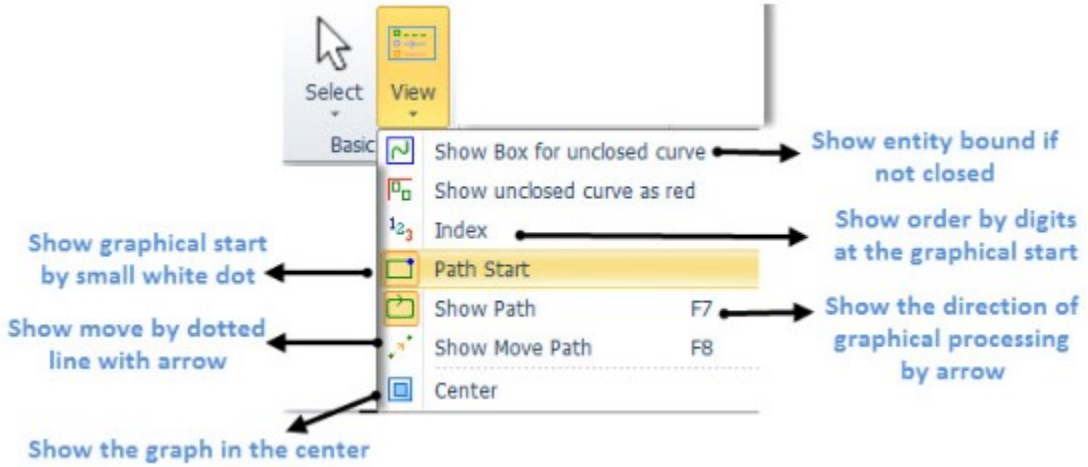
”, the system will allow you to continue the processing from the position of last stopping.

5.4.3 Graphical Operation

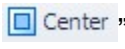
CypCut provides the common drawing functions, which can be available easily from the drawing toolbar on the left. The use of these functions is similar to AutoCAD mostly, and it is very intuitive. Thus, this Manual will not introduce them in details, if you have any questions, please feel free to contact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

5.4.3.1 Graphical Display Effect

"View" in the first column under "Home" menu has multiple buttons which can help to control the display effect, as shown below:



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

When a graph is selected, by clicking the button " 

", the graph will be shown in the center of the screen. If no graphs are chosen, please just click the button directly, and the whole graphs will be displayed in the center.

By clicking the button "" in the lower right corner of the column, a dialog box will be opened, and it can conduct more detailed control for the drawing board, including turning on and off the auto attach

key-points, turning on and off the ruler and controlling the pick precision of mouse.

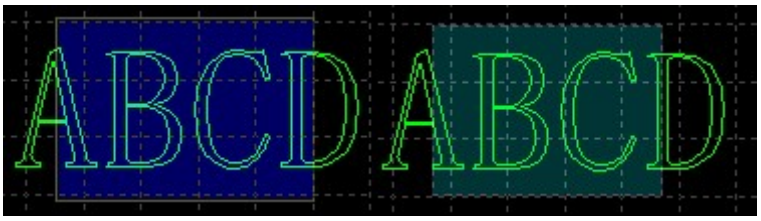
The views can be zoomed by scrolling the mouse wheel in the drawing board. By clicking F3, all the graphs will be shown in the center of the screen. By clicking F4, the machine breadth range will be displayed in the center. The above operations can be selected by clicking the right key of the mouse with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

5.4.3.2 Selection of Graphics

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

translucent rectangle with dotted line will appear and as long as any part of the graph is in the box, the graph will be selected.

The schematic diagram of these two options is shown below. The left one is the option from left to right and BC will be selected; while the right one is from right to left, and ABCD all will be selected. Flexible use of these two methods can help you to choose the graphs you need in a more convenient way.



No matter it is “Click Selection” or “Box Selection”, if you press “Shift” while you make a selection, you can add or cancel selected graphics without the need for clearing the original selection.

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

5.4.3.3 Geometric Transformation

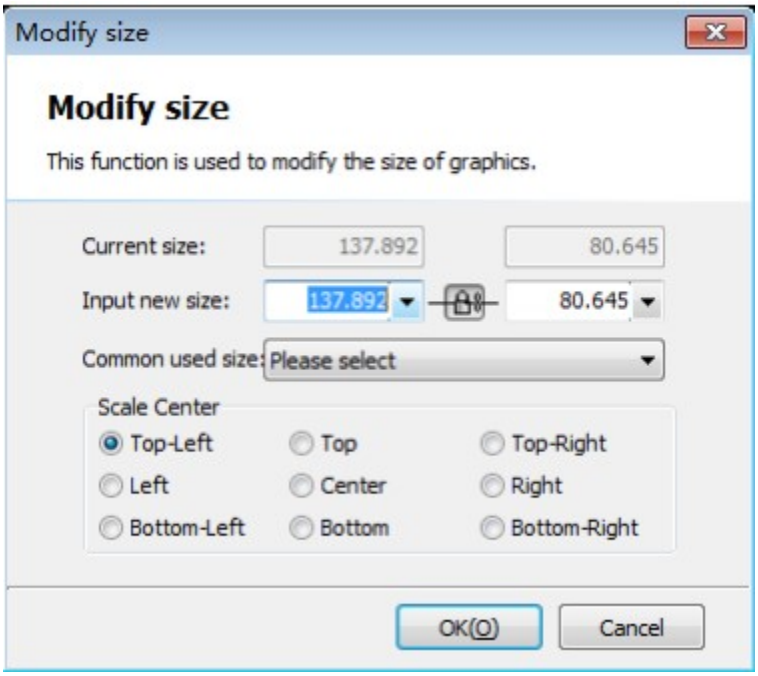
The column “Geometric Transformation” under “Home” menu provides abundant geometric transformation functions. Select wanted transformation graphics before applying. Most of the commonly used geometric transformations can be completed only by clicking the drop-down triangle under “Transform”, for examples: Mirror, Rotate, Align and Scale.

A. Size Modification

CypCut provides 7 fast size transformations, which can be completed by the drop-down menu below the button “Scale”. Click the small triangle under "Scale" button, you can open a drop-down menu, providing selected graph operations of size transformation, as shown below.

For examples: “100mm” means to zoom graphics in equal proportion with a width of 100mm, “2 Times” means to zoom graphics in equal proportion by 2 times.

If you want to input accurate size, please directly click the button “Scale”, the following dialog box will appear, then you can input the new size and complete the size transformation by clicking “OK”.



When the status of lock of the interface is , the length and width are locked as the proportion of the original graphics. If you want to separately input length and width, you can cancel the cancel lock status by clicking the button , and then the button will become .

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

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

B. Interactive Geometric Transformation

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

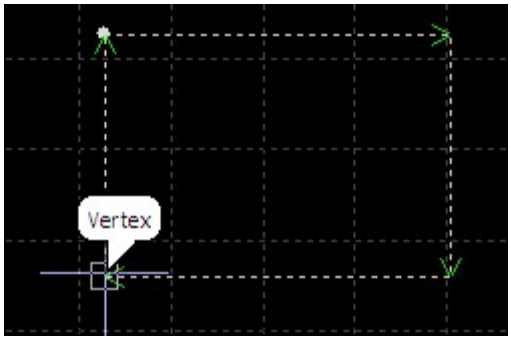
For example, if you want to rotate a rectangle by taking its lower left corner as a basis, you can conduct the operations as follows:

1) Firstly, you need to select the rectangle for operation;

2) You need to click the small triangle below the “Transform” and opening the drop-down menu,

and select “Rotate”, and then there will be a prompt “Please Specify Base Point” in the lower part of the screen;

3) You need to move the mouse to the lower left corner, and then the mouse will be automatically absorbed to the lower left corner. As shown below:

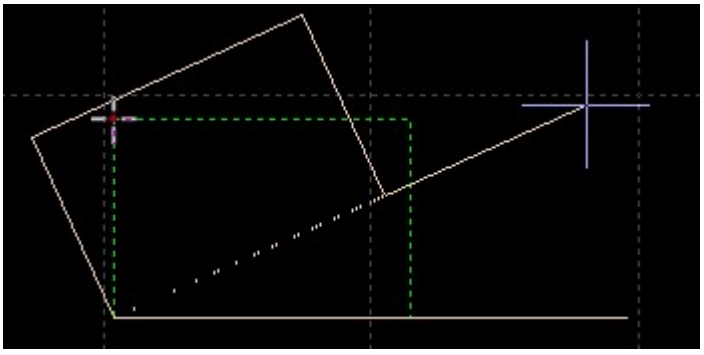


4) You need to click the mouse, and then there will be a prompt “Specify Start Point of Rotation or Input Rotation Angle” at the bottom of the screen;

5) You can complete the operations by directly inputting 45 and then clicking Enter. If you do not know the angle of rotation in advance but want to rotate the rectangle to the position aligning with another graphic, then the first four steps is the same as above, please conduct the following operations from step 5:

6) Please move the mouse to the lower right corner of the rectangle, at this moment, click to form a horizontal line and take it as the start line of rotation.

7) The screen shall appear the prompt “Please Specify End Point of Rotation”. Then the graphics will rotate with the mouse when you move the mouse, and you can complete the operations by clicking the mouse at the expected end point of rotation. As shown below:



The operations of interactive zooming and mirror are similar with this, so there is no further explanation.

C.Quick Translation and Copy

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

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

5.4.3.4.Input of Coordinates and Parameters

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

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

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

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

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

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

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

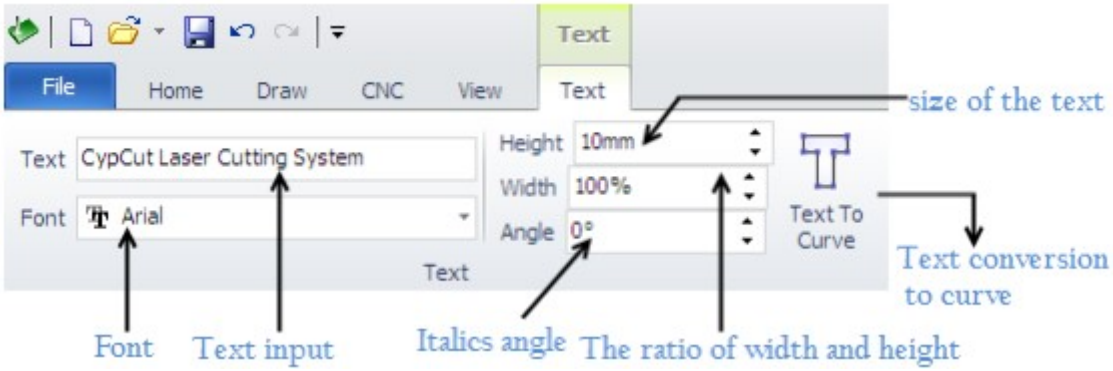
5.4.3.5.Automatic Adsorption

Cypcut will provide the functions of automatic adsorption during drawing according to the needs, including automatic adsorption to the grids, adsorption to the critic points of the graphics, adsorption to the borders of the graphics and so on. You can close the functions of automatic adsorption, and the operation steps are as follows: click the menu "文件", select "User Parameters", then select the tab "Drawing Board" in the opened dialog box, and finally cancel the option "关键点自动吸附". The precision of automatic adsorption can also be set in the above dialog box.

5.4.3.6 Text Input

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

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

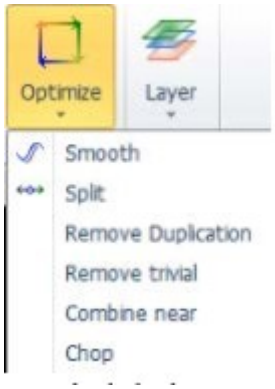


Please note that once the text is converted to the curves, the above option cannot be used any longer. If you would like to design a text with specific font and special effect, please convert it to curves after you design it well.

5.4.3.7 Graphical Optimization

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

to optimize them manually, you can use the right functions in the toolbar. As shown below:



Please select the graphics to be processed, click the corresponding buttons, and then operate according to the prompts.

A. Smooth

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

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

B.Split

Split is to divide the closed graphic into two graphics and the user can edit these two graphics separately. Please click the button “ ”, 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.

C.Remove Tiny Objects

Sometimes the imported graphics may include the curves which are visually imperceptible, which

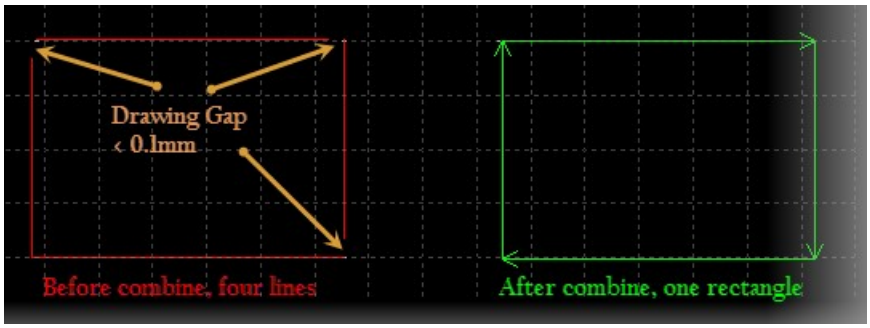
causes the display size to become very small, or move to an abnormal position when processing. These graphics can be deleted through the function “Remove trivial”. You may click the button “Remove trivial”, set the size range of the graphics, and then confirm the operation. The graphics smaller than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

D. Remove Duplicated Curves

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

E. Combine Near

The graphics drawn by using AutoCAD often include the graphs which connect visually while do not connect actually. Through connecting near, they can be combined. Please select the graphics to be merged, then click “ Connect Near ” and input merging accuracy, lastly confirm the operation.



Note: The end points of the graphics in visual may be not the ones in geometric, and the excess backtrack lines may exist in the end points, and these graphics need to be split and deleted firstly through “Split Curve”, and then can be combined.

5.4.4 Technical Design

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

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

Warning! The inappropriate or incorrect parameters may result in poor cutting effect or even damage to the machine, so please set the parameters carefully.

5.4.4.1 Lead lines

A.Distinguish inner and outer mold

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

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

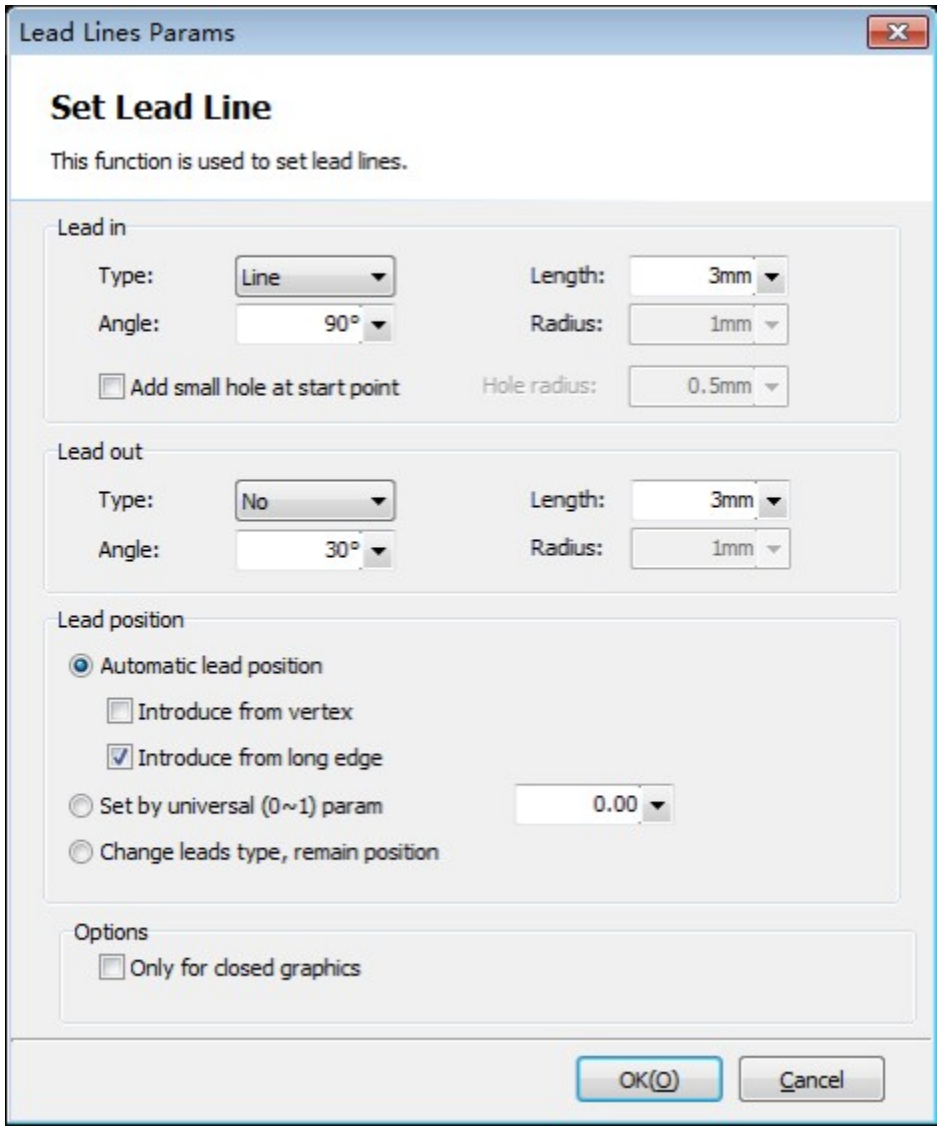
When adding the lead lines, the external layer is yang cut, so it will be led in from the outside; the internal layer is inner mold and will be lead in from the inside. When set inner and outer mold manually, please select the graphics to be set, and then click the buttons “ 

”under “Home” menu.

B.Automatic Lead Lines

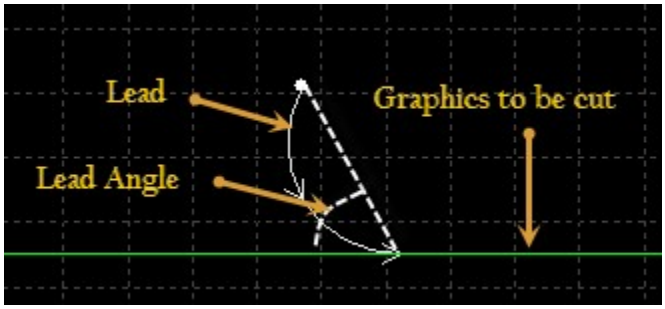
Please select the graphics to be set with lead lines, click the icon “ 

” under “Home” menu,then set the lead lines parameters in the popped window. As shown below:



The supported lead types include Arc, Line and Line + Arc, while the supported parameters consist of lead type, lead angle, lead length and lead radius. You can also choose whether to add a small hole at the starting point of Lead lines.

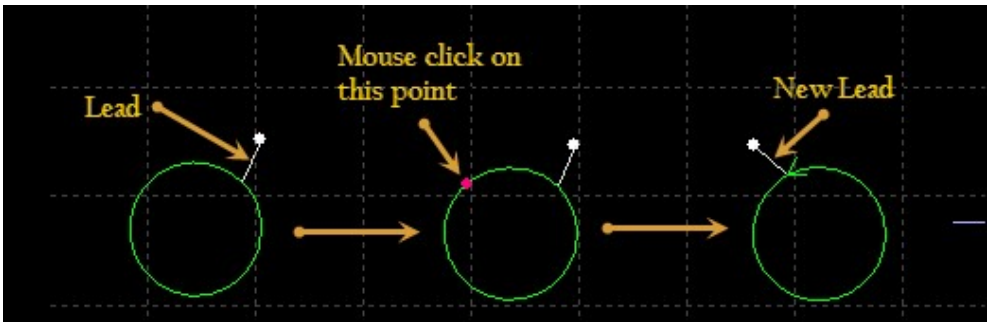
When you select arc leading, the end of the circular arc needs to keep in tangent with the graphics to be cut (no matter how big the set angle is). As shown in the right figure. In fact, the angle set at this moment is an included angle between the connecting line of the start point and the end point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



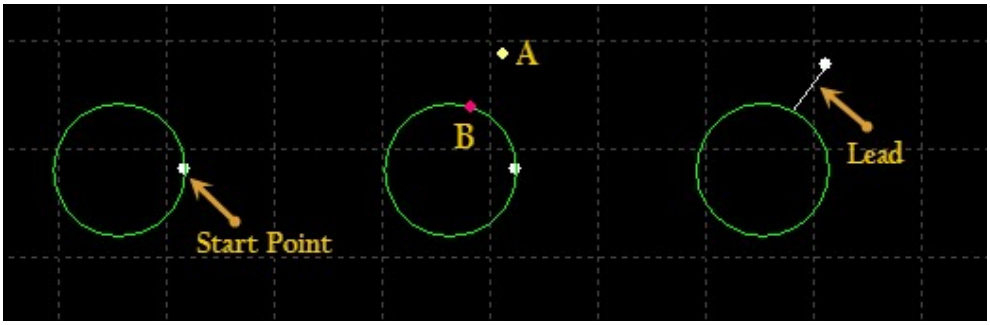
Please note that automatically select the appropriate lead position, it will search preset priority long side or priority vertex in order to determine lead position, thus the previous parameters of the graphics such as lead position and type will be covered. If you have a fixed requirement for the lead position, you can choose to set unified position according to the total length of graphics or un-change the lead position, and only change the type option.

C.Manually Set lead lines

You can modify the lean in manually by clicking the button " " on the toolbar. If you click on the graphics, you can change the position of the lead lines; however, you cannot modify the angle and the length.



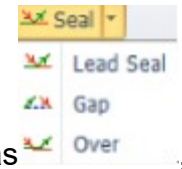
Firstly please click (point A, yellow point) outside the graphics, then click (point B, red point) on the graphics, in this way you can draw a lead line from point A to point B.



D. Check the Lead lines

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

E.Lead Seal, Gap and Over



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

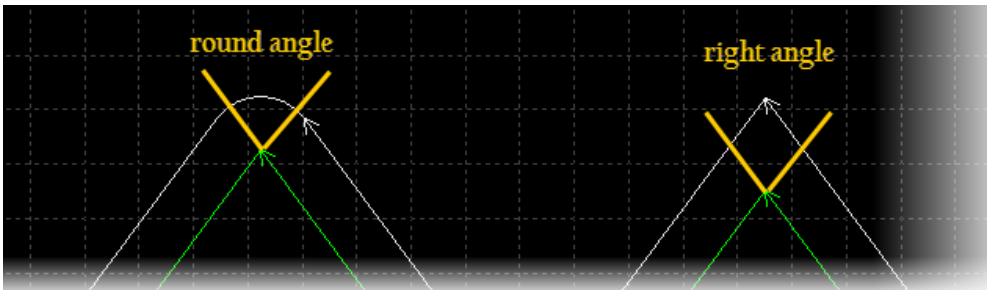
5.4.4.2Cutting Compensation

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

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

The direction of cutting compensation can be selected manually. It can also be judged automatically according to outer mold or inner mold. Outer mold needs outward compensation, while inner mold needs inward compensation. During the process of cutting compensation, you can select to translate the corner in the form of

round angle or right angle. As shown below:



In the figure the green is the original, the white is the compensated track, and the light yellow is the

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

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

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

5.4.4.3 Micro Joint

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

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

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

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

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

for modification.

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

5.4.4.4 Cooling point

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

Cooling points can also be inserted multiple by continuous clicking as well as Micro Joint. Cooling points can still be added after operate the process of micro joint and compensation and so on. Cooling point can be deleting by pressing Shift and then clicking the cooling points.

5.4.4.5 Group

“Group” in CypCut refers that multiple graphics and even multiple “Groups” are combined together to form a “Group”, and the entire “group” will be regarded as a whole. Within the “Group”, the order, the positional relationship between the graphics and the layers are all fixed and they will not be influenced during sorting, dragging and other operations.

Please select the graphics which you need to form a group, and then click the button “ 

” to combine the selected graphics to a group. If you need to cancel the group, please select the “Group” button, which has changed to “ 

” button. If you would like to explode all the groups on the drawing board, please click the small triangle below “Group”, and then select “Explode Graphics”.

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

Although CypCut software allows you to group any graphics and operate them as a whole, we still recommend the users to use the function of group “logically” and only group the graphics which meet

the logical conditions of the “part” as much as possible. From now on we may use these two terms “group” and “part” indiscriminately.

