Fangling CNC laser cutting control system

Instruction Manual (V1. 1)

Model number: L5210H

Shanghai Fangling Computer Software Co., LTD

ShangHai FangLing Computer Software Co ., LTD .

version number	date	revise content	expurgator	assessor
Ver 1.0	202 4/ 8/ 2 0	All, and the initial version of the No	Laser Products Department	

Precautions for use

Read the manual

    This specification is applicable to the L5210H CNC cutting control system produced by Shanghai Fangling Computer Software Co., Ltd. Please read the instructions and local safety regulations carefully before use.

    Note: Due to the continuous improvement of this product, the technical parameters and hardware parameters involved in this manual are subject to modification without prior notice. If you have other questions about this product and it is not detailed, please consult us immediately. We will be happy to answer your questions, suggestions and criticisms. Thank you again for your choice and your trust.

    Note: The design of this product is not suitable for site maintenance. For any maintenance requirements, please return to the after-sales service center:

    Address: Room 103, Building C, Pegasus Travel Science and

    Technology Innovation Park, No.154, Lane 953, Jianchuan Road,

    Minhang District, Shanghai. Sales: + 86-21-34290970

    After-sales service: + 86-21-34121295 Fax: + 86-21-34290970

    E-mail：support@ flcnc . com   sales@ flcnc . comWebsite: www. flcnc. com

Environmental requirements

●The working environment temperature of the NC system is 0℃ to + 50℃, and the relative humidity is 5-95% without condensation.

●Operating voltage is DC + 24V.

●The controller shall be installed in the console electrical cabinet with shielding dust.

●This system is best used in a position away from high electromagnetic radiation such as high pressure and high frequency.

maintenance

●Hands and feet away from the moving machine tool, control operation or manual operation can be performed through the front panel keyboard.

●When operating the machine, do not wear loose clothes and wired ropes to avoid being entangled by the machine.

●The equipment should and should only be operated by trained persons.

●Not the company authorized technical personnel, it is strictly prohibited to dismantle the numerical control system.

●When using, do not splash acidic, alkaline, corrosive and other items on the control system.

high voltage

●Electric shocks can kill people. Installation must be performed in accordance with the installation steps and requirements specified in the instructions for use.

●Do not contact the wire and cable when the power supply is connected.

●The equipment should and should only be operated by trained persons.

<p style="text-align:center">catalogue</p>

Chapter 1 Introduction of Type L5210H control system

1.1 Introduction to the system

L5210H Type CNC system is in the company to absorb the advantages of many domestic and foreign CNC system developed by a more powerful, more convenient operation, more cost-effective products. The product uses three axis digital position control mode, is suitable for laser plane cutting machine.

The control system is light and portable, easy to operate, easy to use, all operations with menu or graphic prompts. All the key switch humanized design, comfortable and convenient.

The L5210H controller adopts high-performance ARM chip and super-large scale programmable device FPGA to run the multi-task real-time operating system, and adopts the combination of software interpolation and hardware interpolation, so as to make the high-speed operation more stable, reliable and rapid response.

The CNC system style is as follows:

Figure 1.1 L5210H front face

Figure 1.2 L5210H back side

1.2 System characteristics

●Chinese, English, Spanish, Portugal, France, Russian, Denmark, Korean, Japanese and other language menu, language one-click switch. Except in Chinese and English, the customer should provide language translation documents, which can support most languages (except Thai).

●5 4 common graphics libraries (including grid graphics), you can choose to set the piece size and hole size.

●Support the EIA code (G code), support the suffix TXT, CNC, NC, MPG, B3 and other G code.

●Support for ESSI code common instructions.

●Automatic edge-seeking function.

●Support the laser tertiary perforation process, and support the focus adjustment.

● Integrated bus height control, through the system to modify the height parameters, monitor the height controller status, convenient operation, simplified wiring.

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●Processing pieces, running time, perforation times and other information statistics.

●Compact keyboard design, but the features are not simple, making the manual input files more comprehensive.

●Figure scale, rotation, mirror adjustment.

●Graph can be arranged in matrix, staggered and stacked.

●The original size of the workpiece and the size of the kerf are displayed simultaneously, which is intuitive and convenient.

●Graphic plate correction, any plate edge can be used as a correction edge.

●Customizable coordinate system, support four coordinate systems of two-dimensional coordinates.

●You can customize the type (normally open or normally closed) and number of all input and output ports.

●It can diagnose all IO status and key status of the system for easy checking and troubleshooting.

●Front / rear U disk interface, convenient for program transmission.

●The system upgrade adopts the U disk upgrade mode, which is convenient and practical, and provides a lifetime upgrade service.

●Support system backup and system restore function, system restore can only restore the operating system, or restore to the factory state.

●All the functions and processes of the whole system can be upgraded online to avoid the worry of after-sales service.

●Can import and export single or all processing files.

●Parameter backup and parameter restore.

●All kinds of processing parameters are complete, which can meet different process needs.

●Can achieve acceleration and deceleration in real time.

●Hand-select the starting row or select the starting point.

●Dynamic / static machining graphics display, graphics zoom in / out, zoom in state dynamic tracking cutting points.

●FPGA high-speed, high-precision insertion control, high-speed operation, smooth operation, low noise.

●Settable starting speed and acceleration time.

●With power failure, breakpoint protection memory function.

●The "Offset cutting" function can avoid the plate waste caused by the nesting calculation error.

●Different management rights and corresponding passwords can be set to safeguard the rights and interests of equipment manufacturers.

●Remote control that supports the USB interface.

1.3 Technical Indicators

1) Number of control axes: 3 axes;

2) Control accuracy: ± 0.001mm.

3) Coordinate range: ± 99999.99mm.

4) Maximum pulse frequency: 1 MHz; maximum operating speed: 30 m / min.

5) Maximum number of program lines: 80,000 lines.

6) Maximum single program: 4M.

7) Time-class resolution: 2ms.

8) System working power supply: DC + 24V DC power input, power greater than 80 W.

9) System working environment: temperature-10℃ to + 60℃; relative humidity 0-95% without condensation.

1.4 System interface

A) DB15-core head motor drive interface, with four shafts.

D) The front panel / rear panel has built-in USB interface for users to transmit cutting code.

C) Support dual network ports for applying EtherCAT bus.

D) EWWxtended IO input output port; PWM output port; analog input output port.

E) optional standard DB9 core header serial port RS232 interface.

F) Equipped with a standard CAN bus five-core interface.

1.5 Hardware configuration

1. Display: 10.1-inch 1280×800 high resolution 16 million color high brightness LCD screen.

2. Memory: 256M SD RAM.

3. User program space: 167 M.

4. Main frequency: main frequency of 400 MHZ system.

5. USB: USB1.1 interface front, support at least 16GB USB disk.

6. Keyboard: a built-in keyboard.

7. Case: the whole steel structure is completely shielded, which can really do anti-electromagnetic radiation, anti-interference, anti-static.

Chapter 2: System start-up

2.1 System control panel

Figure 2.1 The L5210H operation interface

Key description:

[F1] - [F8]: Function key, under different interfaces, there are corresponding function prompts.

[Custom]: spare key.

[Follow]: Open / close the follow function of the cutting head.

[Red light]: control output port of the red light, control the opening / closing of red light.

[Point shot]: the concentricity of the laser beam to detect whether the laser beam is emitted from the center of the slit aperture. The scene is mainly used for laser coaxial tuning and laser cutting head and light out test.

[Light switch]: enable switch of light switch, can only be active after the laser high voltage is enabled. The button is mutually exclusive with the laser red light,

and the red light is turned off after activating the laser gate, and the red light is turned on after closing the laser gate.

[Calibration]: Move the cutting head to the calibration area by manually moving the axis function area, select quick calibration, click the OK button in the popup to start calibration, and establish the curve relationship between voltage and height.

[Back to zero]: control the cutting head to return to the workpiece zero point, used for cutting action test, the cutting head quickly back to the original cutting zero position.

[Walking frame]: The laser activates the red light state, click the "walk frame" function, observe the red light range of the cutting head walking frame, Confirm that the processing area is safe. If the red light exceeds the plate, it means that the processing plate area is not enough to cut, and the point moving axis needs to reposition the zero point of the workpiece.

[Blowing]: applied to the test of manual blowing function.

[Focus axis up]: manually control the rise of the focus coordinates.

[Focus axis down]: Manually control the drop of focus coordinates.

[G]: Defined as a fixed distance move, and the shortcut button triggers this function.

[X]: Defined as the forward function, the shortcut keys trigger this function.

[Y]: defined as the back function, the shortcut keys trigger this function.

[M]: Defined as the empty walk function, the shortcut button triggers this function.

[R]: It is defined as the walk frame function, the shortcut button triggers this function.

[I]: not defined.

[F]: defined as the switch jog / fixed distance function, the shortcut button triggers this function..

[J]: Screen shot function.

[Clear alarm]: Clear all alarm information on the current main interface.

[Z↑PgUp]: in the code interface,it is page up key, in the other interface,it is the torch up key.

[Z↓PgDn]: in the code interface, it is page down key, in other interfaces, it is torch down key.

[HOME]: In the code interface, it is jump to the first line, in other interfaces, it is to increase the speed of the rotation axis.

[END]: In the code interface, it is jump to the last line, the other interface is to reduce the speed of the rotation axis.

[▲]......[▼]: Four-direction keys. The X and Y axis movement can be controlled on the main interface.

[1]: Number 1.

[⬚] The hand-shaped key in the middle of the direction keys is the ALT key, similar to the [F] key, which can switch jog mode.

[▷]: START key to start the cutting. Is also known as the [Start] [F9] key.

[‖]: suspend key, pause the cut, [pause] [F10] key.

[‖]: STOP key, stop the cutting. Also called [stop].

[G], [X], [Y], [I], [R], [J], [F], [M]: are commonly used letter keys. At the same time, it has the reuse function, which can be used as a special function key. Under the main interface, the letter in front of the parameter item on the screen is the shortcut key prompt, which can be used for shortcut operation.

[1] - [9]: The number key. Number keys are configured with different shortcut buttons, and these keys can be customized to configure some functions. For example, in the stop state, the switch of the optical switch can be controlled by pressing [1], the blowing can be manually turned on / off by pressing [2], and the pressing [5] can be adjusted back to zero.

[↑]: Yellow shift key, press this key and the number key at the same time, equivalent to the yellow letter on the number key. For example, press this key and [7], equivalent to character A.

[↑]: Red shift key, press both this key and the number key at the same time, equivalent to the red letter on the number key. For example, press the key and [7], equivalent to character N.

[ESC]: Cancel key, also known as the back.

[←]: Hold down the yellow key to achieve the space bar effect.
[Tab]: User focus switch, (find boundary value)
[Del]: Delete.

[Enter]:Confirmation

2.2 System startup and key operation under the main interface

When power on, the system will first enter the BIOS startup interface:
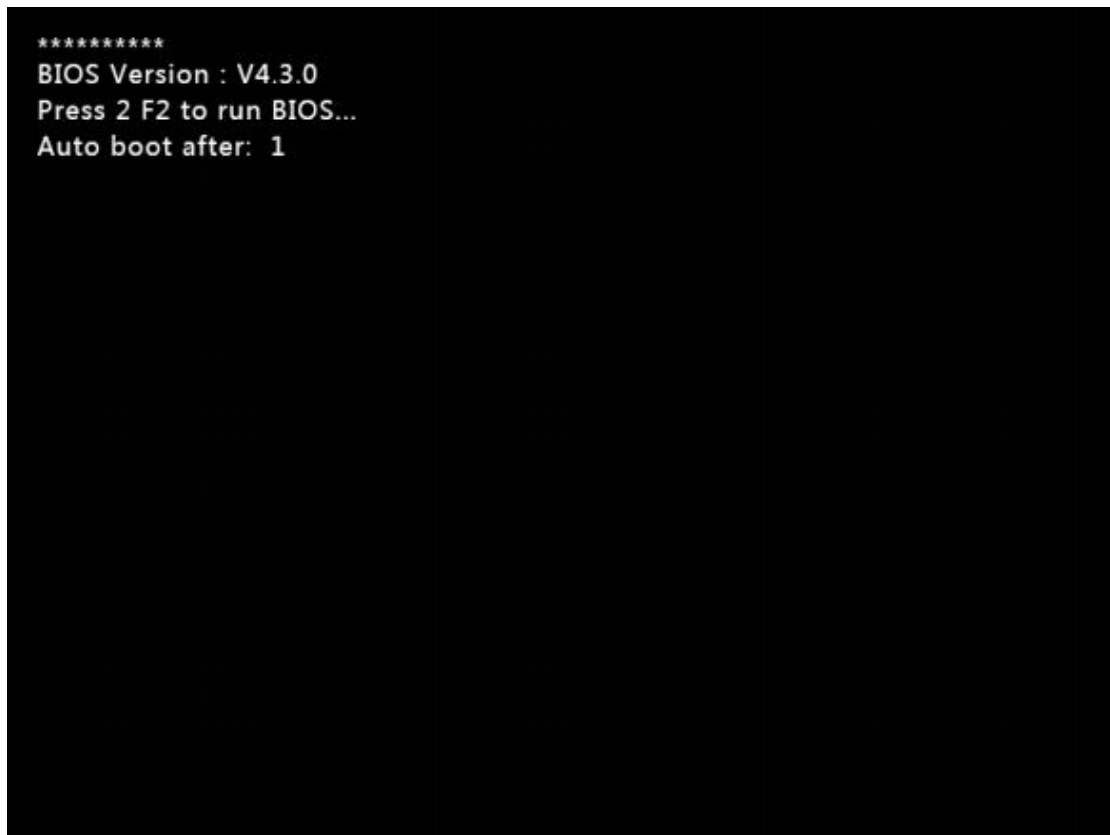
Figure 2. 2 Welcome interface

In the countdown of the startup interface, if the F2 key is pressed, the system enters the BIOS (BIOS operation please refer to "Chapter 12 BIOS use"). If any other key is pressed, the countdown is skip to enter the cutting software. If the key is not pressed, the system will automatically enter the cutting software after the countdown reaches 0.

If there is a boot screen, the system will enter the welcome interface, as shown in Figure 2.3. This boot screen can replace the user with their own picture. Press any key now, and the system will automatically enter the main interface, as shown in Figure 2.4.

Figure 2. 3 Welcome Interface
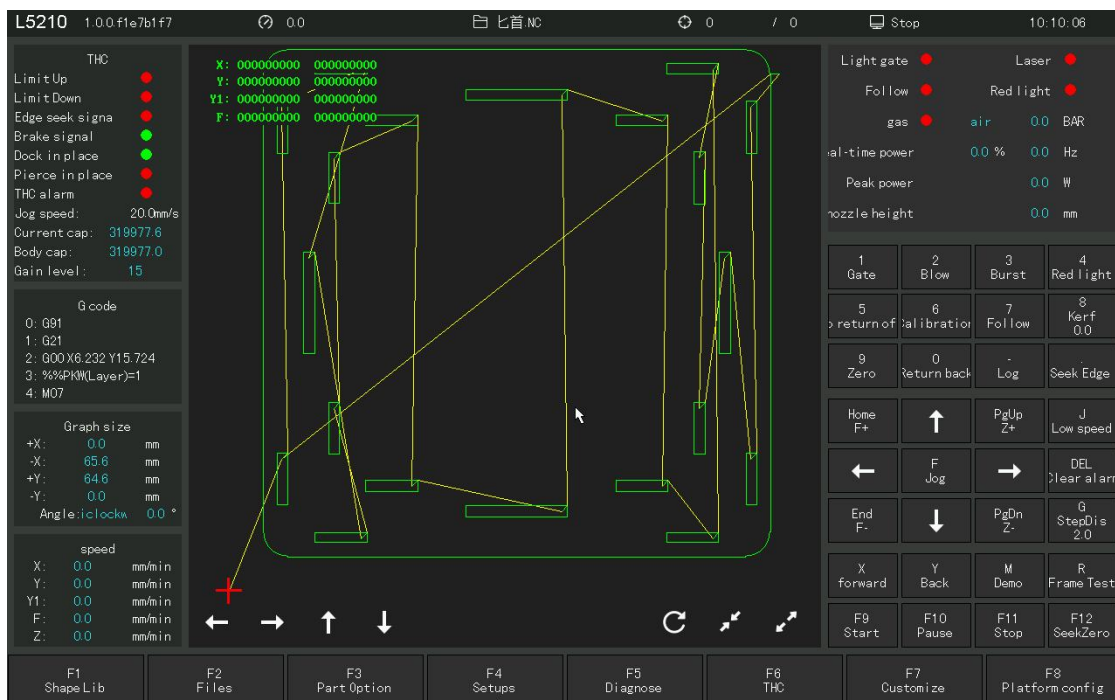
Figure 2. 4 System Interface

Under the main interface, press [F1] - [F8] to correspond to the following functions respectively:

[F1]: Graph management, there are 5 4 kinds of commonly used parts graphics library, most of them have two kinds of piece size and hole size.

[F2]: File management, enter the optional hard disk files, disk files, find files, edit files, delete files, copy to disk (copy to disk), preview graphics and other operations.

[F3]: Part options, starting point selection, repeated arrangement (matrix, staggered, stack), X mirror, Y mirror, select the number of rows, select hole number, scale, code editing, figure restoration and other operations.

[F4]: Parameter setting, all parameters can be set here, global parameters, layer process, user parameters, and system parameters.

[F5]: System diagnosis, input and output diagnosis, keyboard diagnosis, date and time setting, physical port, system definition, etc.

[F6]: Elevator parameters, common parameters, system parameters, calibration, diagnosis and additional functions.

[F7]: Customize, users can customize the display effect of the main interface, such as: display shortcut key letters, display G code, display graphics size, display artifact coordinates, display mechanical coordinates, display real-time speed, can also configure the main interface shortcut function button.

[F8]: Platform configuration, input port definition, output port definition, shaft configuration, machine tool configuration. Coordinate zero, before the machine cutting, can set coordinate zero. (Z axis back to zero: the height controller has a back to zero button。 The controller system will automatically set Z axis back to zero before all axis back to zero)

[X]: Set the cutting speed.

[Y]: Set the manual moving speed.

[G]: Set the moving distance of fixed length. Note: After pressing G to modify the length distance, the manual move mode will automatically switch to the length mode.

[F]: Set the manual moving mode, can set jog, continue and fixed distance.

[Z]: Can set the kerf value before or after cutting.

[-]: Switch monitor window.

[1] - [9]: The number key. In addition, during the operation of the system, pressing these keys can quickly adjust the cutting speed to several percent of the maximum cutting speed. For example, pressing [1] can adjusts the speed to 10%, and pressing [2] can adjust the speed to 20%.

[↑]: Yellow shift key, press this key and the number key at the same time, equivalent to the yellow letter on the number key. For example, press this key and [7], equivalent to character A.

[↑]: Red shift key, press both this key and the number key at the same time, equivalent to the red letter on the number key. For example, press this key and [7], equivalent to character N.

[←]: Hold down the yellow ↑ key and ← to input space.

[ESC]: Cancel, also called exit key.

[Del]: Delete.

[Enter]: Confirm.

2.3 Description of the system main interface

The contents displayed under the main interface are described as follows:

① Displays the controller model and version number.

② Shows the current processing speed. The G code currently being processed, showing the current line and the next row.

③ Display cut file name.

④ Show the status of the cut. It can be run, manual, pause, stop, etc.

⑤ Display the perforation information: perforation number, line number, drilling number, etc.

⑥ Displays the cutting trace of the current processed workpiece. The actual outline of the workpiece is displayed simultaneously with the contour with kerf. (The green line is the actual outline of the cutting piece, and the blue line is the cutting trace with kerf. When cutting, the center of the torch will cut along the blue line.)

⑦ Custom monitor window. Display the value of common items, display real-time running data, convenient to view the running state. Can configure G code display, graphics size information, artifact coordinates and mechanical coordinate information, real-time speed, etc.

⑧ Function menu, displays the name of [F1]...... [F8] function key. Displays different function names under different operation interfaces.

⑨ Watch window. Show the IO status. The signal light is a green "●" light, indicating that the signal is valid or occurring; A red lamp "●" indicates that the signal is invalid or did not occur. For example, when pressing the [follow] button, the follow indicator on the screen turns green,

Send a follow instruction to the height controller, press the [follow] key again, and the indicator light turns red to stop the following action.

⑩ Parameter display. A shortcut key is prompted before the operation item.

  Displays some common parameters, press the shortcut key to quickly modify

  the parameters.

⑪ Processing area operation button, can manually move, cut torch lift, focus axis

lift, forward and backward, start, pause, stop, empty walk, back to zero, walk frame

and other

operations
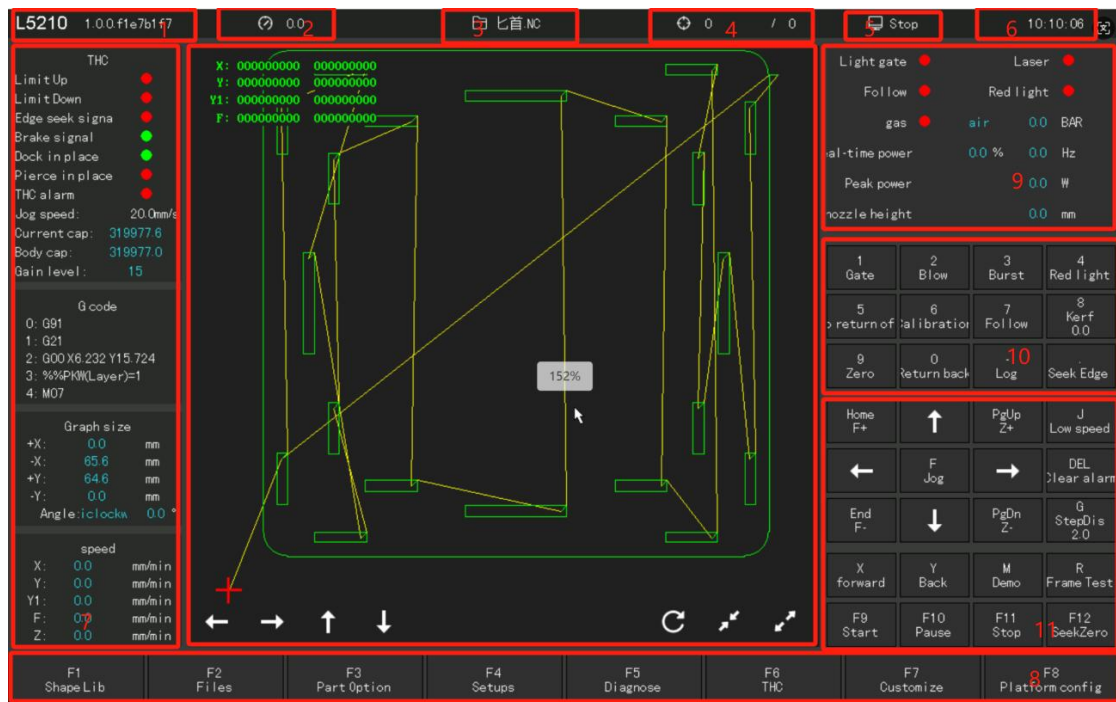
Figure 2.5 Main interface of the system