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

A.Sorting of Group

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

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

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

B.Processing of Group

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

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

5.4.4.6 Scanning

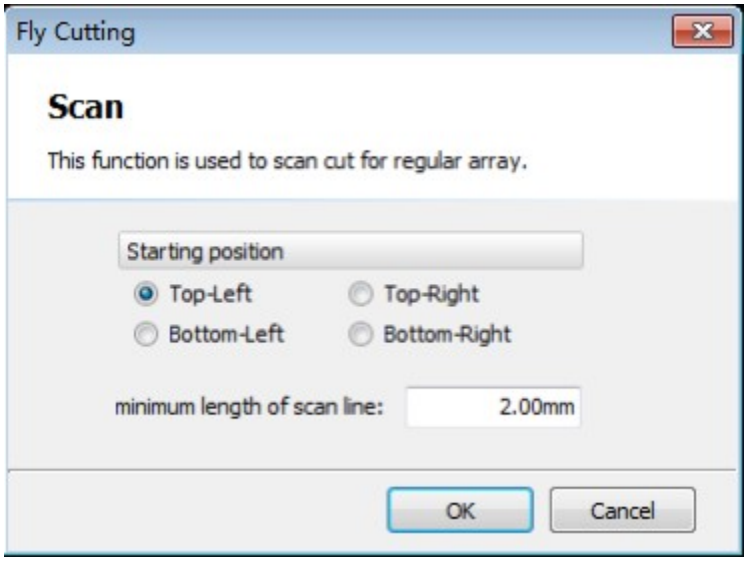
When the graphics to be cut are regular (such as rectangular, full circle, polygon) and possess a certain regular arrangement, you can connect the cutting line segment with same direction by scanning to conduct flight cutting, which will greatly improve the cutting speed and save cutting time.

It recommends that users sort graphics needed to be scanned before scanning. This operation can optimize the path of scanning and save move time.

Click " 

" button under “Home” menu and then enter the fly cutting parameters setting interface.

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

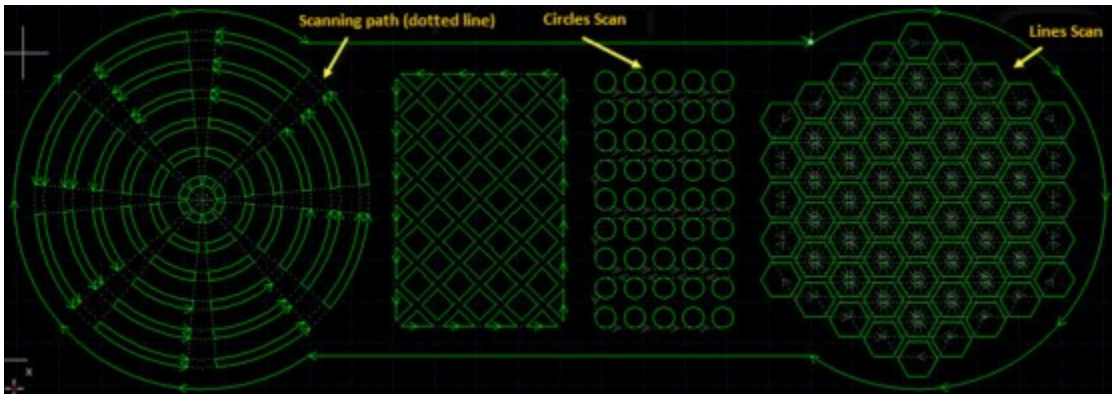


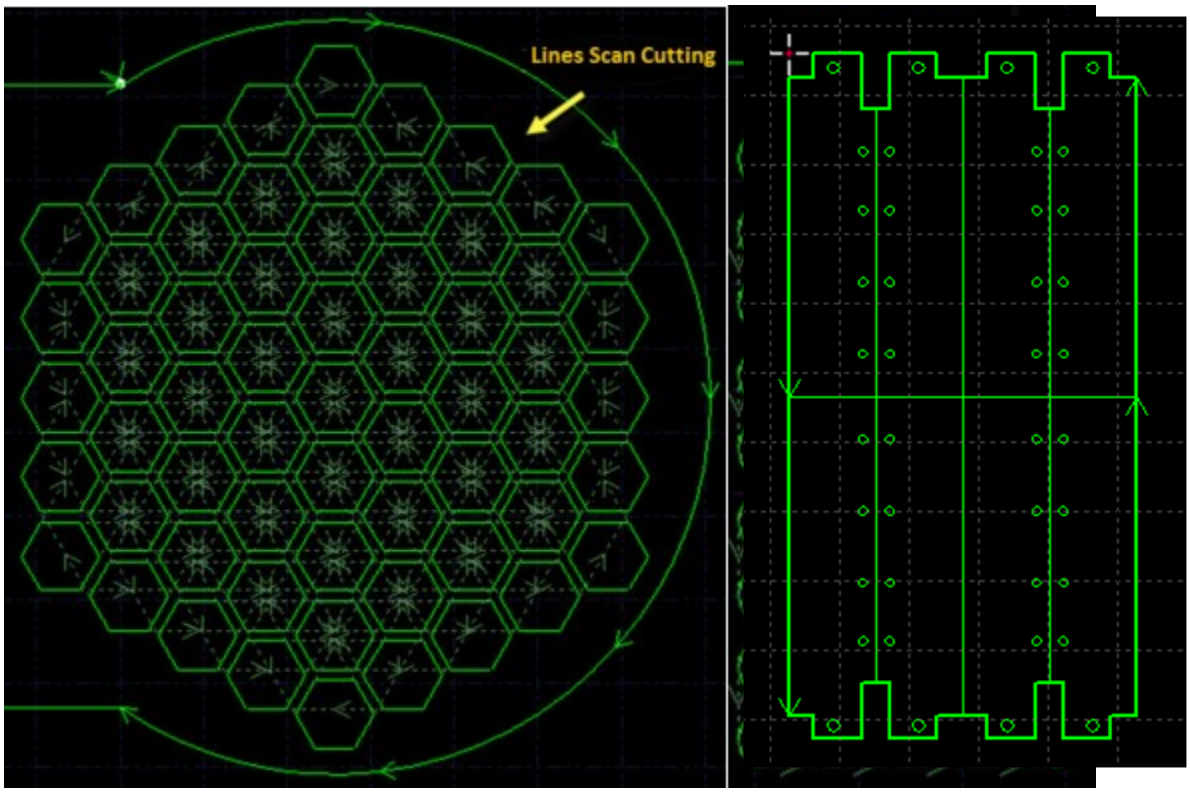
“ 

” under “Scan” button under " 

" applies to rectangle and the straight line with same direction, and " " applies to arcs and circles of natural fly cutting. If you choose "Arc sort before scan", circle or arc will be sorted from top to bottom and then conduct fly cutting. The graphics after fly cutting will automatically become a group.

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





5.4.4.7Coedge

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

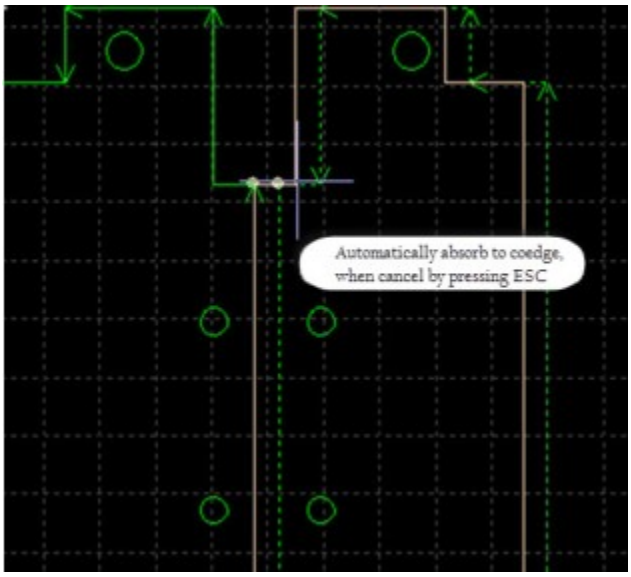
After selecting two or more graphics which you need to coedge and then clicking the button “Coedge” on the toolbar, CypCut will try to coedge the selected graphics. If the selected graphics cannot meet the conditions of coedge, the window “Draw” at the lower left corner of the interface will display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

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

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

A.Coedge Automatic Adsorption

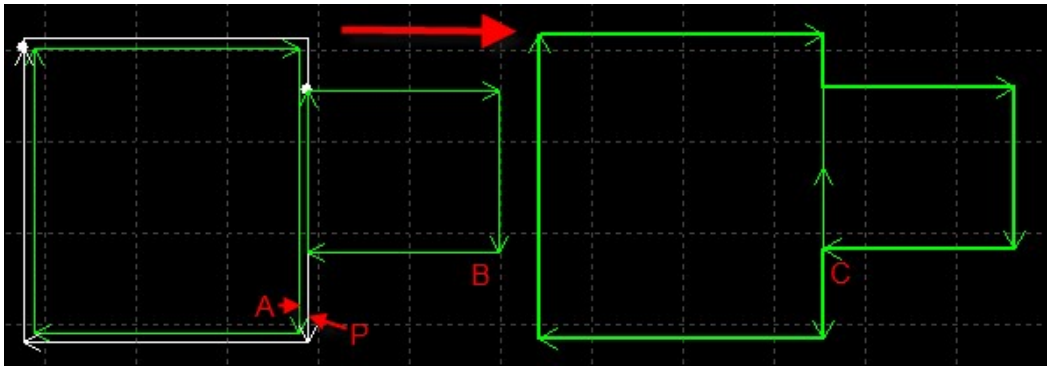
In CypCut, when you drag the graphics to the position where you may coedge them, CypCut will try to adsorb automatically and display the corresponding prompted message. You can drag together the two graphics which you need to coedge very easily, and the function of automatic adsorption will help you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



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

B.Compensated Coedge

If you hope to still retain the cutting compensation after coedge, firstly please compensate the graphics which you need to coedge, and then coedge them. In any case, “Coedge” will keep the processing track unchanged. If the coedged graphics contain compensation, the compensated track will be retained after “Coedge” and the original will disappear. As shown below.



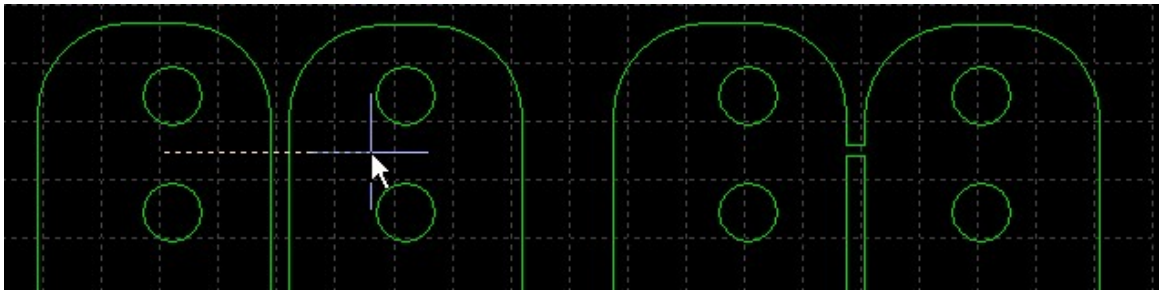
In fact, in the figure above, the original A cannot be coedged with the graphic B, and only the compensated track P can be coedged with it. Even if you move the graphic B to the position near to the original A, you still cannot coedge them because it is not the track to be processed.

5.4.4.8 Bridge

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

To bridge two graphics, please click the button “ 

”, and then draw a line on the screen. And all the graphics intersected with it will be bridged together two by two. As shown below:



Bridge needs to specify two parameters. The first parameter specifies the maximum distance between two adjacent curves, and you can bridge them when the distance between two graphics is less than the specified parameter. The second parameter specifies the width of bridge.

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

5.4.4.9 Nest

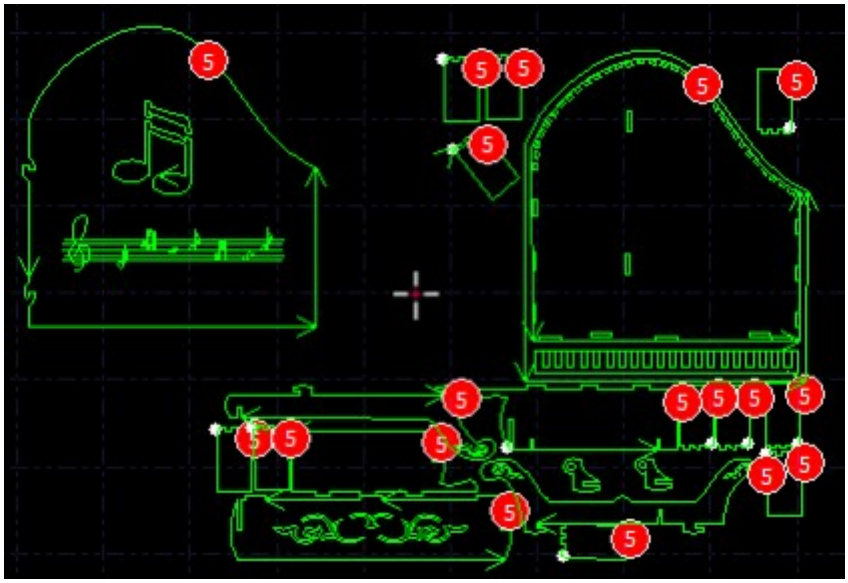
Nest function is used for reasonably arranging given parts on the plate with maximum utilization.

CypCut not only supports nest through a key, but also provides a number of optimization parameters for you to make fine adjustments, such as: Gap, Plate Margin, Rotate Angle, Auto coedge and Create remnant and so on. Click " 

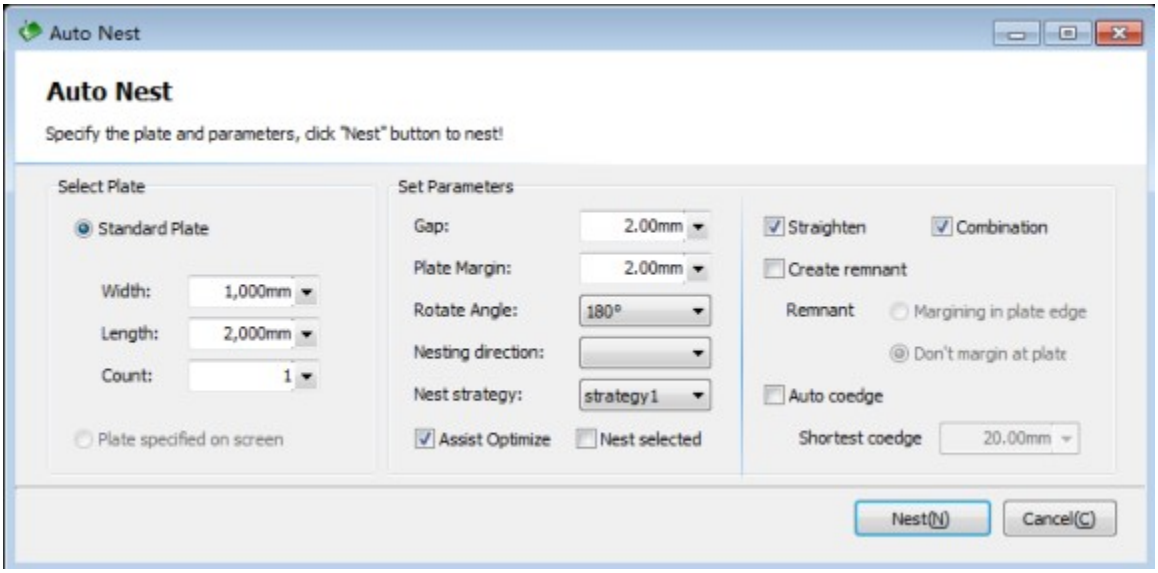
" button in “Home” page or “Nest” page to achieve this function.

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

" button under “Nest” page, and then click "Set as plate"; Or select the graphics and click right key to select "Set as plate". You can also click "AutoNest" button to set the length, width and count of standard plate in Auto Nest interface. Similarly, the number and parts can also be set in the similar method. The graphics before nesting is shown as below:



Auto Nest needs to set some parameters. "Gap" means setting a size not smaller than the distance between the parts and components; "Plate Margin" parameter specifies the plate border of parts nesting remained; "Rotation Angle" refers to the adjustment angle of rotating parts during nesting, and in the case of not allowing to have relative rotation between parts and plates, lease select "prohibit rotation"; "Nesting direction" means a direction where the parts is close to the plates.



“Nesting strategy” means the strategy that is used to calculate the results of nesting by the program. Currently, auto nest offers five strategies:

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

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

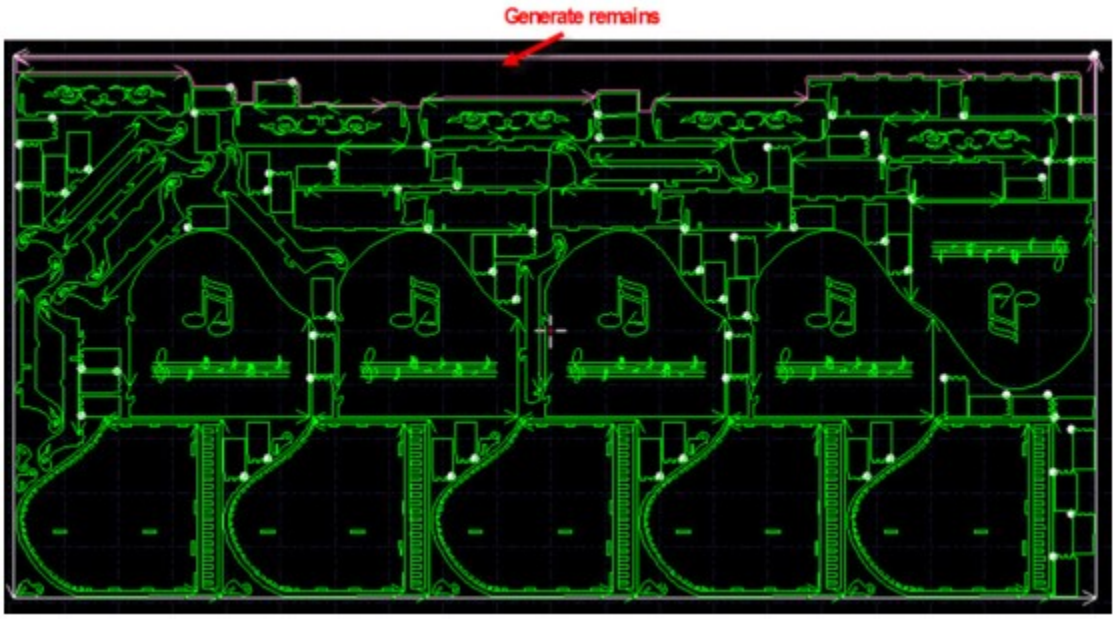
Array pattern: Arrange parts into the plate by array pattern when parts have fewer types; It is recommended to use this strategy, especially when single part nesting.

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

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

Graphical after nesting will also have a certain optimization options: select "Assist Optimize "will automatically optimize graphics after nesting, but also will consume more time, you can choose according to the actual situation; " Straighten " straighten parts of crooked posture before nesting; “ Combination ” will automatically distinguish parts of complementary shape and then couple together for nesting, to improve the nesting speed and neat of parts arrangement; If you select "Auto coedge ", you

need to set the shortest coedge, only when the coedge length of graph is greater than the value, co-edge will be performed automatically, Note: this function can't be simultaneously used with "Assist Optimize". Graph after nesting is shown as below:



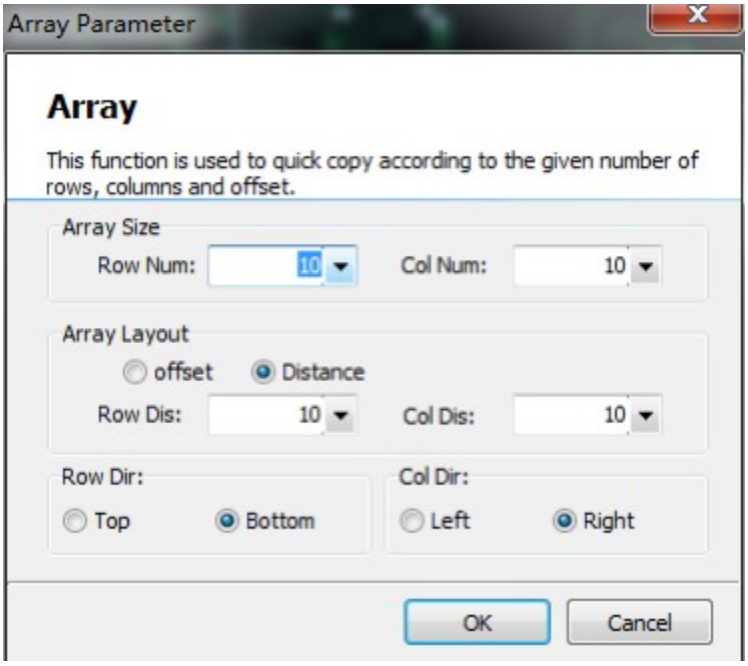
You can also deal with remnant after nesting. Select "Create remnant" will draw remnant shape drawn on the board, so you will cut down remnant easily.

5.4.4.10 Array

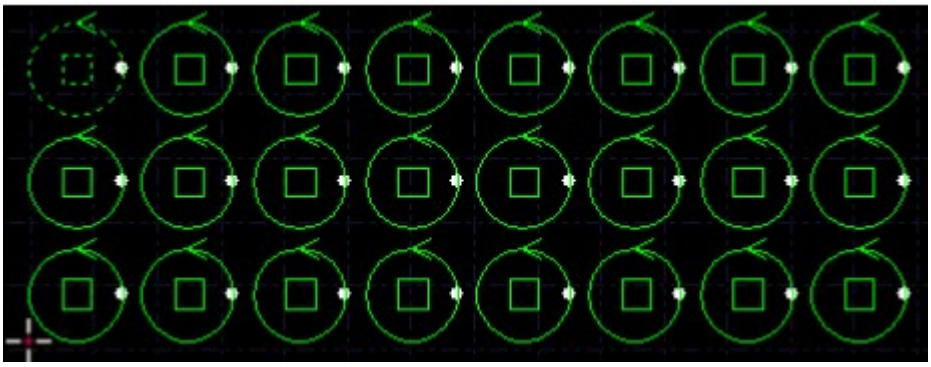
"Array" command can be used to quickly and accurately copy an object, CypCut provides three ways of array.

A. Rectangular Array

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

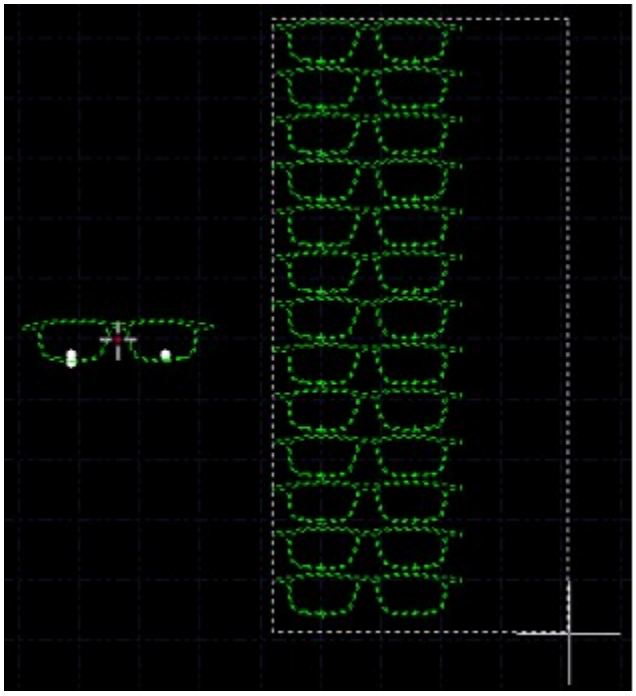


Set the number of rows, columns, offset and direction and then can quickly copy the selected graphics, as shown below:



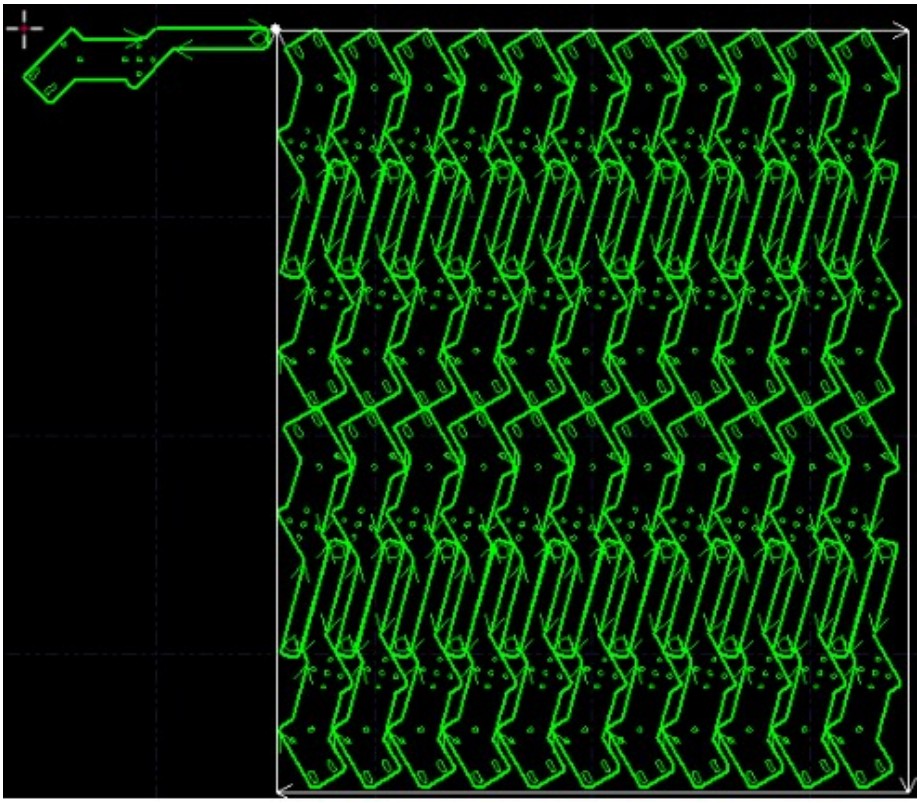
B.Manual Array

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



C. Full Fill Nest

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

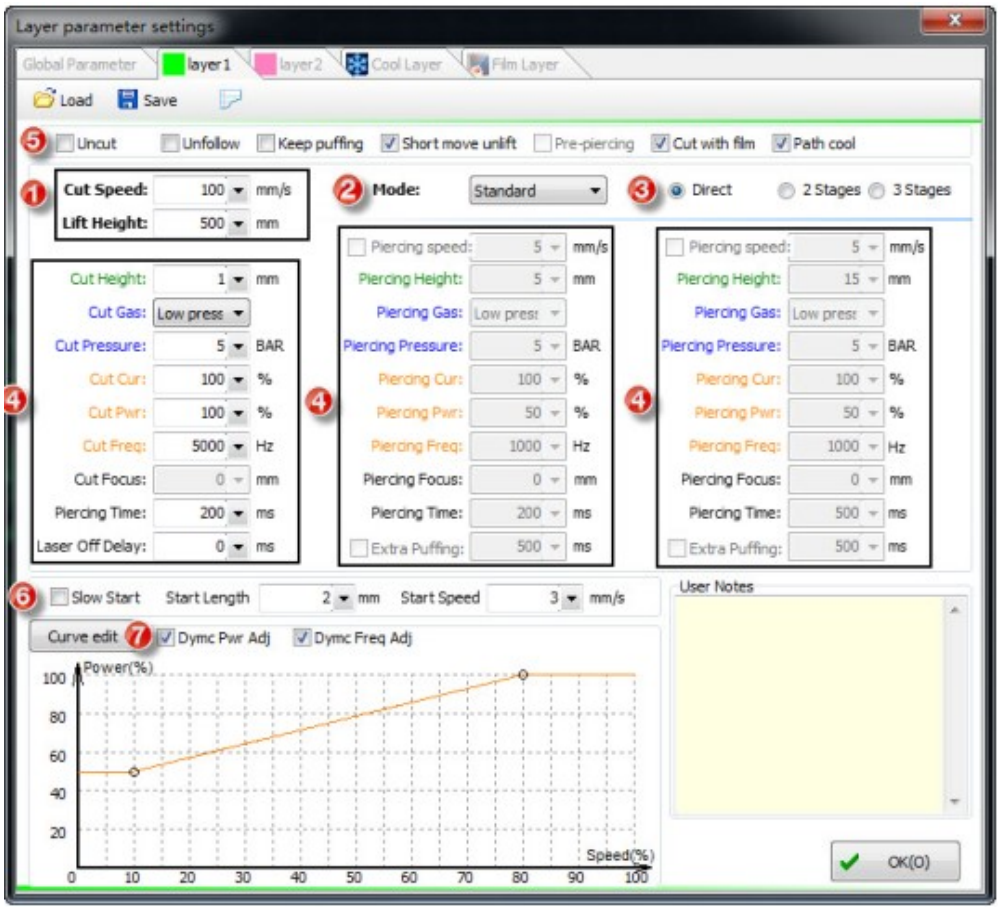


5.4.4.11 Layer Parameters

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

You can open the dialog box “Layer Parameter Settings” by clicking the button “ 

” under “Home” menu. This dialog box includes almost all the technical parameters required for processing. The first page of the dialog box is “Global parameter” and they are used to control the parameters outside the layers, including motion parameters, default parameters of laser and gas, and follow parameters and so on. The other pages of the dialog box list all the currently used layers, and you can set the parameters of this layer separately by clicking every layer.



Note: Different options may be displayed in the dialog “Layer Parameter Setting” due to different lasers, different gas pipeline configurations and different followers. The above figure is only used for reference, and the actual contents displayed in your software shall be taken as the criterion.

A.Descriptions of Parameters

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

① Basic 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.
Lift Height	Set the lift height of laser head after cutting a segment of curve. Z-axis will lift to a certain height after suspending the cutting, and the height is lift height.

② Cutting mode	
Standard	Cutting according to set standard parameters.
Fixed Height Cut	Cutting with fixing laser head at a certain height.
Extra-plate follow	When you select the mode, the knife point can be docked off the board. During actual cutting, portion of the laser head outside the plate will stay in the "Reference height", and follow cutting after detecting in the board. Commonly is used for cutting metal plate. The setting pattern of "Reference height" is that save the parameters by the path of “CNC” _ “BCS100” _ “save reference height when follow outside plate”, when the laser head move to the appropriate height.
③ Piercing mode	
Direct Cutting	Punching and cutting use the same parameters, which are commonly used for thin board cutting.
Two stages piercing	Piercing and cutting use the same parameters, which are commonly used for thick board cutting,. You can choose whether needs progressive piercing.
Progressive piercing	Based on stage piercing, the piercing method of variable defocusing amount is used, i.e., slowly fall when piercing, and this method is commonly used for thick board cutting. During stage piercing, the piercing time can be set to be a small value, such as 100MS. At this time, actual piercing time = 100MS + the time required for slowly falling to the cutting height from the piercing height.
Three stages piercing	Based on stage piercing, conduct another stage piercing. You can choose whether needs progressive piercing. And this method is commonly used for thick board cutting
④ Cutting Parameters	
Cutting Power	Set the laser power used in cutting, i.e., the duty ratio of

	PWM modulation signal.
Cutting Height	Set the height from the laser head to the board during cutting.
Cutting Pressure	Set the pressure of auxiliary gas during cutting, and use it with proportional valves or multiple valves.
Cutting Frequency	Set the carrier frequency of PWM modulation signal during cutting, i.e., the laser number within one second. The larger the value is, the more continuous the laser.
Cutting Gas	Set the type of auxiliary gas used in cutting.
Cut focus	The position of focus far from Sharp-tongued of cutting head nozzle.
Piercing time	Delay for piercing plate, so make cutting more fully.
Laser off delay	Delay for ensuring complete cutting before laser off.
The definition of piercing parameters, such as pressure and power and so on are similar to the cutting parameters, which can take effect only when the option of “2 stages” in ③ is selected.	
Piercing speed	Set the speed from piercing height slow down to the cutting height,during progressive piercing
Extra puffing	Set time for puffing with laser off after piercing, in order to make the plate cool.
⑤ Other parameters	
Uncut	The layer process is not processed.
Unfollow	Height controller is not carried to follow motion when this layer is during cutting.
Keep puffing	Keep puffing during cutting.
Short move unlift	After select this option, if the move distance between two graphics is less than the value of “Unlift move distance less than” set in global parameter, then Z axis is not elevation and directly moves to the beginning point of the next graphics to start

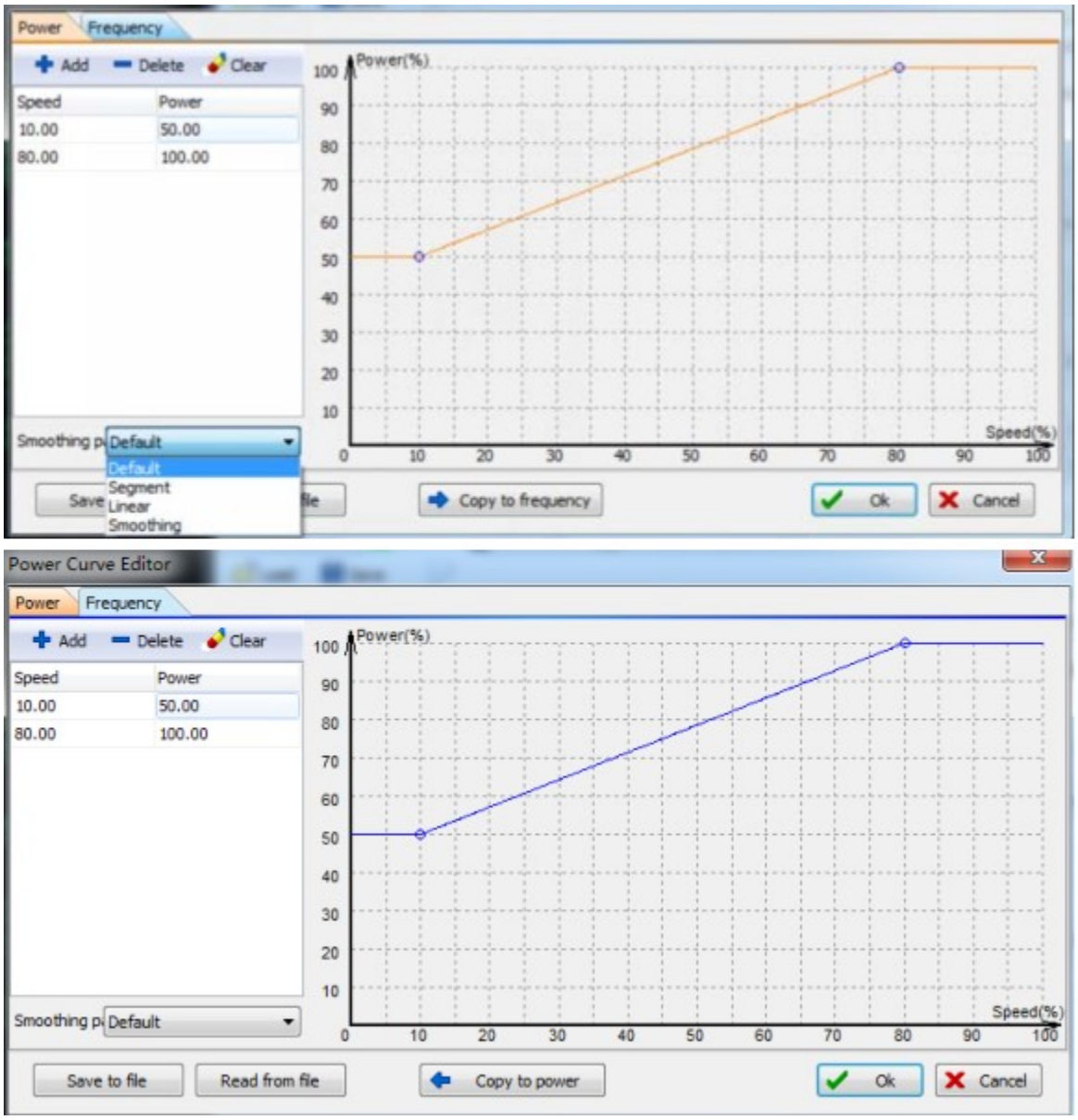
	processing, after the above graphic complete processing.
Pre-piercing	Before actual cutting, piercing in advance at the beginning point of graphics (or lead starting point). CypCut provides auto group pre-piercing. You can select this option in the global parameter. Note: This option is not available with “Cut with film”.
Cut with film	You can use film parameter to perform one time cut with film along the cutting path, and then perform normal processing according to layer parameters. After selecting this parameter, “film layer” setting page will appear.
Path cool	After a single graphic normal processing, process one time with laser off and puff on along the original track, in order to accelerate parts rapid cooling and reduce the impact of thermal expansion and contraction effect on the accuracy of the work-piece. After selecting this parameter, “Cool layer” setting page will appear.
⑥ Slow start	
Start length	Set the length of slow start, to prevent cut thick plate without completing at the beginning.
Start speed	Set the speed of slow start

B. Dynamic power and frequency adjustment

After selecting “ 

”, the cutting power and frequency will vary with the changes in speed during the cutting process, and the specific changes are determined by the power and frequency curve. You can click “ 

”button to edit power and frequency curve.



As shown above, the X-coordinate of power / frequency curve represents cutting speed, while the Y-coordinate represents cutting power / frequency, with a unit in percentage. You can add the appropriate speed corresponding to power point and select the curve smoothing pattern. You can also click " 

" to copy the power curve as frequency curve. By this table, it can reflect the percentage of actual power/ frequency in cutting power/ frequency when the actual movement reaches the turning and the speed drops to a few percent of target speed. Note: Adjusting frequency in real-time makes sense only after selecting "Dymc Pwr Adj".

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

the power of laser is as follows:

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

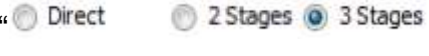
However, the power cannot be less than a pre-set minimum value, anyhow. Generally, it is set to be 10%, i.e., 500W * 10% = 50W.

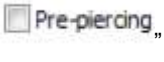
If "  " is not selected, the power will remain unchanged in the cutting process. Referring the above example as a reference, the power in the cutting process is as follows: 500W X 90% X 80% = 360W.

C. Piercing Ways

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

D. Pre-piercing

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

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

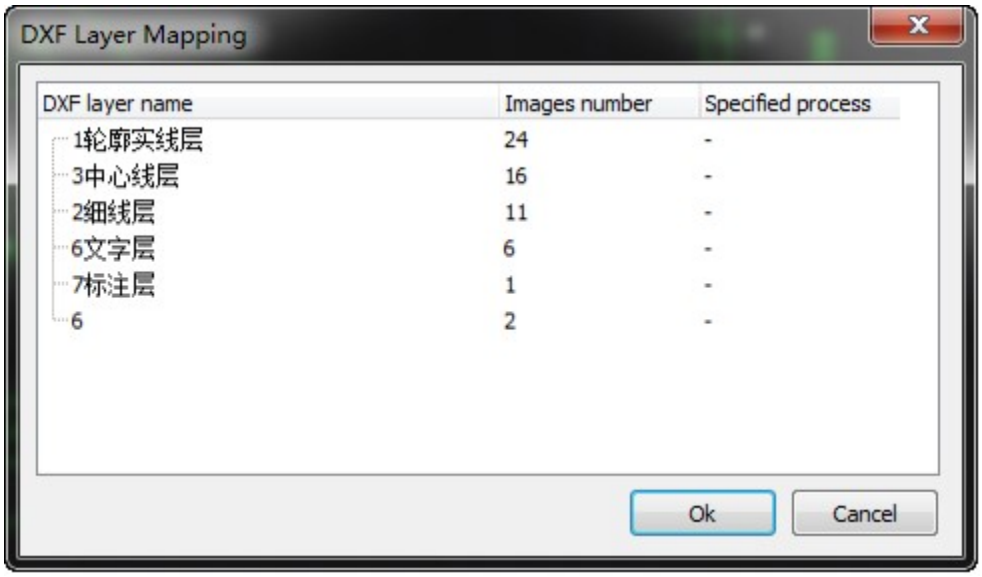
E. Material Library file

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

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

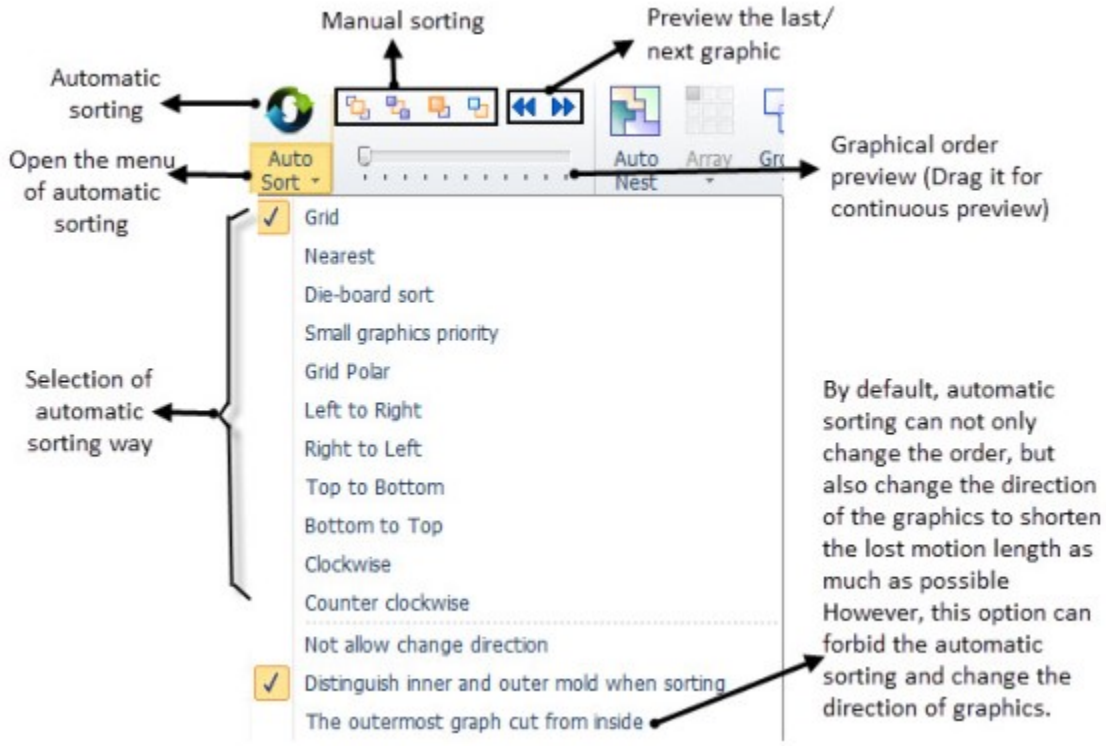
F. Layer setting

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



5.4.4.12 Sorting and Path Planning

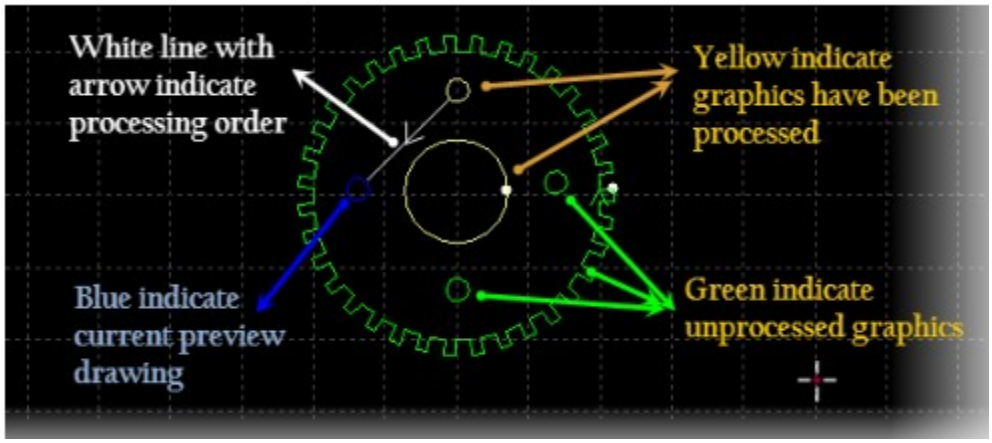
You can find the column shown below in the page “Draw” of the toolbar. It includes all the functions listed in the above figure, furthermore, there are tools for graphical alignment at the top. As shown below:



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

A.Order Preview

You can preview the processing order by dragging the progress bar “Graphical Order Preview” or clicking the button “ ”. The figure below demonstrates a screen when previewing the parts.



The order preview is fully interactive and it can be more easily controlled than simulation processing. You can also zoom in the position where you would like to observe carefully and preview

forward and backward repeatedly. All the move paths will be shown by clicking the button “” und drop-down triangle button of "View" on the common toolbar, and they will help you to look over the whole processing order.

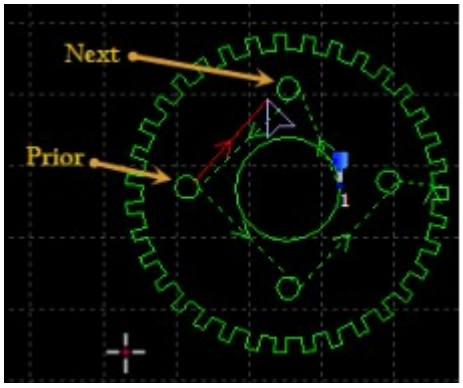
B. Manual Sorting

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

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

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

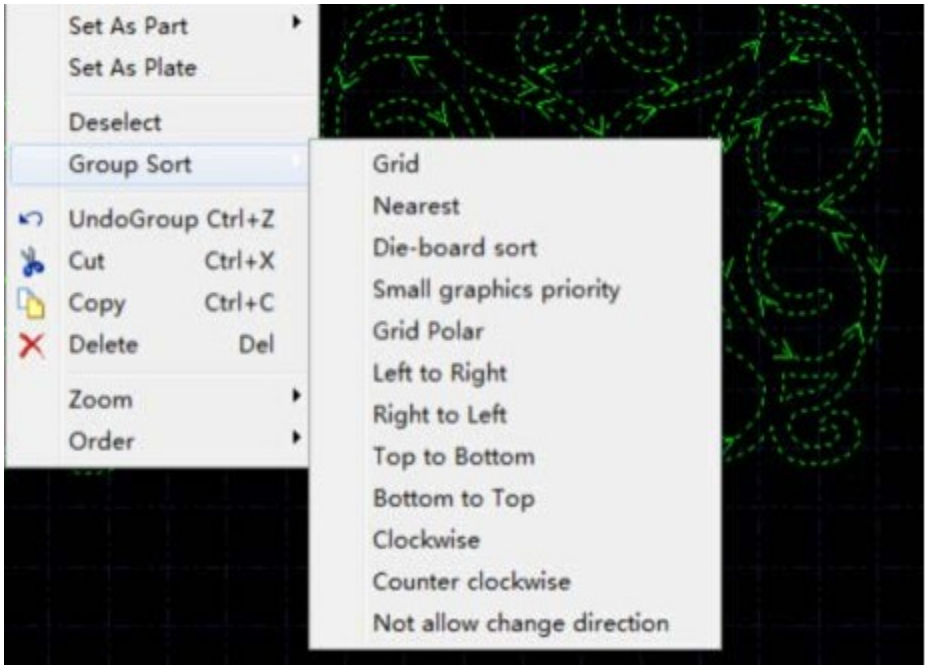
Except the manual sort of fine-tuning, you can also perform the manual sort more intuitively through “Manual Sorting Mode”. The system will enter the “Manual Sorting Mode” after you click the button “” on the left toolbar of the main interface. The move path and the digital display of the graphical order will be opened automatically on the screen. According to your expected order, the processing order of the graphics will be set after you click with the mouse one by one. If click an incorrect position by mistake, you just need to click again from the incorrect position or cancel the operation with the right key. If you just would like to adjust the order between two graphics, you can hold the mouse and draw a line from one graphic to another, and then you can set the order between these two graphics. As shown below.



C. Partition Sorting

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

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



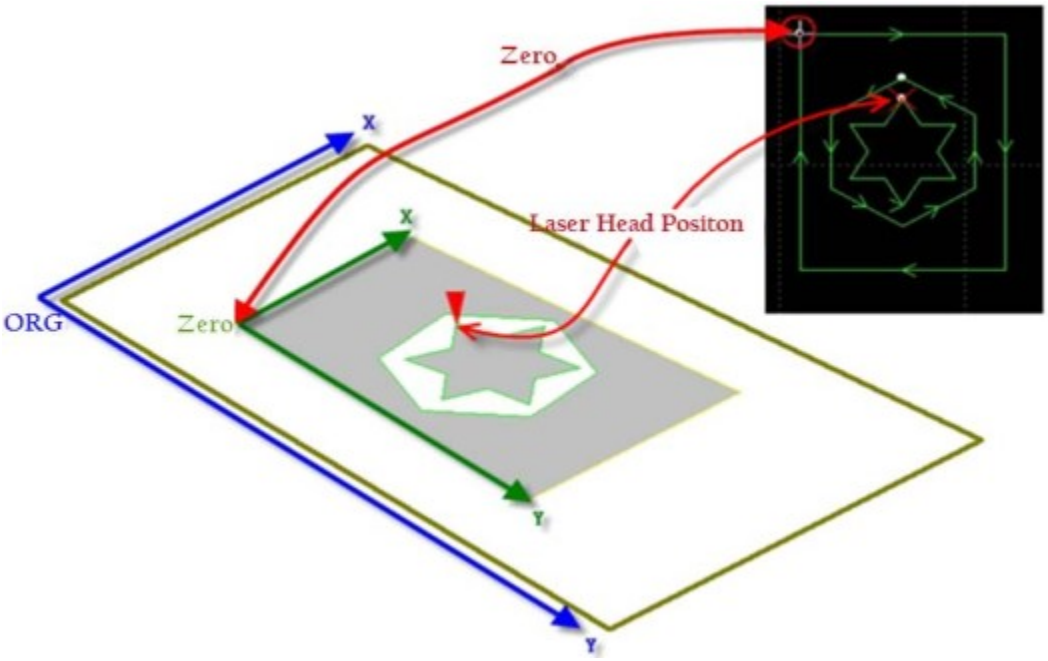
5.4.5 Work Control

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.