2.4 Main interface function index


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主界面

F1图形管理   F2文件管理  F3部件选项  F4参数设置   F5参数设置   F6调高器   F7自定义   F8平台配置

  F1片尺寸    F1硬盘文件              F1全局参数    F1输入诊断    F1常用参数            F1输入定义
  F2孔尺寸    F2U盘文件              F2图层工艺    F2输出诊断    F2系统参数            F2输出定义
             F3查找文件              F3用户参数    F3键盘诊断    F3标定                F3轴配置
             F4编辑文件                          F4日期时间    F4诊断                F4机床
             F5删除文件              F5系统        F5 物理端     F5附加功能
             F6复制U盘              F6导入
             F7预览图形              F7导出                                          F7从站扫描
  F8确认      F8确认                F8保存        F8系统定义    F8保存                F8保存
```
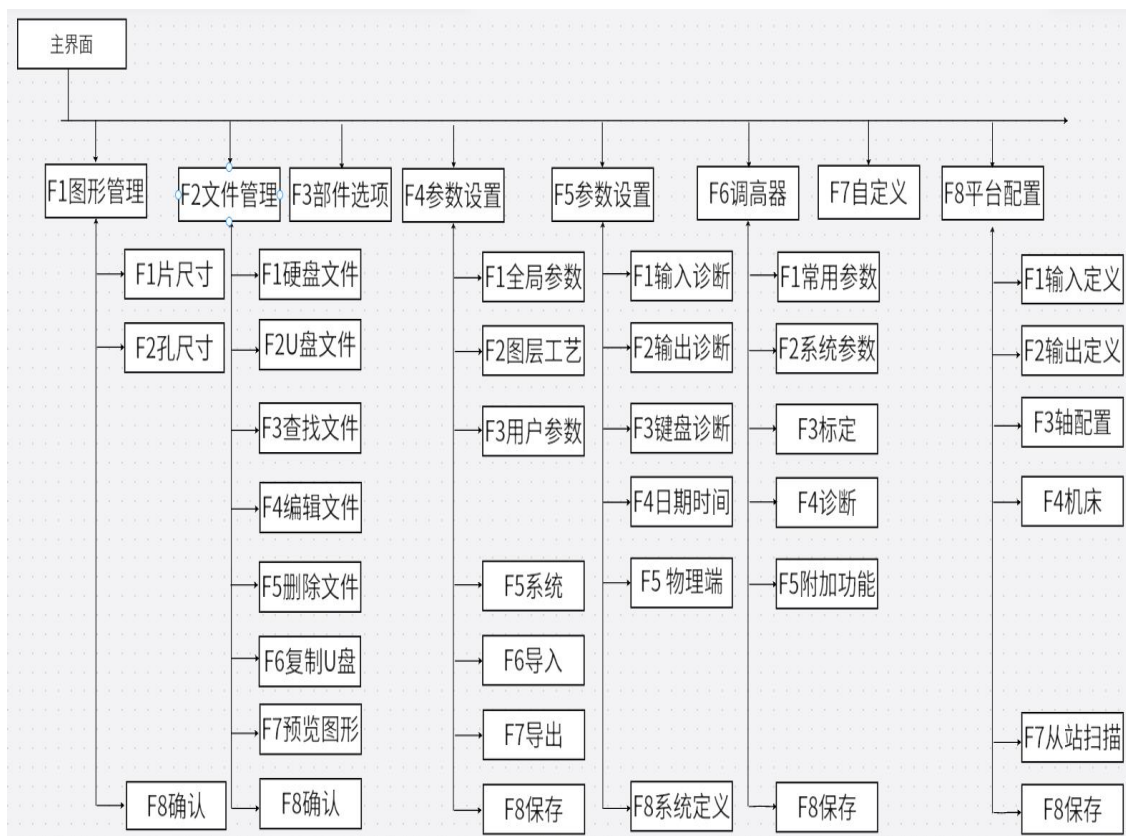
Figure 2. 6 Main interface of the system

Chapter 3: Cutting function

Under the main interface, it is the real-time cutting interface, as shown in Figure 3.1.
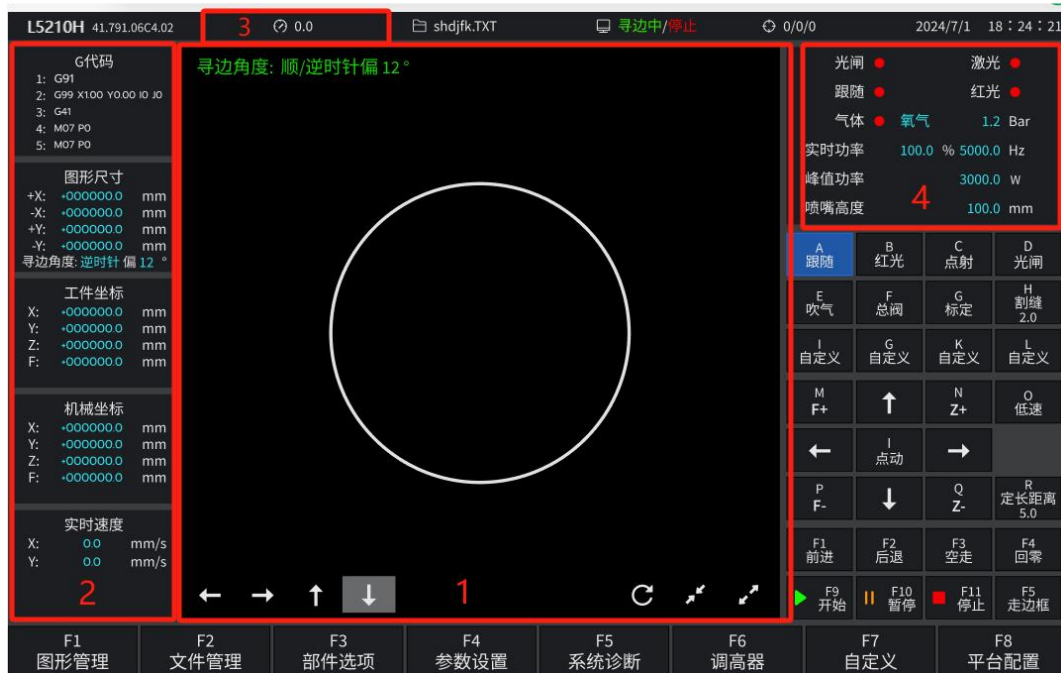
Figure 3.1 Cutting function interface

① Displays the cutting trace of the current processed piece. The actual outline of the piece is displayed simultaneously with the outline with the kerf. (The green line is the actual outline of the cutting piece, and the blue line is the cutting track with kerf. When cutting, the center of the torch will cut along the blue line.)

② Displays the G code currently being processed, the actual running speed of XY and the motion coordinate value of the current cutting torch in the process of processing, the G code display area shows the current line and the next row, which is not displayed during the cutting operation process, only after pause.

③ Display the current processing speed.

④ Display the real-time status, light switch, gas, and real-time power and nozzle height during processing data.

X: It represents the absolute coordinate of X where the torch is currently cut.

Y: It represents the absolute coordinate of Y where the torch is currently cut.

Under the cutting interface:

● Press [X]: Forward button, the forward / backward speed modification needs to be modified in the global parameters.

● Press [Y]: Back button, the forward / back speed modification needs to be modified in the global parameters.

● Press [F]: to change the current manual move mode. It can be switched between jog, continue and fixed length.

● Press [G]: modify the distance fixed distance manual move.

● Press [8]: Set the kerf value before or after cutting.

● M: empty walk, empty walk along the processing track. During move, there is no torch fall and follow, no open light, no open gas.

● R: walk frame. Before processing, walk along the frame of the processing track, to ensure that the processing pattern is in the plate area.

● F9: Start cut.

● F10: Pause the cut, suspending all actions in progress.

● F11: Stop, can pause all ongoing action in the system.

● Upper, lower, left and right 4 direction keys: move the cut torch manually when passing the torch.

3.1 Moving Forward

Press the [X] key in the cutting interface, and the system starts to go empty. This process does not control any IO switch process such as laser opening and perforation, and moves the cutting torch along the outline of the cutting figure. Press the [F10] key to suspend.

This function is to check the cutting path, whether the code is correct, and when the piercing process is required before cutting. To stop the empty walk, press the "stop" button.

The forward / backward speed is set separately from the cut speed, the forward / backward speed can be set in the F4 parameter setting-F1 global parameter.

3.2 Back

During processing, if you need to return along the original track due to incomplete cutting, the following process can be performed as follows:

●Press the Pause button to pause the cut.

●Press the [Y] key in the cutting interface, and the cutting machine returns along the original track. When the cutting torch retreats to the position to step back, press the "pause" button. If it retreats too much, press [X] to advance by empty line and then advance to the required position.

Note: The empty walk and backward function can be repeated until the cut torch is in the ideal position.

●During the backward process, press the [F10] key again, and the system stops running.

● When the cutting torch is in the ideal position, press the "start" key again, if the current cut code line is G01 or G02 or G03, the system will perform the automatic perforation (i. e., laser perforation) before executing these procedures, and then continue running the current program, if the current line is not G01 or G02 or G03, the system directly performs the current line program.

The backward speed and forward speed are the same speed and are set separately from the cutting speed, e "forward / backward speed" can be set in the F4 parameter setting-F1 global parameter.

3.3 Cut Return / Offset Cut / Only Return

When the cutting torch is outside of the actual path of the current processing piece, for example, manually moving the torch to another place during the cutting, and pressing the start button again, Figure 3.3 prompts:
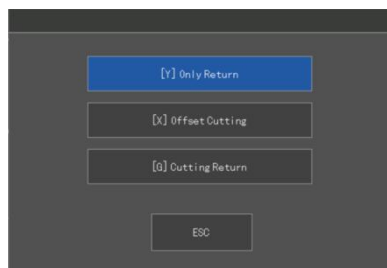
Figure 3. 2 Offset Cut Return

The occurrence of this prompt is:

When the processing is suspended, it is necessary to move the cutting torch away from the actual processing workpiece due to mechanical failure or other reasons.

●Cut return: If [G] is pressed, the system considers the current point as the pause point, and when the cut is started again, the cut will start directly from the offset position.

● Offset cutting: If [X] is pressed, the system thinks that the current point is the pause point. When the cutting is started again, the cutting will continue from this point, that is, the cutting point is offset. When the cutting is suspended or the power is cut off, if the cutting torch has offset or the plate has translation or the user wants to offset cut artificially, you can press this key. This feature is particularly useful when the torch is moved manually. Or after the power failure, after the power failure recovery, the need to re-direct the torch position.

●Only return: If [Y] is pressed, the system only quickly returns to the pause point before the offset, and then stops. In the cutting process, if found that the cutting torch was defective, or any other problems, need to move the cutting torch out of the cutting area for maintenance, when the maintenance needs to return to the pause point can press this key. After returning to the pause point, press the "Start" button again, and the system automatically starts cutting along the original track.

3.4 Return to reference point

When the processing stops, if [O] is pressed, the system will automatically return to the starting point of the processing workpiece. During the return process, the user can also press the "stop" key to stop, and can continue to press [O] to return to the reference process, or press the start key to cut again. Return references and stops are not limited by the number of times.

3.5 Select the perforation points

Before starting cutting or after cutting stop, you can select the perforation number in the F3 part options.

Figure 3. 3 Note of perforation

The position of the perforation point can be entered manually. You can also press ESC to exit, without manually entering the perforation point position, and then press the left and right arrow keys to select the perforation point.

3.6 Dynamic magnification

After the processing begins, the graphic amplification and reduction button of the cutting interface can be enlarged and reduced at will to "dynamically enlarge".

At this time, the processing graphics will be enlarged in full screen and can be tracked dynamically.
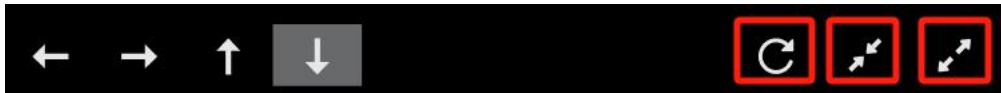
Figure 3. 4 Cutting interface function keys at dynamic amplification

●Press the graph amplification button on the far right continuously, the system will enlarge the graph step by step, and the highest amplification to three levels.
●Press the left restore button to exit the zoom display and return to the normal cut interface.

3. 7 Exit the cut

When the cutting is not completed, whether the cutter is in the cutting or pause state, if the [F11] key is pressed at the cutting interface, the system will directly exit the cutting. When the cutter is in the pause state, pressing the pause button on the panel again will exit the cut. If you press [Enter], exit the cutting. After exiting the cutting, if it is under the floating coordinate system, the click will start to recalculate the zero-point coordinates at the current position of the cutting gun for processing.

3. 8 Walk frame

Before starting the processing, press the R button to walk frame. After pressing the R button, the system will walk counterclockwise along the black wire frame shown in Figure 3. 1 0, with the starting point in the lower left corner. After walking, the system prompts:
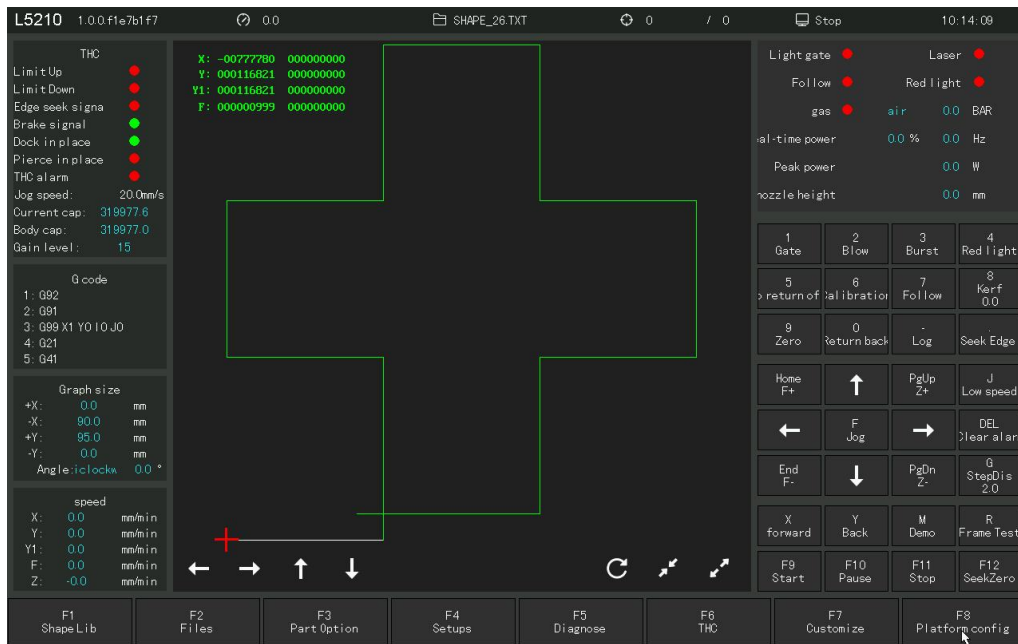
Figure 3. 5 Walk through the border

Figure 3. 6 returns to the reference point

By pressing ENTER, the system automatically returns to the starting point of the part machining. If ESC is pressed, the system stops at the current point.

During walk frame, you can also press STOP to pause and press START to continue. Pressing 0 again will go back to the starting point.

3.9 Seek edge

In the actual laser cutting process, it is inevitable that there will be some angle after the plate is placed on the workbench, which makes the workpiece coordinates does not match with the machine tool coordinate system. At this time, if start cutting directly, it will cause a lot of waste of the plate. The edge-finding function can help users to automatically calculate the tilting Angle of the plate, so that the workpiece coordinate system can match with the coordinate system of the machine tool, and increase the utilization rate of the plate.

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At present, the edge finding function can support the edge finding of the rectangular plate, and the calculated angle will be displayed in the edge finding result in the left display area of the main interface. The system supports two seeking modes: automatic edge seeking and manual edge searching. Automatic edge searching has two-point edge seeking and three-point edge seeking. After parameter is set, click "save" to start edge searching, and the machine will automatically conduct edge searching.