5.4.5.1 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.

A.Mechanical Coordinate System

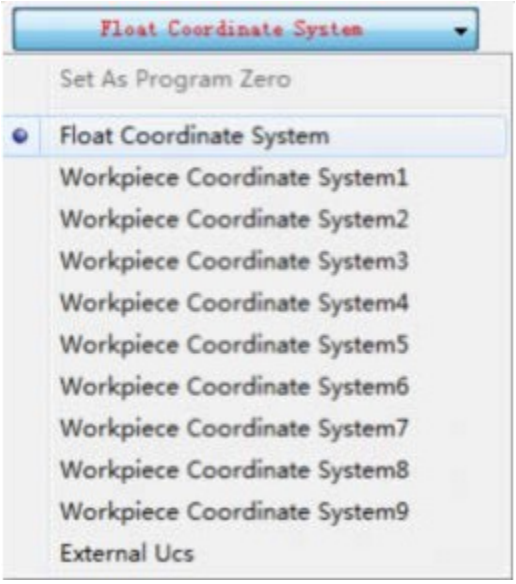
The mechanical coordinate system is uniquely determined by the machine structure and the machine parameters. At any time all the coordinate systems set through clicking “Go Origin” are consistent with each other. You can reset the mechanical coordinate system through clicking “Go Origin” in the “CNC”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

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

B.Program Coordinate System

Because the coordinate system of machine tool is fixed, you need to introduce the workpiece coordinate system for convenient use. The direction of each coordinate axis of all the program

coordinate systems in CypCut is fully consistent with the machine coordinate system. Only the zero point of the coordinate system is different, and it is called program zero point. The program coordinate system is divided into the floating coordinate system and the workpiece coordinate system.



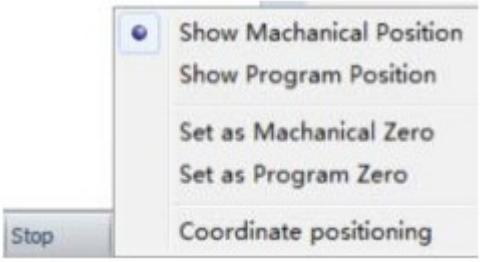
The button at the top of the console can be used to select the program coordinate system, and it can also be used to select “Floating Coordinate System”, nine “Workpiece Coordinate Systems” and one “External Ucs”.

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

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

Click status bar " 

"at the bottom. You can choose to “Show Machanical or Program Position. You can also set zero here of the two coordinates. If you select "coordinate positioning", laser head will be positioned to



a specified coordinate position.

C.Searching Zero Point after Exception Occurs

Case one

If the processing is interrupted only due to the exception of external equipments such as the laser and auxiliary gas, and they do not cause the coordinate system to deviate, you can click directly “Return Zero” to go to the zero point.

Case Two

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

5.4.5.2 Alarms

CypCut will monitor all the parts during the running of the machine. Once it monitors the alarms, it will display immediately the alarm in red title bar and take measures such as stopping the motion. Before the software alarms are removed, many operations will be forbidden, and users need to check the machine and operation again after the alarms are canceled. One example of the alarm is as shown below.

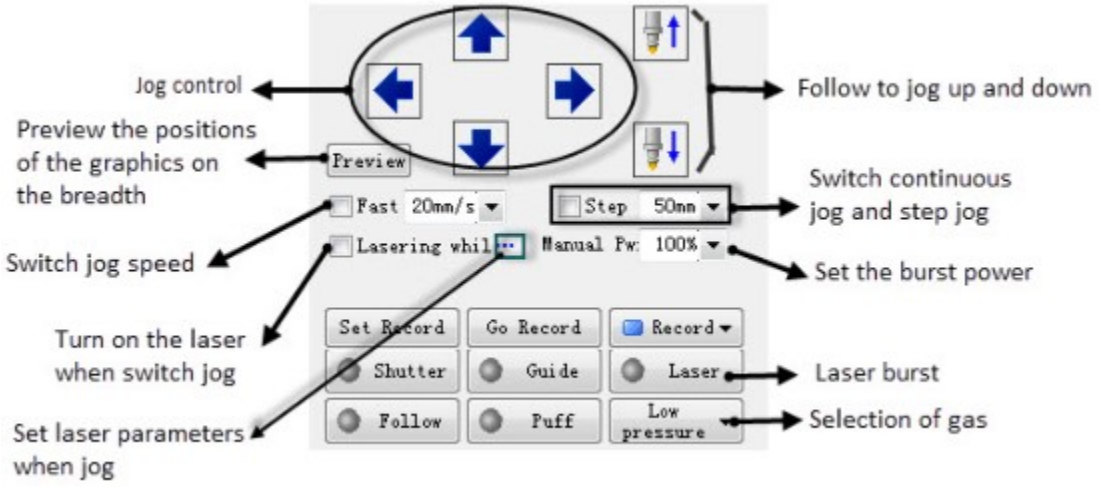
Except the title bar, the “Alarm Window” at the lower left corner of the interface can also display the alarm information. After the alarms are removed, the red display of the title bar will disappear, however, the information in the “Alarm Window” will be retained. You can look over all the history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

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

take the necessary measures as soon as possible.

5.4.5.3 Manual Testing

The functions of the manual control on the console are shown in the following figure:



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

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

The current position of the machine tool can be recorded by clicking “ Set Record ”, and the machine can return to the previously recorded position by clicking “ Go Record ” if required later. Six positions can be recorded in total and they will be selected through “ Record ”.

5.4.5.4 Soft Limit Protection

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

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

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

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

5.4.5.5 Frame

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 operate “Edge Seek” before framing, the software will record the results. The laser head will move along the inclined rectangle during framing, that is to say, move along the actual frame which is corrected by the “Edge Seek”. See the Chapter “Edge Seek” for the details.

5.4.5.6 Processing and Dry Cut

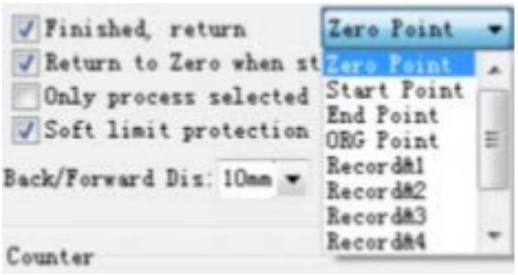
You can start processing by clicking the button “ ” on the console. During the processing the monitoring screen will be displayed as below. It includes the information such as the coordinates, the speed, work time, follow height and so on.

When displaying the screen above, it cannot be switched to other pages of the toolbar, in order to prevent from modifying the graphics during the processing. However, the menu “File” can still be used. If you need to modify the parameters during the processing, please pause firstly, and then click the button “Layer” on the right toolbar of the interface.

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

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

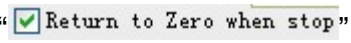
By default, it will return to the zero point automatically after completing the processing. If you would like to return to other position after the processing, please select the needed position on the console. The supported positions include zero point, start point, end point, origin point and record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

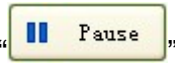


Every time when the processing is finished, the process count on the console will add 1, and when it reaches the preset times, a dialog box will be popped to prompt so that you can control the production. You can open "Auto Pause" interface to control piece management and auto pause by clicking the button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

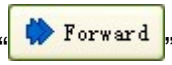
5.4.5.7 Stop, Pause and Resume

If you need to stop the processing, please click the button "" on the toolbar during processing or the button "Stop" on the console. After stopping, the machine will return to the zero point. If you

do not hope to go back to the zero point, please cancel the selection of option "  " on the console.

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

If you need to continue to work, please click the button "  " on the toolbar during processing or the button "  " 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.

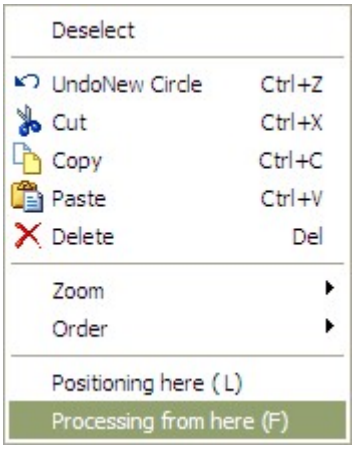
During the pause, you click the button "  " or the button "  " so that the machine can move backward or forward along the processing track. The distance and the speed of every motion can be set through the button "  " on the console.

5.4.5.8 Breakpoint Memory

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

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

5.4.5.9 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 “ 

” and “ 

”.

5.4.5.10 Global Parameters

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

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

Motion Parameters	
Move Speed	Speed during move (not the speed during processing).
Move Acceleration	The maximum acceleration of each shaft during move. It needs to be used with move speed.
Frame Speed	Speed of framing.
Cut Acceleration	The maximum acceleration of each shaft during track processing. It needs to be used with cut speed.
Laser Parameters	
PWM Frequency	PWM frequency used by laser in manual mode
Default Current	Peak current used by laser in manual mode
Default Pressure	Air pressure used in manual mode
Gas Delay	Delay time used in step “Delay for Gas On” of PLC during punching
Initial gas delay	Additional delay time on the basis of gas delay when puff after

	processing
Switch gas delay	During replacing the gas, Delay time that is used to discharge all existed gas and enter new gas .
Cooling point delay	Puff time during cooling.
Follower Parameters	
Maximum follow height	Each type of cutting head has a upper limit height to follow. When you need to follow the height above this maximum height due to demand, such as piercing, the height controller will follow through two steps, that is, firstly follow to the position near the plate surface, and then lift up. This parameter is used to set the height of the upper limit for following.
Using frog style Lift	After Z-coordinate lifts to the specified height, X-coordinate and Y-coordinate begin move, so as to shorten the time of move.
Enable follow in dry cut	The default Z-axis can't move in the default case of "dry cut". If users want to follow during "dry cut", the user can select this option.
Disable follow	Following and cutting is needed during normal processing. If you do not need to follow during the processing, you can select this option.
No alarm during piercing	Under the environment, such as cutting thick plates, large quantities of spark generated during piercing could cause alarm of height controller, thereby interrupting the process. If you select this option, you can ignore the alarm of capacitance class generated by height controller during piercing. Of course, ignoring the alarm will also bring some risks.
Unlift when move distance less than	If you select "Short Move unlift", when move length is less than this length, the height controller will not lift during moving and keep following.

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

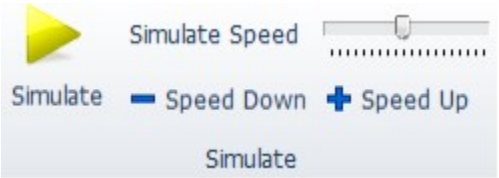
5.4.6 NC auxiliary function

5.4.6.1 Analog Processing

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

Click " 

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

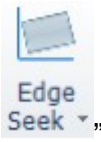


5.4.6.2 Edge seek

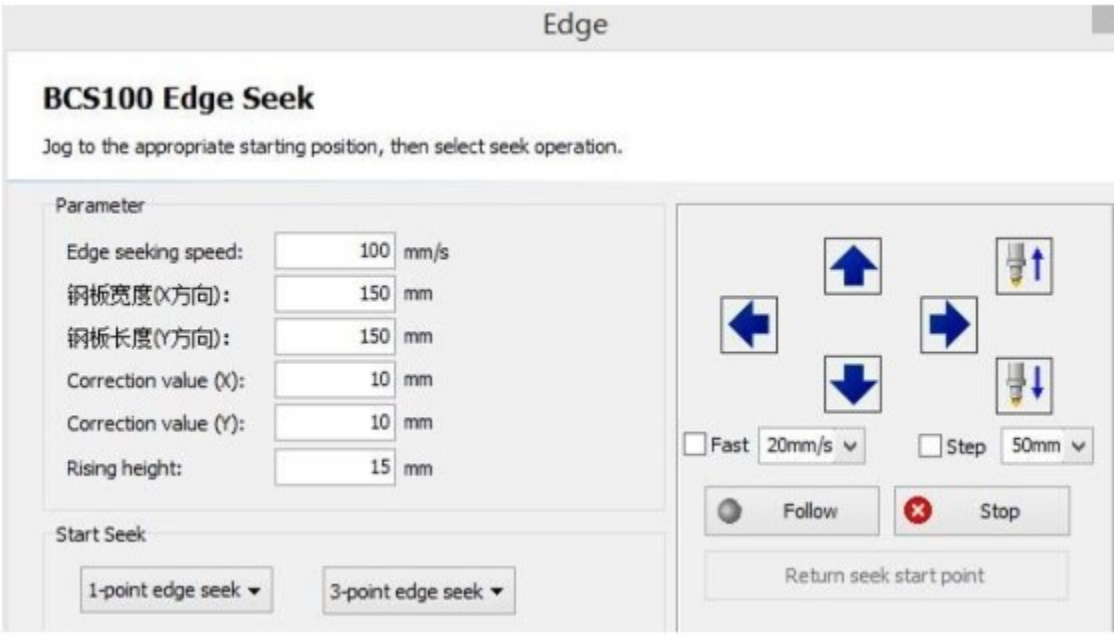
CypCut software supports “BCS100 edge seek”, “Infared edge seek” and “Manually edge seeking”. By clicking "Edge seek" drop-down triangle button, you can choose the most appropriate way to seek edge, in order to determine the placement of the plate. Seek results will be displayed in the top

right of the drawing area, as shown below:

A.BCS100 edge seek

By clicking “ 

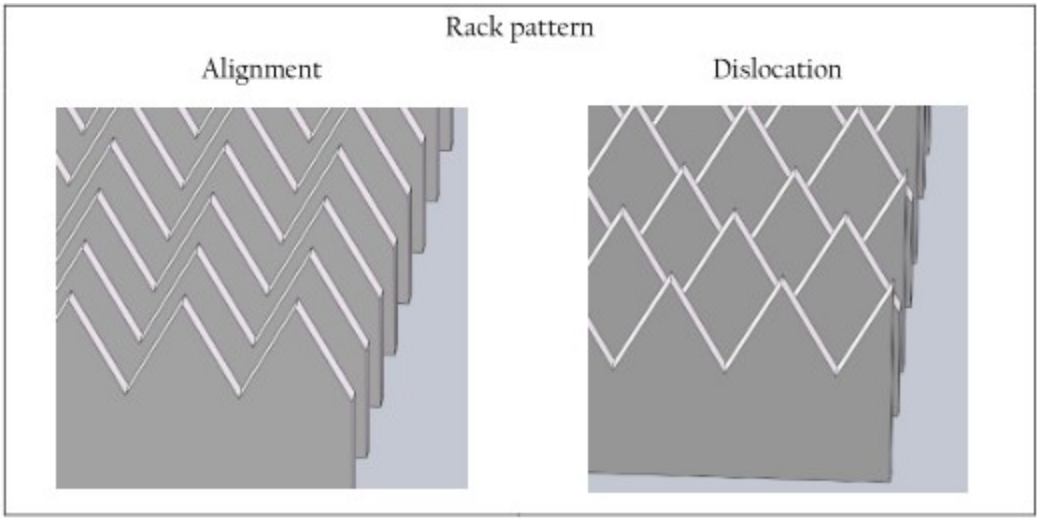
” button under the "CNC" page or clicking "BCS100 edge seek", you can enter the edge interface.



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

After unlocking advanced parameters, you can set the following parameters.

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



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

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

Note: Please return origin to correct the machine coordinate system and confirm cutting head can properly follow before you operate

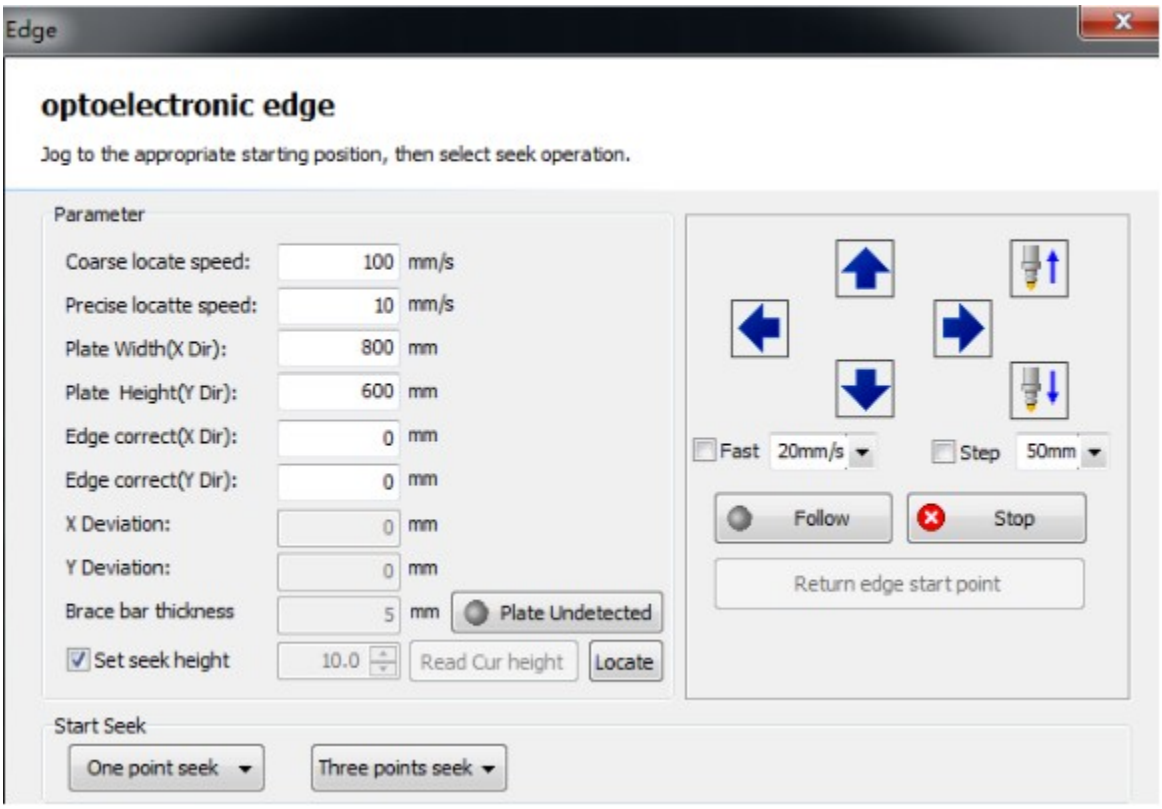
edge seeking. The inclination angle of steel should not exceed 10 degrees.

Other settings and instructions of “BCS100 edge seek” refer to Appendix.

B.Infared Edge seeking

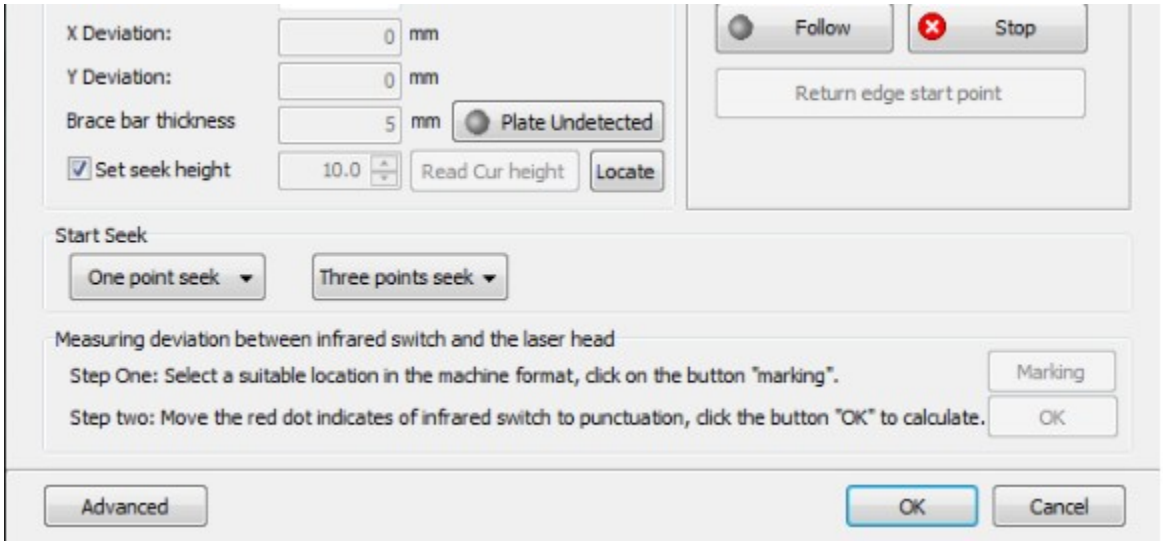
At present, the software uses “Infared Edge seeking” function required matching with OmronE3Z-L61 model switch.

Before the first edge seek, the offset value of the photoelectric switch and laser Center should be determined and set in advanced parameters. Before the actual edge seek, please make sure to move the cutting head to the nearby stopping point (among upper left, lower left, upper right, lower right) as the starting position of edge seek.



“Infared Edge seeking” needs to set some parameters. Coarse positioning speed is the speed of coarse positioning during edge seek, and recommended value is 100mm/s. Fine positioning speed is the speed of fine positioning during edge seek, which will affect the accuracy of edge seek, recommending setting value as 10mm / s without exceeding 30mm / s. The smaller the fine positioning speed is, the longer the time of edge seek is and the higher positioning accuracy is. Plate size and correction value is similar to "BCS100 edge seek".

The deviation between the photoelectric switch and the laser head can be corrected by setting advanced parameters and filtering rack interference.



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

Note: Plate tilt angle should not exceed 40 degrees.

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

5.4.6.3 PLC process

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

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

5.4.6.4 Go origin

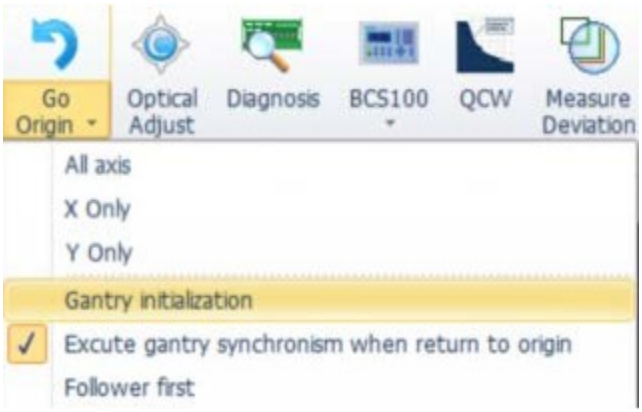
A.Return to origin

You can click the " 

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

B.Gantry synchronism

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



Click the drop-down triangle of "Go origin" on the "CNC" Page and select "Gantry initialization", as shown on the right:

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

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

Specific steps and precautions, please, refer to Appendix.

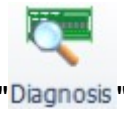
5.4.6.5 Optical adjustment

During the specific processing, if you need to locate the cutting head to a specific point, you can

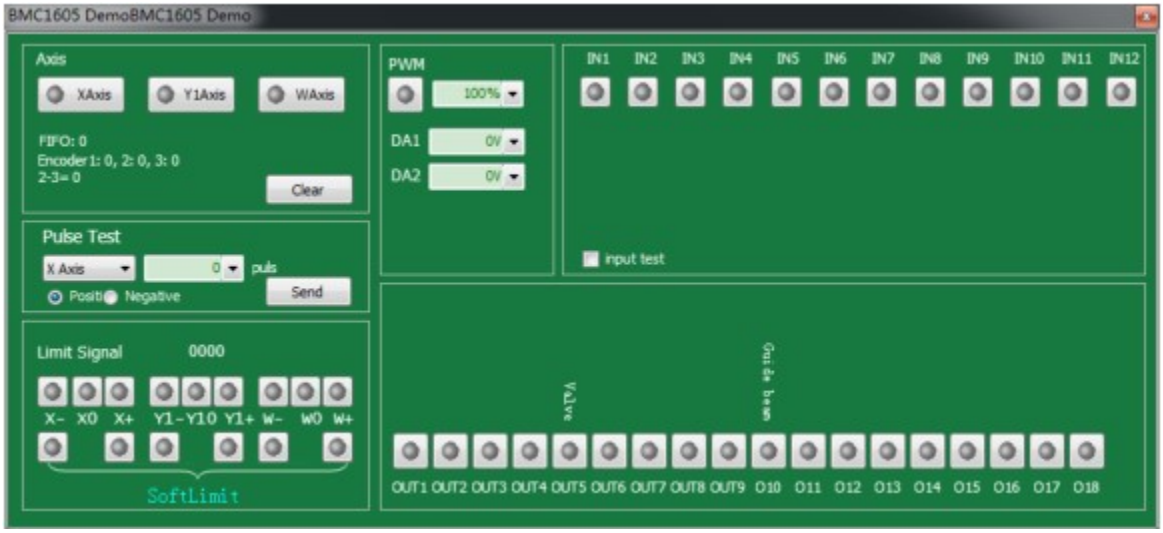
click " " button, and input a specific coordinate you want to locate, as shown at right.