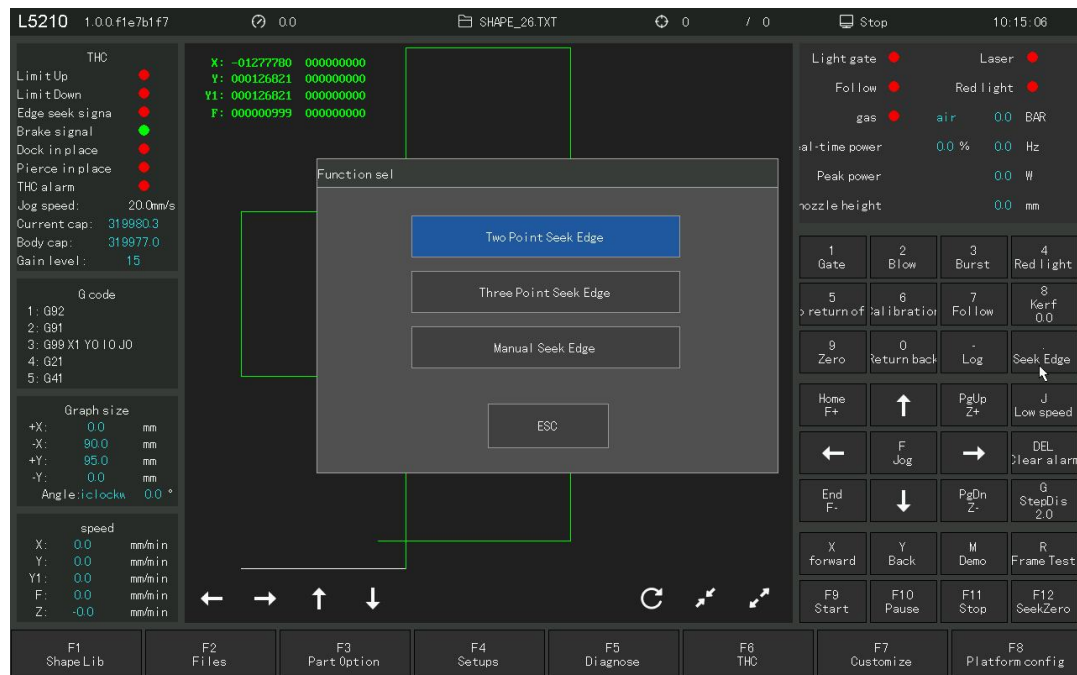
Figure 3. 7 Side search

3.9.1 Three-point edge search

Click the edge search button on the interface, and the pop-up will display the edge search option dialog box. Select three-point edge search, as shown in the figure:
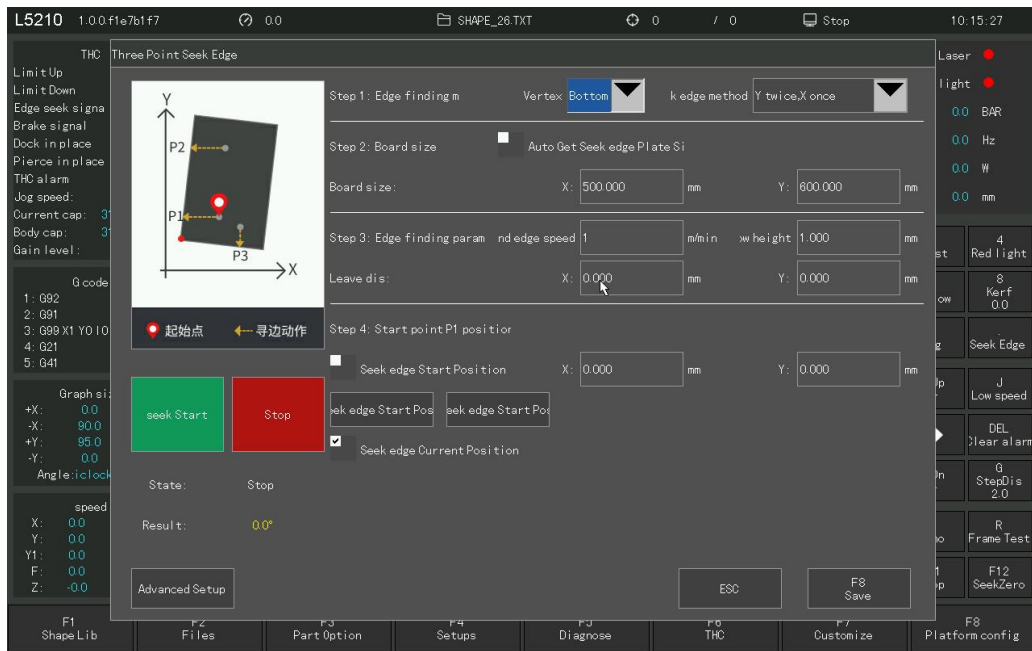
Figure 3. 8 Three-point edge search

Edge seeking strategy

- Set the edge search direction: select top left, bottom left, top right and bottom right for edge search.

- Edge seeking strategy: you can choose searching to X twice to Y direction once or choose to searching to Y direction twice to X direction once to calculate the Angle and deflection angle.

Plate size

Plate dimensions can be obtained by the program or entered manually.

- Program acquisition: pre-read the plate specifications from the processing program.

- Plate size: manually enter the current plate actual specification. X is the length of the plate in X-axis direction of the machine tool. Y is the length of the plate in the Y-axis direction of the machine tool. Please note that the wrong plate size is risky, please enter by the actual plate size!

Edge seeking parameters

- Edge seeking speed: Set the speed of fast edge seeking.

- Follow height: set the distance between the cutting head nozzle and the plate when seeking the edge.

- Side distance X: the distance between the edge from the X direction to the edge after edge seeking, and offset to the board after setting.
- Side distance Y: the distance between the edge from the Y direction to the edge after edge seeking, and offset to the board after setting.

Edge seeking advanced parameters

Edge seeking sensitivity: the greater the edge seeking sensitivity, the more sensitive.

Edge seeking follow intensity: there are two levels to choose, strong, weak.

Edge correction X: corner point offset X, correct the position of the edge point based on the edge Angle.

Edge correction Y: corner point offset Y, correct the position of the edge point based on the edge Angle.

Two-point distance X: the distance of the second point in the X direction, length of X * set percentage.

Two-point distance Y: the distance of the second point in the Y direction, length of X * set percentage.

Lift height after edge seeking: the height of the Z axis to be lifted after edge seeking.

Specify the edge seeking starting point

- Current position of cutting head: use the current position of cutting head as the starting point of edge search.
- Set the starting point: take the set position as the starting point, which can get the current position or manually set.
- specified position.

Note: Please return to the origin to correct the machine coordinate system, and confirm whether the cutting head can follow normally before edge searching.

3.9.2 Two-point edge seeking

Two-point edge search is suitable for irregular plates containing a straight edge. Compared with the three-point edge search, the two-point edge search can only get the deflection Angle of the plate, can not find the processing zero, so after the end of the two-point edge search, also need to manually move the cutting head to the appropriate position for processing.
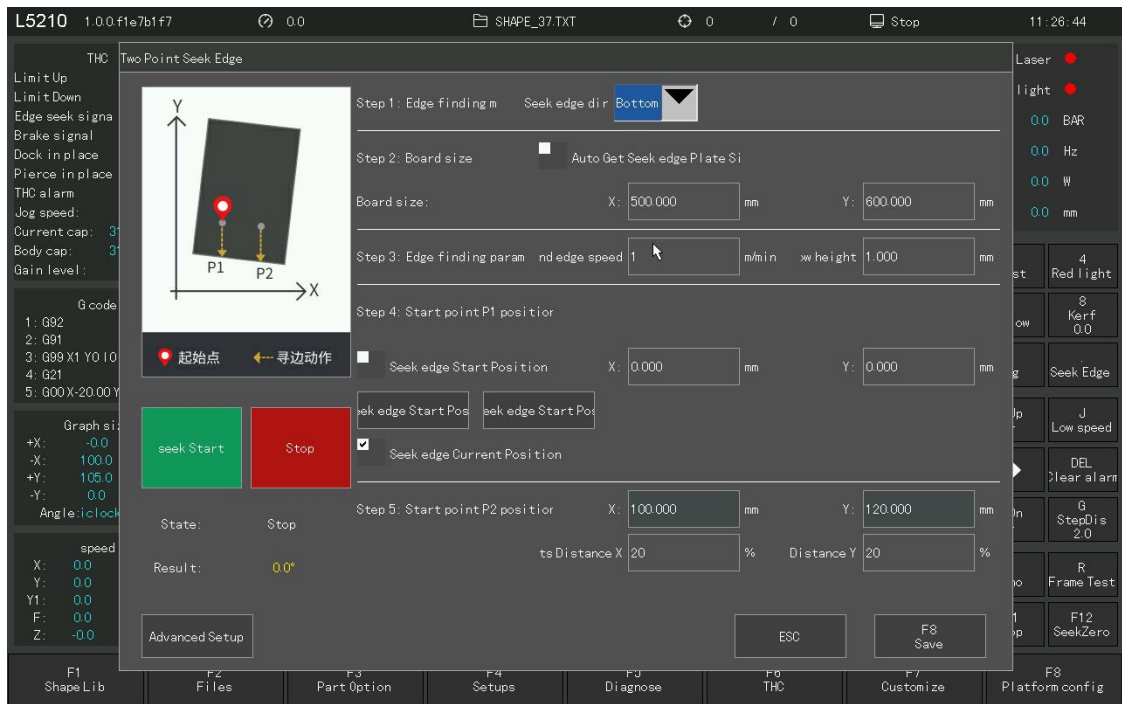
Figure 3. 9 Two-point edge search

Edge seeking direction: you need to manually select the edge seeking direction according to the position of the straight edge of the plate. For example, when there is a straight edge on the right side of the plate, hoping to use this edge to find out the deflection Angle of the plate, you need to choose [right].

The two-point edge seeking parameter is the same as the three-point edge seeking parameter. After setting the edge seeking parameter, click Save to start edge seeking.

3.9.3 Manual edge searching

Manually move the cutting torch to the edge of the plate, record the coordinates of two different positions on the one edge of the plate respectively, and the system will automatically calculate the offset Angle of the plate. The greater the distance between the two points, the more accurate the Angle is.

Click the "Manual edge search" button, according to the schematic in the dialog box, the plate is oblique, click the direction button to move to the edge of the X axis, click the "F6 Save" button to obtain the P1 point coordinates, click the direction button to move to another point of the X axis, click the "F7 Save" button to obtain the P2 point coordinates, the button will automatically calculate the Angle, manual edge search can be set, the edge search results as shown in the following figure:
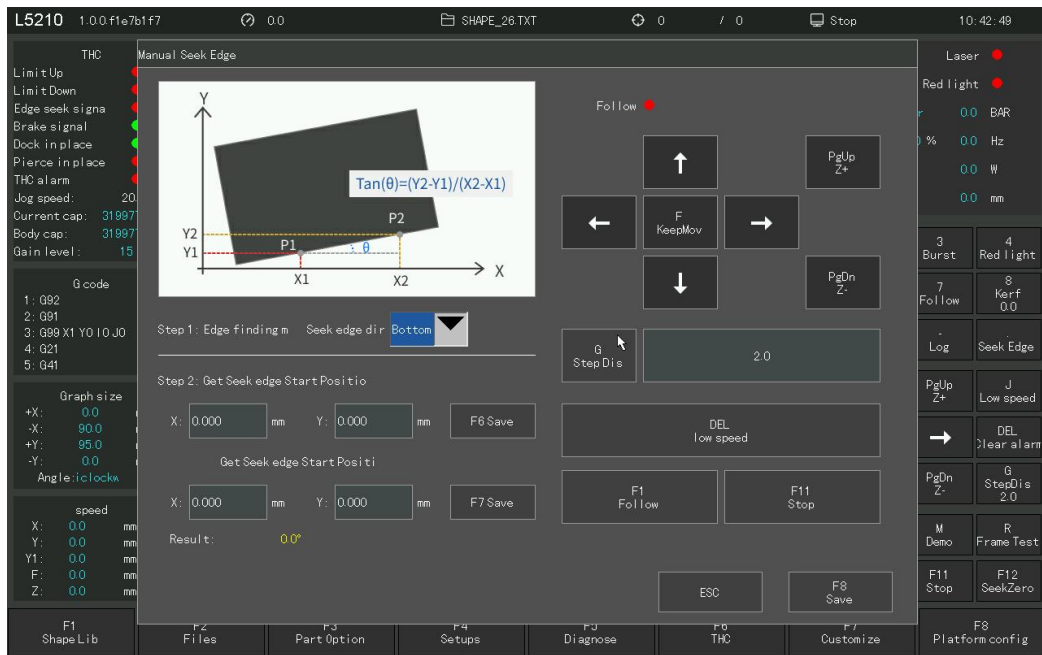
THC
Limit Up ●
Limit Down ●
Edge seek signa ●
Brake signal ●
Dock in place ●
Pierce in place ●
THC alarm ●
Jog speed: 20
Current cap: 31997
Body cap: 31997
Gain level: 15

G code
1: G92
2: G91
3: G99 X1 Y0 I0 J0
4: G21
5: G41

Graph size
+X: 0.0
-X: 90.0
+Y: 95.0
-Y: 0.0
Angle:iclockw

speed
X: 0.0   mm
Y: 0.0   mm
Y1:   0.0   mm
F: 0.0   mm
Z: 0.0   mm

Manual Seek Edge

Tan(θ)=(Y2-Y1)/(X2-X1)

P2
Y2
Y1   P1   θ
        X1   X2

Step 1: Edge finding m   Seek edge dir Bottom ▼

Step 2: Get Seek edge Start Positio
X: 0.000   mm   Y: 0.000   mm   F6 Save

Get Seek edge Start Positi
X: 0.000   mm   Y: 0.000   mm   F7 Save

Result: 0.0°

Follow ●

↑   PgUp Z+
←   F KeepMov   →
↓   PgDn Z-

G Step Dis   2.0

DEL low speed

F1 Follow   F11 Stop

ESC   F8 Save

Laser ●
Red light ●
      0.0   BAR
%   0.0   Hz
      0.0   W
      0.0   mm

3 Burst   4 Red light
7 Follow   8 Kerf 0.0
. Log   . Seek Edge
PgUp Z+   J Low speed
→   DEL Clear alarm
PgDn Z-   G StepDis 2.0
M Demo   R Frame Test
F11 Stop   F12 SeekZero

F1 Shape Lib   F2 Files   F3 Part Option   F4 Setups   F5 Diagnose   F6 THC   F7 Customize   F8 Platform config

Figure 3. 10 Manual edge finding

Chapter 4 Part Options

Before cutting, "F3 Part options" is available on the main interface. Press [F3] to enter the component options menu:
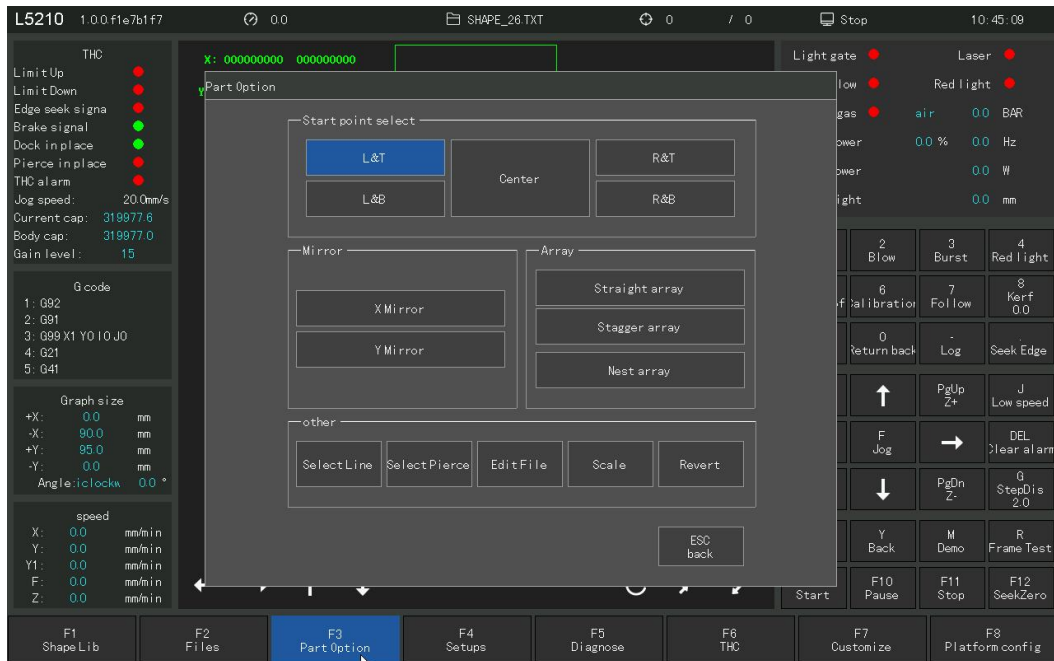

Figure 4.1 Part Options

4.1 Starting point selection

After pressing [F3], enter the part option interface, you can select the starting point by manual touch and mouse and keyboard. System prompted to select the starting point:
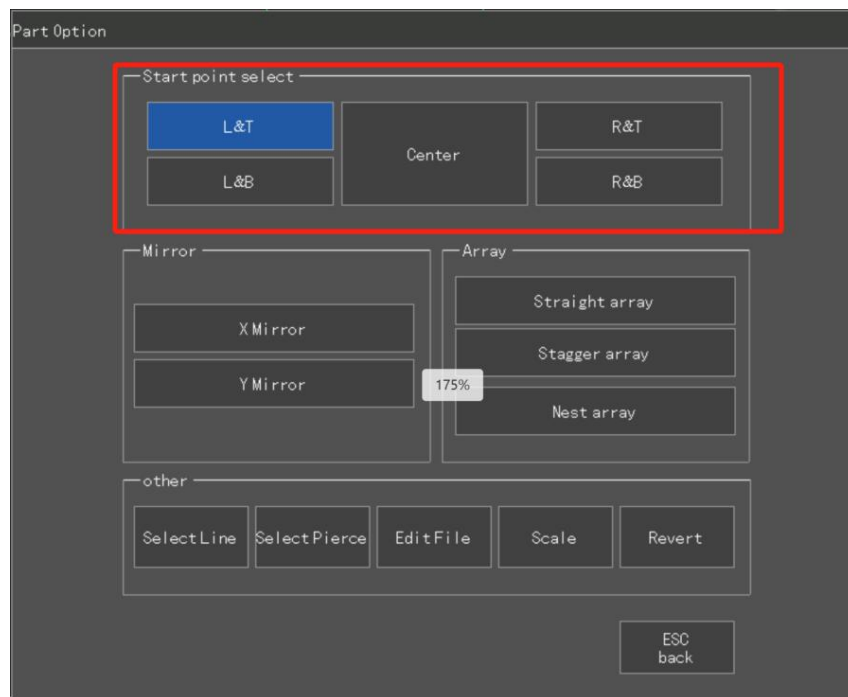
Figure 4.2 Starting Point Selection

After clicking the corresponding starting point to select the position, the starting point of the cutting part automatically jumps to the corresponding position. For example, when the starting point is the lower right, the starting point of the part automatically jumps to the lower right corner. Shown in Figure 4.3 and Figure 4.4.
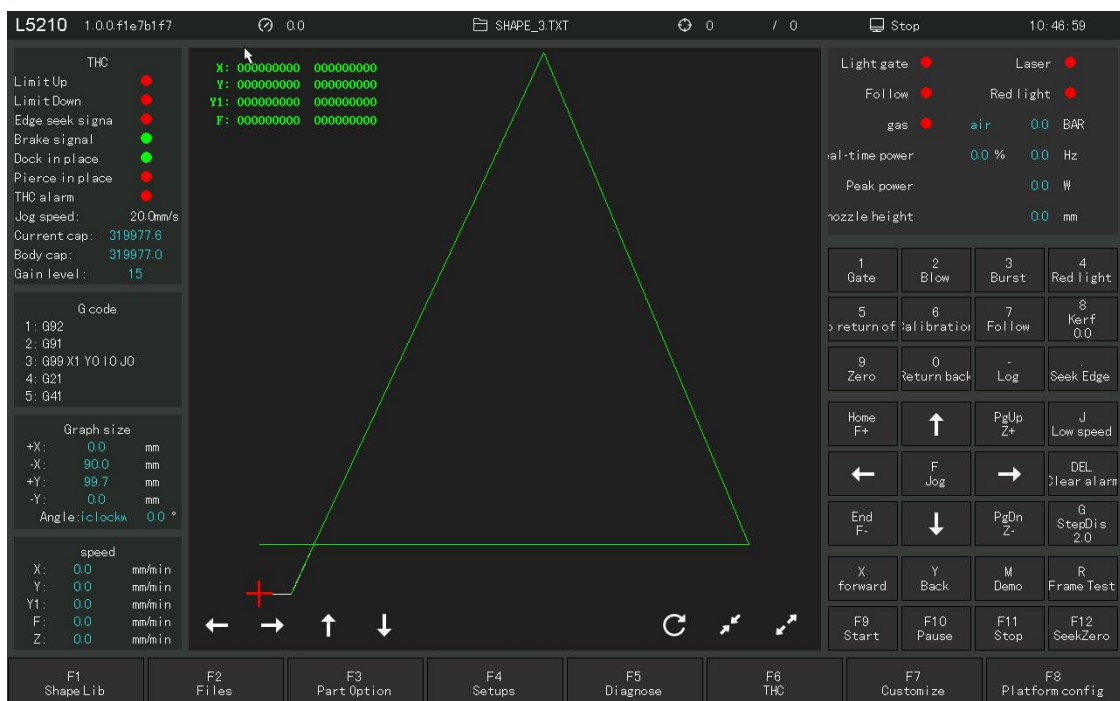

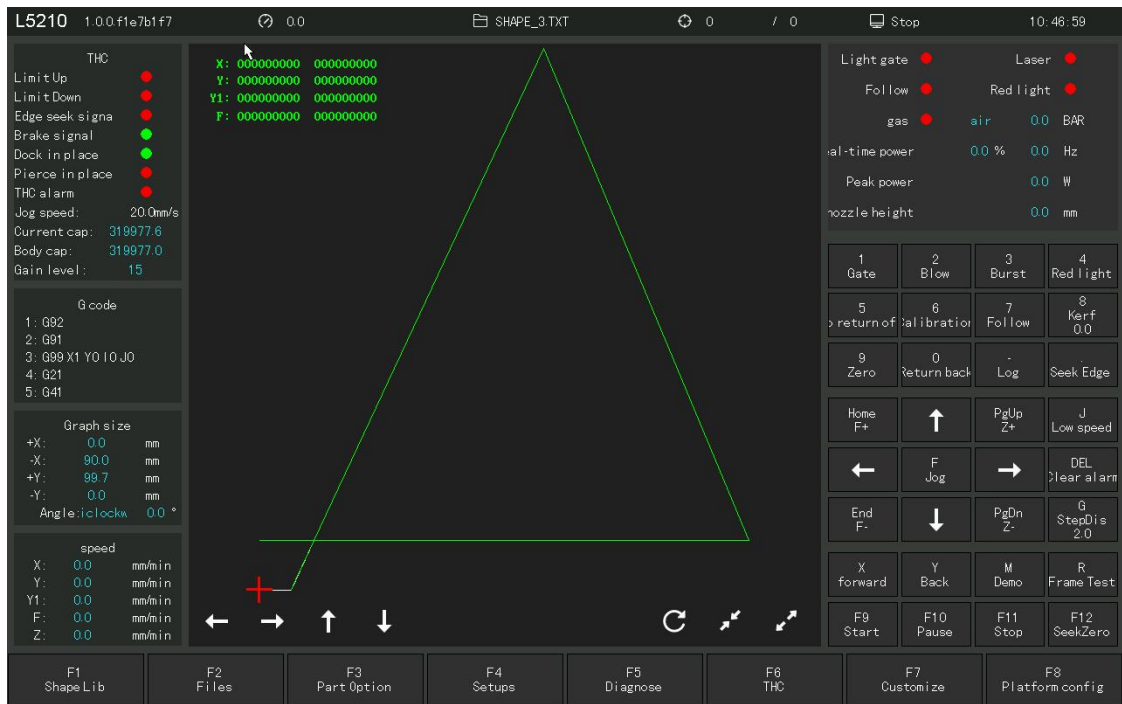Figure 4.3 Where the starting point before pressing F4

Figure 4.4 After pressing F4, the starting point is on the lower right

4.2 XY mirror

● Press [X] to mirror the horizontal axis (X axis), that is, up and down mirror.

●Press [Y] to mirror along the vertical axis (Y axis), that is, the left and right mirror.
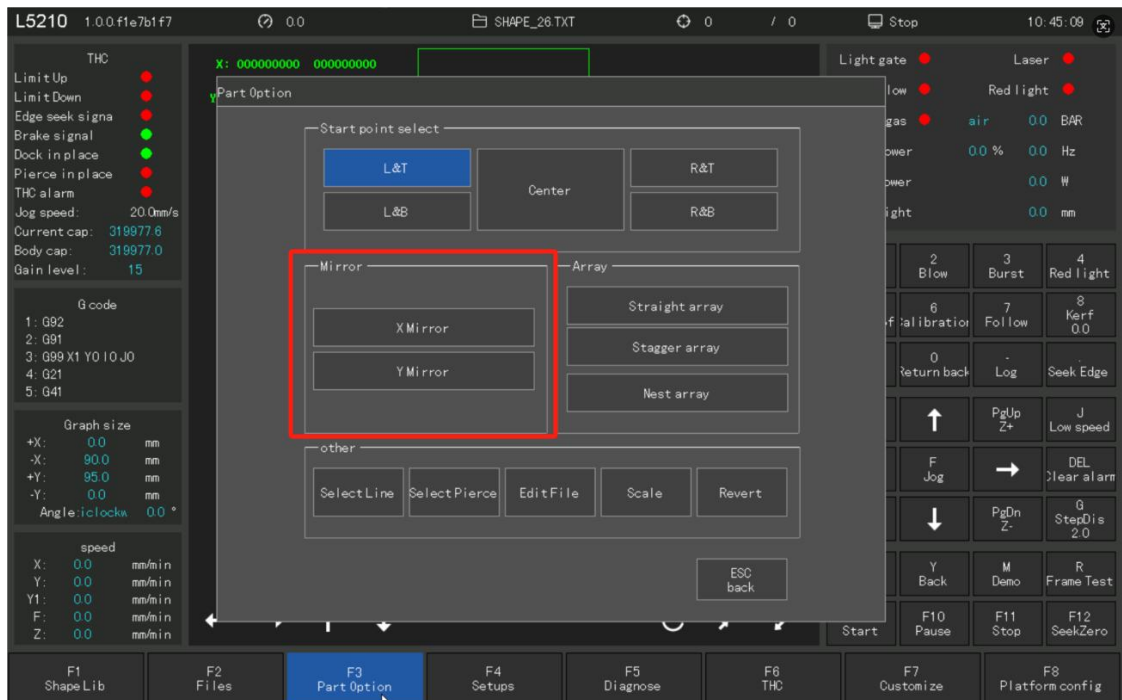
Figure 4. 5 Mirror image

4.3 Array

Under the part option interface, select the array option. The system prompt is shown in Figure 4.6. Select the matrix, staggered and overlapping arrangement. If clicking the Straight array, the result shown as in Figure 4.7 and Figure 4.8; The Stagger array result shown as in Figure 4.9 and Figure 4.10; Nest array shown in Figure 4.11 and Figure 4.12;

Figure 4. 6 Permutation selection

Figure 4. 7 Matrix arrangement parameters

Figure 4. 8 Matrix arrangement effect

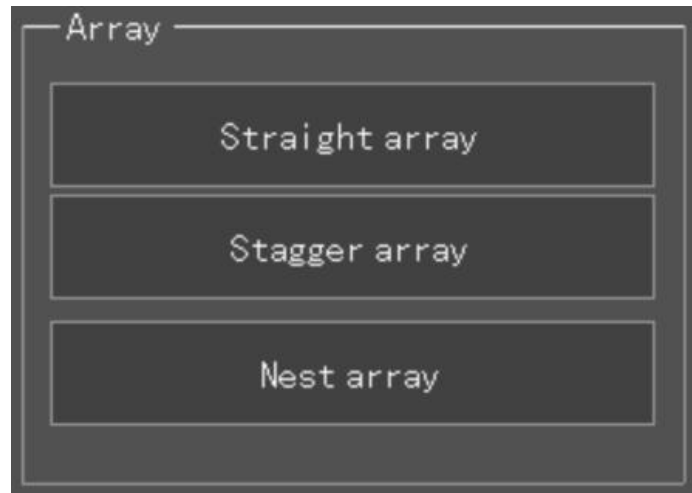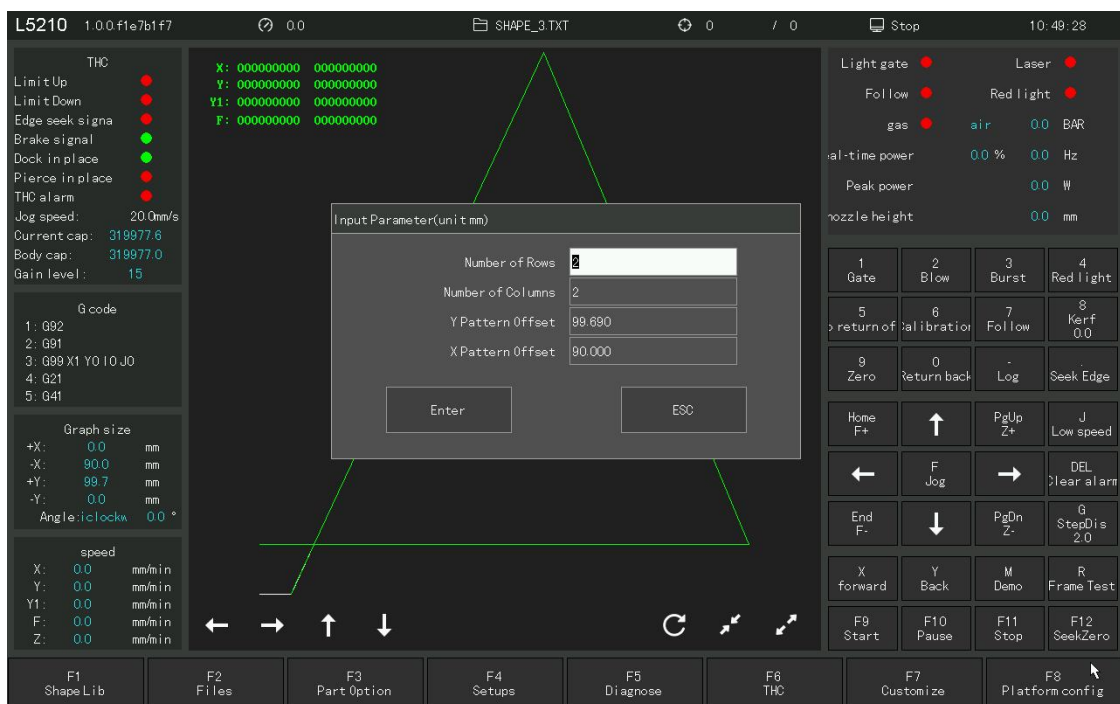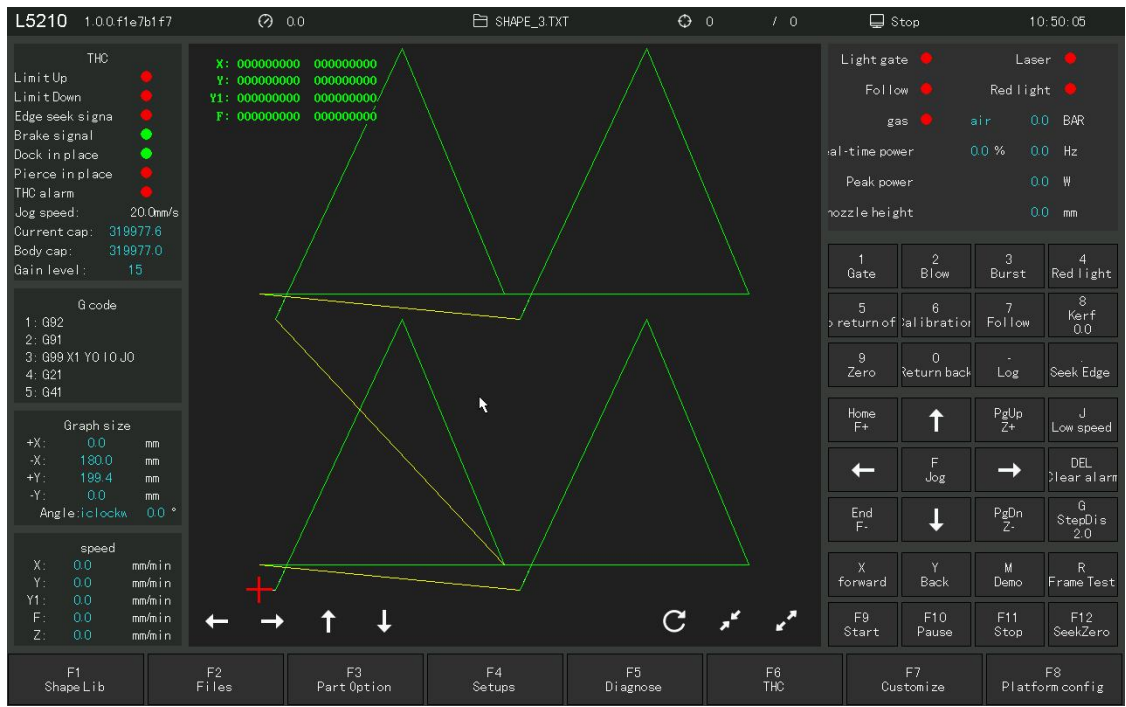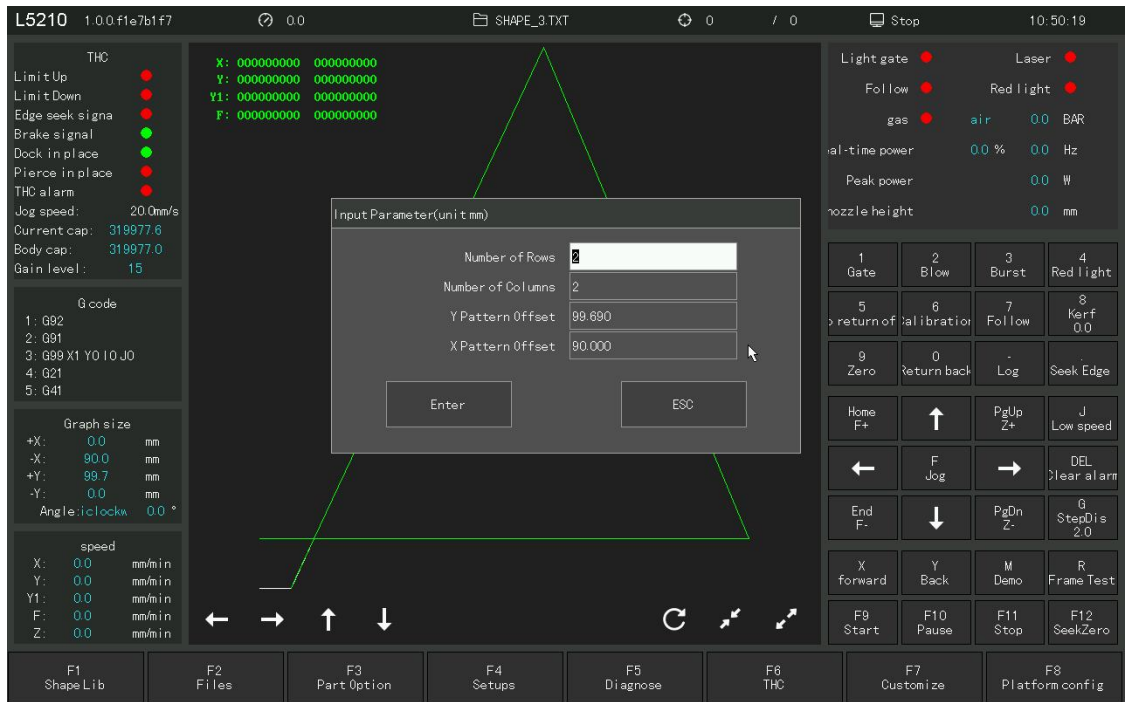Figure 4. 9 Interleaved arrangement parameters
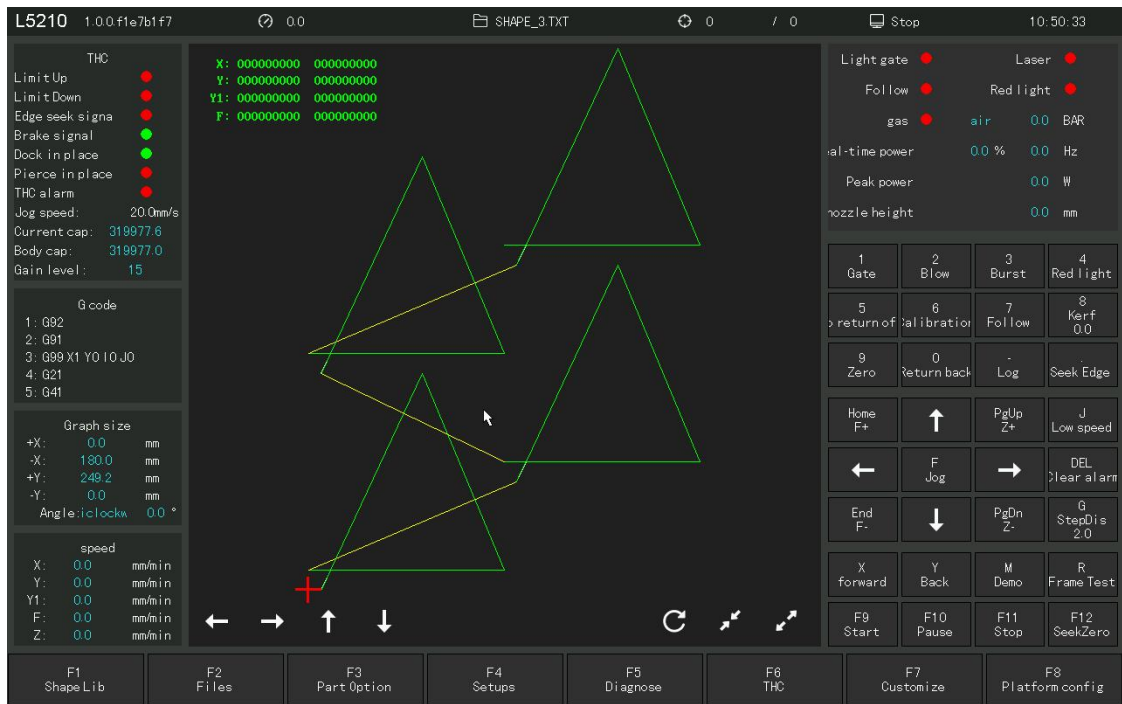
Figure 4.1 0 Effect of staggered arrangement
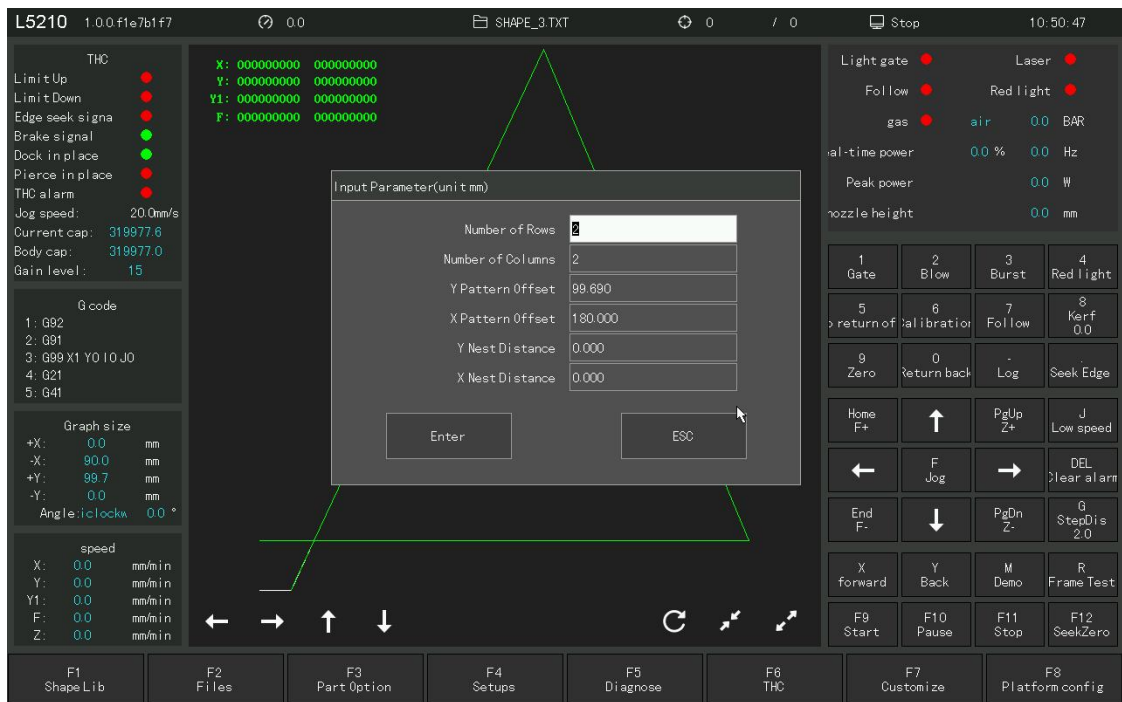
Figure 4.1 1 Vertical arrangement
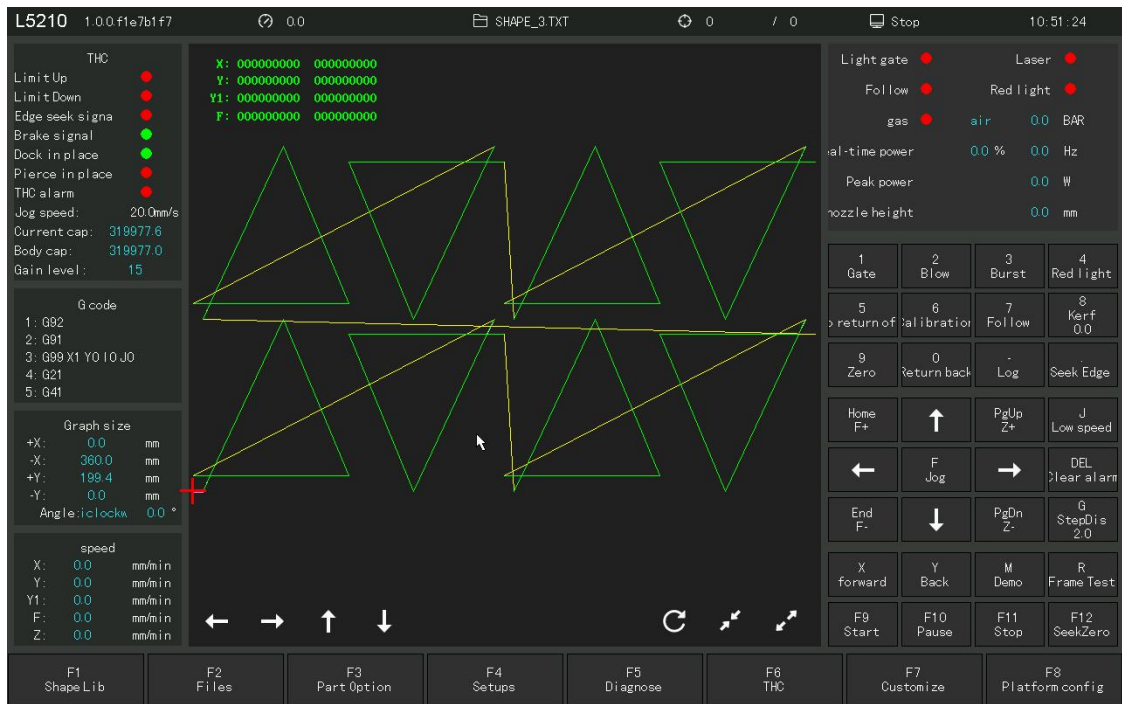
Figure 4.1 2 Vertical arrangement effect

Note: stagger array is mainly used in figures suitable for inter-arrangement, such as triangle, trapezoid, etc. The stagger array is first to rotate the current figure in the center 180 degrees, and then the original figure and the rotated figure, inserted arrangement, combined into a new figure. Then put the new graph combined after the matrix arrangement.

parameter declaration:

Number of rows: two graphs are combined into a graph in a centrosymmetric way, the number of rows of combined graphic to be arranged.

Number of columns: two graphs are combined into a graph in a centrosymmetric way, the number of columns of combined graphic to be arranged..

Line spacing: Two graphs are combined into a graph in a centrosymmetric way, the space of line array of the combined graphic.

Column spacing: Two graphs are combined into a graph in a centrosymmetric way, the space of column array of the combined graphic.

Line nest: the distance between the center Y direction in a centrosymmetric manner. This parameter can be of negative values.

Column nest: the spacing between two figures in the X direction when two figures
are inserted in a centrosymmetric way. This parameter can be of negative
values.

4.4 Select lines

Under the assembly option interface, click the "Select line" button to select the
lines. System shown in Figure 4. 13.
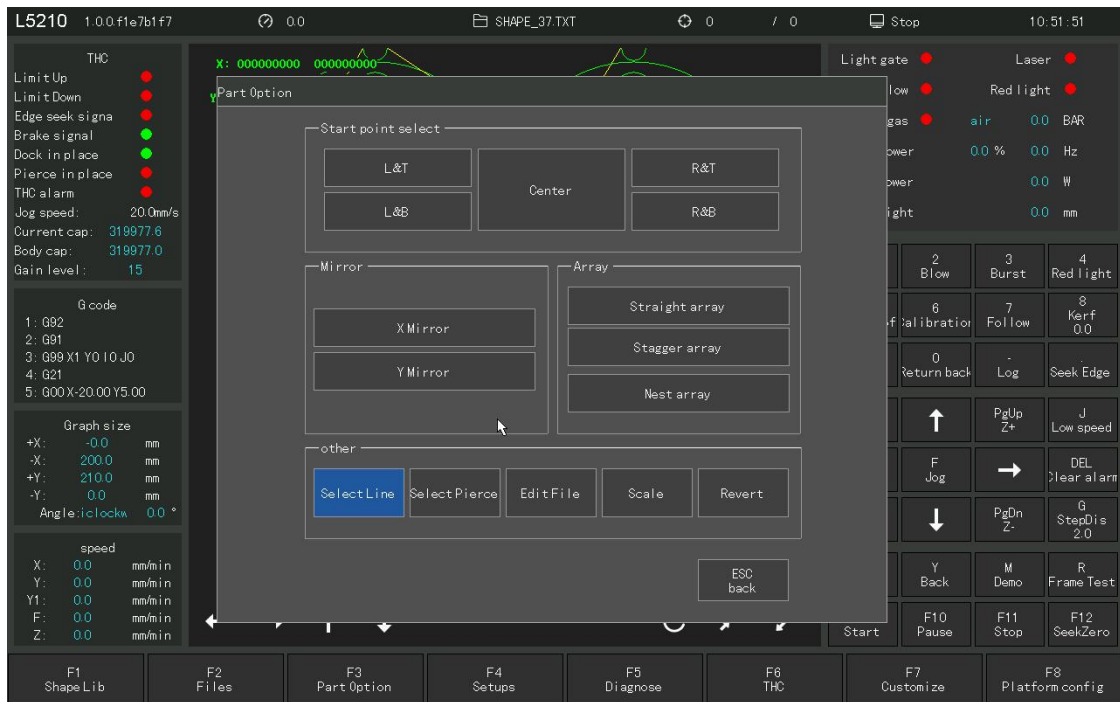
Figure 4. 13 Line Selection and number selection

Click the "Select tline" button to select the line number for cutting. The
system prompts in Figure 4. 13, when you can directly enter the line number for
processing, or press ENTER to enter the line selection interface or select lines.
After the line selection is completed, press [F8] to confirm
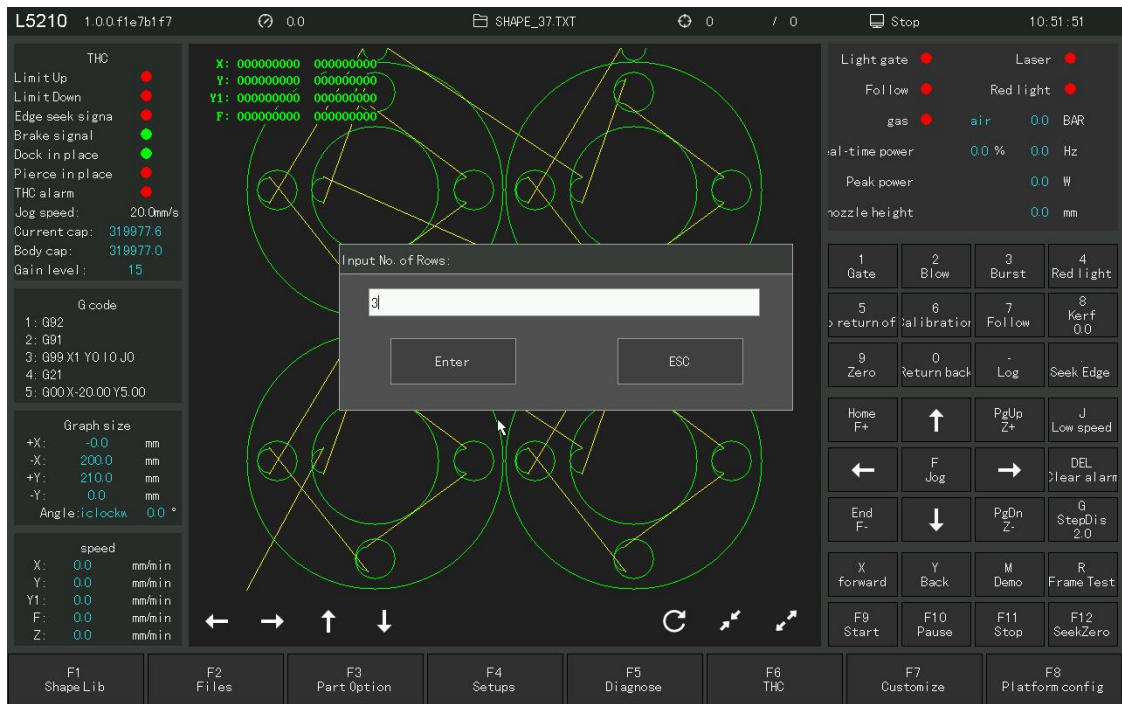
Figure 4. 14 Line selection prompt
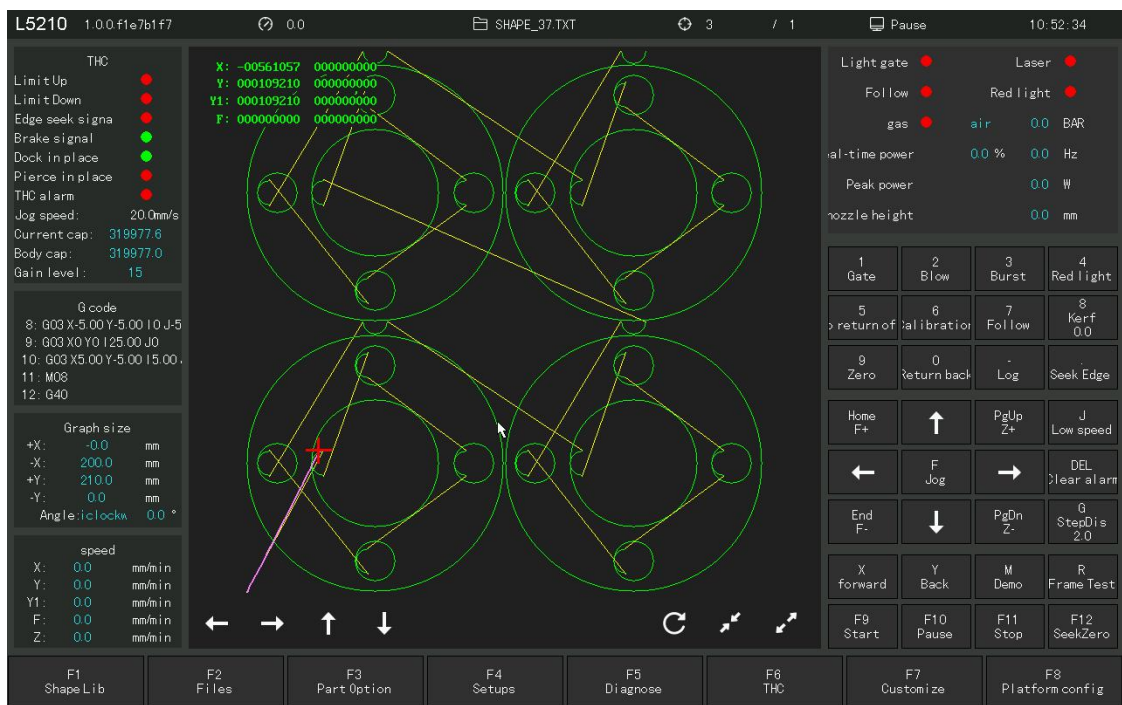
Figure 4. 15 Cursor after line selection

4.5 Select the hole number

Similar to the operation of the selected rows. The number selection function corresponds to the perforation point in the selected processing file, requiring an M07 statement in the G code or ESSI.

4. 5.1 Operation after selecting the hole number

After line selection or number selection, click Enter to return to the main interface of the system.

1) Move from the current position to the new position after the selection or selection and then process.

At this point, the system will go directly to the selected perforation point, as shown in Figure 4. 16, and then pause for further operation.
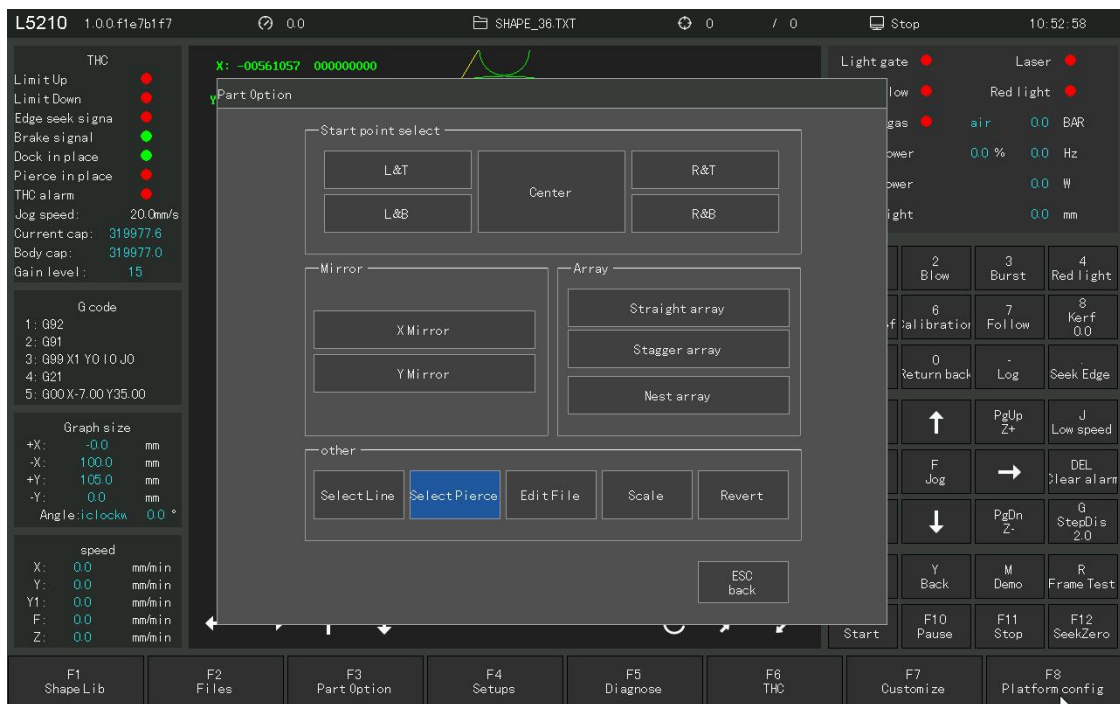
Figure 4. 16 Direct air line to the selected perforation point
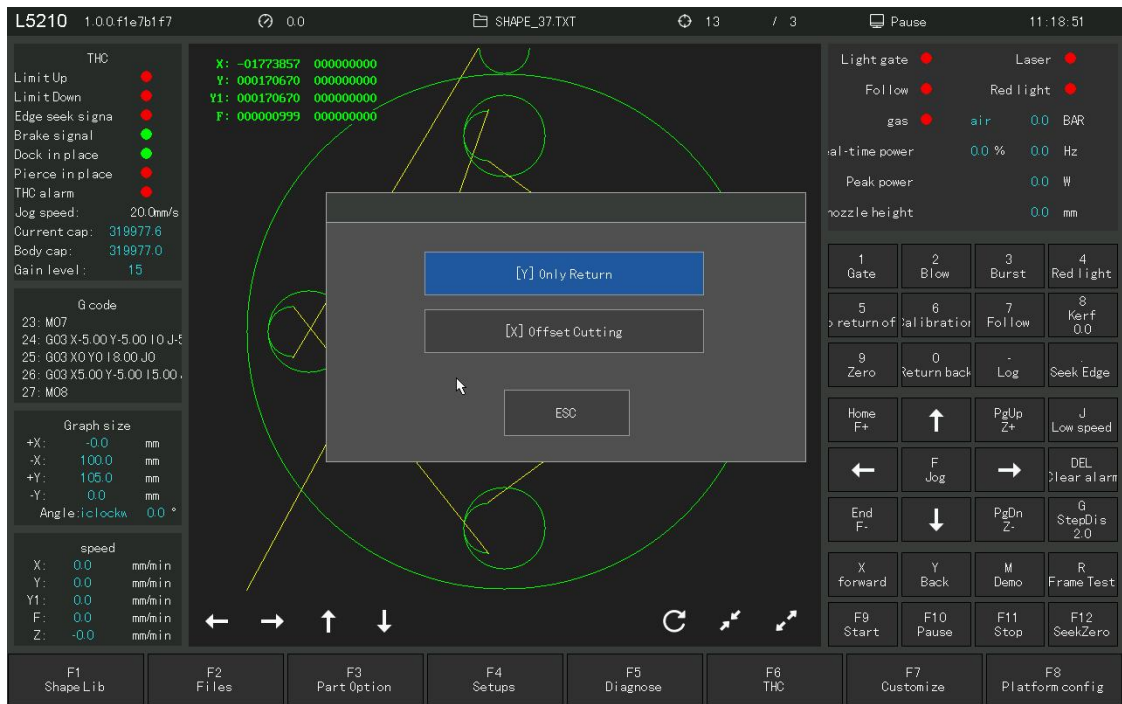
Figure 4. 17 Operation of line selection

2) Direct processing from the current position.

Press START at the cutting interface, and the system prompt is shown in Figure 4. 17. Press [Y], the system will also directly walk empty to the selected line number or perforation point, and then pause for further operation. Press [X], the system will go to the selected line / hole number, and press [STRAT] to start processing in the current position. That is, the cutting begins at the offset position.

4.6 Scale

Under the component options interface, press [F4] (Scale) and the system prompts in Figure 4.1 8.

After entering the proportional parameter, press [Enter], and the system will automatically scale in or out of the input parameters.

Note: Scaling also scales the lead lines.
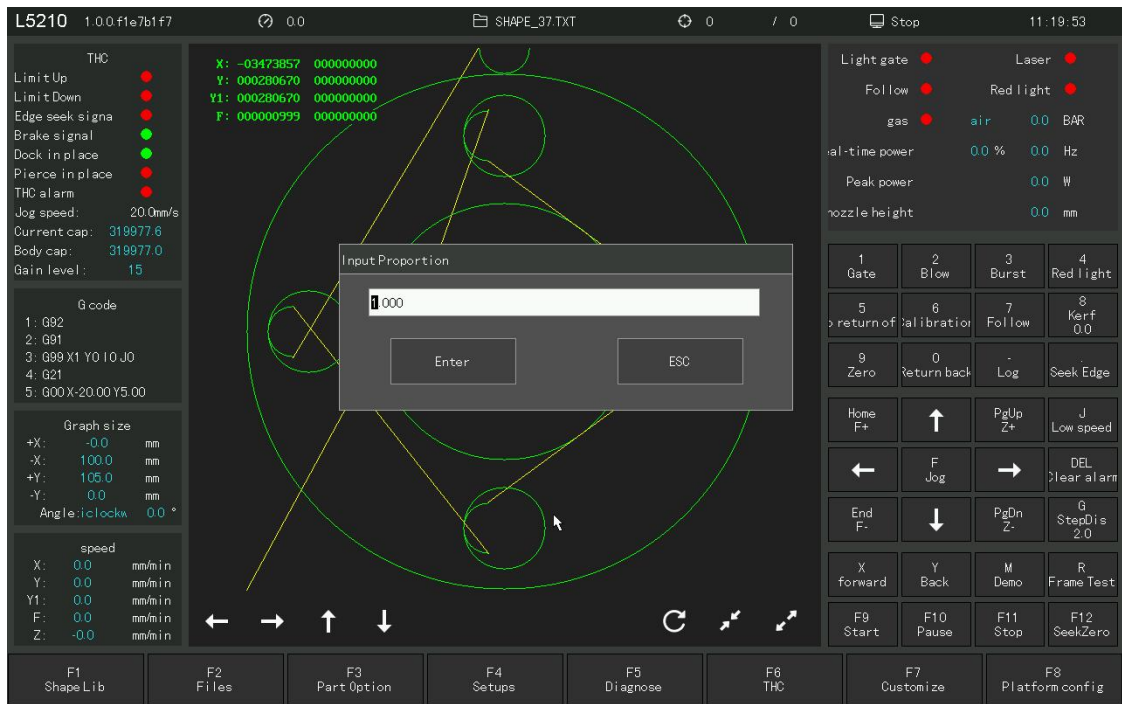
Figure 4.1 8 Scaling

4.7 Graphic restore

If you want to cancel all the mirror, rotation, correction, scale, array of the graph, press the "Restore" button under the component option interface, restore to the original state of the drawing, and cancel all the mirror, rotation, correction, scale, arrangement, and other operations.

Chapter 5: Manual Functions

Under the main interface, there are a variety of manual operation function buttons to realize a variety of manual operation modes.

The speed in the manual state is controlled by the manual speed parameter in the F4 parameter setting-F1 global parameter. When moving manually, the speed cannot be adjusted. The cutting needs to be suspended and enter the parameter setting interface for setting.

Figure 5.1 Manual moving parameters

5.1 Point function

When entering the manual interface for the first time, the system defaults to click, or press [F] to select the click function. At this point, press either direction key and hold it down, the system will move in that direction, release the direction key, and the system stops moving.
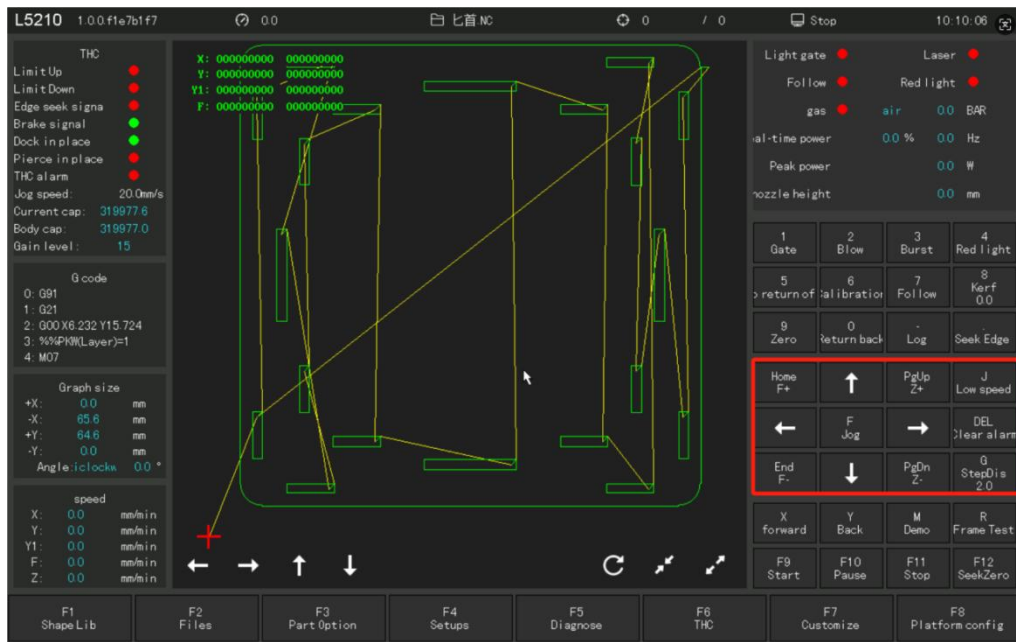
Figure 5.2 Touch the operation button

5.2 Jog

Press [F] to enter the fixed length in the manual interface. System prompts for fixed distance:
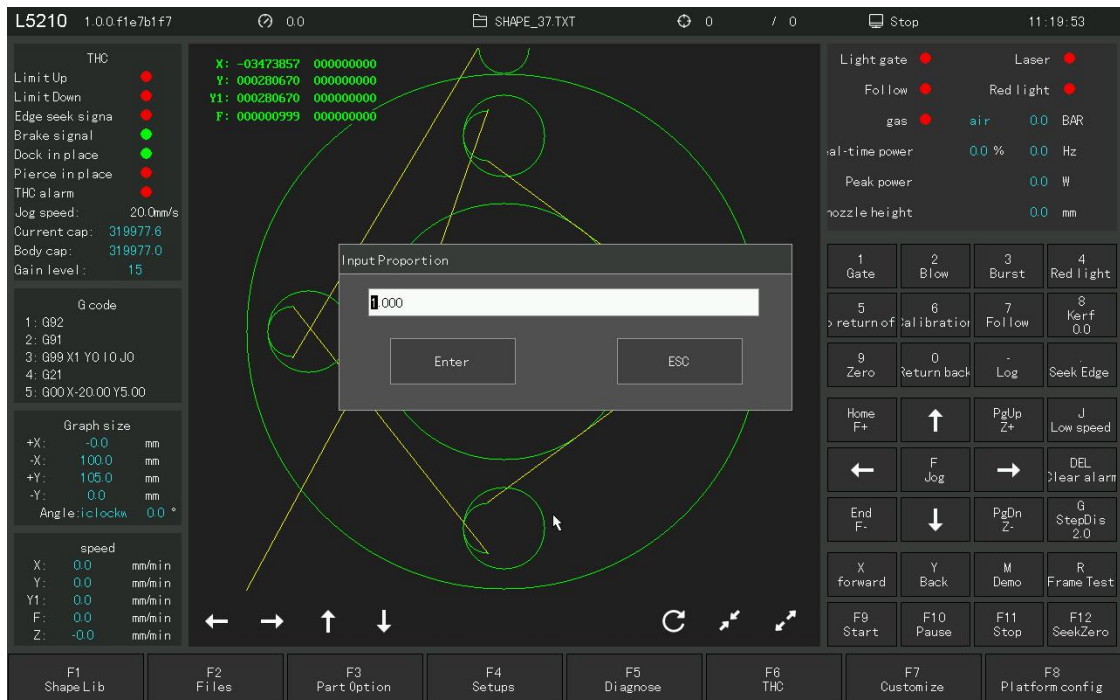
Figure 5. 3 Input fixed long distance

Press ENTER after input a distance. At this time, press any direction key and release, the system will move the fixed distance and automatically stop. During the movement, if any direction key or stop key pressed, the system will also stop moving.

Chapter 6 File Management

The system supports cutting code with txt, cnc, nc, B3, MPG. Maximum size of a single G code file is 4M, and the maximum number of lines is 80000 lines. You can edit, compile, delete, export internal files, or import external U disk files.

Note:

1. The total number of files in the local hard disk should be less than 5000, and the number of files in a single hard disk folder should not exceed 1000.

2. The total length of the file path in the superior disk cannot exceed 133 bytes. A Chinese character is calculated by two bytes, and letters and characters are calculated by one byte.

3, the native hard disk folder name is 13 bytes. A letter or character by a byte.

4. The maximum single file name is 64 bytes.

Press [F2] under the main interface to enter the file management interface, as shown in the following figure is the file management interface.
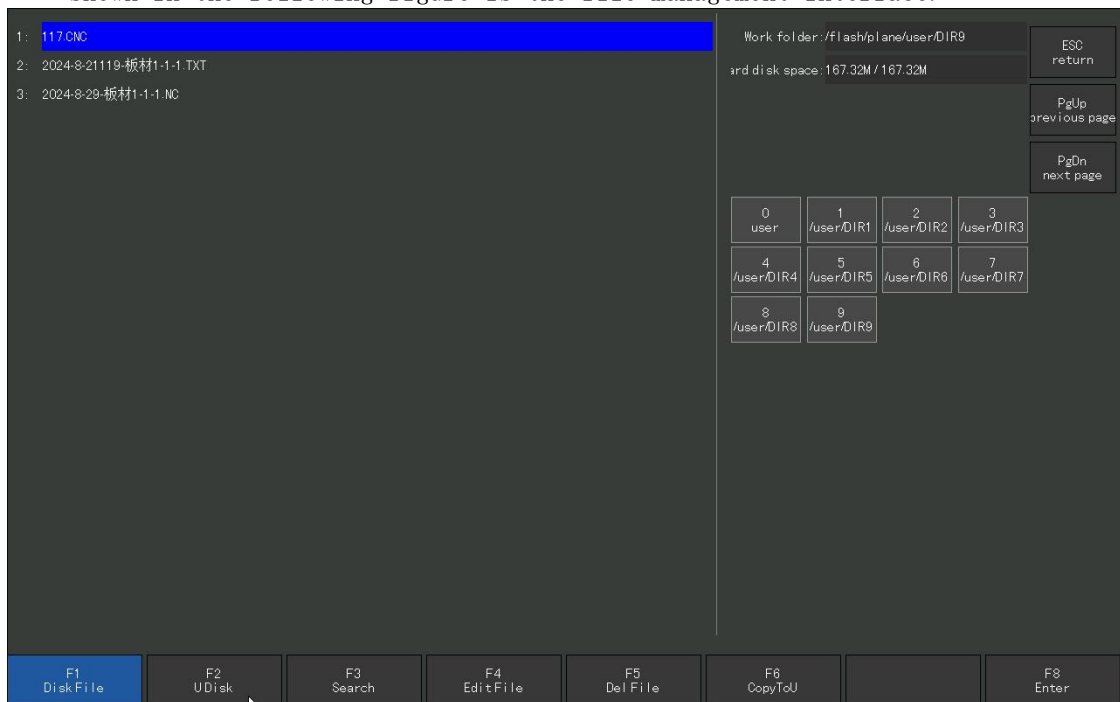
Figure 6.1 File management interface

6.1 Hard disk file

In the file management interface, code files can be imported, and hard disk files and U disk files can be copied to each other.

Press [F1 disk file] to enter the hard disk file list, as shown in Figure 6.1, and the system only lists the supported G code files.

Press [F 3 Search], the system can find part or all of the characters of the input file name. Press ENTER, the system will list all the files containing the input string.

Press [F4 Edit file] edit the file if the current cursor is a G code file. Refer to Section 6. 5 for editing.

Press [F5 Delfile] allowing you to delete current file or current folder and all files in it.

Press [F6 CopytoU], if the current cursor is a G code file, copy the current file / folder to the external U disk, provided that the U disk is inserted in the USB interface of the system.

Press [F8 enter], if the current cursor is a G code file, transfer the current processing file to the system, after adding the file, the system will automatically return to the main interface.

6.2 U disk file

In the F2 file management interface, press [F2] to enter the U disk file interface.
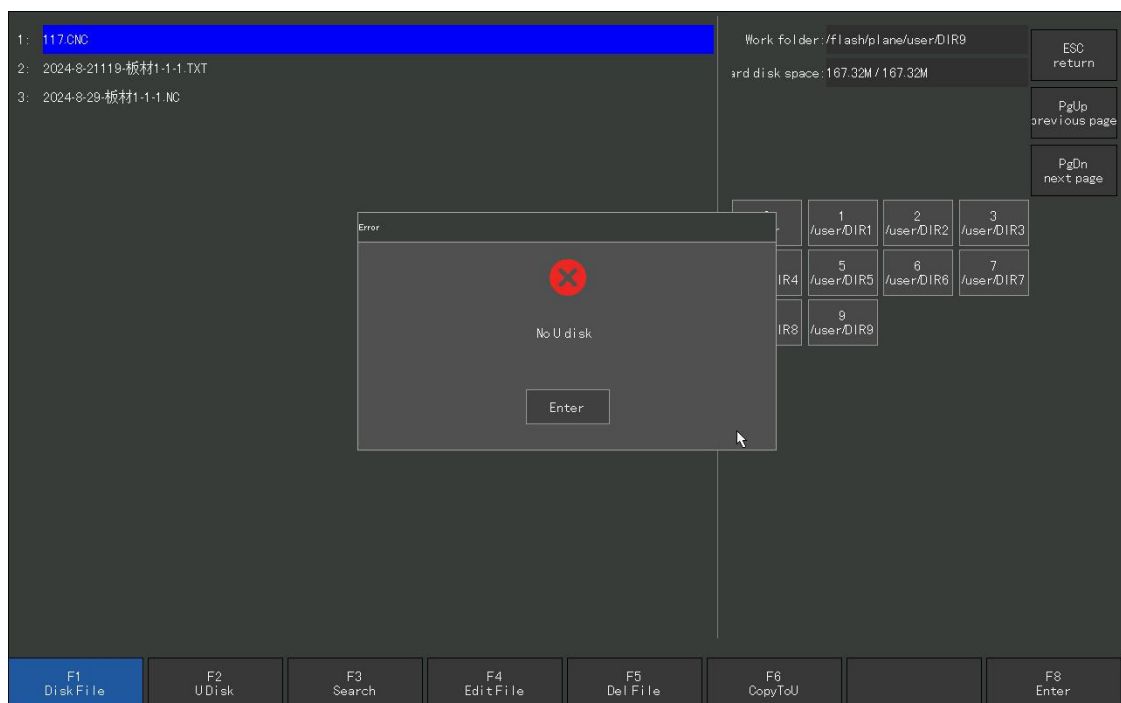
Figure 6.2 U disk file

Under this interface, [F6] automatically changes from "copyToU" (copy to disk) to "copy to hard disk" (copy to internal hard disk). After selecting the corresponding file, press [F6], and the system will automatically save the file to the current folder of the internal hard

drive.
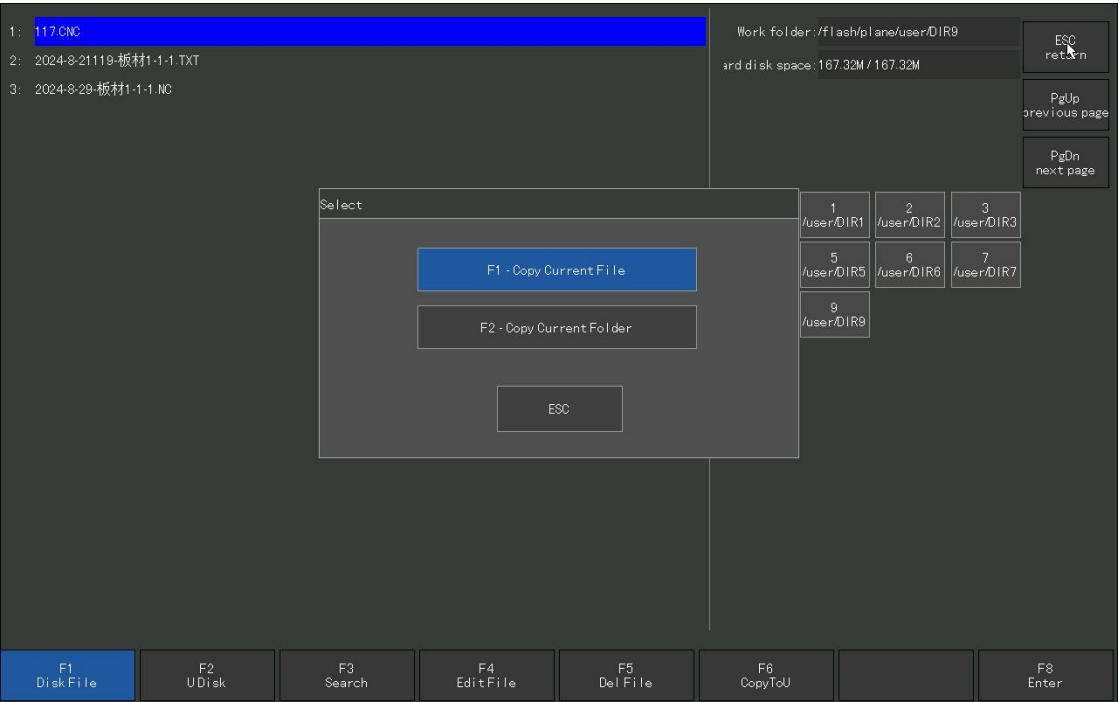
Figure 6.3 Replace Copy the current file / copy the current folder

Note: The documents in the superior disk can also be processed directly according to [F8] confirmation or [ENTER].

When the file on the U disk is saved to the internal hard disk, the file name can be saved without changing, or saved after modifying the file

name.
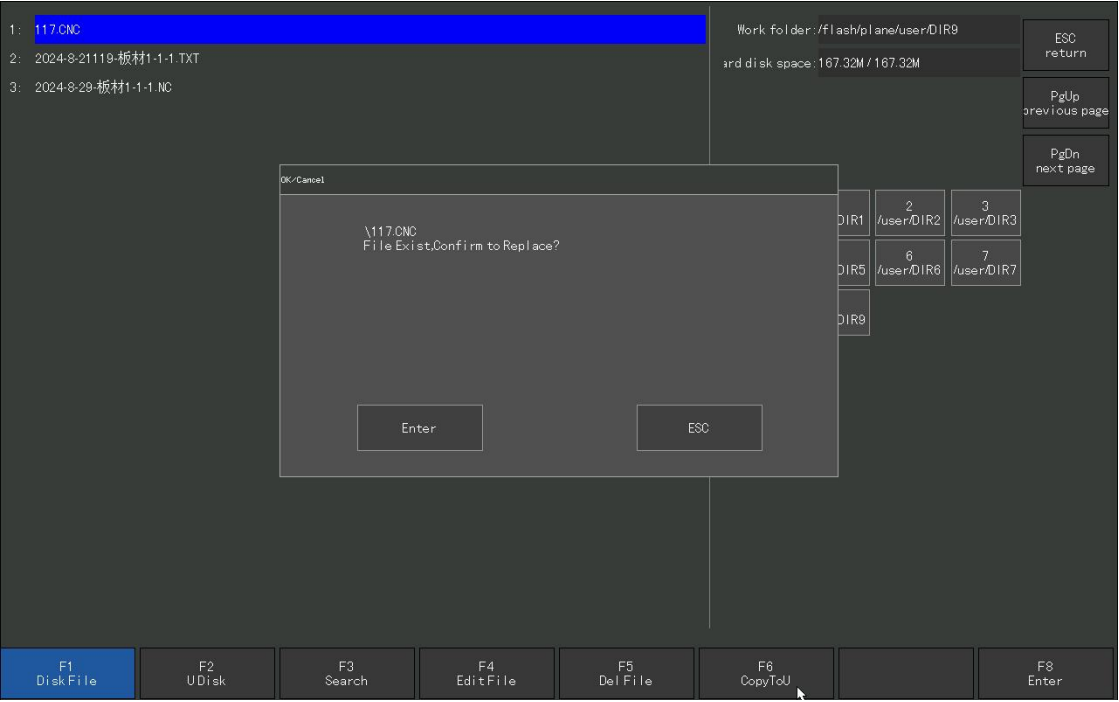
Figure 6.4 Same replacement file name, whether to override?

If you want to replace an internal file, press [Enter]. If you want to change the file name again, press [Esc] and change the file name before saving it.

6.3 Search

Press [F3] under the file management interface to find the file. Enter part or all of the characters of the searched file name, press ENTER, and list all of the files containing the input string.

6.4 Code editing

Under the code interface, move the cursor to the file name to be edited and press [F4] to edit the code.

When entering characters, some keys are reuse keys, directly press the reuse key, the input character is the lower key (regular character), [Shift] and reuse key at the same time, the input is the upper key of the reuse key.

When editing the code, press [F2] to insert a row behind the current edit line, and press [F3] to delete the current edit line. Press [Home], the cursor automatically moves to the first character of the current edit line, press [End], and the cursor automatically moves to the back of the last character in the current line.

Each edit line supports a maximum of 128 characters.
Before starting cutting, must save first, otherwise the system cannot perform breakpoint recovery or power recovery. After editing the code, press [F8] to save it.
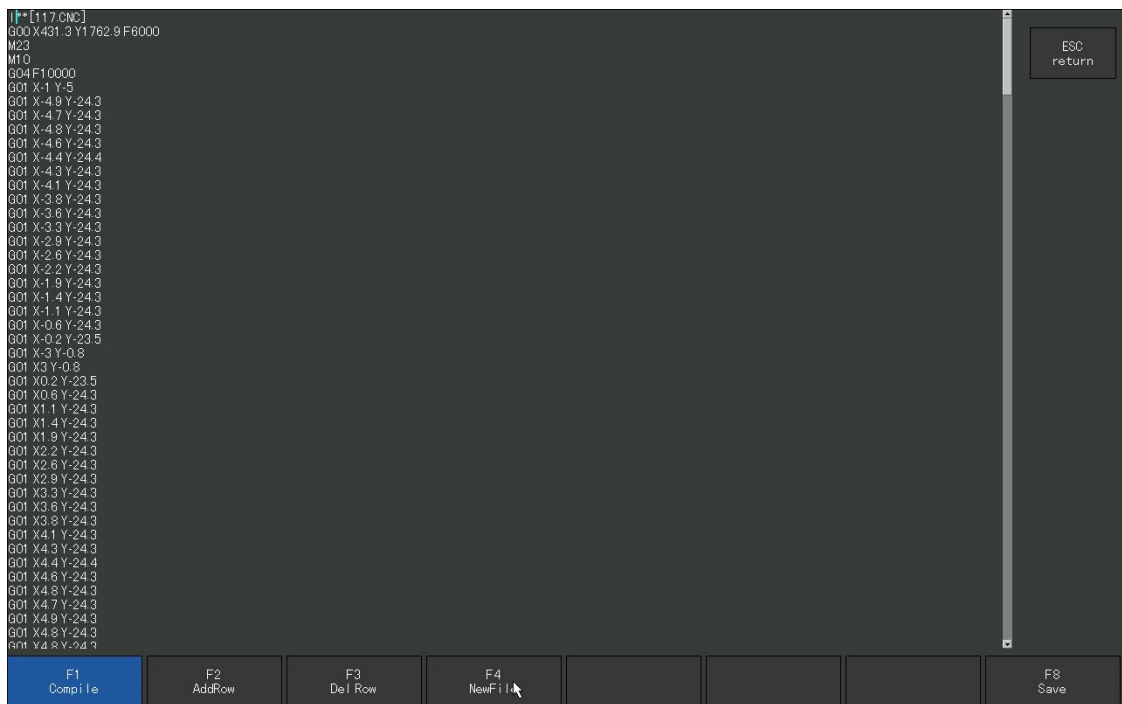
Figure 6. 5 Edit code

6.5 Delete the file

In the file management interface, press [F5] to delete a file, and the dialog box will pop up as shown in Figure 6.5. Select to delete the file of the current cursor, or all files in the currently selected folder, or empty all files.

[F1] Delete file: The G code file with the current cursor is deleted.

[F2] Delete folder: all G code files in the current folder are deleted.

[F3] Empty all files: delete all G code files.
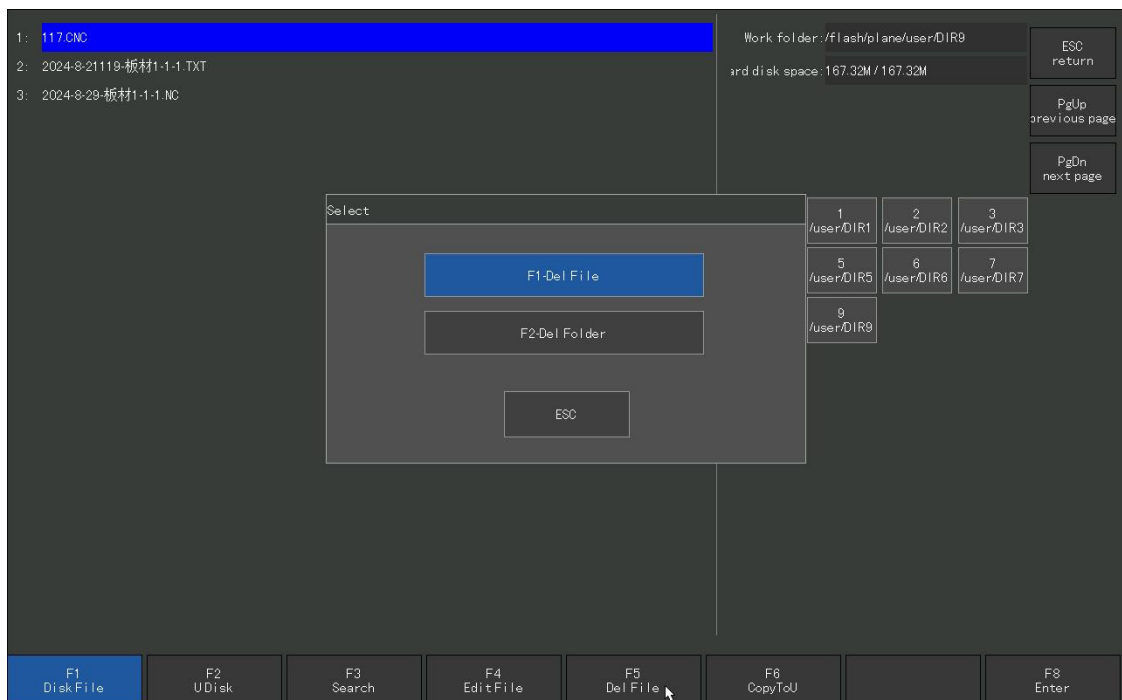
Figure 6.6 Delete the files

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6.6 Create a new file

In the code editing interface (see section 6.4). Press [F4] to create a new file, you can manually build files.

Figure 6.7 New file

6.7 Compile the code

After creating a new code or editing code, if you want to know if the current input code is valid, you can use the editing state and press [F1] to compile the code and check if the code is correct.
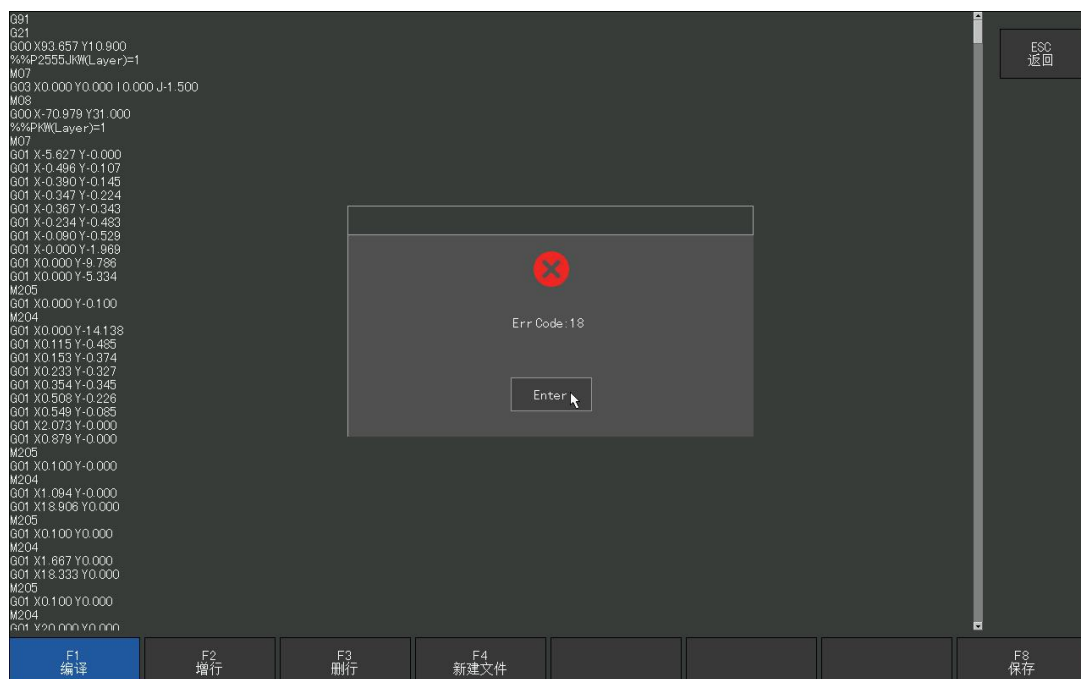
Figure 6.8 Compile file

Chapter 7 Parameter setting

Under the main interface, press [F4] to enter the parameter setting interface, as shown in the figure below is the parameter function interface.

Figure 7. 1 Parameter setting interface

7.1 Interface Index
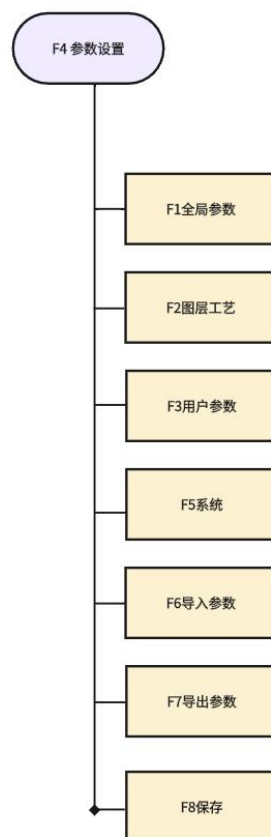
Figure 7. 2 Parameter setting interface index

7. 2 Global Parameters

Global parameters: cutting speed, manual moving speed, empty move speed setting, kerf value, cutting type selection, system mode parameters, etc.

Figure 7. 3 Global Parameter interface

Figure 7.1 common parameter of the system.

The parameter name	unit	scope	Parameter remarks
Manual low speed	mm/min		The low speed of moving the torch
Manual mid speed	mm/min		The mid speed of moving the torch
Manual high speed	mm/min		The high speed of moving the torch
G00 move speed	mm/min		The speed at which the cut torch moves when performing G00 or quick return. When moving empty, the torch will move only, not cutting.
Forward / backward speed	mm/min		Speed when forward or backward along the path during a pause in the cutting.
Blowing gas pressure	BAR		The outlet pressure of the air valve is controlled by DA, and the air pressure is linear with DA.
Open gas delay	s		Time to open the air before the light opens

Advance open gas time	s		Opening time before move in place
Short dis not close gas length	mm		The gas is not closed within this distance length
Burst peak power	%		Percentage of the peak power
Burst pulse frequency	Hz		The number of times the signal goes from high to low and returns to high per second
Burst duty cycle	%		Proportion of the power-on time relative to the total time within a pulse cycle
Burst time	ms		Press the click button to start the time, after this time the click will be closed
Leap frog enable			After enabling, will use frog method to do empty walk.
Short dis not up			When the empty move length is less than the set value, the cutting torch will go directly to the next perforation point without lifting the torch for processing
Micro connect used fly cut			Microlinks use flight cutting
Start point			Starting point: default, center, upper left, lower left, upper right, lower right

Note: Kerf compensation (cutting torch radius value, only plate cutting can be set): In order to ensure the dimensional accuracy of cutting parts, the user sets the kerf compensation value according to the cut kerf width, and the system will automatically generate a new cutting path to compensate the cut joint. The kerf value can be modified before cutting a workpiece and is not allowed after cutting.