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

5.4.6.6 Diagnosis

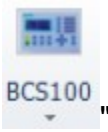
During processing, click the " 

" button, you can observe the state information of each cutting part, in order to determine whether there is a problem in the process.



Motion axis shows each axis signal and the corresponding encoder feedback value; Pulse test is used to send fixed pulse to single axis, in order to test the accuracy of pulse equivalent; Limit signal is used for displaying whether the cutting head is hit limit; PWM is used to show the situation of laser switch; The valid situation of 12 inputs and 18 outputs are also shown.

5.4.6.7 BCS100

This function must be used compatible with our height controller BCS100. By clicking " 

", you can operate a series of actions in the software, such as Return to origin, Follow to, Absolute positioning and one key calibration, to control BCS100. And you can also operate via BCS100 monitoring interface without operating on the entity, which is more convenient and quick.

5.4.6.8 QCW

QCW is a mode of laser operation. CW and QCW is two modes d of laser. CW is continuous light, and QCW is pulse laser. By clicking " 

" button, you can set the appropriate optical parameters.

5.4.6.9 Deviation measurement

When click " 

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

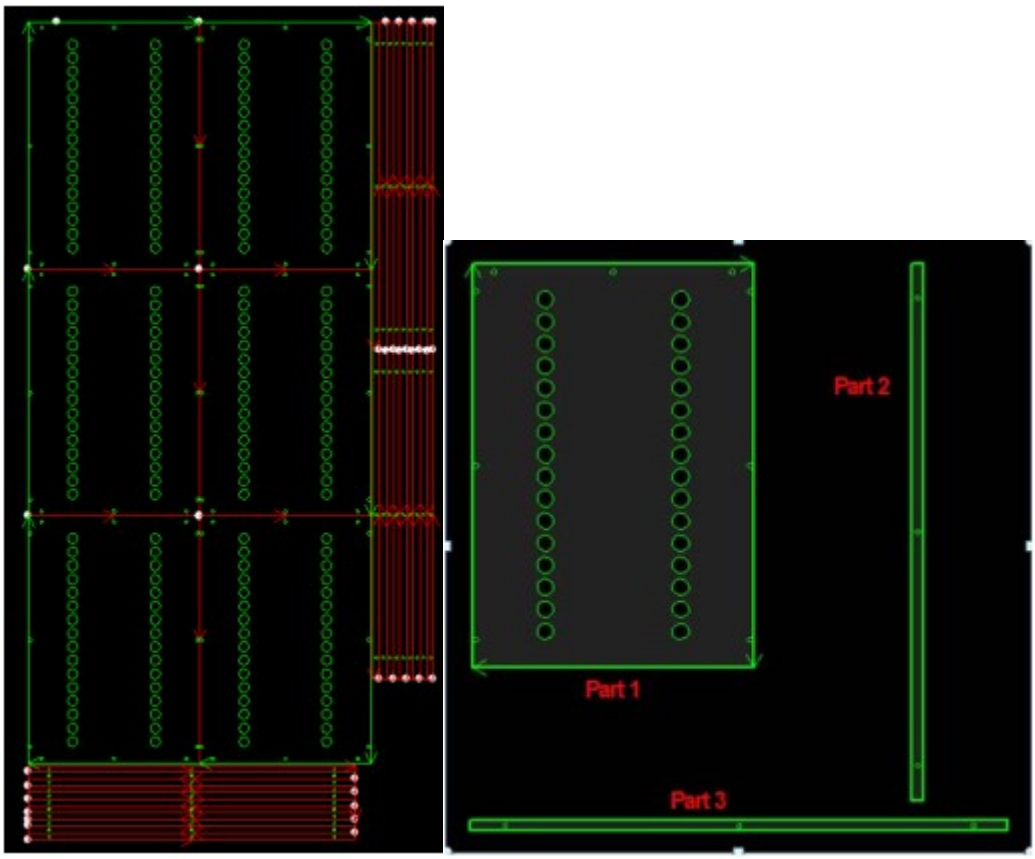
5.4.7 Appendix

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

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

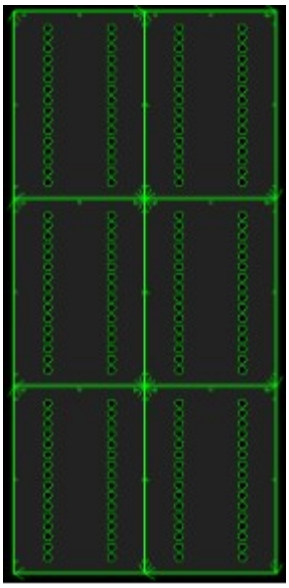
It can be seen from the figure that the original drawing consists of 10 narrow parts below 6 large parts and narrow workpieces (9x2=18) at right, exactly occupying the space a steel plate.

We now first draw 3 parts in the original drawing, and generally the 3 parts are all from the DXF drawings of customer. As shown below:



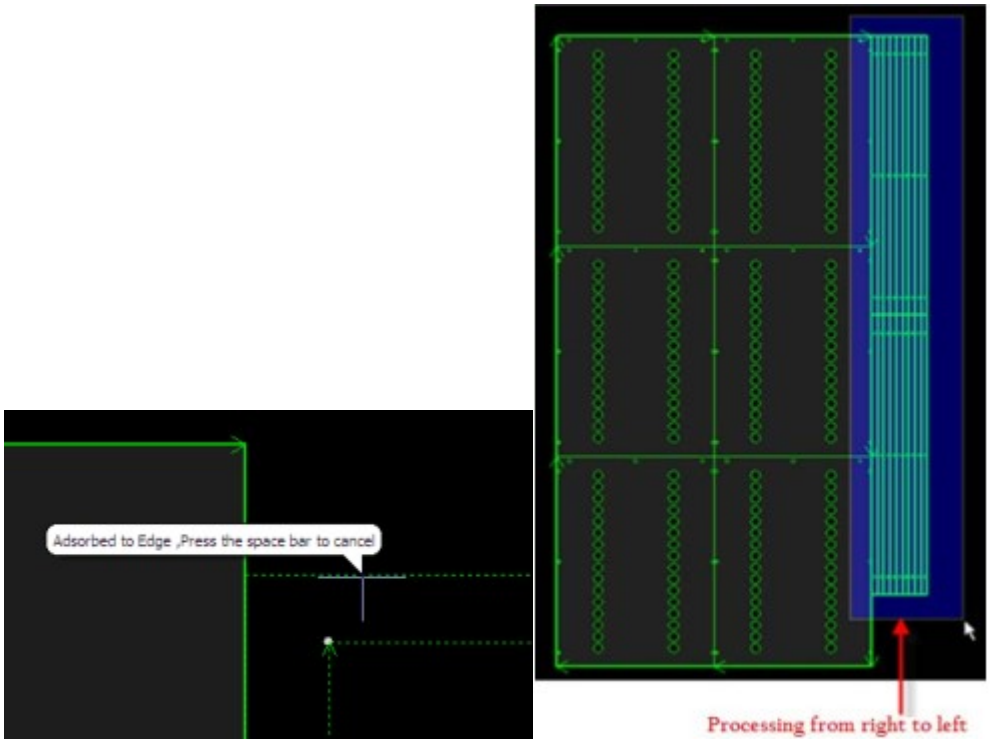
Step 1: First select all graphics of each part, respectively implement “Group”. After grouping, the outer contours of parts will be shown in bold.

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



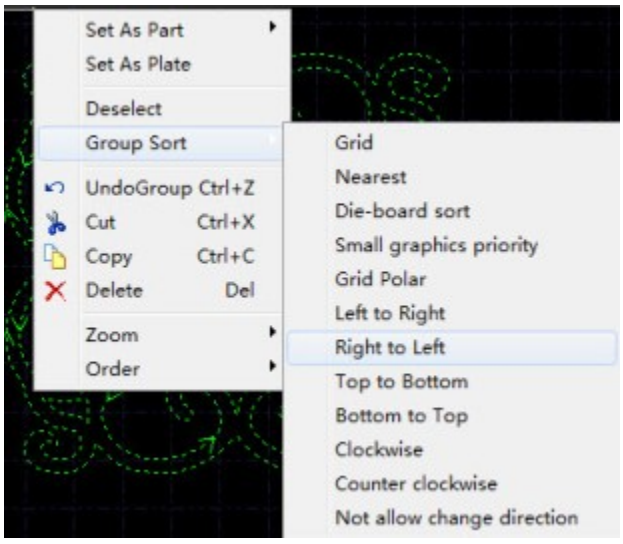
Select the 6 arrayed parts, and complete coedge for the above 6 parts by clicking “Coedge”.

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



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

As shown at right, you can select all 18 Part 2 by pulling out a pale blue box from the upper left corner of Part 2 to the lower right corner, while Part 1 will not be selected.



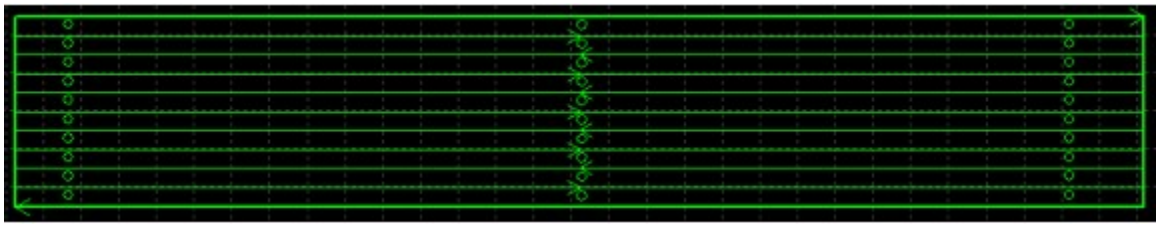
You can complete the coedge of 18 Part 2 by clicking “Coedge”. Please note that the processing order of Part 2 must be from right to left, or steel plates will jitter or even deviate due to the lack of support.

Select coedge Part 2, click the right mouse button, and then select the right-to-left sorting from the

pop-up menu. As shown below: Attentive user may ask why the coedge needs to be conducted after dragging Part 2 to the boundary of Part1. They think that it is difficult to conduct selection.

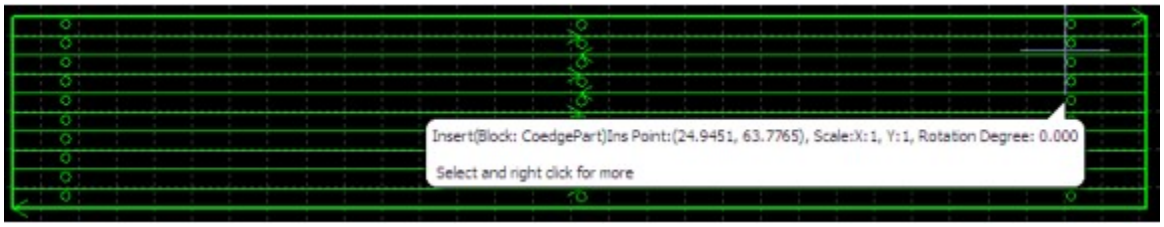
In fact, the order can be exchanged. Here we first conduct coedge for Part 3 and then drag it to the position below Part 1.

Select Part 3, make an array with 10 rows and 1 column, and then get the following figure.



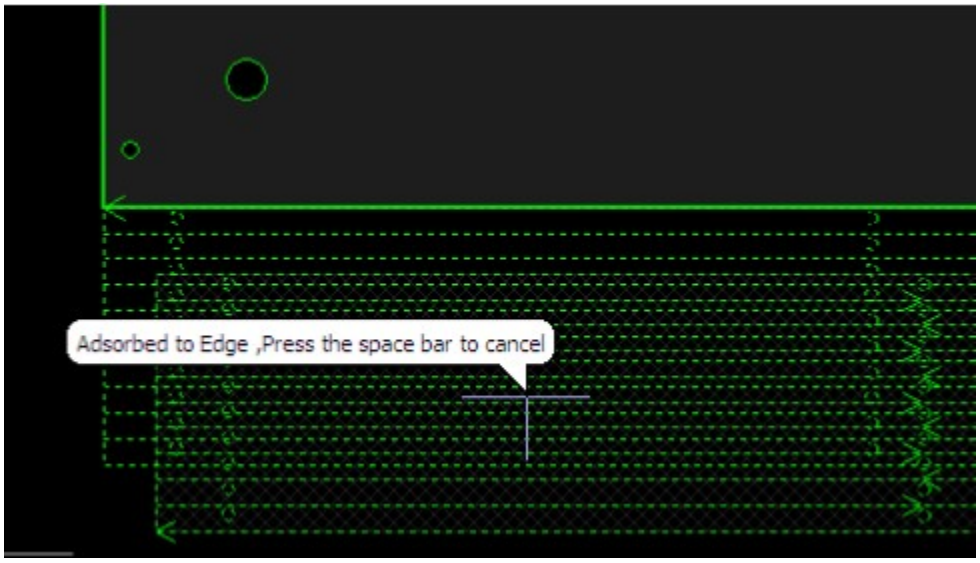
After selecting 10 Part 3 and clicking “Coedge”, the coedge of Part 3 is completed and they become a whole. As shown below. Please note that the thickness of the lines is different. Each Part 3 has a bold outline border before coedge, the whole has a bold outline border after coedge, and the coedged line segments in it are all shown in thin lines.

When the mouse is suspending above Part 3, corresponding prompt will be displayed, showing that it is a combination.



Similarly, we need to conduct a sorting for Part 3 from bottom to top, so as to prevent the steel plates from jittering and deviating due to the lack of support.

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



Next, select all the graphics to coedge all Part 1, Part 2 and Part 3.

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

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

5.4.8 Shortcut Key

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

Shortcut key	Effect	Service conditions
Ctrl + A	Select all the graphics	None
Ctrl + C	Copy graphics to clipboard	Select graphics to be operated
Ctrl + Shift + C	Specify “Base Point” and copy command	Select graphics to be operated
Ctrl + O	Open the file	None
Ctrl + P	Show/hide the graphic direction and lost motion track	None
Ctrl + V	Paste graphic in the clipboard to	There are copied graphics

Shortcut key	Effect	Service conditions
	the drawing board	in the clipboard
Ctrl + W	Adapt to window	None
Ctrl + X	Cut the graphics to Windows clipboard	Select graphics to be operated
Ctrl + Y	Redo the cancelled orders	There are cancelled commands
Ctrl + Z	Cancel the orders just finished	There are finished commands
F3	Check all of the graphics	None
F4	Check the whole machine range	None
F5	Check the graphics in the zone of selection	Select graphics to be operated
F6	Open the dialogue box “Layer Parameter Settings”	None
F7	Show/hide the processing path	None
F8	Show/hide the motion path	None
DEL (Delete)	Delete the selected graphics	Select graphics to be operated
SPACE (Space)	Repeat the last command	Last command can be repeated

5.5 WKB Wireless Keyboard

KEY	Introduction
Start	Start work
Pause	Pause work
Trace	Machine to go around the upcoming processing graphics
Stop	Stop work
Gas	Open and close gas
Follow	Control laser head follow the board
Shutter	Control laser shutter open
Laser	Control laser paunch
Back	Trace back along the working route
Edge seek	Use to seek the edge of the board before cut
Zero	Go back to the origin
Foward	Trace foward along the working route

Box	Control the machine to go around the outer frame of the upcoming processing graphics
	W axis move at anticlockwise
	W axis move at clockwise
	Laser head move up
	Laser hand move down
	Move foward
	Move left
	Move right
	Move back
Fast	Move fast,use with move key
Step	Move step by step,use with move key

6 Maintenance and trouble shooting

6.1 Overview

In order to ensure the normal use of G series laser cutting machine, we must carry on the daily maintenance and maintenance of the equipment.The whole machine due to the combination of high precision components, during routine maintenance must be careful, strictly in accordance with the operating rules and by hand for maintenance, not barbaric operation, so as to avoid damage to components.

In principle, the user should be standing on spare parts:

a)acetone： Purity 99.5%, water less than 0.3%, capacity 500ml a bottle.

b)Absorbent cotton: 5 packs.

c)Alcohol: 500ml, more than 99.5% purity.

d)Lens paper: 5.

e)Inflatable ball: 1.

f)Dropper needle: 1(medical).

g)Cotton stick: 2 bags.

h)Million with a table: 1.

6.2 Daily maintenance and repair.

a)Daily before the boot, carefully check the laser, water chiller, water and pipes have no leakage.

b)Check whether the laser ready state button is damaged (check the indicator light), the machine tool emergency stop button is normal.

c)Check the X axis, Y axis, Z axis of the limit switch and the installation of the screw bolt is loose, the axis of the limit switch is sensitive.

d)Check whether the switch table is sensitive (configuration switch table).

e)After a long time, check the lens of the focus lens and protect the lens with no damage

f)After the completion of the work,clean up the cutting waste inatimely , clean the work site, keep the work site neat and clean.At the same time do cleaning work of the machine, to ensure that all parts

are clean and dirty, the machine can not put debris.

g)When the daily work is completed, open the drain valve at the bottom of the air compressor cylinder to drainage.After the waste water discharged,

close the valve(if use the compressed air)

h)After the completion of the daily work, according to the shutdown steps to shut down, and then turn off the total power supply of the whole machine.

6.2.1 Cold water machine inspection

Cold water unit should be carried out regular maintenance, in order to ensure that the machine is in good condition.If you are in trouble, you should ask professional technical personnel to carry out maintenance.

The daily maintenance of chiller should pay attention to the following aspects:

a Regular cleaning and heat sink, cleaning method: brush to the heat sink carefully brushed, then use compressed air to blow.

b Regular cleaning of the condenser.

c Regularly check the water level in the water tank of the cold water unit, if the water level is too low, the water should be added in a timely manner.

d Regularly check the terminal of the electrical equipment, and dust.

e Regularly check the water system in the joint water leakage, the pipeline is aging, if there is leakage phenomenon should be timely replacement of the relevant components.

f Regularly check water chiller water tank of water, if cooling water quality variable, turbidity, a decline of transparency, to timely modification of cooling water drain off, the replacement of the new cooling water.

g Clean the filter elements on a regular filter impurities, if the filter is damaged, should be replaced in a timely manner, the filter must be replaced by the manufacturers requirements of the standard filter.

6.2.2 Optical system inspection and cleaning

A. Matters needing attention

1)Optical lens (protective mirror, focusing mirror, etc.) surface, do not touch the hand directly, so that it is easy to cause the mirror.If there is grease or dust on the mirror, it will seriously affect the use of lenses, should be timely to clean the lens.

2)Optical lens is strictly prohibited the use of water, detergent and other cleaning. The surface of the lens is coated with a special film, and the surface of the lens can be damaged if the lens is used for cleaning the lens.

3)Do not place the lens in a dark, damp place, so that the surface of the lens will be aged.

4)Lens surface must be clean, such as stained with dust, dirt, or water vapor, easy to absorb laser damage to the lens coating; light affects the quality of the laser beam, the weight is no laser beam generated.

5)When the lens is damaged, please replace the lens in a timely manner.

6)Do not use too much pressure when installing or replacing a protective mirror or focusing mirror, otherwise it will cause distortion of the lens, thus affecting the quality of the beam.

B. The method of install or replace optical lens:

1) wear clean clothes, clean your hands with soap or detergent, do not touch surfaces of lens; when taking lens from the side , do not touch the lens coating surface.

2) Do not blow the lens when assembling, place lens on special paper;do not fall and do not make any force on the coated surface of the lens; mirror holder should be clean, clean the lens holder with gas gun, put the lens in the lens holder gently.

3) Do not use much force when lens is mounted to the lens holder,or lens will be distortion, affecting the quality of the beam.

4)Precautions of replace the optical lenses :

Be careful when removing the lens to prevent bumps lenses; do not exert any pressure on the lens; wear clean gloves when take the lens from the box; prevent dust and other things fall on the lens; When get the lens, using a spray gun to remove dust, put it on the optical lens special paper; when assembling ,remove dust and keep clean;do not use excessive force,not to deform the lens; after assembly, remove dust of lens.

C.Step of cleaning the lens

1) Clean the lens with lens paper:Blow off the dust from the lens surface; clean the surface of the lens with alcohol or lens paper, lens paper should be flat on the surface , use 2 to 3 drops of high purity alcohol or acetone,horizontally withdraw the paper ,operate several times, until the mirror is clean; if the mirror is dirty, the paper can be folded 2 to 3 times, repeat the above steps until the mirror clean. Do not use dry lens paper to drag the mirror.

2) Clean the lens with cotton swab: first,blow off the dust of the mirror with gas gun ; then clean with a cotton swab ; with the new high-purity alcohol or acetone moistened swab ,wipe the lens along a circular motion from the center of the lens; repeat the operation until the lens is clean; clean the lens with a clean cloth to remove scars on the mirror; not to scratch the mirror;observe the lens in the good light place, if the reflection of the lens is good, it is clean;if not,continue to clean the lens; When lens has good cleaning, according to the method described above, placed the mirror to the holder. Do not use used cotton to clean lens.

D.Optical lens storage

1) If optical lenses properly stored, the quality can keep good ..

2) Storage Temperature is 10 ~ 30 degree, the lens can not be placed in the freezer compartment or similar environment, or it wil frost, easy to damage lenses; temperature storage can not be greater than 30 degree, otherwise it will affect the coated surface of the lens.

3) The lens is saved in the box, do not vibrate,or cause deformation of the lens, affecting the performance of the lens.

6.2.3 Electrical Inspection

Mainly check the stability of the supply voltage ,keep the electrical cabinet neat and clean and well ventilated.Check the integrity and safety of the various parts of the line.

6.2.4 Laser Device Inspection

Lasers specific maintenance referring to the choice of laser instructions

Annual maintenance lasers

1) Clean up the cooling pipes.

2) Replace the cooling water inside the chiller.

3) Keep clean of the laser device.

6.2.5 Inspection and replacement of cooling water

a. Release hose clamps, unplug the pipes,place the water cooler into a suitable location;

b. Open the chiller drain valve (in chiller bottom), run the water away ;

c. Check inside of the tank ,clean the inner wall of the tank;

d. Shut drain valve, filling pure water in the tank, observe water level gauge, water was added to 85% -95% of the total capacity of the tank;

e. Place chiller,make connection the water tube and check for leaks;

6.2.6 Maintenance cycle

a. Check the laser device,chiller,air compressor according to the instructions.

b. Check the fiber laser machine at first time 24 hours later, repair again after 100 hours,and then six months later to check,then every six months or a year (depending on the client usage) to examine and repair.

6.3 Maintenance of Fiber Laser Cutting Machine

Do daily maintenance before running the fiber laser machine, Stop the machine and check it if there is unusual sounds.When shut down the machine, clean the work table and around of the machine.Do not place unrelated items.

a. Check the oil level of centralized lubrication pump (if insufficient,timely filling oil), and adjustments to the lubrication pump refueling time, guarantee that the X-axis guide, Y-axis guide, Z-axis guide and screw fully applied lubricants, make sure of machine precision and extend X, Y, Z axis guide life; when the machine motion i sound bigger, checking gear rack lubrication, timely filling oil.

b. Clean dust of linear guide and screw on the Z axis once a week.

c. Clean the outlet and furnace filters weekly.

d. Check the cooling water level, if insufficient add it in time.

e. Check the mirror and the focusing mirror, cleaning optical lenses every half month, in order to ensure its service life .

f. Checked filter in the gas line, and remove fluid and debris.

g. Check the cables and the line of distribution cabinet ensure the normal use .

h.After six months , the fiber laser machine need re-adjusted to ensure precision .

6.4 Maintenance of long time no use

If the fiber machine don’t use for long time ,the machine parts should smear butter, wrapped anti-embroidered paper, and for the other part to regularly check , prevent rust and timely move rust (Dust cover can be used), and clean and check the machine regularly.

6.5 The Trouble Analysis and Trouble Removal

6.5.1 The Problem of Follower

Alarm and anomaly analysis

1) Z+/Z- limit enable

When system checked Z+/Z- limit input is enabled, the alarm happens. The reason includes:

► Z+/Z- sensor detect something.

► Z+/Z- sensor is broken. Or it is used for long time, there is oil contamination and powder on the surface.

►The parameter of “Limit logic” can be set to normal open or normal close

► The wiring is not correct.

2) Out of Z range

When Z moves large then range, which is a parameter of system, the alarm will be throw out. If it is wrong alarmed, take attention in the range parameter, if the system returned origin, and if the encoder feedback is correct.

3) Z- limit continue enable

When system is returning origin, it moves back when z- sensor is enabled, but can’t quit the z- sensor enable area, the alarm happens. Take attention if the sensor is broken.

4) Servo alarm

When system checked NO. 14 input ALM is enabled, which reflect the servo alarm status, the alarm is shown on the screen. The reason of servo alarm includes:

►The servo alarms.

►The “Servo Type” parameter is not correctly set.

►Wiring is not correct.

►Electrical system disturbs the wire.

5) Encoder moves abnormally

When system keeps in stop status, the encoder feedback value changed, there will be this alarm. The reason lead to the alarm includes:

►The axis vibrates by outside force.

►Wiring wrong, the zero speed signal does no effect.

►Servo rigidity is very low.

►The encoder wire is disturbed. The shield is needed, and should be connect to the ground. Add some wire magnet ring is better.

6) Encoder no response

The system try to move, send out speed command as voltage, but the encoder feedback value does not change at all. The alarm happens. The reason includes:

►Wring error.

►Servo type is wrong. Servo must have speed control mode.

►Servo parameter is not correctly set. It should be switched to speed control mode.

7) Encoder deviation large

When the difference between destination position and feedback position is too large, the alarm happens. It reflects the servo can't follow the speed command correctly. The reason includes:

► Encoder feedback direction is wrong. The relative parameter should be modified.

► Wiring error or disturb make the encoder feedback wrong.

► The mechanic is stuck, the really position can't follow the destination position.

8) Capacity is 0

When system can't check the capacity of the spray, the capacity value is shown as 0 on the screen. The following situation may cause the alarm:

► The spray touched the board below.

►There is water in cutting head.

► The local capacity of the cutting head is large, which is out of the check

range of the preamplifier.

► The preamplifier is broken.

► Connection is not fixed.

► In the internal of cutting head, the positive of capacity (spray) is short circle with the negative of capacity (the shell of machine).

9) Local capacity small

When local capacity changes less, the alarm happens. The reason includes:

►Connection or some part is changed or moved. You can do calibration again.

►Laser shoots on the spray, the temperature gets very high is short time. Man's hands can't stay on the pray.

► Blow leads to the change of distance of positive pole (spray) and negative pole (shell of the machine).

► Connection is not fixed.

►The parameter of calibration range is low can also lead the alarm. In 2D mode 15mm is recommended. And 10mm is recommended in 3D mode.

►One of the reason is the cutting fire and electronic affects the capacity sensor when the board material is stainless steel.

If there is plastic film on the surface of steel, remove the film first. Check if the machine is connect to the ground well. The following height should be large than 0.5 mm. Improve the blowing pressure.

10) Follow deviation large

When system check the H height (the distance between spray and board) changes large in short time in follow state, the alarm happens. The relative parameter is interpreted in Chapter 2.5.5. The alarm reason includes:

►Cut out of the board. There is nothing to follow below.

►Board is vibrating heavily.

11) Sample capacity large

When sampled capacity is larger than the largest capacity in calibration, the alarm happens. The

reason includes:

►The spray touched the board below.

►There is water in cutting head.

►Connection is not fixed.

In the internal of cutting head, the positive of capacity (spray) is short circle with the negative of capacity (the shell of machine).

12) Expiration of time

There is no more time permitted to use this system.

13)The time is over

Setup time is over .

b) Analysis of Common Problems

1) There are significant jitter and mechanical shock following the movement.

►FG amplifier housing or foot controller poor contact with the machine housing.

►The machine casing measured capacitance is negative, when the amplifier housing and the machine housing poor conductivity, the capacitance between the positive and negative impedance is large. Such measuring circuit load will change, result in large measurement error. If can not pass good mechanical connection, add one wire between the amplifier and the machine metal casing to reduce the AC impedance, but this single point of AC impedance connection should be bigger than mechanical connection . Specific targets is achieved DC resistance of less than 10 ohms.

►Speed of progression for the follow movement is set too high

it will lead the movement jitter if speed of Follow movement of the series is set too large,the recommended series of 3 to 7.

►Floating bad calibration

There will be shaking When it is bad between data and smoothness of BCS100 stored in the capacitor . In this case, please re-do the calibration capacitor floating head until stability and smoothness as excellent or good.

► if there is a big disturbance on the site, please reduce "servo gain factor" parameter.

2)When the machine do follow movement ,it often collide board.

►Calibration range is too small or Z-axis speed setting too large.

The smaller calibration range setting ,the smaller of distance movement , at the same time if the Z-axis speed set too high, while follow speed is still not down to 0, then it will overshoot. Larger of Z-axis speed track in place , the greater of the overshoot.So the Z axis is greater than the speed of 100mm / s, the calibration range of recommendations 15mm. While the Z axis is greater than the speed of 250mm / s,

►Servo rigidity is too small

If servo rigidity is too small, it will lead to lag in response of the servo control signal of the controller, resulting in the collision board.Such as Panasonic MINAS A5 series servo recommend rigid set of not less than 13.

►Capacitance Calibration problem

When deviation is larger for BCS100 stored capacitance and the actual measured capacitance , it will has collision when follow the movement .

►No warm-up

Please preheat 2 to 5 minutes waiting amplifier sampling capacitor stable, then operate BCS100 controller.

►Ceramic body nuts are not tightened

If ceramic body did not tighten the lock nut ,it may cause instability in capacitance is detected.

3) Follow height does not match the actual settings height.

►Calibration problem.

►Do not re-calibrated floating capacitance after changing the nozzles, the above phenomenon will happen.

►Laser light scattering to the nozzle, or blowing is not normal and other reasons, resulting in abnormal increase nozzle temperature (above100 ℃), change the cutting head ‘s capacitance.

►If not touch the plate in the intelligent calibration, the actual follow height is higher than the setting height. Turned off the control panel and set again.

4) Elevation height is not normal.

When the fiber laser machine working, the height is lower and lower ,then check the mechanical connection,it is not normal .

5) When you upgrade prompt display"parity error, ARM failed upgrade"

The upgrade file may be infected with the virus.

6.5.2 Fault and Troubleshooting

Trouble	Reason	exclusion methods
No auxiliary gas output	1. Insufficien air pressure; 2. Wrong the gas channel selection 3. The solenoid valve is damage, or no control voltage output.	1.Check the gas line pressure; 2.Check air channels is correct in the process parameters;3.Check the solenoid valve, and associated circuitry;
Abnormal sound for axis running	1. NO lubricating oil of axis motion components ; 2. The moving parts have to interfere with the fixed compensation items;	1. Add the oil;Check running path security of the moving parts running security.
No laser or laser power shortage	1.NC signal is not sent; 2. lens is dirty or damaged; 3. The nozzle is damaged or blocked; 4. The optical path is incorrect 5. The laser alarms	1. Check the connection between CNC laser machine console ; 2. Check the protective lens; 3. Replace the nozzle; 4. Adjust the laser path 5. May water cooling machine temperature is too low, until the temperature reaches the requirement to restart the laser machine.

Cutting is not the same size with graphics and drawings	1. Program input errors; 2.The positioning accuracy influence; 3. The servo motor is damage; 4.The servo drive is damaged	1. Check the program; 2. Detection of precision machine tools; 3. Check the servo motor and servo feed drives if damaged, please replace them
Inductive head alarms	1. Amplifiers cable is loose . 2. The nozzle is loose, or ring loose. 3. System Problems The nozzle is damaged, or has iron slag.	1. Fastening 2. Fastening 3.Recalibration Floating 4. Replace or clean the nozzles
Motor alarms	1.Motor without electricity 2 .Motor alarms	1. Motor energized, disarm the alarm 2. Check servo drive alarm information (see Table 1), to restart the motor power can disarm the alarm. Such as repeated alarm, please contact us.

Equipment Failure Information Trouble Removal

Table 1

If the alarm is detected, the servo amplifier touchscreen will displays alarm code

No.	Display	Name	English	Type
1	oc 1	过电流 1	Overcurrent 1	serious fault 重大故障
	oc2	过电流 2	Overcurrent 2	
2	oS	超速	Overspeed	
3	Hu	过电压	Overvoltage	
4	Et 1	编码器异常 1	Encoder Trouble 1	
	Et2	编码器异常 2	Encoder Trouble 2	
5	ct	控制电路异常	Circuit Trouble	
6	dE	存储器异常	Memory Error	
7	cE	电机组合异常	Motor Combination Error	
8	tH	再生晶体管过热	Breaking Transistor Overheat	
9	Ec	编码器通信异常	Encoder Communication Error	
10	ctE	CONT 重复	CONT (Control signal) Error	
11	oL 1	过载 1	Overload 1	
	oL2	过载 2	Overload 2	
12	LuP	主电路电压不足	Main Power Undervoltage	minor faults 轻微故障
13	rH 1	内部再生电阻过热	Internal Breaking Resistor Overheat	
14	rH2	外部再生电阻过热	External Breaking Resistor Overheat	
15	rH3	再生晶体管异常	Breaking Transistor Error	
16	oF	偏差超出	Deviation Overflow	
17	AH	放大器过热	Amplifier Overheat	
18	EH	编码器过热	Encoder Overheat	
19	dL 1	ABS 数据丢失 1	Absolute Data Lost 1	
	dL2	ABS 数据丢失 2	Absolute Data Lost 2	
	dL3	ABS 数据丢失 3	Absolute Data Lost 3	
20	AF	多旋转溢出	Multi-turn Data Over Flow	
21	iE	初始化错误	Initial Error	

7 transport, shipping and storage

7.1 the packing

G series laser cutting machine laser is packed in wooden cases, small parts are packed in cartons, etc, for the other parts are all in the external packed in polyethylene foam and protective film packages, protected from external objects damaged parts of laser cutting machine.

7.2 Transportation and precautions

a. When the fiber laser machine is in transportation ,it should avoid rain, moisture,tilt,rodents,potholes and other hazards,and ensure good ventilation:temperature in the range of -10 degree ~ + 40 degree, relative humidity is less than 80%. Time is not more than 24 hours of transport and storage, allowing the ambient temperature does not exceed 70 degree. DO not put the outdoor for long time . If there is reasons for storage in the outside , please check the above requirements and ensure the fiber machine is good condition.

b. Do not climb,stand or place heavy objects on the product box,.

c. Do not use the cable connected to the product to drag or carry the product

d. non-collision,scratch panel and display.

e. Products avoid damp,exposure and rain.

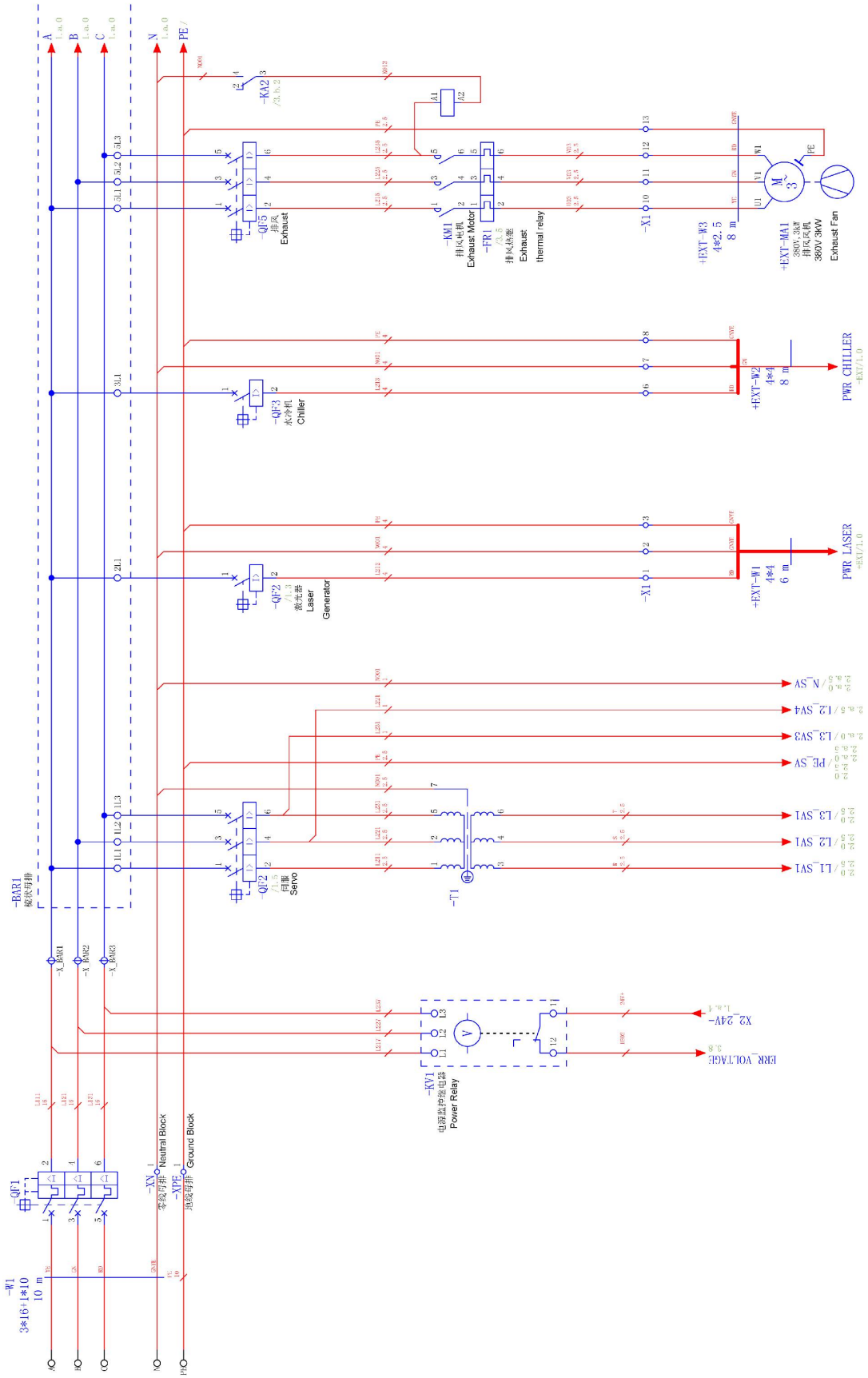
f. Pay attention when lifting the fiber machine, make sure non-collision. When lifting rope is not scratching the machine, if not avoided, it must be isolated with soft objects.

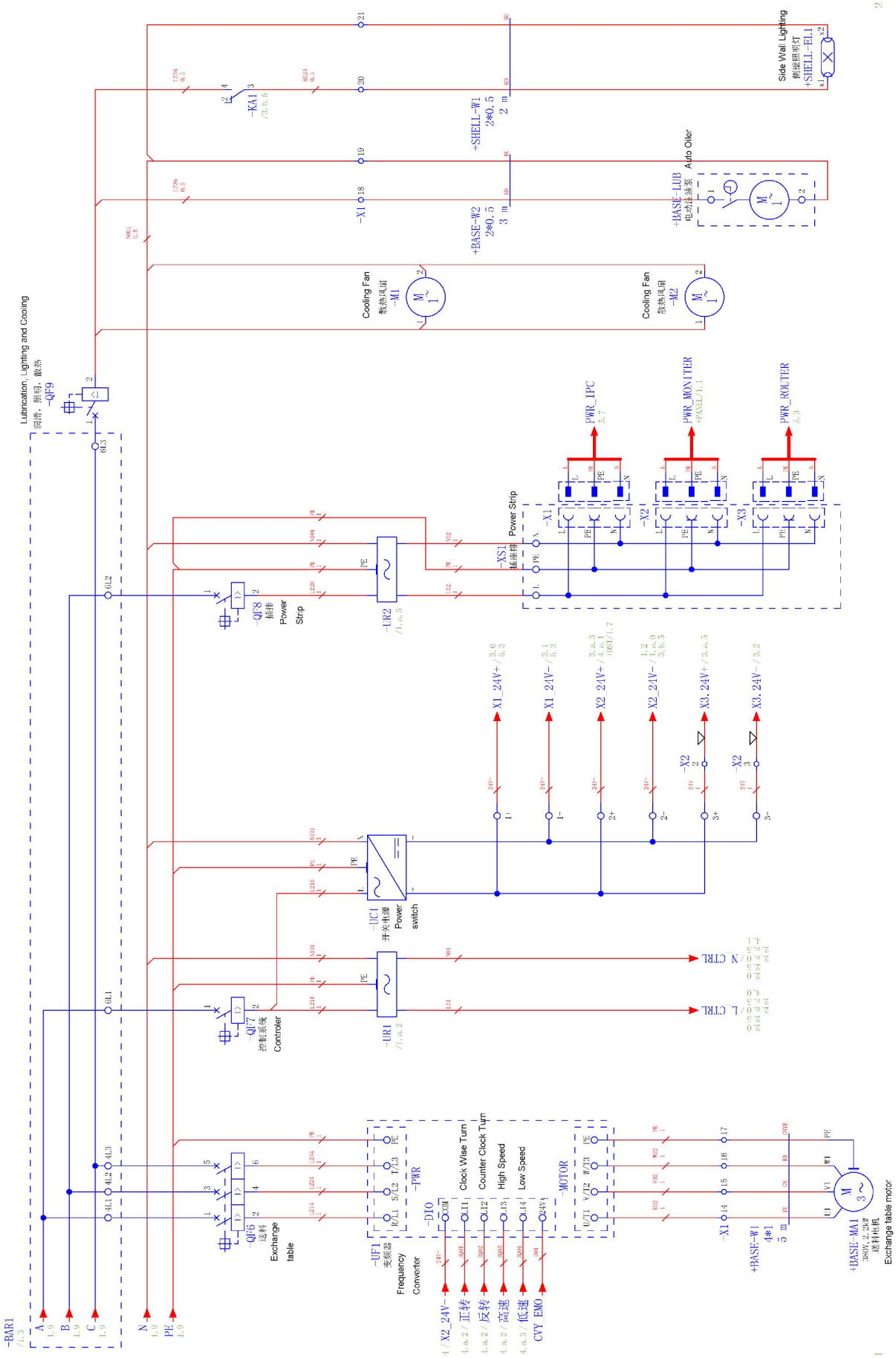
Appendix A Technical Specification

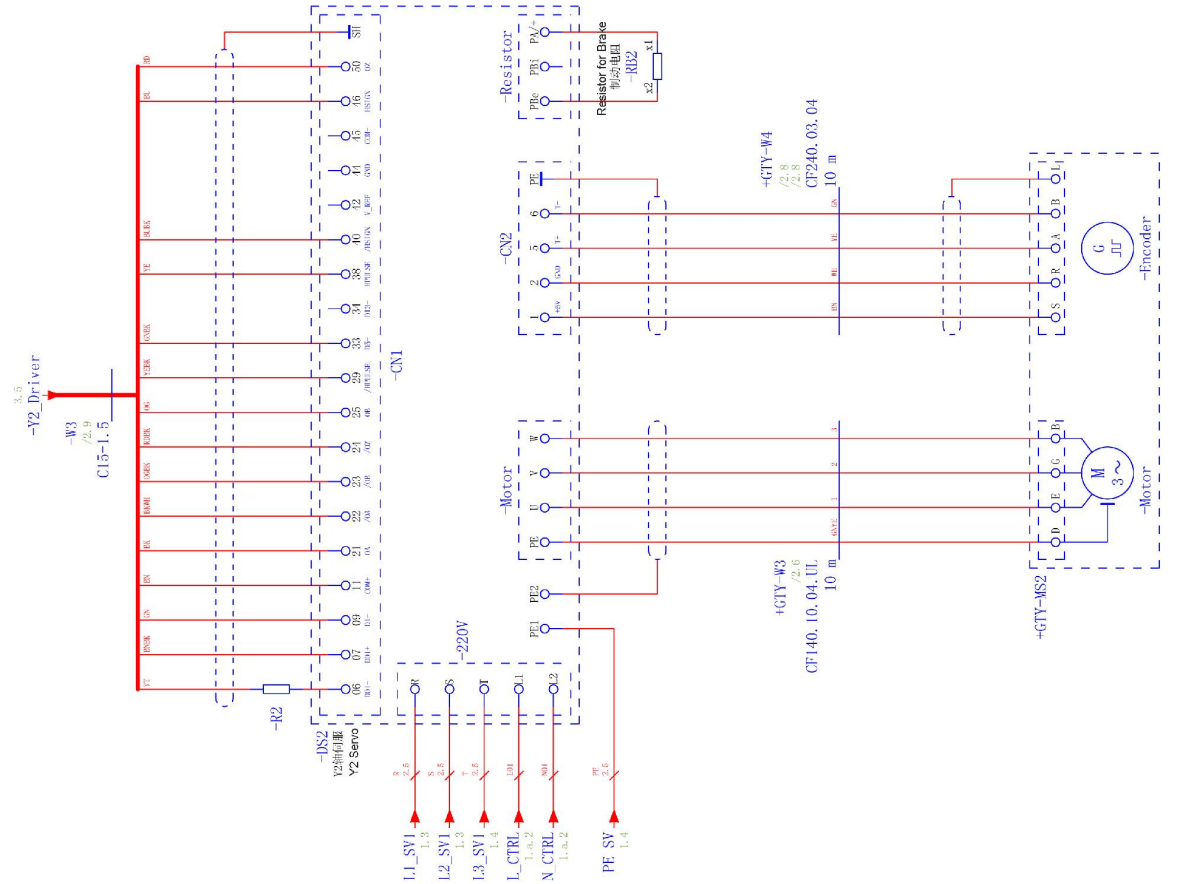
The main technical indicators of G series machine

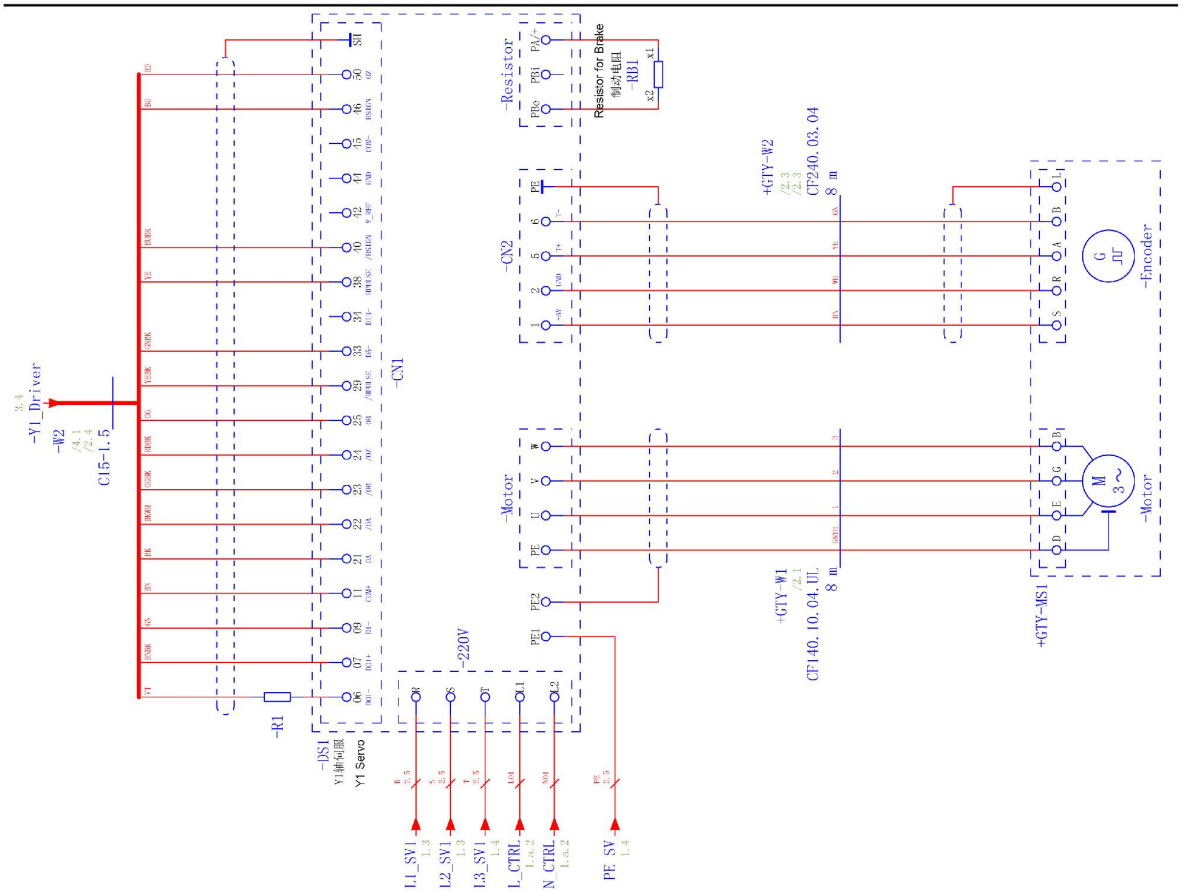
Working area	3000mm×1500mm(2500×1300)
Travel X-axis	3000mm(2500mm)
Travel Y-axis	1500mm(1300mm)
Travel Z-axis	120mm
X, Y axis positioning accuracy:	±0.03/1000mm
X, Y Axis repeat positioning accuracy:	±0.02/1000mm
Max running speed	80000mm/min
Control system	Cypcut
Worktable Maximum load	800kg
Machine weight	4 tons
Dimension	4500mm×2600mm×1800mm
Switchboard power:	12 KVA (500 w with laser machine)
Power transmit	three-phase power
Power supply Rated voltage:	380V
Frequency	50Hz
Total power protection rating:	IP54