7.3 Process parameters of the laser layer

Layer process parameters: all parameters used in laser cutting, involving cutting, marking, evaporation, film, cutting, etc.

Figure 7. 4 Layer process

As shown in Figure 7.2, the process parameters of the laser processing layer are set in the laser cutting state.

Table 7.2

The parameter name	unit	scope	Parameter remarks
Process			
The nozzle height	mm		The height of the cutting torch. This value determines the distance of the cutting torch from the plate during the cutting process, also known as the following height or the cutting height.
Cut gas type			Choose oxygen, nitrogen, and air.
Cut gas pressure	BAR		Pressure of gas during cutting (can be controlled)

Cut peak power	%		Peak power in the process of the maximum power of the laser (duty cycle and pulse frequency of real-time power. For example, laser maximum power is 3000W, cutting peak power is 50%, it represents the system of the cutting control laser power range will not exceed 1500W, real-time power represents the second power is 800W, the next second power control in 900W, is the real-time value in the process of movement)
Cut duty cycle	%		Proportion of the power-on time relative to the total time within a pulse cycle.
Cut pulse frequency	Hz		The number of times the signal goes from high to low and returns to high per second.
The focus position	mm		Location of the laser focus (energy maximum point, similar to a magnifying glass in the sun, can focus a highest energy point)
Cut residence time	s		Delay time before the torch start moving (that is, when laser is open, delay for a period of time, otherwise starting cutting directly)
Lift height	mm		After finish cutting, lift the torch to set height.
M08, do not close power			Do not close the air valve when performing the M08 lifting
Close power delay	s		When executing M08, delay a period of time and then close the laser
Enable focus control			Initiate the control of the focus axis
Manual speed of Focus-axis	mm/min		Speed of manually move focus-axis. The shortcut [SHIFT] + [R] controls

			the focus axis up, [SHIFT] + [T] controls the focus axis down.
Positioning speed of focus-axis	mm/min		The speed of focus movement during perforation process
Enable PWM adjustment			When enabed, the real-time power of the laser will be adjusted according to the system speed.
PWM adjustment			The real-time power can be adjusted in real time according to the speed by setting the relevant parameters, as shown in 7.2.1.
Perforated choice			No perforation, primary perforation Secondary perforation and tertiary perforation
Progressive enable			Do not close the laser and follow the specified location at the specified time
Types of perforation gas			Nitrogen, oxygen, and air
Perforation gas pressure			The air pressure during perforation, and each stage of the perforation corresponds to one parameter
Progressive time	s		Time from one position to another
Perforation peak power	%		The maximum power during perforation, the percentage of the peak power
Perforation duty cycle	%		The number of times the signal goes from high to low and returns to high per second
Perforation pulse frequency	Hz		Proportion of the power-on time relative to the total time within a pulse cycle
focus position	mm		The position of the focus in the focus axis
Perforation stay time	s		Perforation time
Blowing time after closing light	s		Turn off the laser first, and then delay it for a while to close the

			air valve
The nozzle height	mm		

●Process: Select the relevant layer process and enter the process setting interface.

7.3.1 PWM regulation

The PWM adjustment, set the parameters of the PWM adjustment according to the speed value.

If you want to adjust the real-time power in real time according to the speed, enable the "PWM adjustment enables". In the PWM adjustment interface, set the speed, duty cycle and frequency. Two adjacent sets of data can form a linear relationship between "speed-duty cycle" and "speed-frequency". Every speed in this interval can correspond to the unique duty cycle and frequency, and the real-time power can be adjusted according to the speed.
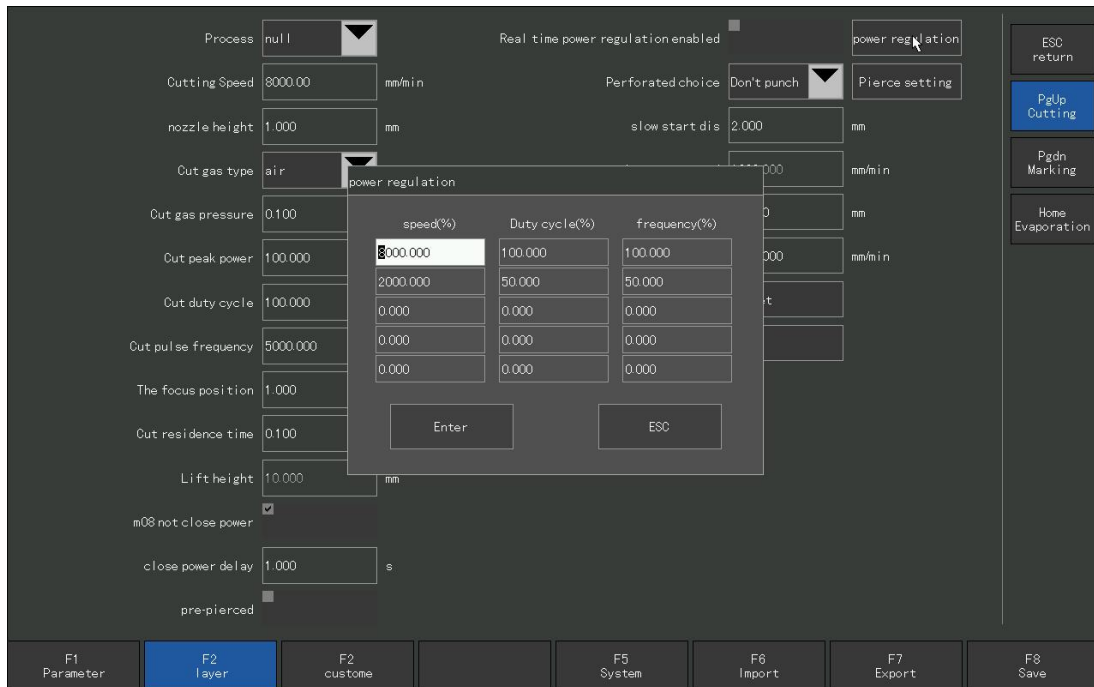
Figure 7.5 is shown for PWM regulation

7.4 User parameters

User parameters: Common user function parameters.

Figure 7. 6 User parameters

After pressing [F4] to enter the parameter setting interface, [F 3] is a common parameter for users.

●Default coordinates: optional relative coordinates, absolute coordinates. If G90 (absolute coordinates) and G91 (relative coordinates) are specified in the G code, the ones specified in the G code shall prevail; if no coordinates are specified in the G code, the configuration item shall prevail, and the default is relative coordinates.

● **Forbidden F: when enabled, the F-code is disabled. The F instruction after the G code (i. e. the speed limit instruction) is ignored.**

● IJ coordinate type: if there is no G02 / G03 in the G code, will take setup. If there is, then the G02 or G03 in the code will be the commend of the arc type. In general, the IJ coordinates of the circular arc are relative coordinates, and only the few G codes are absolute coordinates.

● **Enable cut compensation in EIA code: when enabled, kerf can be added. If not, cannot add kerf.**

●Remote control type: optional remote control with No, usb, P2P connection. Refer to the Remote Control input chapter.

●Default unit: metric system, British system. The metric system is generally used.

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- Small line segment fitting: when there are too many small line segments in G code, there may be continuous jitter or vibration during the operation of the machine tool. If this parameter is set to "yes", the system will fit the small line segments into a complete curve, which can make the movement smooth and continuously and reduce the jitter. In other cases, use No for this parameter. When small line segment fitting is turned on, the disadvantage is that the line segment accuracy will be partially reduced.

- Optimization array G00: After checked, a new algorithm is used to optimize the cutting path of the repeated pattern.

- Display the perforation number: whether the perforation number is displayed on the cut figure.

- statistical information: Number of perforation: record the number of laser perforation, can be manually cleared.

Number of pieces: record the number of parts processed by laser, can be manually cleared.

Cutting distance: record the length of laser cutting and can be manually cleared.

Cutting time: record the laser cutting time, can be manually cleared.

Running time: record the laser running time and can be manually cleared.

7.5 System Parameters

System parameters: maximum speed limit, plate Angle memory, motor parameters and mouse touch screen switch parameters.
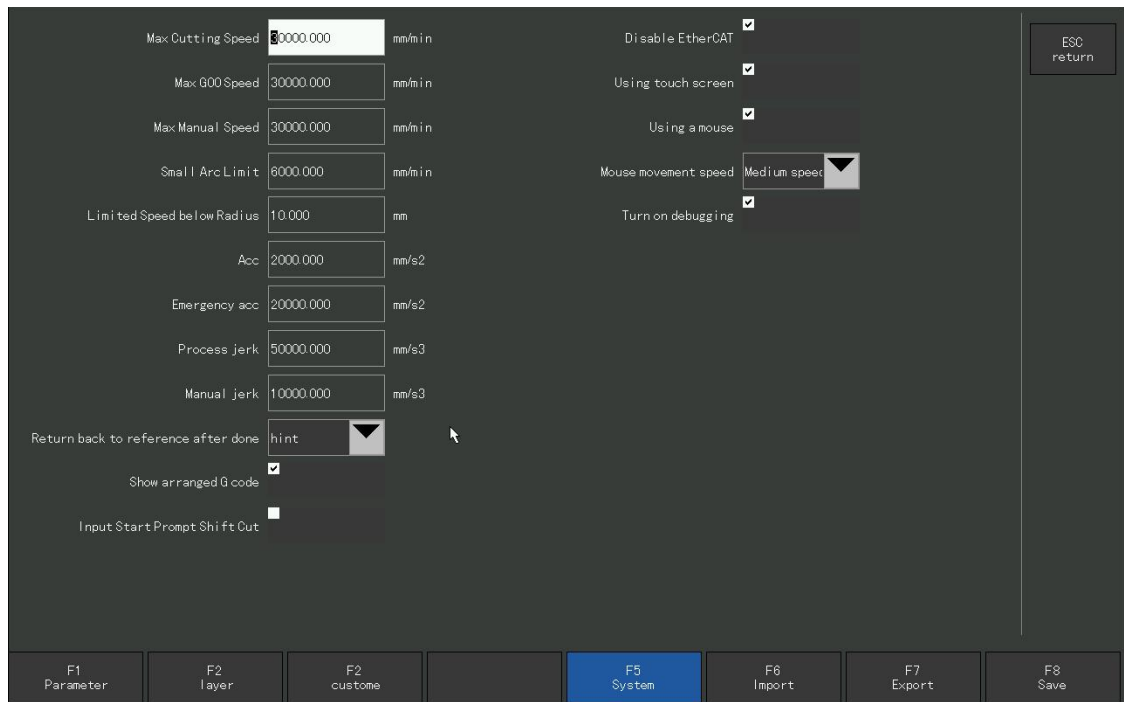
Figure 7. 7 System Parameters

System parameters, with the interface as shown in Figure Figure7.7.

- Max cutting speed: Max cutting speed of process.

- Max GOO Speed: Max empty walk speed.

- Max manual speed: Max manual speed.

- Small arcSpeed limit: the system will automatically slow down when cutting small circles and arcs.

- Small arc speed limit radius: arc radius value of limited small circular.

- ACC: the maximum acceleration of each axis, work together with the cutting speed.

- Emergency ACC: The maximum acceleration of each axis when the machine meets emergency stop.

- Plate Angle memory: When enabled, the plate correction angle will be saved for next plate, the next plate still has a correction Angle. If not enabled, the next plate needs to be corrected again.

- Manual Angle for plate correction: When enabled, the manual input Angle is also used as the Angle of plate correction. This Angle will be displayed in the main interface. If the plate Angle memory function is turned on, the Angle will be added to the plate correction Angle and be saved.

- Allow output when emergency stop: whether the system is allowed to output signal during emergency stop enabling. In a normal emergency stop, the security system

will close all outputs, but in some cases, the signal can be output during the emergency stop, so this option for customers to choose

● Breakpoint recovery enable: whether to open the breakpoint recovery function.

● Laser process enabling: after checking, the laser process parameters take effect.

● Force zero: Not allow to start working with out zero, and the function will take effect after checking.

● P2P startup: Whether to pop up offset prompt when enable P2P control mode.

7.6 Parameter import

Press [F6] under the parameter setting interface can realize the batch import of parameters from the U disk or the native hard disk. As shown in Figure Figure 7. 8.

Import from the U disk: first to insert the U disk into the system USB interface, and the U disk internal has the corresponding parameter file, the parameter file can only be the parameter file exported from the same system as the system model. Then select the parameter file that needs to be imported in the U disk, and click Enter.

Import from the hard disk, the first thing to determine that the local hard disk has saved parameter files. Click Enter to select the parameter file saved in the local hard disk, and click Enter.
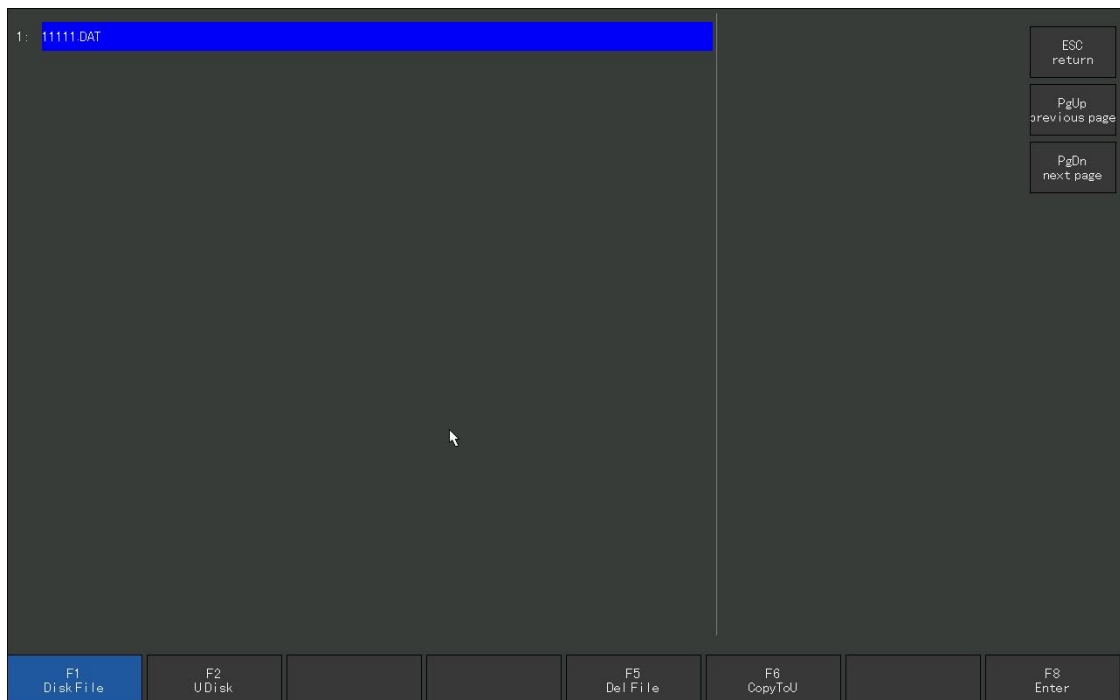
Figure 7. 8 Parameter Import

7. 7 Parameter export

When the parameter setting is completed, can press [F7] under the parameter setting interface to export the parameters, and you can select export to the U disk or the native hard disk.

Export to the U disk, first to insert the U disk into the local USB interface above, and then select export to the U disk, name the parameter file , click Enter to complete the parameter saved to the U disk.

Export to the hard disk, save the parameters in the local hard disk, and recover at any time when needed.
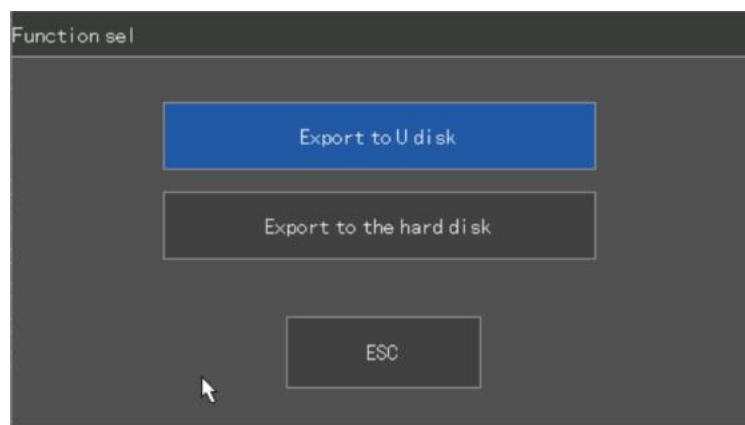
Figure 7. 9 Parameter export
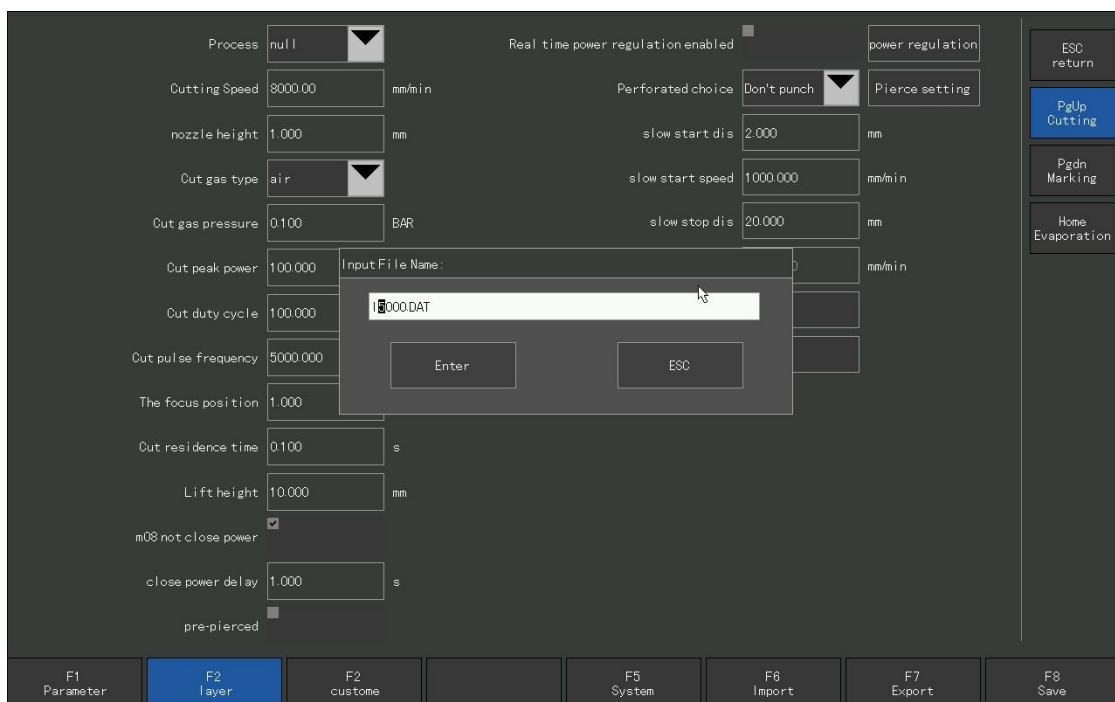
Figure 7.1 0 Parameter export file name
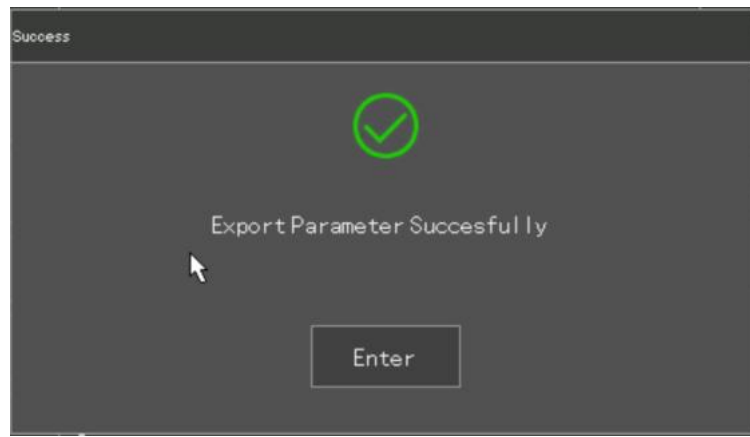
Figure 7.1 1 Parameter export was performed successfully