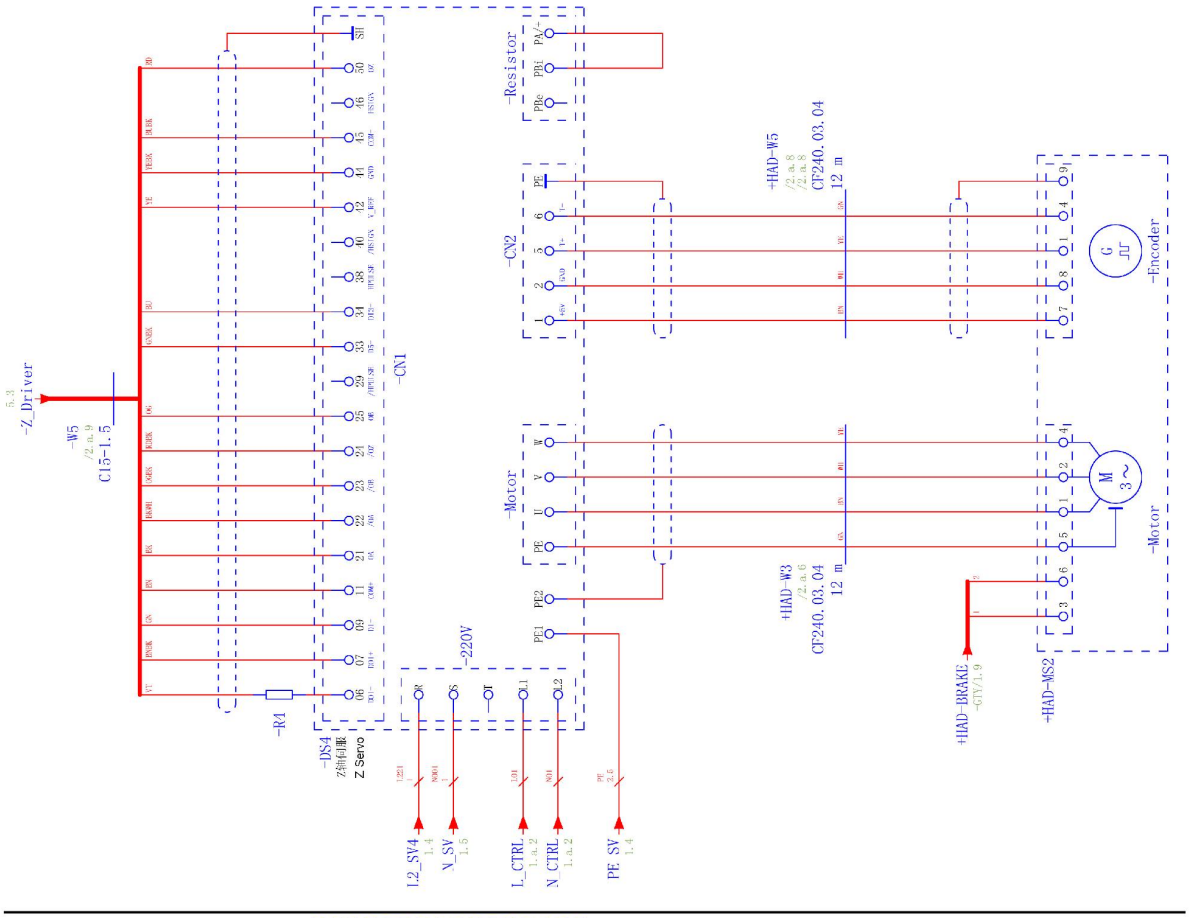
Appendix B Schematic Drawing

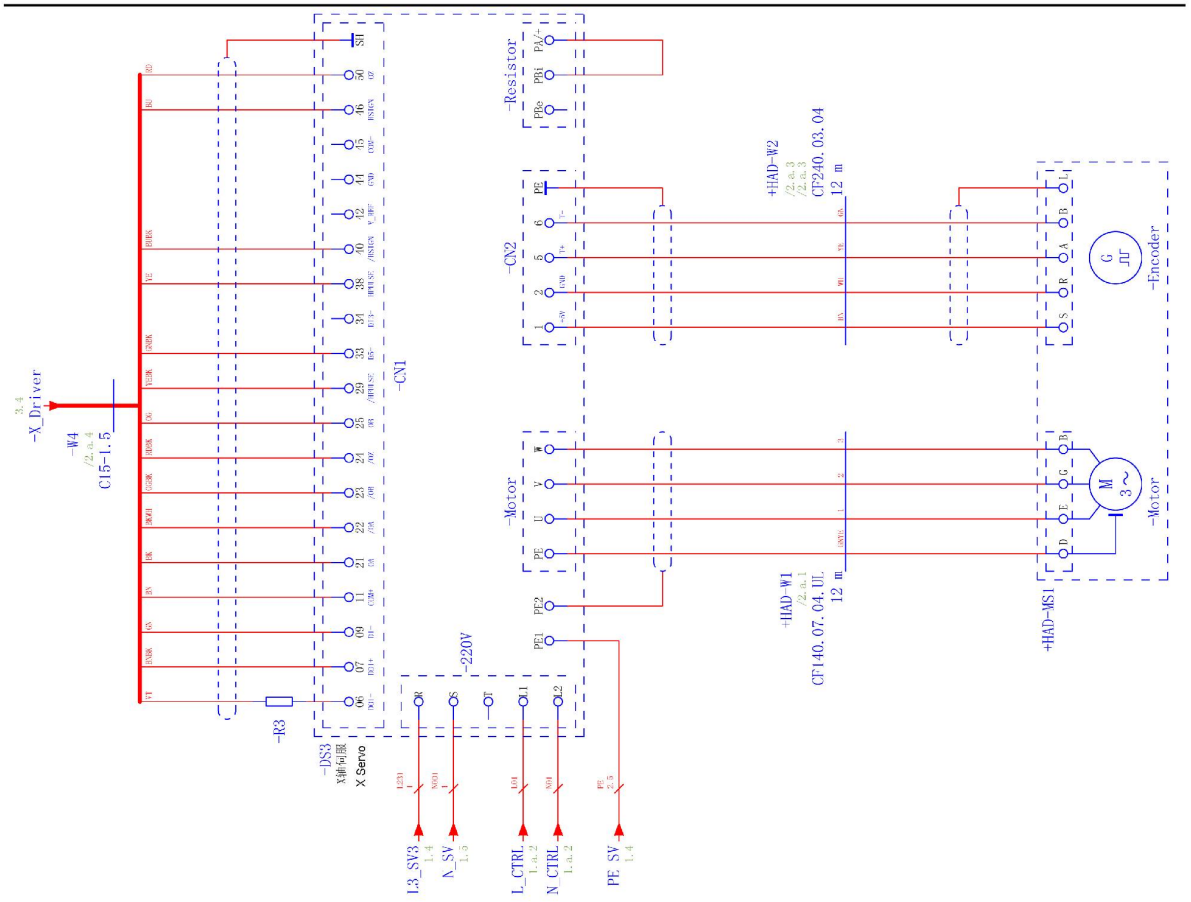



Lubrication, Lighting and Cooling
润滑，照明，散热
-QF9
Side Wall Lighting
侧旁照明灯
+SHELL-EL1
+SHELL-W1
2*0.5
2 m
-KA1
+BASE-W2
2*0.5
3 m
Auto Oiler
+BASE-LUB
电动注油泵
Cooling Fan
散热风扇
-M1
Cooling Fan
散热风扇
-M2
PWR_IPC
PWR_MONITER
PWR_ROUTER
Power Strip
-XS1
插座排
-X1
-X2
-X3
-QF8
插排
Power Strip
-UR2
-QF7
控制系统
Controler
-UR1
-UC1
开关电源
Power switch
X1_24V+/-
X1_24V-/-
X2_24V+/-
X2_24V-/-
X3_24V+/-
X3_24V-/-
N CTRL
L CTRL
-QF6
送料
Exchange table
-UF1
变频器
Frequency Converter
-DIO
-PWR
-MOTOR
Clock Wise Turn
Counter Clock Turn
High Speed
Low Speed
CVT EMO
+BASE-W1
4*1
5 m
+BASE-MA1
380V, 2.2kW
送料电机
Exchange table motor
-BAR1
A
B
C
N
PE
X2_24V-
正转
反转
高速
低速


-Y2_Driver
-W3
C15-1.5
-CN1
-DS2
Y2 Servo
-R2
-Resistor
Resistor for Brake
制动电阻
-RB2
-CN2
-Motor
-Encoder
-GTY-MS2
+GTY-W4
CF240.03.04
10 m
+GTY-W3
CF140.10.04.UL
10 m
-220V
L1_SV1
L2_SV1
L3_SV1
L_CTRL
N_CTRL
PE SV


-Y1_Driver
-W2
C15-1.5
-CN1
-DS1
Y1 Servo
-R1
-Resistor
Resistor for Brake
制动电阻
-RB1
-CN2
-Motor
-Encoder
-GTY-MS1
+GTY-W2
CF240.03.04
8 m
+GTY-W1
CF140.10.04.UL
8 m
-220V
L1_SV1
L2_SV1
L3_SV1
L_CTRL
N_CTRL
PE SV


-Z_Driver
-W5
C15-1.5
-CN1
-R4
-DS4
Z轴伺服
Z Servo
-CN2
-Resistor
-Motor
-Encoder
-HAD-W5
CF240.03.04
12 m
-HAD-W3
CF240.03.04
12 m
-HAD-BRAKE
-HAD-MS2
-220V
L2_SV4
N_SV
L_CTRL
N_CTRL
PE_SV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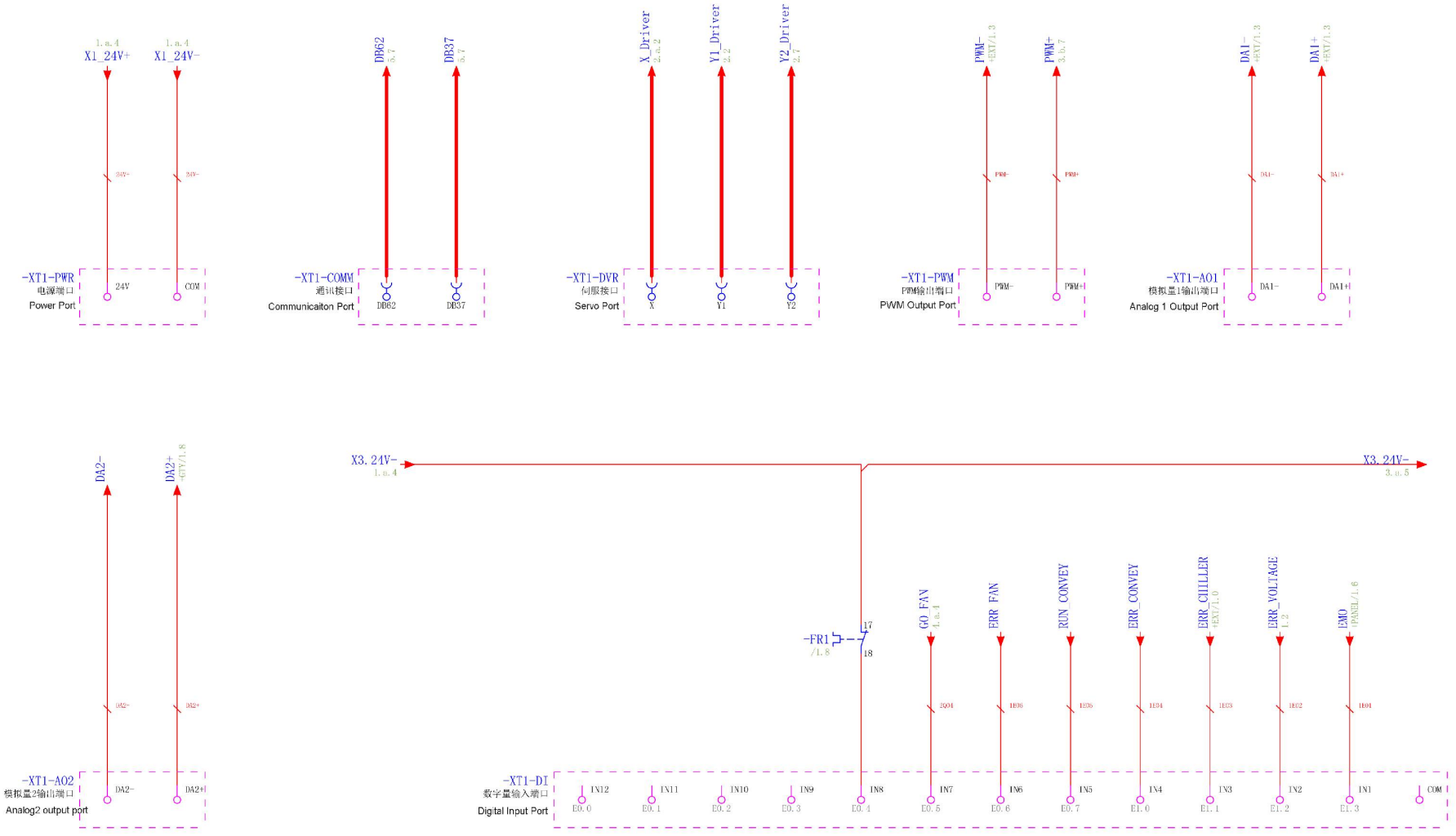
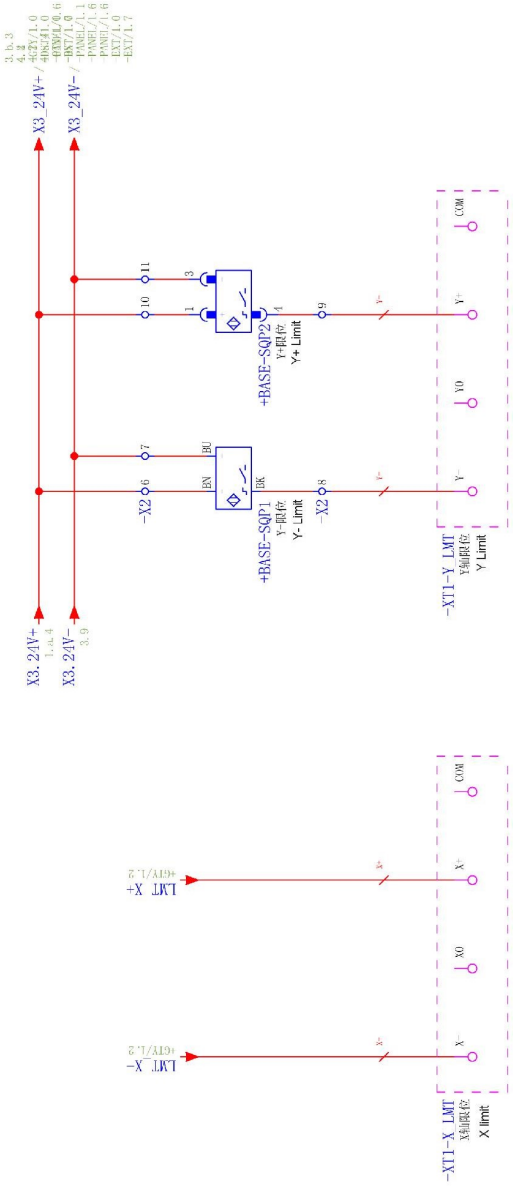
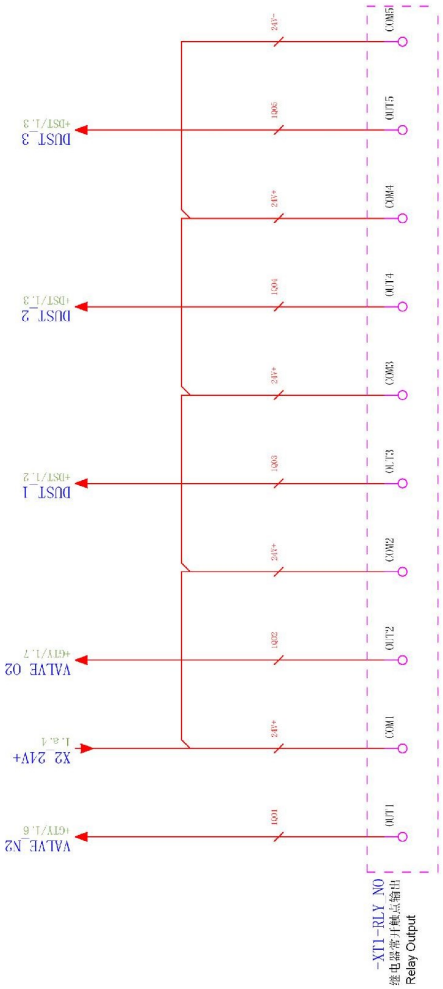
-W4
C15-1.5
-CN1
-R3
-DS3
X轴伺服
X Servo
-CN2
-Resistor
-Motor
-Encoder
-HAD-W2
CF240.03.04
12 m
-HAD-W1
CF140.07.04.UL
12 m
-HAD-MS1
-220V
L3_SV3
N_SV
L_CTRL
N_CTRL
PE_SV

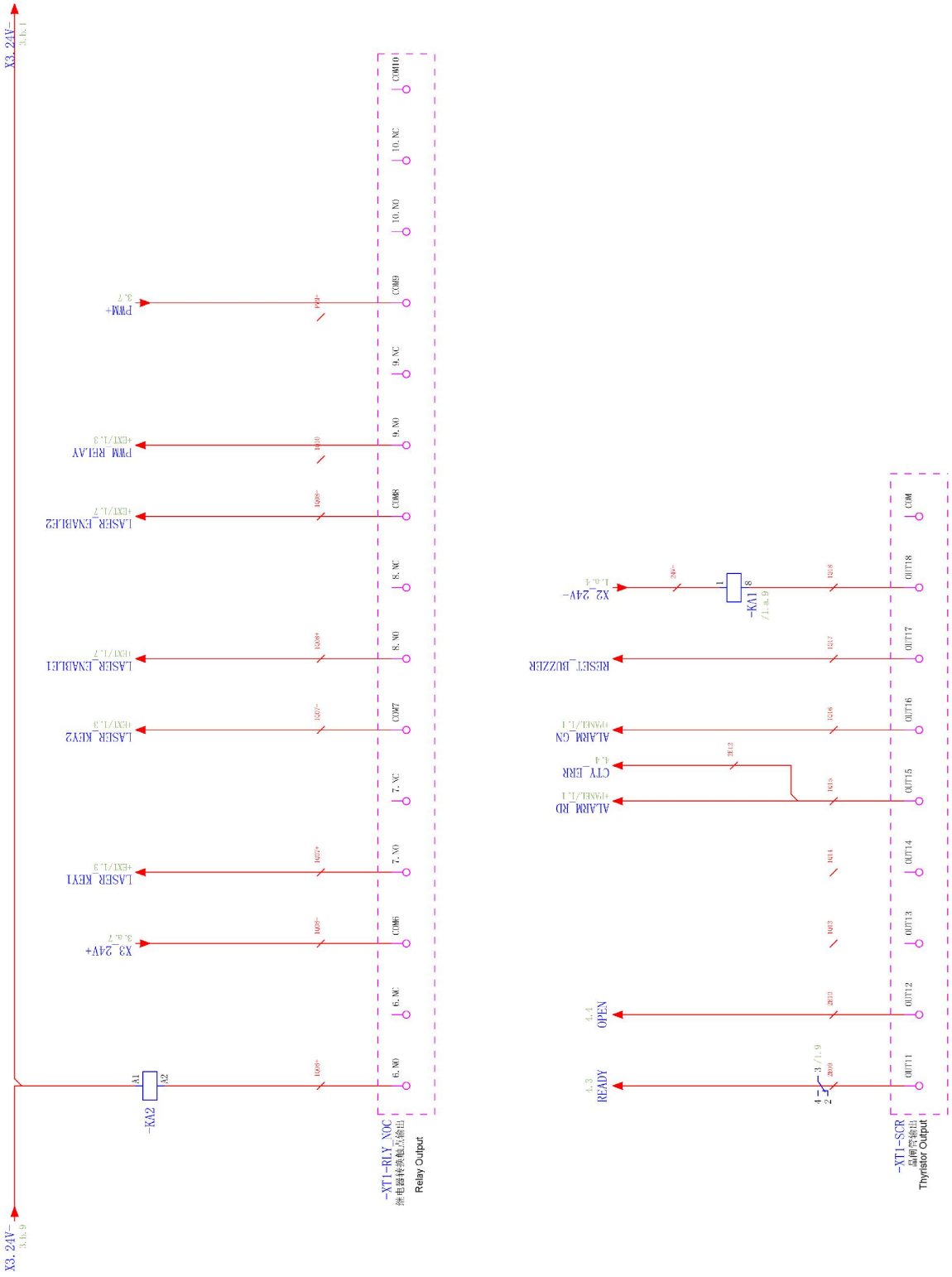


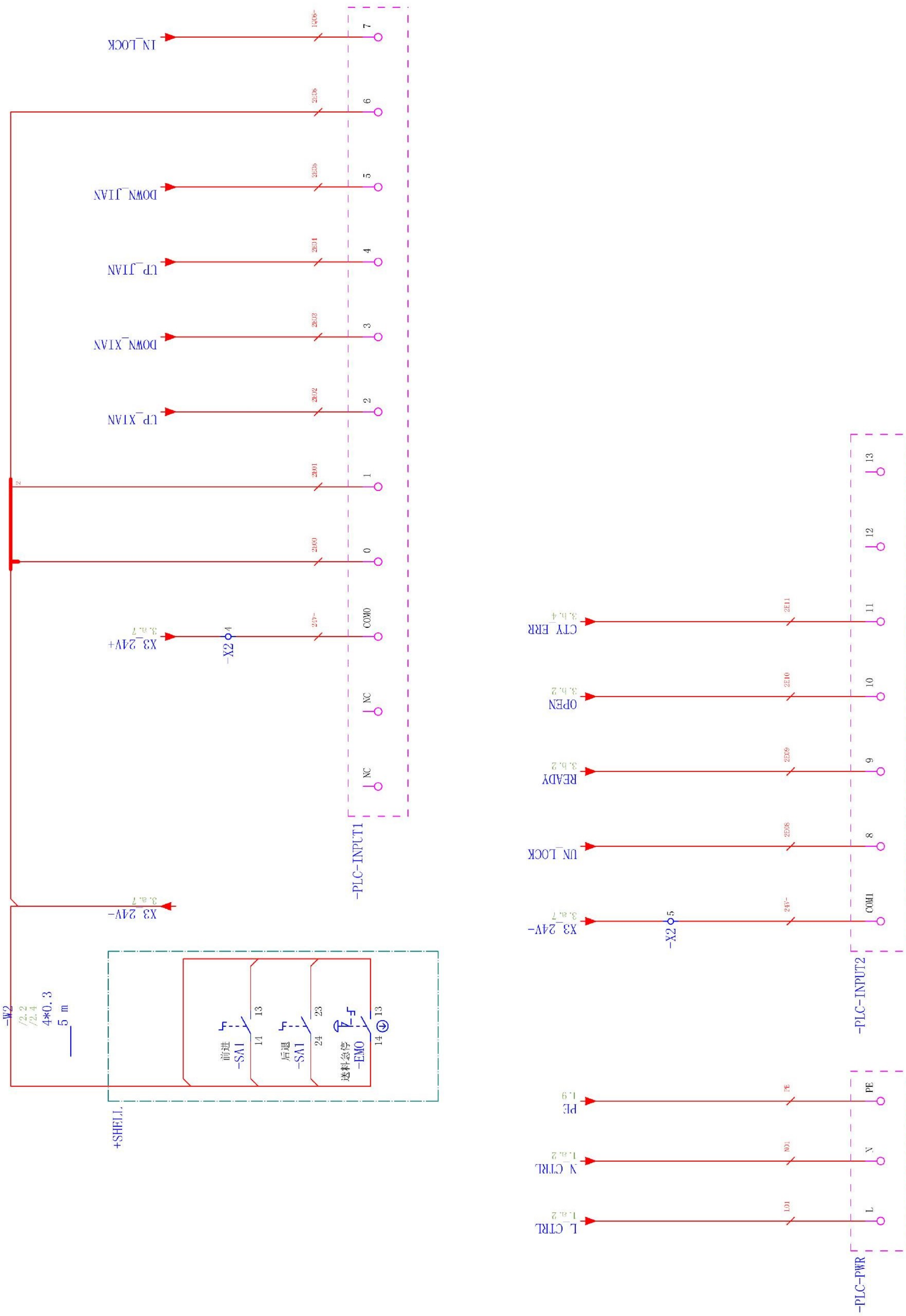
IN10，IN11，IN12输入口跳线改为ACT_HIGH

IN10, IN11, IN12 Input Jumper change to Act_High

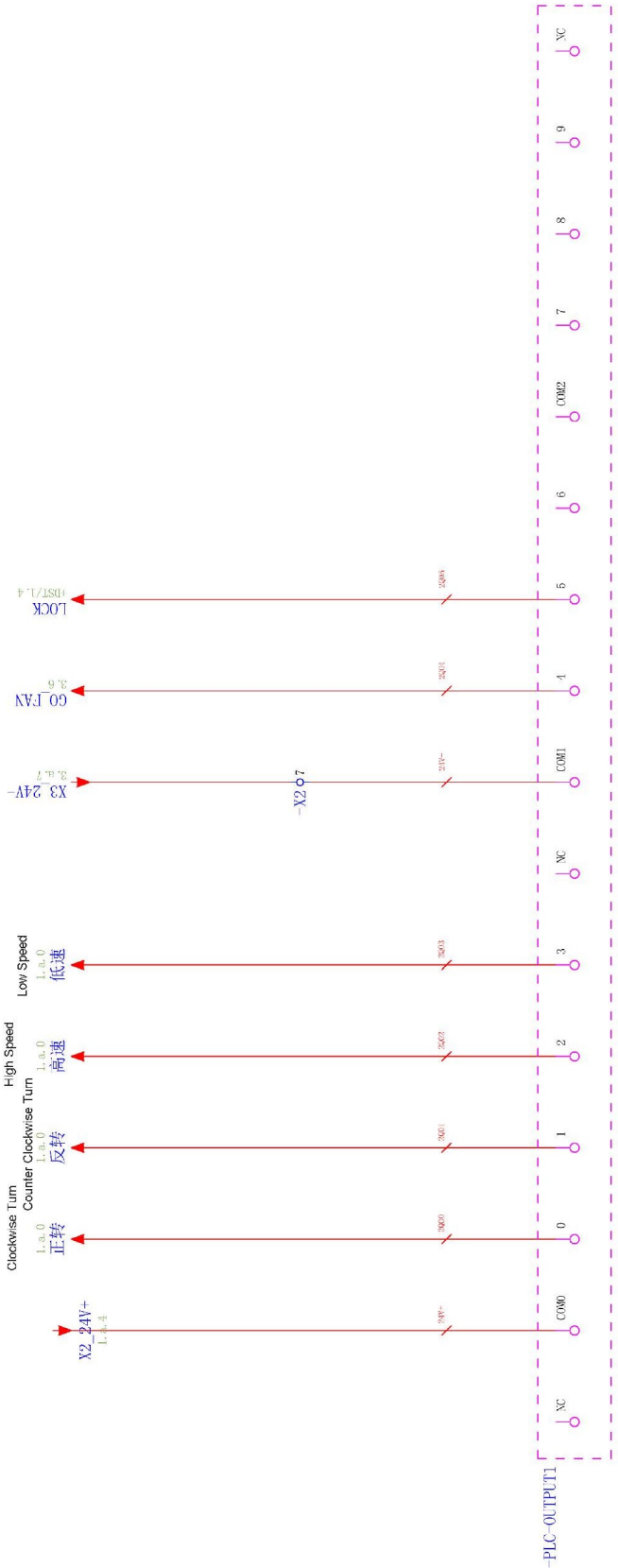

X3_24V+
X3_24V-
+BASE-SQP2
Y+限存
Y+ Limit
+BASE-SQP1
Y-限存
Y- Limit
-X2
-XT1-Y LMT
Y轴限存
Y Limit
X3. 24V+
X3. 24V-
LMT_X+
LMT_X-
-XT1-X LMT
X轴限存
X limit