This function combined with the import parameters function can achieve a rapid adjustment of the cutting parameters required for different thickness plates. Using the function of export parameter, the cutting parameters of the corresponding thickness plate can be saved in the local hard disk or U disk in advance. When cutting the plate of the corresponding thickness, the import parameter function is used to import the corresponding parameters from the U disk or hard disk.

7.8 Save the parameters

After modifying the parameters, save them in [F8].

Note: After any parameter has been modified, and for the modified parameter to take effect, it must be saved, otherwise, the system still uses the unmodified parameters.

Chapter 8 Diagnose Function

Press [F5] under the main interface to enter the system diagnose interface. Under the diagnose interface, the output and input of the system can be diagnosed, as well as the key button, and the system self-test can also be performed.

8. 1 Diagnose interface index
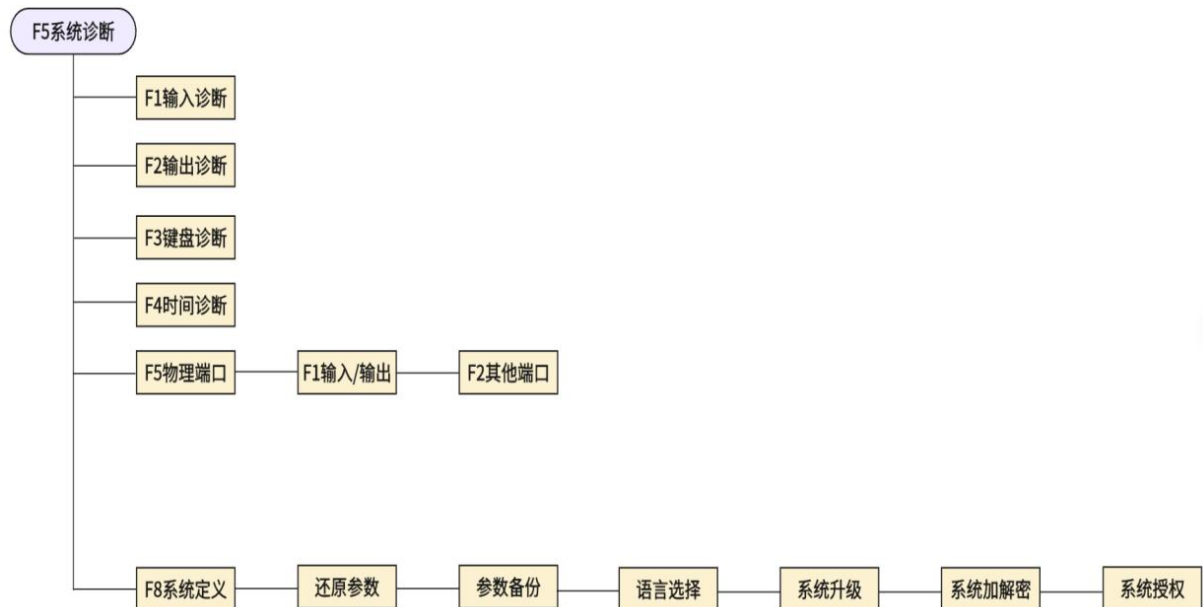
Figure 8. 1 Diagnoses interface Index

8.2 Enter the diagnosis

In this interface, as shown in Figure 8.2, the system will read the status information of the current input IO and display the information of the current input IO port. Green "●" means the input is valid, and red "●" means the input is invalid. When the external input signal changes, it can be displayed here.

Function	Port	status		Function	Port	status	
X plus Limit	I4	●		Emergency Stop	I9	●	ESC return
X minus Limit	I5	●		Laser alarm	I10	●	
Y plus Limit	I2	●		Water chiller alarm	I11	●	
Y minus Limit	I1	●		Gas alarm	I12	●	
focus axis up limit	NU	●		gun alarm	I13	●	
focus axis down limit	NU	●		air alarm	I14	●	
Z轴上限位	I7	●		oxygen alarm	I15	●	
Z轴下限位	I8	●		nitrogen alarm	I16	●	

F1 Input	F2 Output	F3 KeyBrd	F4 DateTime	F5 Physical Port	F6 Oscilloscope		F8 System Def

Figure 8. 2 Input the diagnosis

8.3 Output the diagnosis

Under the diagnose interface, press [F2] to enter the output diagnose interface, as shown in Figure 8.3.

Function	Port	status		Function	Port	status	
Light gate	01	●		Z-axis brake output	09	●	ESC return
Red light	02	●		None	NU	●	PgUp Switch
Main valve	03	●		None	NU	●	
Empty air valve	04	●		None	NU	●	
Oxygen valve	05	●		None	NU	●	
Nitrogen valve	06	●		None	NU	●	
TorchUp	07	●		None	NU	●	
TorchDn	08	●		None	NU	●	

F1 Input	F2 Output	F3 KeyBrd	F4 DateTime	F5 Physical Port	F6 Oscilloscope		F8 System Def
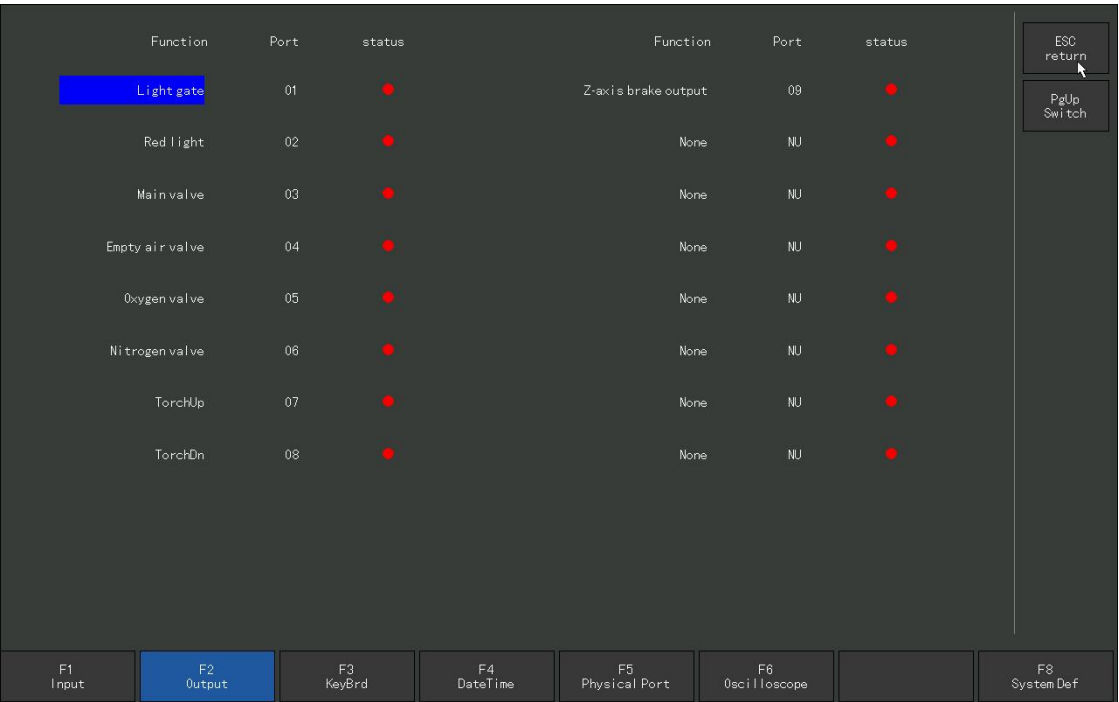
Figure 8. 3 Output diagnosis

Under the output diagnose interface, press [↑], [↓], [←] and [→] to move the cursor to the corresponding output port. On each output signal, open and close the corresponding

output port on [Enter]. Green "🟢" means the output is valid, and red "🔴" means the output is invalid.

Open and close the output port to drive the external relay, solenoid valve and other circuits.

8.4 Keyboard diagnosis

Press [F5] to enter the keyboard diagnose interface.

Figure 8.4 interface of diagnose keyboard

F4000 keyboard key value table

key	key assignments
G	71
X	88
Y	89
F	70
M	77
Z	90
A	65
B	66
C	67
D	68
E	69

key	key assignments
0	48
1	49
2	50
3	51
4	52
5	53
6	54
7	55
8	56

key	key assignments
+	43
—	45
.	46
Del	127
BACK	25
ENTER	24
SPACE	32
Pg Up	21
Pg Dn	22
HOME	15
END	16
ALT	70
START	13

	9	57

follow		26
Nitrogen valve		28
Oxygen valve		11
air valve		30
apply the brake		
laser		31
Total close		12
F1		
F2		
F3		3
F4		4
F5		5
F6		
F7		
F8		

Under the interface of Figure 8.4, press the key of the keyboard for the key code (key value). Most of the keys have coding value (a few function keys have no key code). If the corresponding code is not displayed, it means that the key may fail.

8.5 Date and time

Press [F7] under the system diagnose interface to set the date and time of the system
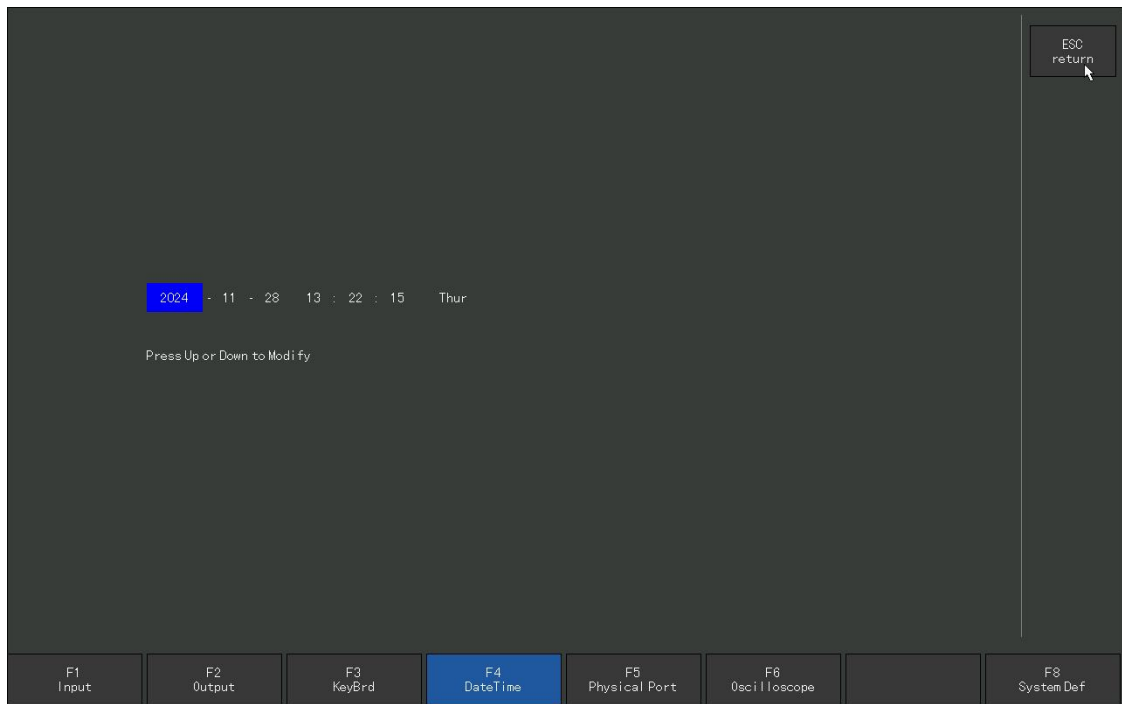
Figure 8. 5 Date and Time

Move the cursor below the corresponding date or time or week, and press [↑] or [↓] to adjust the system time. If the button battery of the circuit board is adequately powered, the time set here can be remembered after power failure.

8. 6 Physical port

Press [F 5] to enter the physical port interface under the system diagnose interface.

In the physical port setting interface, there are input / output ports, other ports, including DA port test, PWM test, and serial port diagnosis function.
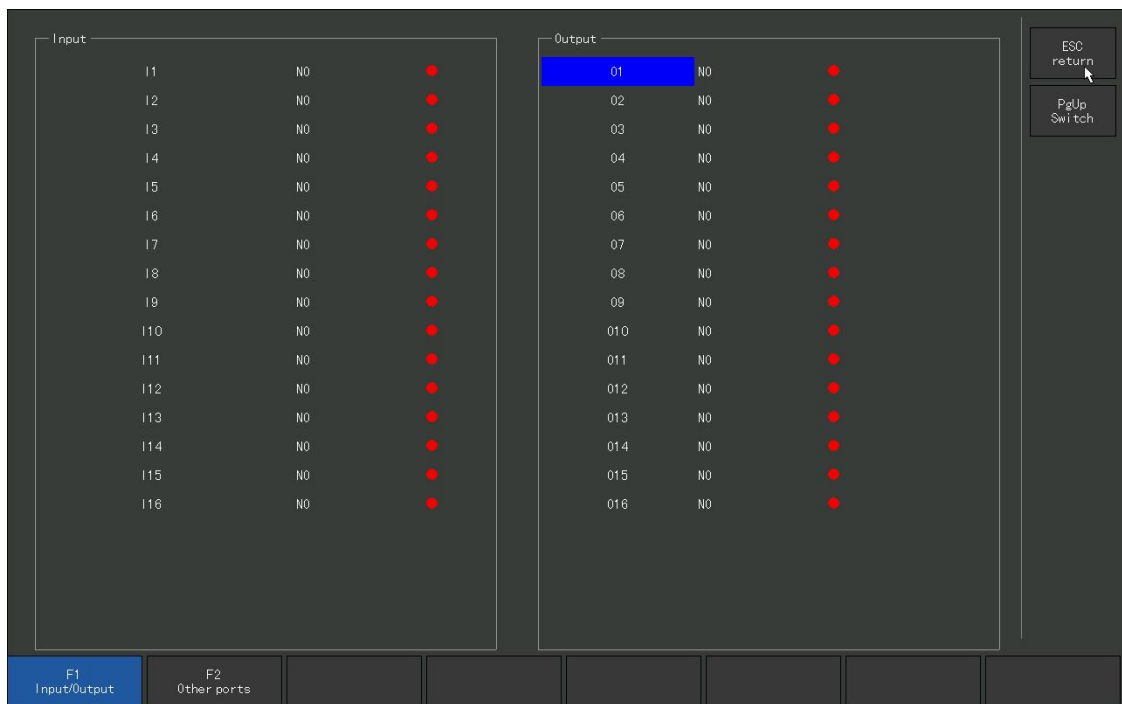
Figure 8. 6 Input / output ports
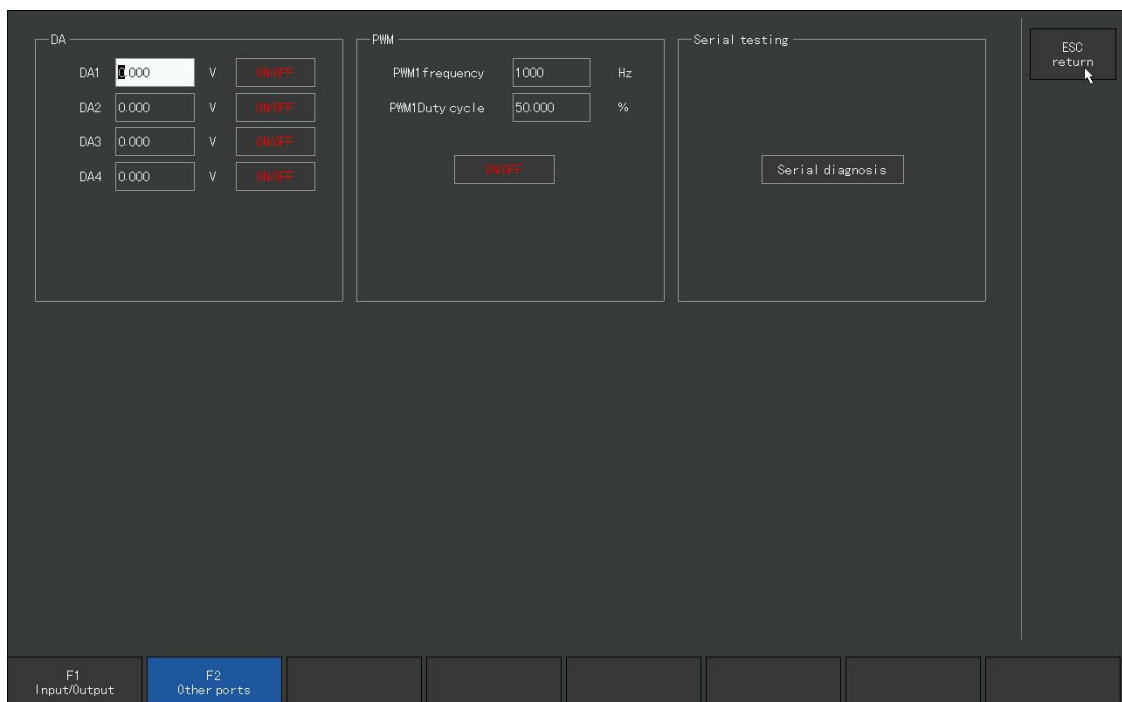
Figure 8. 7 Other ports

8.7 Oscilloscope

Under [F5 system diagnosis] interface to enter [F 6 scope] interface.

Under the oscilloscope interface, the process of some data changing in a certain time can be displayed through two-dimensional graphics, for example can monitor IO status, AD / DA values. Generally, for the tester analysis program, occasionally customers encounter problems, can also guide the customer to monitor

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the map to development for analysis and use (need to be set in "F7 configuration" to see the waveform), the figure below:

Figure 8. 8 Oscilloscope

8.8 System Definition
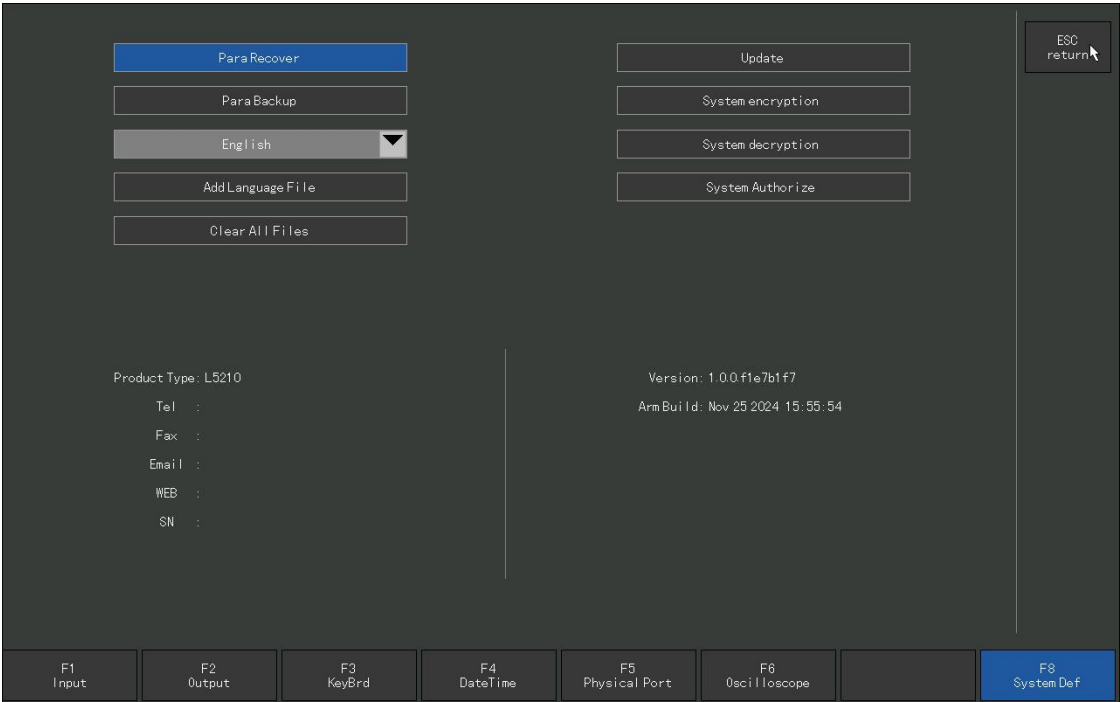
Figure 8. 9 System Definition

Press [F8] under the system diagnosis interface to enter the system customization interface, which can restore parameters, parameter backup, modify the system input port,

output port configuration, modify the system coordinates, configuration of motor drive parameters, site configuration, encryption and decryption operation, language switching, function authorization and other operations.

8.8.1 Parameter backup and restore

Parameter backup: the process of backup parameters is to press [F 5] (System Diagnosis) - [F8] (System Definition) -select the parameter backup button under the main interface of the system and click. The system prompts to enter the password, enter the password "1396", press the [Enter] key, the system will back up the current parameters to the default parameters and pop up a " restore parameters success!" Tip box, as shown in Figure 8.12, press the [Enter] key.

In the future use, if the parameters change unexpectedly or modified by mistake, you want to restore the parameters, you only need to "restore parameters". The parameters are stored in the systems local file system.

Note: The equipment manufacturer must make the parameter backup after completing the installation and debugging of the whole equipment.
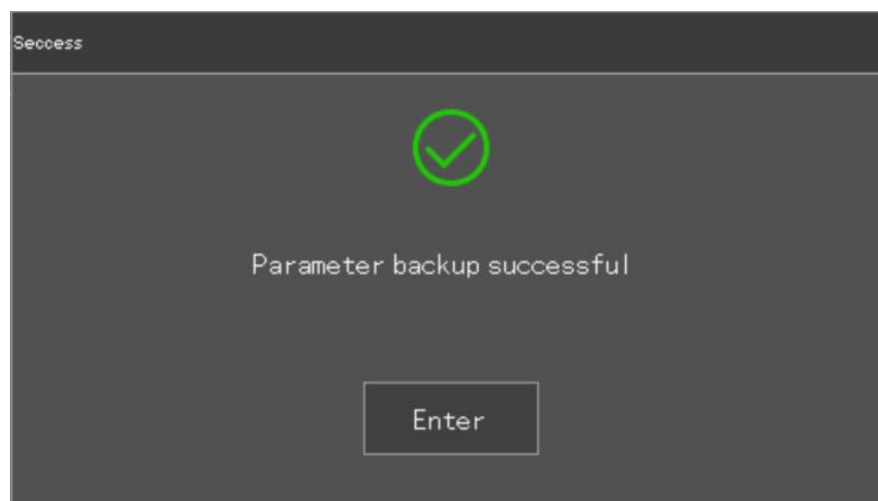
Figure 8. 10 Successful parameter backup

8.8.2 Language Switching

Press [F5 system diagnosis], [F8 system definition], press [F6 language]. You can switch between multiple languages until you choose the language you need. After pressing [ESC] to exit, the interface language switches to the selected language.
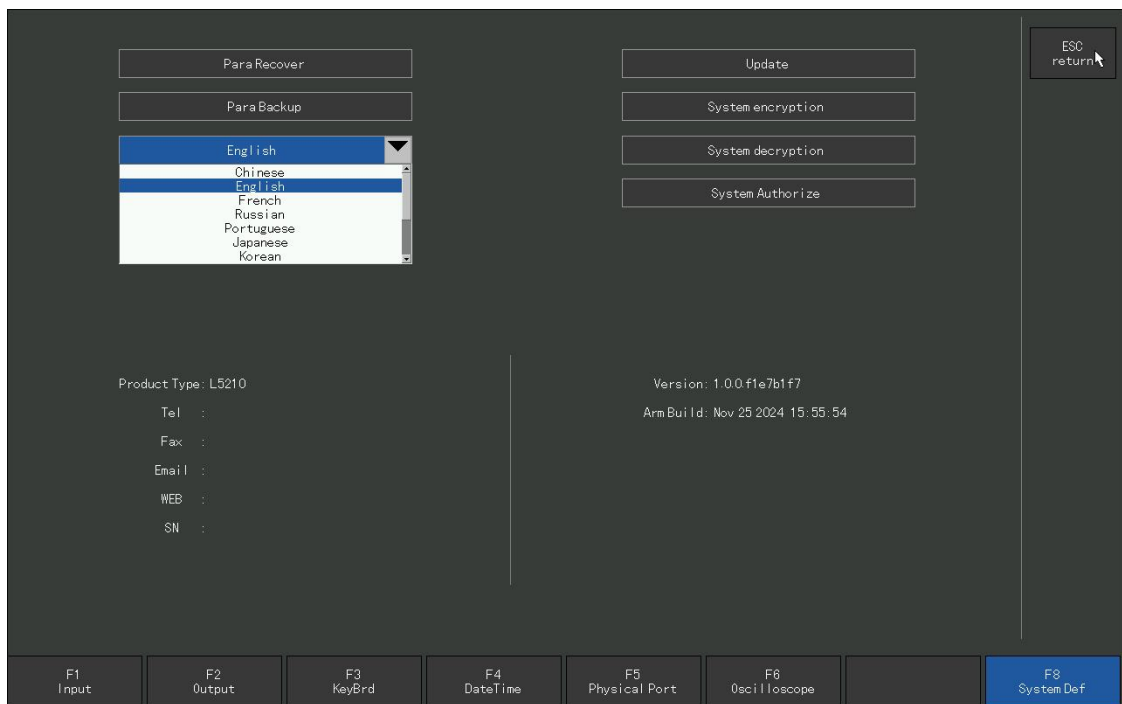
Figure 8.1 1 Language switching

8. 8.3 Add a language file

Obtain the language package file from the company (＊＊＊. LAN), copy the language pack file into the disk, and store it in the \ lan folder of the disk, and the disk is inserted into the USB port of the system. On this interface (Figure 8. 11), move the cursor up and down to Add Language file and press [ENTER]. Import success or failure will be prompted.
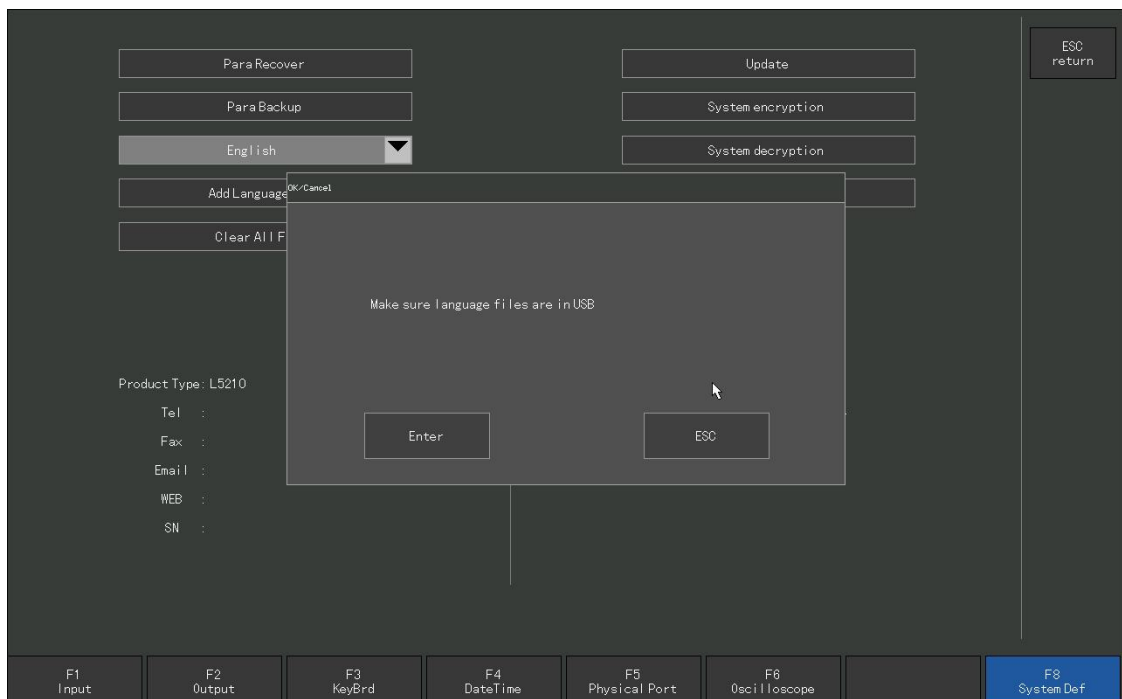
Figure 8.1 2 Add a language file

The system can support language files in most countries, and it can also customize language files. Please contact us if you need it.

8.8.4 Encryption

Press [F5 system diagnosis] and [F8 system definition] on the main interface, and press the system encryption button. This system can be encrypted. Encryption divides time encryption and frequency encryption.

If the system has time or times of encryption, then the encryption expires, the system will not continue to use, must be decrypted before continuing to use.
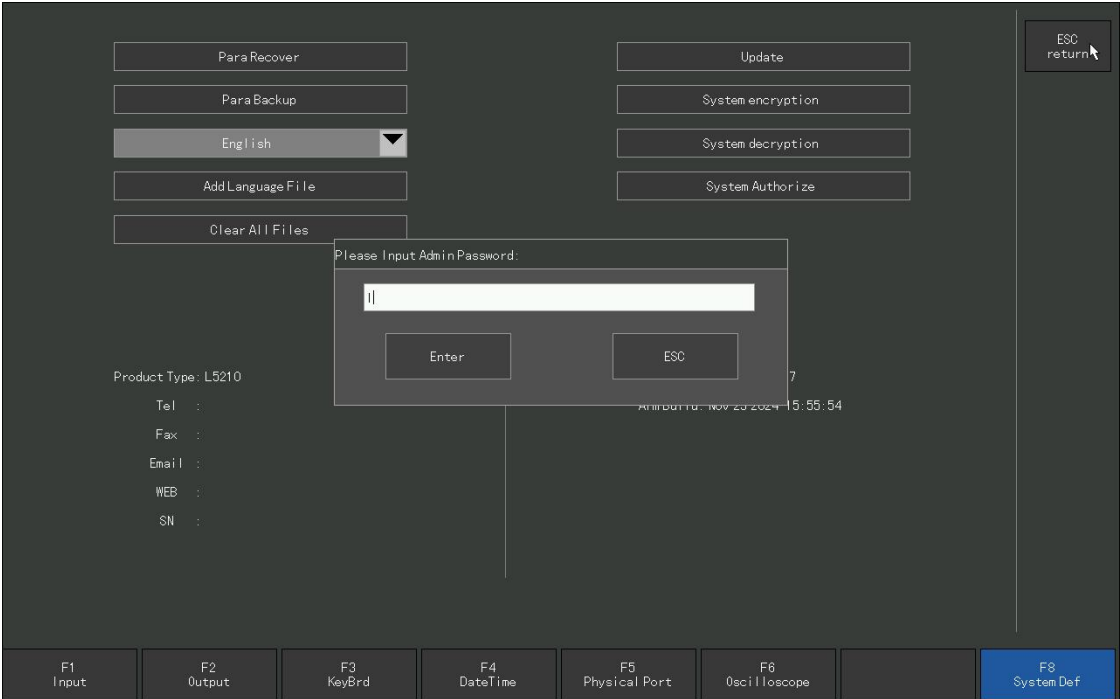
Figure 8.1 3 for encryption

8.8.5 Decrypt

Press [F5 system diagnosis] and [F8 system definition] on the main interface, and press the system decryption button. The system can be decrypted.

8.8.6 Empty the files

Press [F5 system diagnosis] and [F8 system definition] on the main interface, then press [↓] to move the cursor to the "Empty the file" button, and press [ENTER]. After emptying, all cut code files under the hard disk file are cleared.
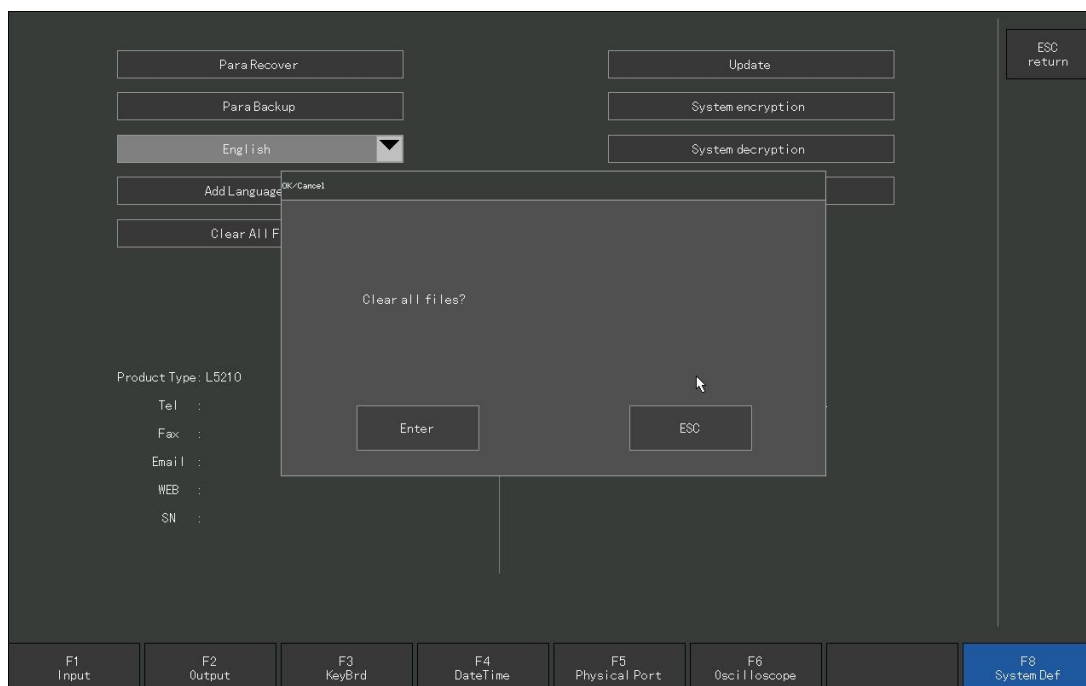
Figure 8.1 4 Empty the files

8. 8.7 System upgrade

In the main interface, press [F5 system diagnosis], [F8 system Definition], and then press the system upgrade button to upgrade the program. At this point, ensure that the U disk is inserted into the USB port of the system, otherwise the prompt box will pop up to remind "No upgrade file found!". If the U disk has been inserted, a dialog box will pop up when pressing [System Upgrade]. Please click OK button or press [ENTER] to confirm, and the upgrade prompt shown in Figure 8. 15 will appear.
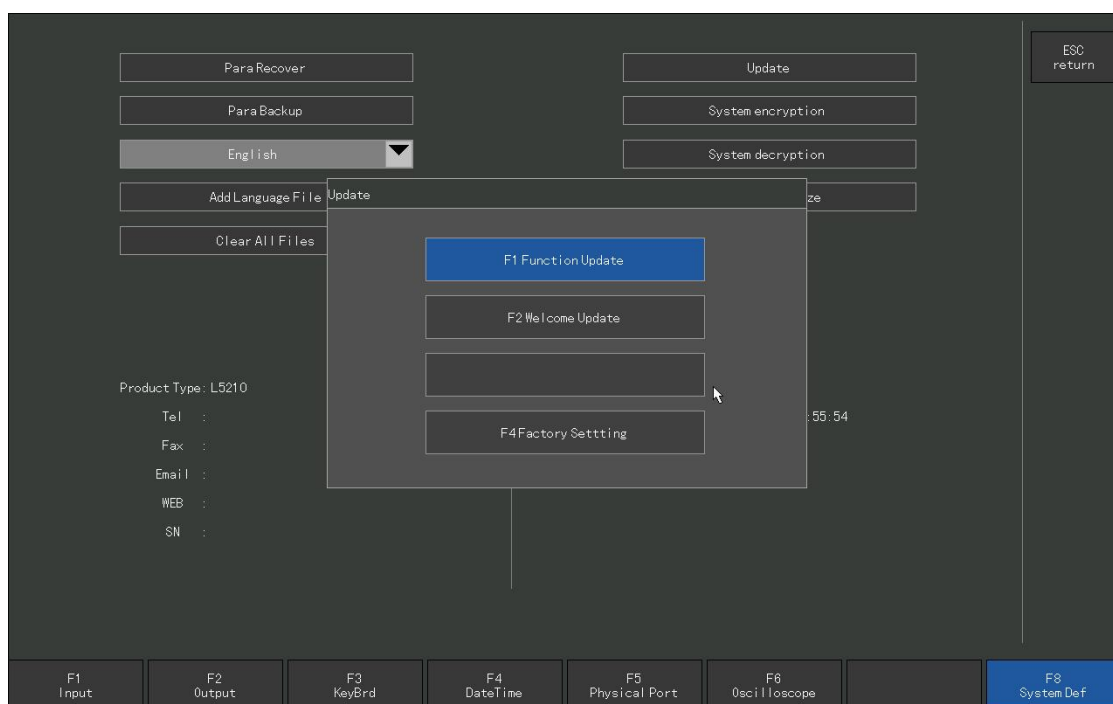
Figure 8.1 5 System upgrade

[F1] Function upgrade: After pressing [F1], make the function upgrade, and the file corresponding to the function upgrade is F2000V5.upg.

[F2] Interface upgrade: After pressing [F2], upgrade the interface. The upgrade file name corresponding to the interface upgrade is WELCOME.bmp (8-bit depth bitmap) or welcome.jpg, with a resolution of 1200*800. Put the file in the U disk root directory. Interface refers to the welcome picture when boot. Please contact us about how to make the welcome interface.

[F4] Factory Settings: After pressing [F4], the system will be restored, and the restored system here will be completely restored to the state of factory, that is, parameters, IO port configuration, coordinate direction definition, etc., will be restored to the factory state. In general, please do not use this feature to restore the system.

8.9 Log

A log button is configured in the custom function area on the right side of the interface. The log information is divided into system log, alarm record and terminal.

Users can enter the log interface through the log button, and enter the system operation log to view the system running log. When the main interface is in the alarm / warning state. At this time, click the alarm log to quickly view the alarm details.
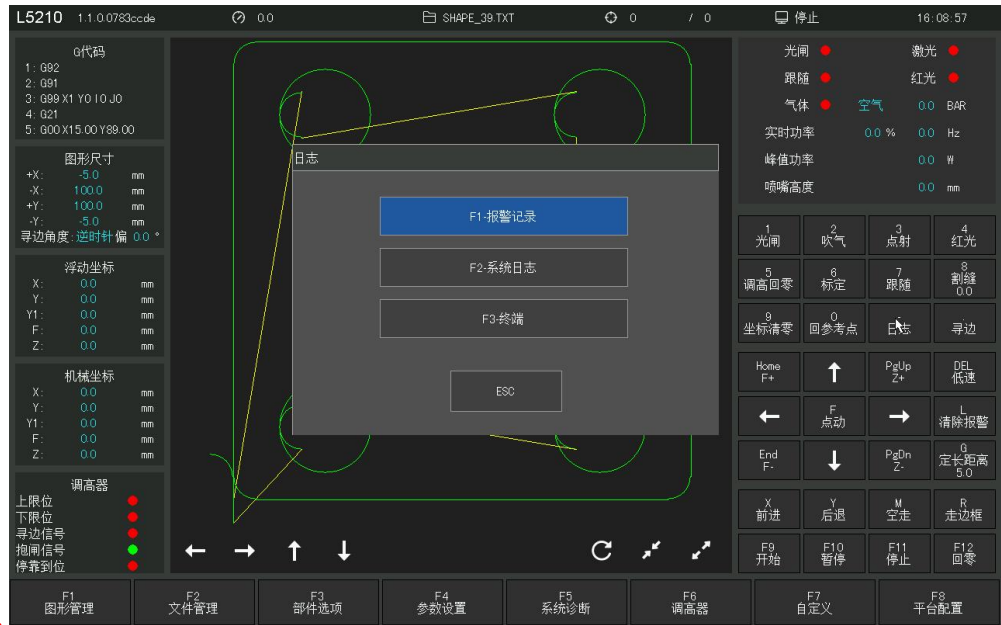
Figure 8.1 6 Alarm log entry

Alarm log