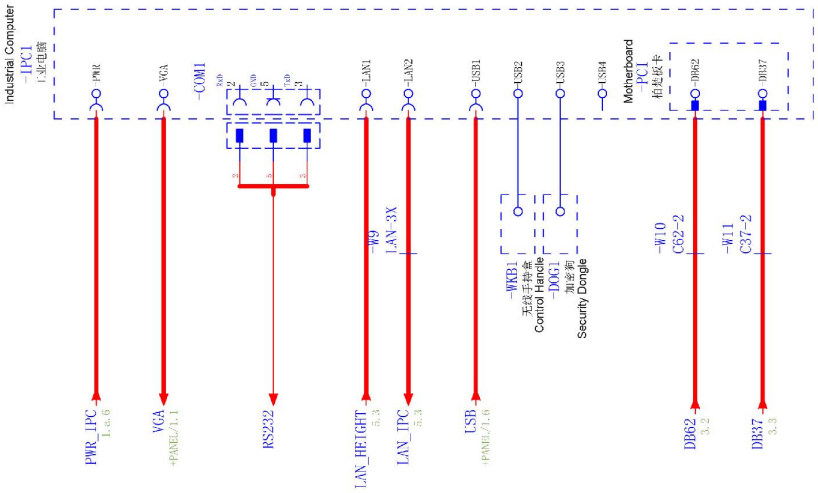

DUST_3
DUST_2
DUST_1
VALVE_02
X2 24V+
VALVE_N2
-XT1-RLY NO
继电器开关点输出
Relay Output

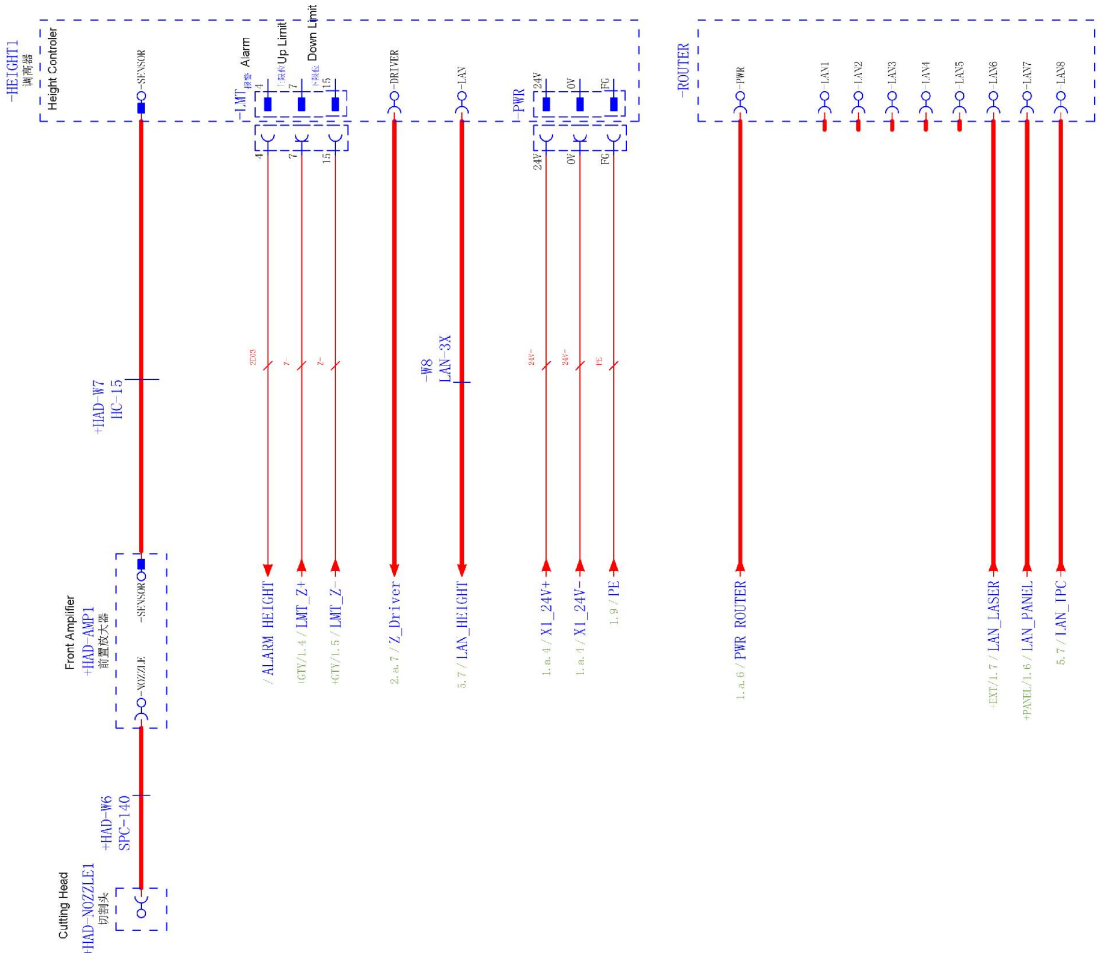

X3.24V+
X3.24V-
-XT1-RLY_NOC
继电器转换触点输出
Relay Output
-KA2
-XT1-SCR
晶闸管输出
Thyristor Output
-KA1
X3_24V+
LASER_KEY1
LASER_KEY2
LASER_ENABLE1
LASER_ENABLE2
PWM_RELAY
PWM+
X2_24V-
ALARM_RD
ALARM_GN
CUT_ERR
RESET_BUZZER
READY
OPEN

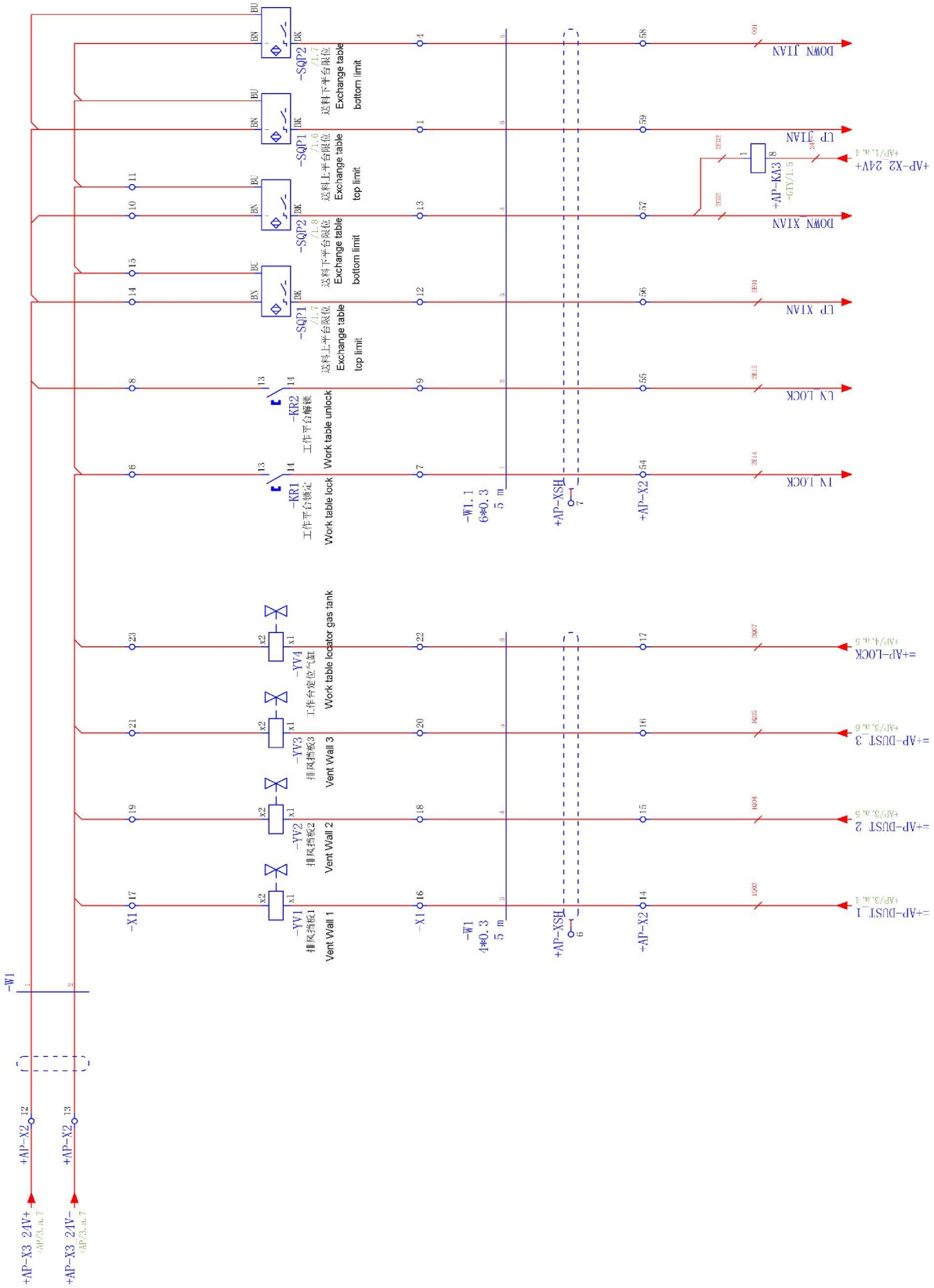


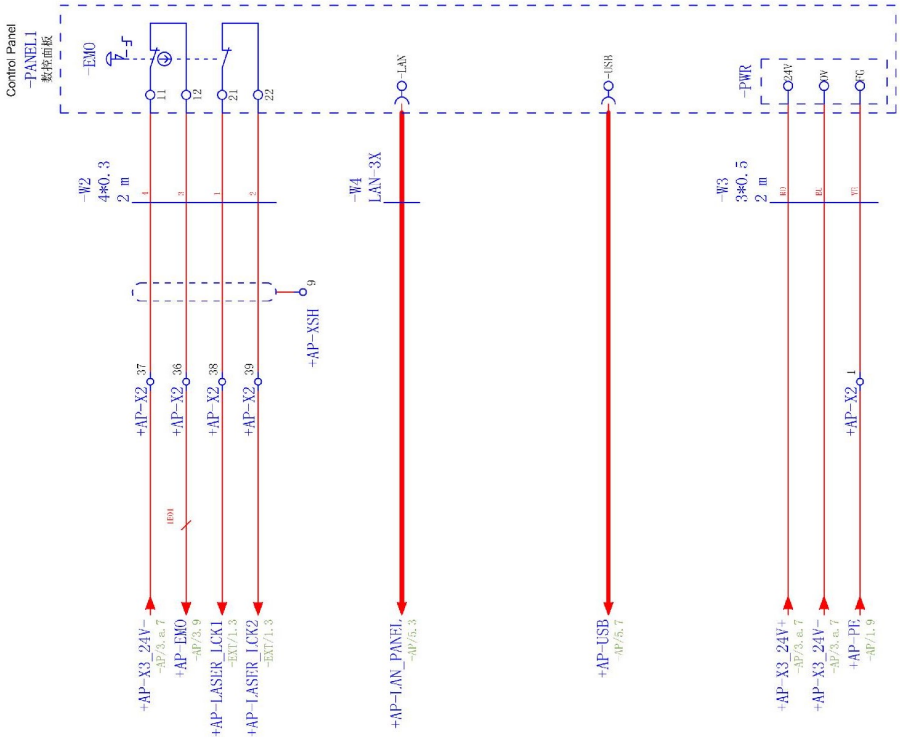
IN_LOCK
DOWN_JIAN
UP_JIAN
DOWN_XIAN
UP_XIAN
X3_24V+
X3_24V-
-X2
COM0
NC
-PLC-INPUT1
-W2
4*0.3
5 m
+SHELL
前进
-SA1
后退
-SA1
送料急停
-EMO
CTY_ERR
OPEN
READY
UN_LOCK
COM1
-PLC-INPUT2
PE
N_CTRL
L_CTRL
-PLC-PWR

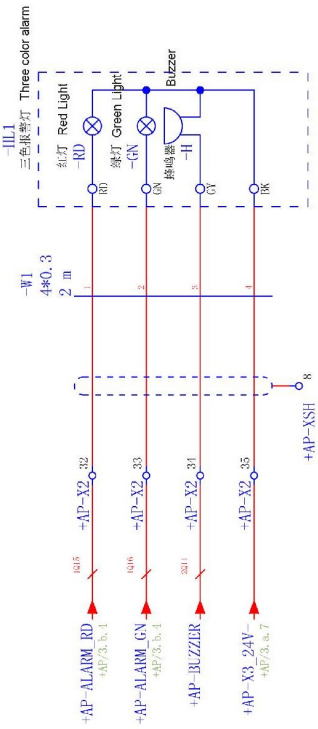

-PLC-OUTPUT1
XC
COM0
0
1
2
3
NC
COM1
4
COM2
6
7
8
9
XC
X2_24V+
Clockwise Turn
正转
Counter Clockwise Turn
反转
High Speed
高速
Low Speed
低速
-X2
X3_24V-
GO_TAN
LOCK

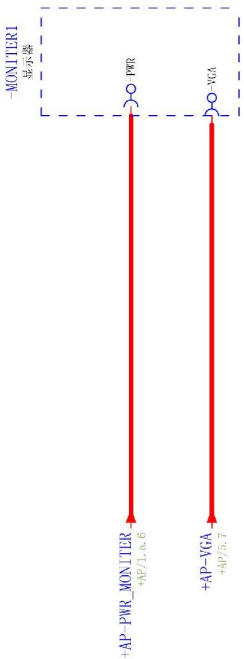

Industrial Computer
-IPC1
工业电脑
-PWR
-VGA
-COM1
-LAN1
-LAN2
-USB1
-USB2
-USB3
-USB4
Motherboard
-PC1
柏龙板卡
-DB62
-DB37
PWR_IPC
1.6.6
VGA
+PANEL/1.1
RS232
LAN_HEIGHT
5.3
LAN_IPC
5.3
USB
+PANEL/1.6
-W9
LAN-3X
-WKB1
无线手持盒
Control Handle
-DOG1
加密狗
Security Dongle
-W10
C62-2
-W11
C37-2
DB62
5.2
DB37
5.3

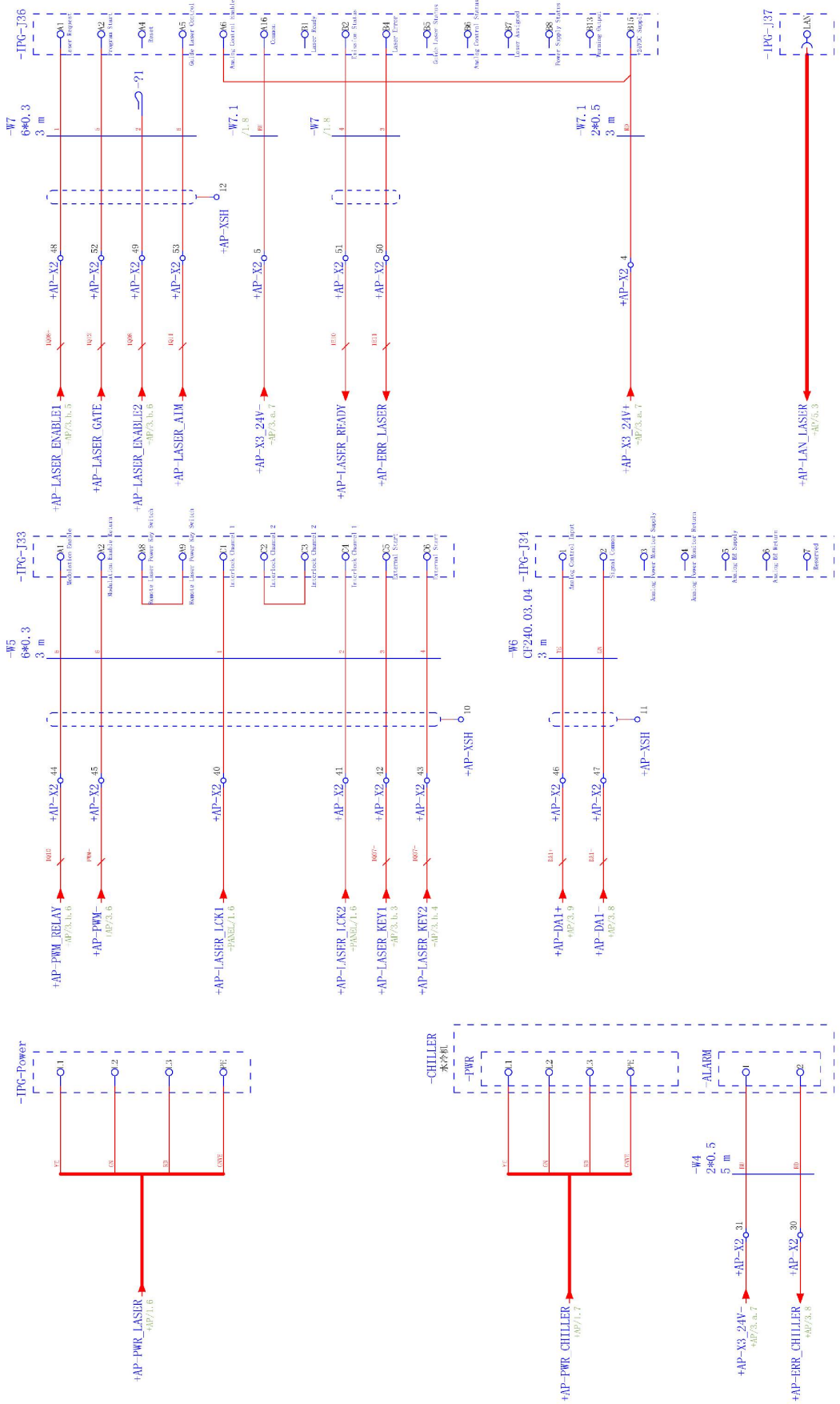

-HEIGHT1
调高器
Height Controler
-SENSOR
-LMT
Alarm
Up Limit
Down Limit
-DRIVER
-LAN
-PWR
24V
0V
PE
-ROUTER
-PWR
LAN1
LAN2
LAN3
LAN4
LAN5
LAN6
LAN7
LAN8
+HAD-W7
HC-15
-W8
LAN-3X
/ ALARM HEIGHT
(GTV/1.4 / LMT_Z+
+GTV/1.5 / LMT_Z-
2.6.7 / Z_Driver
5.7 / LAN_HEIGHT
1.6.4 / X1_24V+
1.6.4 / X1_24V-
1.9 / PE
1.6.6 / PWR ROUTER
-EXT/1.7 / LAN_LASER
+PANEL/1.6 / LAN_PANEL
5.7 / LAN_IPC
Front Amplifier
+HAD-AMP1
前置放大器
-NOZZLE
-SENSOR
+HAD-W6
SPC-140
Cutting Head
+HAD-NOZZLE1
切割头


-W1
+AP-X2
+AP-X3 24V+
+AP-X3 24V-
-SQP2
-SQP1
-KR2
-KR1
-YV4
-YV3
-YV2
-YV1
-X1
-W1
+AP-XSH
+AP-X2
+AP-KA3
+AP-X2 24V+
DOWN JIAN
UP JIAN
DOWN XIAN
UP XIAN
LN LOCK
TN LOCK
=+AP-LOCK
=+AP-DUST_3
=+AP-DUST_2
=+AP-DUST_1
Exchange table bottom limit
Exchange table top limit
Work table unlock
Work table lock
Work table locator gas tank
Vent Wall 3
Vent Wall 2
Vent Wall 1


Control Panel
-PANEL1
数控面板
-EMO
-W2
4*0.3
2 m
-W4
LAN-3X
-W3
3*0.5
2 m
-PWR
LAN
USB
24V
0V
PE
+AP-X2 37
+AP-X2 36
+AP-X2 38
+AP-X2 39
+AP-X2 1
+AP-XSH
+AP-X3 24V-
+AP-EMO
+AP-LASER_LCK1
+AP-LASER_LCK2
+AP-LAN_PANEL
+AP-USB
+AP-X3 24V+
+AP-PE


-ILL1
三色报警灯
Three color alarm
红灯 Red Light
-RD
绿灯 Green Light
-GN
蜂鸣器
Buzzer
-H
-W1
4*0.3
2 m
+AP-X2 32
+AP-X2 33
+AP-X2 31
+AP-X2 35
+AP-XSH
+AP-ALARM_RD
+AP-ALARM_GN
+AP-BUZZER
+AP-X3 24V-


-MONITTER1
显示器
PWR
VGA
+AP-PWR_MONITTER
+AP-VGA


-IPG-J36
-W7
6#0.3
3 m
+AP-LASER_ENABLE1
+AP-LASER_GATE
+AP-LASER_ENABLE2
+AP-LASER_AIM
+AP-XSH
-W7.1
+AP-X3_24V-
+AP-LASER_READY
+AP-ERR_LASER
-W7.1
2#0.5
3 m
+AP-X3_24V+
-IPG-J37
+AP-LAN_LASER
-IPG-J33
-W5
6#0.3
3 m
+AP-PWM_RELAY
+AP-PWM-
+AP-LASER_LCK1
+AP-LASER_LCK2
+AP-LASER_KEY1
+AP-LASER_KEY2
+AP-XSH
-IPG-J34
-W6
CF240.03.04
3 m
+AP-DA1+
+AP-DA1-
+AP-XSH
-IPG-Power
+AP-PWR_LASER
-CHILLER
-PWR
+AP-PWR_CHILLER
-ALARM
-W4
2#0.5
5 m
+AP-X3_24V-
+AP-ERR_CHILLER

Appendix C Contact BesCutter.Com

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