During the operation of the machine, the system will monitor all components. Once the alarm is detected, it will be displayed in the red title bar, and measures such as stop movement will be taken. Before the system alarm is eliminated, a large number of operations will be prohibited. Please check the machine until the alarm is eliminated.
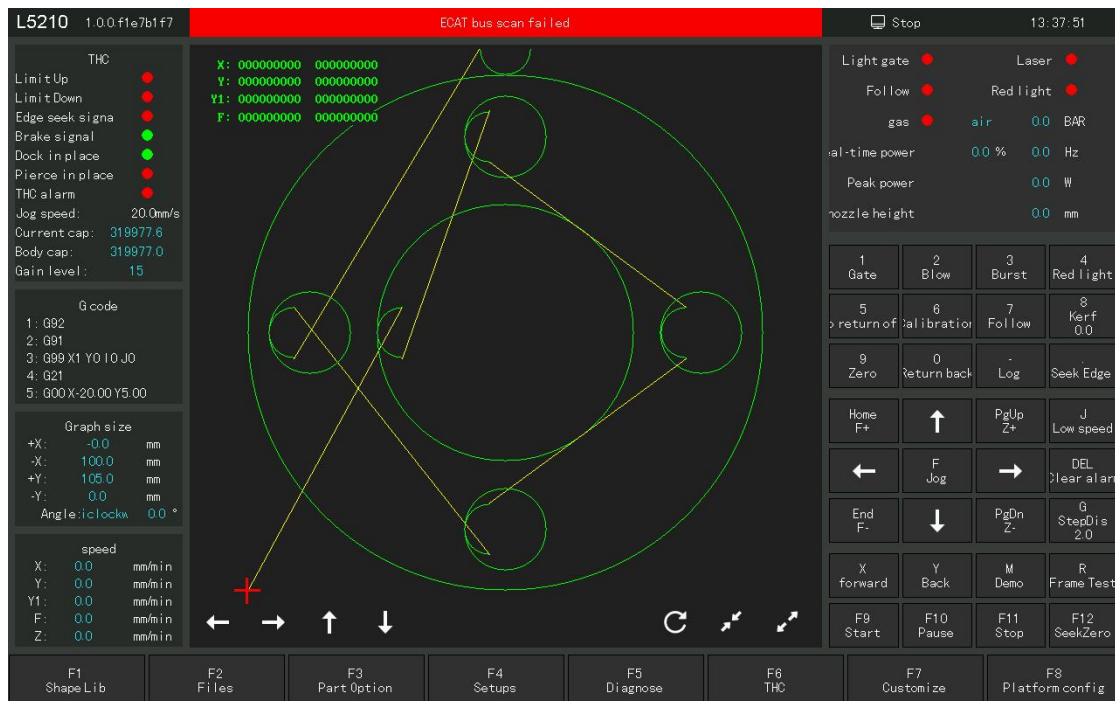
Figure 8.1 7 Alarm display of the main interface

You can enter the —— "Alarm Record" module through the log button to view the cause of the alarm generation and the solution method. In addition to the alarm, if the system detects other abnormal operation, the alarm information will be displayed according to the abnormal level, including warning, reminder, message, etc. This information will not cause the machine to stop moving, but it is still recommended that you pay attention to the information displayed by the system to take the necessary action as soon as possible.
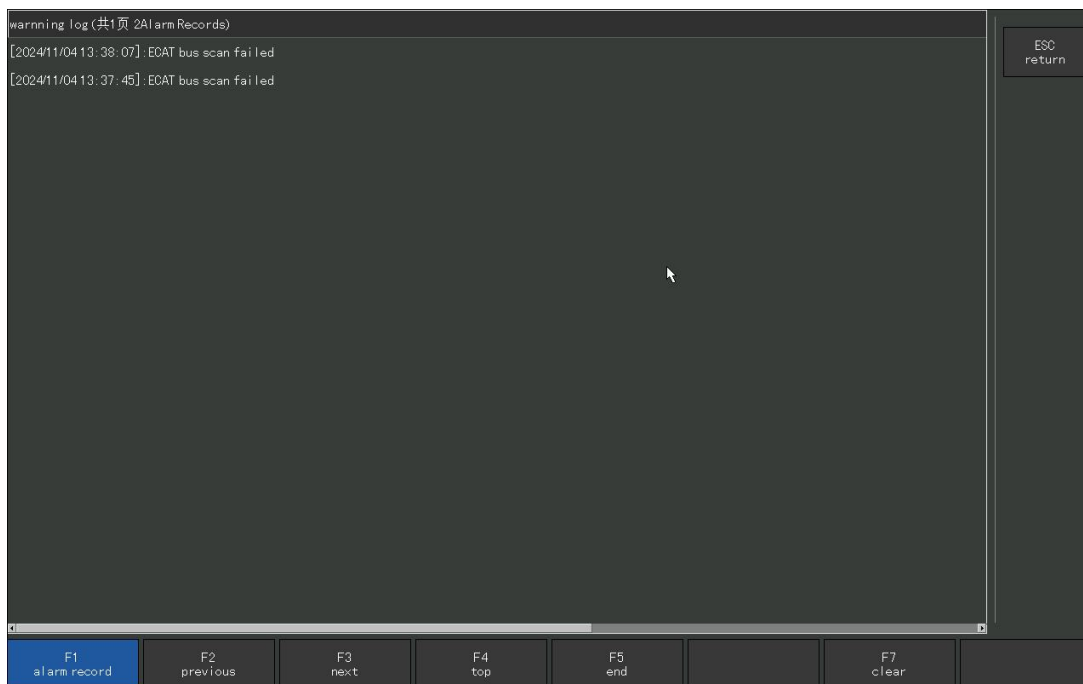
Figure 8.1 8 Alarm information

system log

The serial number shows the step sequence of the relevant operation, the date is the execution date of the step sequence, and the log number and content show the corresponding number of the operation and the corresponding content of the operation. When the operation log is added, it will increase downwards on the page. Therefore, you need to find the latest action log at the bottom of the page, as shown below.
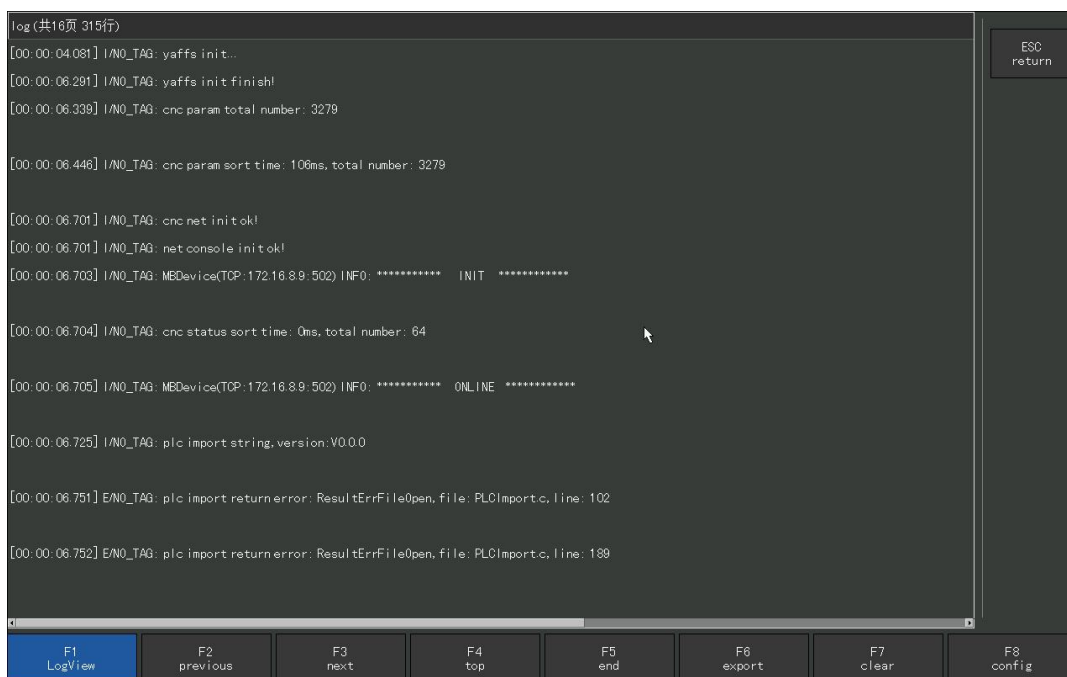
Figure 8.1 9 Log information

Chapter 9 Height controller

When the control system is successfully connected with the laser height controller, press [F 6] to enter the THC parameter setting interface. After the THC parameters are set, click [F8 Save] to connect to the built-in height controller.

The THC parameters are divided into common parameters, system parameters, calibration, diagnosis, additional functions, etc. The following describes the parameter settings for each part.

9.1 Common parameters

After pressing [F 6] to enter the parameter interface of the height controller, [F1] is a common parameter of the height controller.
The following set parameters are used by the height regulator. For details, refer to the instructions for the height regulator. Brief descriptions of these parameters are listed here:

Figure 9.1 Common parameters of laser elevation modulator

Table 9.1

The parameter name	unit	scope	Parameter remarks
Parking coordinates	mm		The stopping coordinate after zero or closing, which is also the target position of the cutting head after finish cutting. The value does not exceed the Z axis stroke, and try not to be too close to the plate surface
Z axis stroke	mm		The maximum distance that the Z axis can be moved down from the mechanical origin.
Follow method			Follow mode when the regulator control mode is IO mode: ●Follow directly ●Progressive follow ●perforation
Empty move speed	mm/s		The speed at which the head moves up and down in the non-cut state. Not greater than (screw pitch * max speed / 60). Unit mm/s. In order to improve the operation efficiency and stability of the elevator, it is recommended to set the speed around the servo motor rated speed.
Acceleration	G		Acceleration during the cutting head movement
Jog move low speed	mm/s		Not greater than (screw pitch * upper speed / 60). Must be less than the jog moving high speed.
Jog move high speed	mm/s		Not greater than (screw pitch * upper speed / 60), must be greater than the jog moving low speed.

Back to zero speed	mm/s		Movement speed during the back to zero. The zero speed is not recommended to be too high. It is recommended to start from low speed to prevent the zero speed from exceeding the mechanical travel.
Back to zero distance	mm		The distance between the mechanical coordinate frame origin and the upper limit bit.
Whether back to zero when boot			When the system is powered off and restarted, the control regulator will return to zero first
Whether to stop after back to zero			Whether to park after back to zero

9.2 System parameters

Laser regulator system parameters, interface as shown in Figure 9.2.

Figure 9.2 System parameters of laser height controller

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Table 9.2

The parameter name	unit	scope	Parameter remarks
Screw pitch	mm	0.01-100	The distance that the screw turns around to drive the nut moving, also called the screw guide. the greater the value is, the faster the Z axis moves. It is recommended to use the ball rod with 5-20mm guide.
Upper speed	rpm	10-6000	Maximum speed of the servo motor operates safely.
RPM gain	rpm/V	10-2000	The servo motor speed of 1V voltage, shall be consistent with the parameters in the servo driver.
Number of pulses per turn		2-60000	The number of pulses output by the encoder per turn of the servo motor, shall be consistent with the parameters in the servo drive.
Servo direction		Forward, reverse	The rotation direction of the servo motor, can be set to either forward or reverse.
Encoder direction		Forward, reverse	The direction of the encoder pulse feedback, which can be set to either forward or reverse.
Servo type			Choose from Panasonic, Delta, Yaskawa, Mitsubishi, Fuji, Schneider, Dongyuan, Gaochuang, Huichuan
Perforation touch delay	ms	0-6000	Set the alarm detection sensitivity of the touch plate (the capacitor is zero at this time) when perforation. The smaller the value is, the more sensitive. Will ignore alarm when set as 0. During the perforation of the height controller, the head touches the plate due to the warping or slag. If the delay time exceeds, the head will automatically lift back to the docking position and alarm. Reasonable setting of this parameter can effectively protect the torch head during perforation (reduce the value), or reduce the false positives caused by the reverse slag (increase the value).

Cut touch delay	ms	0-6000	Set the alarm detection sensitivity of the touch plate when cutting (the capacitor is zero at this time), the smaller the value, the more sensitive. Will ignore alarm when set as 0. During the cutting process, if the plate is touched due to the warping of the workpiece or the overthrust of the torch, the torch head will automatically lift back to the docking position and alarm.
Empty move touch delay	ms	0-6000	Set the alarm detection sensitivity of the touch plate (the capacitor is zero at this time) when the height controller stops. the smaller the value is, the more sensitive. Will ignore alarm when set as 0. In the height controller stop state, if the torch head touches the plate due to moving the X / Y axis or other reasons, the torch head will automatically lift back to the docking position after the delay time
Follow error alarm	mm	0-99	If the difference between the current height and the following height in the following state is greater than the following error alarm, and the duration is greater than the following error delay, the following error alarm will be triggered. The possible reasons: the torch moves out the plate, the plate jitter abnormally, etc. that caused sudden change of capacitance. The greater the

			delay of the following error, the better the inhibition of the capacitance mutation.
Follow error delay	ms	0-6000	If the difference between the current height and the following height in the following state is greater than the following error alarm, and the duration is greater than the following error delay, the following error alarm will be triggered. The possible reasons: the torch moves out the plate, the plate jitter abnormally, etc. that caused sudden change of capacitance. The greater the delay of the following error, the better the inhibition of the capacitance mutation.
Local capacitor change alarm value		0-9999	It is recommended to set to 10% to 20% of the valid value in the floating head calibration result
Enable real-time calibration			After the real-time calibration is enabled, the regulator will fine-tune the calibration curve according to the body capacitance change to compensate for the influence of the cutting head by the environment or the cutting temperature rise, thus reducing the number of manual calibration of the regulator.
Enable active anti-collision			Predict whether the cutting head will touch the plate before following and lift it before the collision.
Enable the non-metal calibration			Floating head calibration function of non-metal sheet metal or non-metal workbench.
Enable vibration suppression			When cutting a thin plate surface,

			the plate will vibrate due to the cutting airflow disturbance, and the cutting head will also produce vibration when following, which may cause the wavy lines of the cutting section. When enabled, this vibration is effectively reduced. The vibration suppression intensity is controlled by the vibration suppression time.
Vibration inhibition time		0-6000	When cutting a thin plate surface, the plate will vibrate due to the cutting airflow disturbance, and the cutting head will also produce vibration when following, which may cause the wavy lines of the cutting section. When enabled, this vibration is effectively reduced. The vibration suppression intensity is controlled by the vibration suppression time (parameter range 0-9999).

9.3 Calibration

Calibration is an operation of the laser height controller. This interface is used to set the parameters and conduct the calibration operation. During the calibration operation, [PgUp] and [PgDn] control the point movement rise and drop

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respectively.

Figure 9.3 System parameters of the laser level modulator

Floating head calibration: Floating head calibration is to measure the correspondence between the capacitance and the position of the cutting head and the plate.

● Current capacitance: The current capacitance value between the cutting head and the plate is actually displayed as the frequency.

● Calibration range: the maximum height lifted by the cutting head during calibration.

● Stability: Stability is a static characteristic of a capacitance. If the stability effect does not reach the "medium" or above level, please check whether the machine tool or the plate surface vibrate, or whether the cutting head and the plate surface accumulate ash or hang slag, or whether the grounding of the machine tool and the amplifier is ideal.

● Smooth degree: it reflects the dynamic characteristics of the capacitance changes during the calibration process.

● Effective value: the transformed value of the capacitor from 0.5mm from the plate surface to infinity. Reflects the measurement range of the nozzle sensing.

The larger the measurement range, the better the tracking accuracy and stability.

● [Start]: Start calibration.

● [Clear]: Clear the calibration parameters.

Automatic setting: automatic setting is the process of adaptive adjustment of the height controller motion control system parameters, and then get the best active gain level based on the existing machinery, the user can also manually modify the parameter.

● Following gain level: Following gain level can be adjusted to follow the following speed, the higher the level, the faster the following speed, but in some cases may appear vibration instability. Parameter range 1-30, default value is 11, can be obtained by automatic setting or manually modified.

● [Start]: Start setting.

9.4 Diagnose

Under the diagnose interface, you can view the working status of the height controller, the input and output port status and other information. It can diagnose the working state of the elevation and troubleshoot.
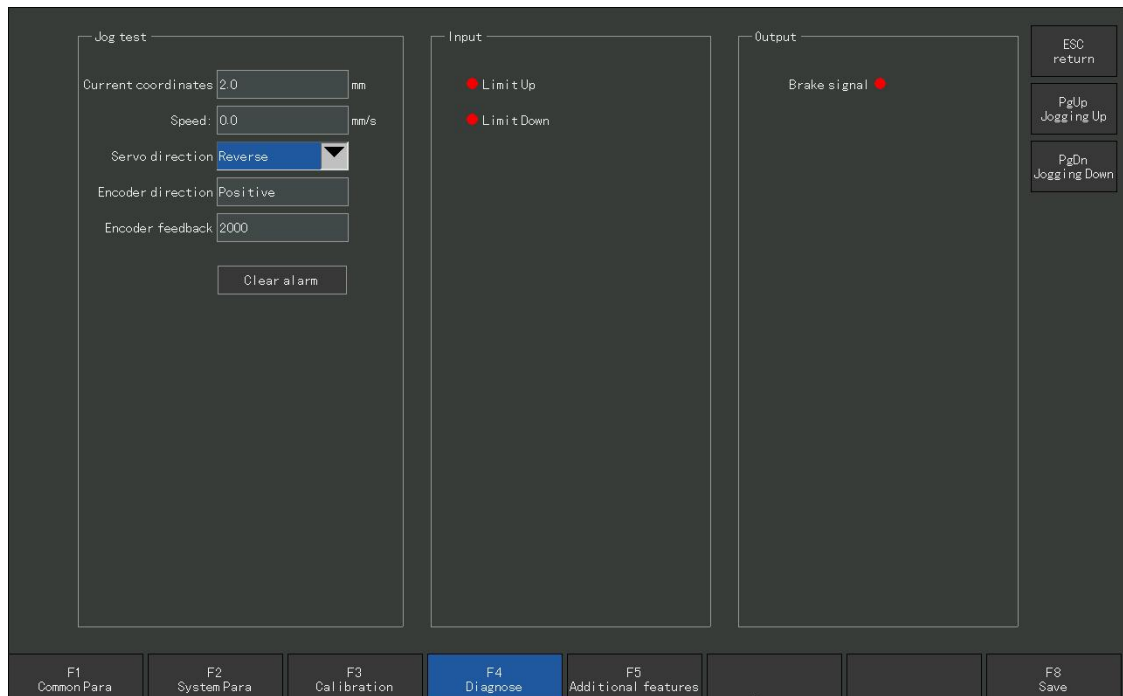
Figure 9.4 Laser height-modulator diagnosis

Jog test

Current coordinates: Current coordinate position of the elevator.

Current speed: the speed at which the height regulator is currently running.

Servo direction: The direction of the servo rotation can be changed.

Encoder direction: display the encoder pulse direction.

●import

Upper limit: Elevator upper limit status. Green light indicates that the signal is active or occurring.

Lower limit: Elevator lower limit status. Green light indicates that the signal is active or occurring.

● output

Braker signal: current state. Green light indicates that the signal is active or occurring.

9.5 Additional features

Under the additional function interface, you can view the alarm information, calibration information and calibration curve. Check the alarm history of the height controller, and determine whether the work is good.
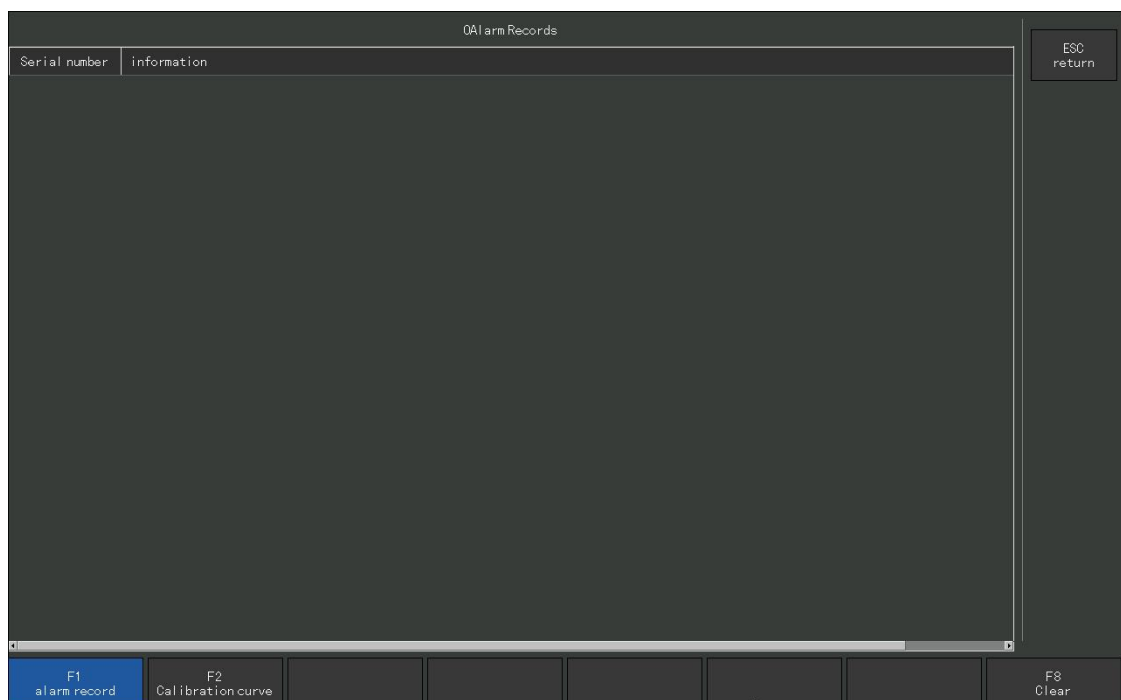
Figure 9.5 Alarm record of laser elevation ator

When there is some alarm in the height controller (such as: servo alarm, abnormal encoder, zero capacitor, etc.), need to clear alarm before use.

Chapter 10 Custom configuration

Under the main interface, press [F 7] to enter the custom page, as shown in Figure 10.1.
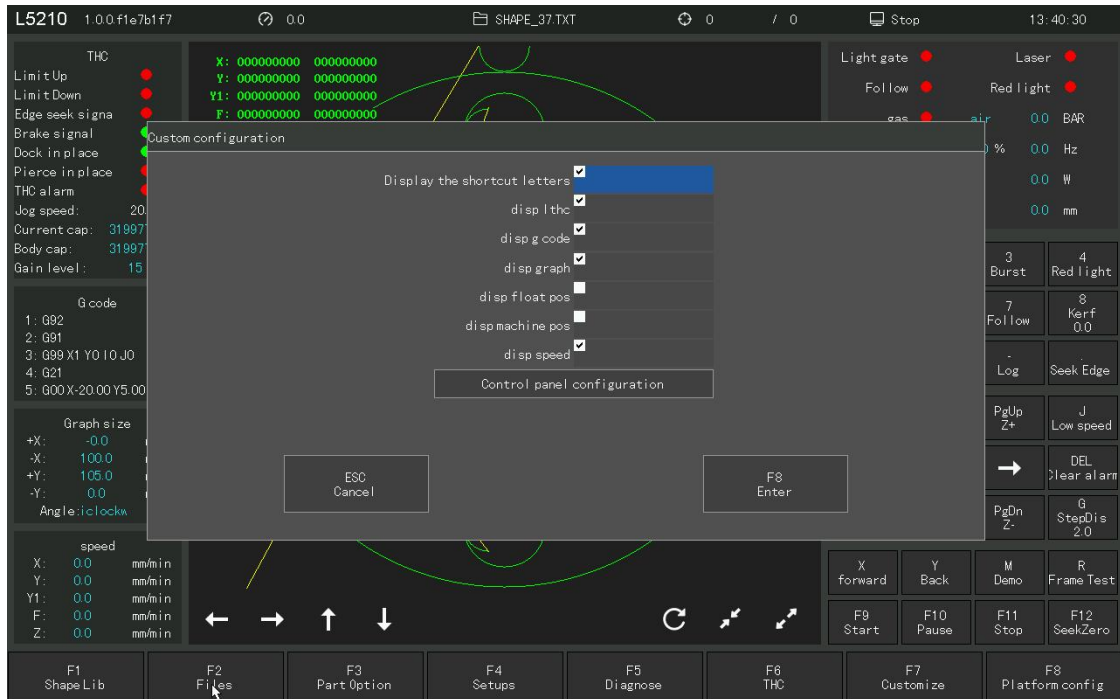
Figure 10.1 Custom display information

10.1 Customize the display status configuration

Under this interface, you can customize the display status of the left side of the toolbar on the main interface and the function button on the right side, so that users can configure the corresponding function button according to their own operation habits.

● Display shortcut letters: the corresponding shortcut button will be displayed on the top of the right bar of the main interface, and the user can close or open it.

● Display G code: display the G code currently being processed, display the current line and the next row. Not displayed during cutting, only show after pause.

● Display graphic size: displays the currently processed graph size, including X +, X-, Y +, Y-, and the rotation angles of the graph.

● Display the artifact coordinate: display the coordinate value corresponding to the zero point of the current cutting torch, which is the floating coordinate.

● Display the mechanical coordinates: display the coordinate value of the machine tool coordinate system corresponding to the current position of the cutting torch.

● Display real-time speed: displays the current processing speed, which changes during processing.

● Display the regulator information: display the status information of the regulator, so as to observe some real-time state of the regulator, to ensure that the processing process is more stable.

10.2 Control Panel configuration

The control panel configuration allows users to customize the configuration of many common function buttons. After the configuration, the function buttons on the main interface will change accordingly.
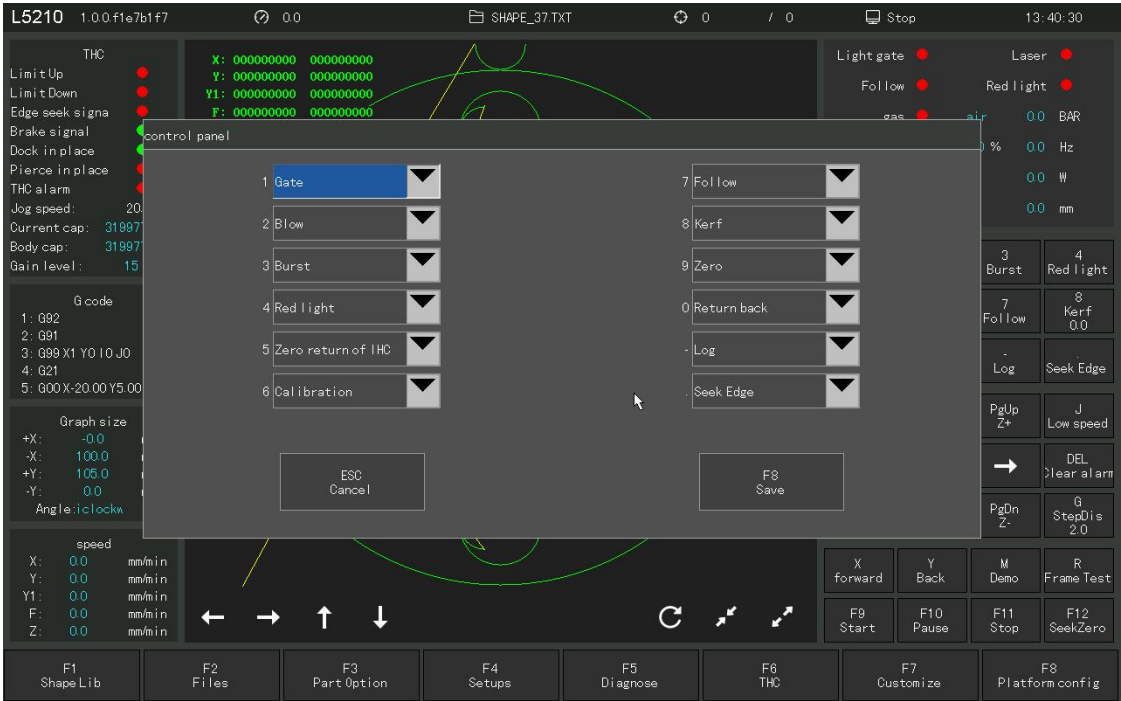
Figure 10.2 Custom control panel function buttons

There are 12 function buttons in the main interface, which can be customized, and 19 functions can be customized in the custom button. After clicking the custom button function configuration in the 12 buttons, press F8 to save the parameter Settings.

follow	Red light	bursts	Light switch	Blow

master valve	demarcate	kerf	Back to parking	Back to zero
Coordinates back to zero	Break point recovery	X axis back to zero	Y axis back to zero	F axis back to zero
F axis back zero	log	Back to reference	Seek edge	None (configuration as empty)

Chapter 11 Platform configuration

Under the main interface, press [F 8] to enter the platform configuration interface. As shown in the figure below, the platform configuration interface function.

When entering the platform configuration interface, the system prompts the password to input "1396", and press [Enter] to enter the configuration definition interface of the system.

11.1 Input port definition

The controller can change the definition of the input IO port according to the needs of the user, including the serial number of the changed IO port on the input terminal, the NO or NC type of the input port, and the following 8 IO ports function definitions. Press [F 8] to enter the configuration definition interface, and then press [F1] to enter the input definition interface. As shown in Figure Figure 8.14.

Under this interface, press [↑], [↓], [←] and [→] on the operation panel, move the cursor to the place to change the type or number, position the cursor to the option to modify, press the [Enter] key to open the tab of the drop-down box where the cursor is located, select through the [↑] and [↓] moving cursor, and press [Enter] again to set the selected parameters again.

Serial number: 01~10,14~23.

Type: NO often open (low level effective), NC often closed (high level effective).

Function: limit, emergency stop, gas alarm, laser alarm, water cooler alarm, forward, backward, left, right, head alarm, deceleration input, torch up, torch input, focus axis upper limit, focus axis lower limit, X axis zero input, Y) input 1, input 2,3, input 4,5,6,7 and 8.
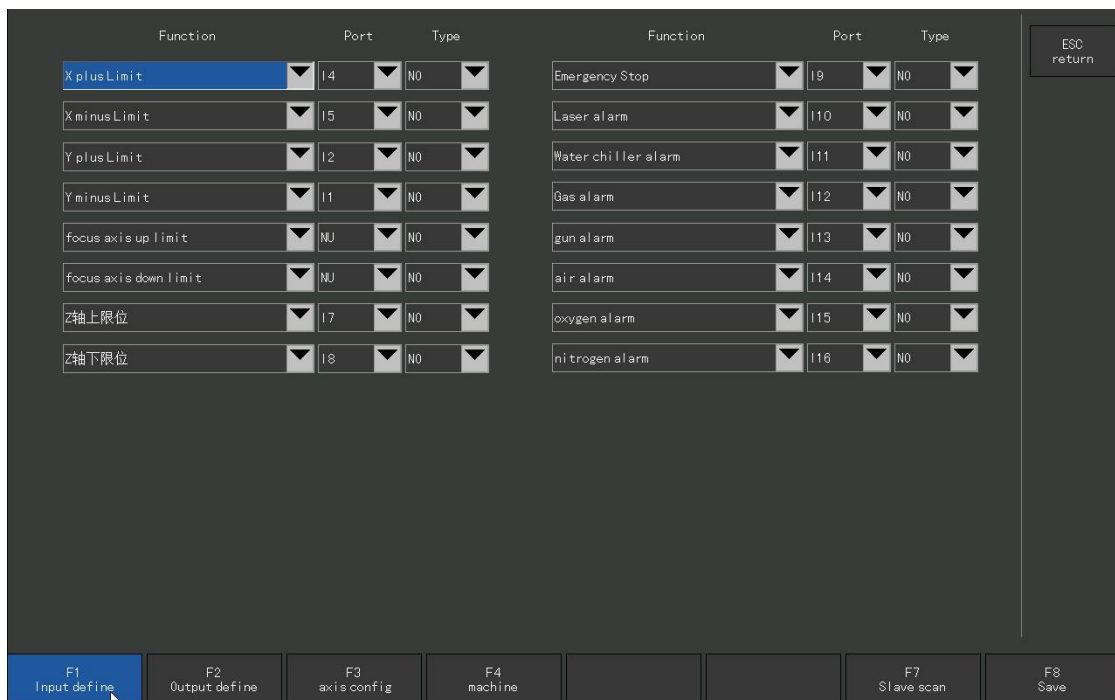
Figure 11.1 Input port definition

11.2 Definition of the output port

The controller can change the definition of the output IO port according to the needs of the user, including changing the serial number of the changed IO port on the output terminal and the NO or NC type of the output port. As shown in Figure 8.15.

Under this interface, press〔↑〕,〔↓〕,〔←〕and〔→〕on the operation panel to move the cursor to the place to change, position the cursor to the option to change, and press [Enter] to open the tab of the drop-down box where the cursor is located. Move the cursor〔↑〕,〔↓〕and press [Enter] to set the selected parameters again.

The output port type is the triode leakage output type.

Type is NO, indicating that the output signal is normally open (the output effective level is low level). Type is NC, indicating that the output signal is normally closed (the output effective level is the high level).

Figure 11.2 Definition of the output ports

11.3 Axis configuration

Figure 11.3 Axis configuration

Arrange the parameters for each axis to ensure that each axis can move normally.

- Axis selection: you can select axis X, axis Y, and focus axis.

- Physical channel: select the point axis port, you can customize and configure the axis number of each axis.

- Axis direction: play debugging function. In processing page, click X +, the torch will move to the X axis positive direction, the actual machine on the X axis negative direction, this phenomenon shows the motor reverse, check the axis direction reverse, in processing page, click X +, the page to the X axis positive direction, the actual machine head will also move to the X axis direction.

- Number of pulses: the number of pulses to be sent when the machine moves 1mm along the X axis or Y axis.

- Acceleration: the acceleration of machine movement.

- Soft limit enable: enable the system soft limit function.

- Positive and negative soft limit parameters: set the maximum minimum of positive and negative soft limit for each axis.

- Servo alarm enables: receive and respond to the servo alarm signal of pin 14 in the servo interface, otherwise the signal will be responded.

- Servo alarm input port: set the NO and nc type of servo alarm input signal.

- Zero enable: When enabled, the current axis will go back to zero, otherwise the current axis will not go back to zero.

- Back-zero order: Back-zero order of the currently selected axis. For example, set to 1, indicating back to zero, the current selected axis will return to zero first, and then the other axis back to zero.

- Forward in the zero direction: set the zero direction of X / Y axis, and the default is back to the negative direction of X / Y axis. Choose yes, and then return to zero in the positive direction of the X-axis.

- First return zero speed: the speed of the current axis for the first time to find the approximate range of the return zero switch, so the speed can be slightly larger.

- Second return zero speed: the speed of the current axis at the second time, the range of the return zero switch has been determined, so the speed needs to be smaller to improve the accuracy of back to zero.

- Zero offset: the position of the actual machine zero relative to the return zero switch. If the position of the return zero switch is not the zero position of the machine tool, this parameter is required to set the zero position of the machine tool.

- Machine docking position: the coordinate position where the current axis needs to dock after zero.

11.4Machine tool parameters

Set the machine tool parameters, including the height controller configuration, laser configuration, gas configuration, speed planning configuration, network configuration, user login permission, and coordinate system configuration.
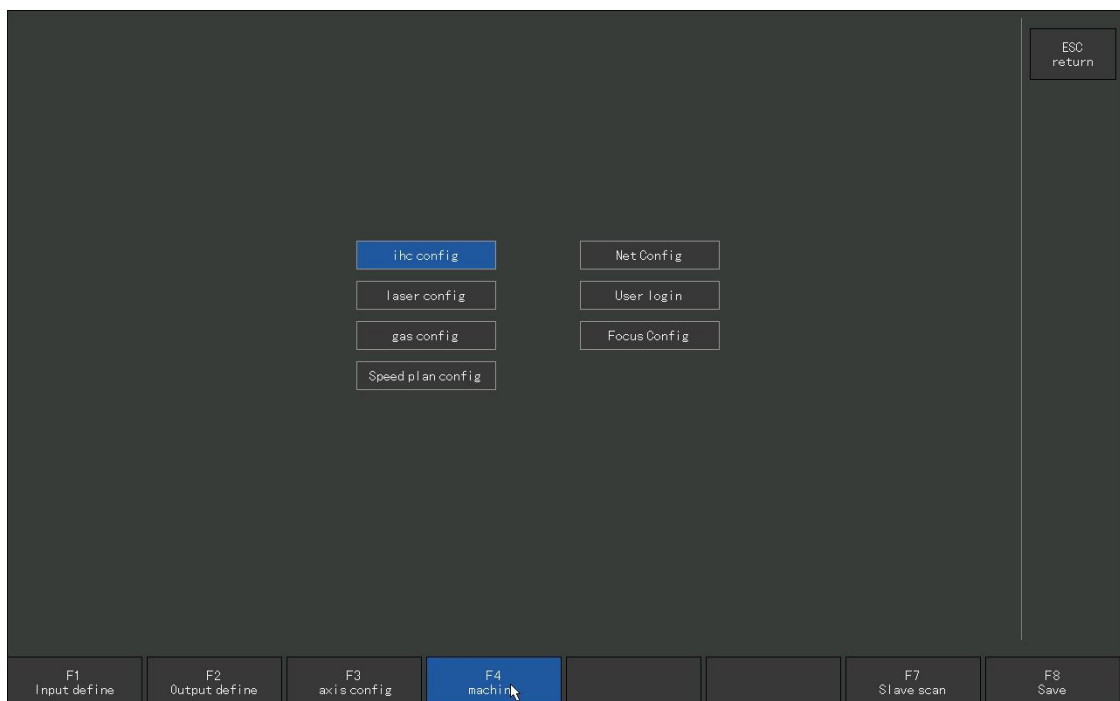
Figure 11.4 Machine Tool Parameters

11 . 4.1 Elevator configuration

To communicate and connect with the laser height controller, these device parameters must be set in the THC configuration. In the regulator configuration, the communication parameters of the laser regulator can be set, as shown in Figure 11.5.
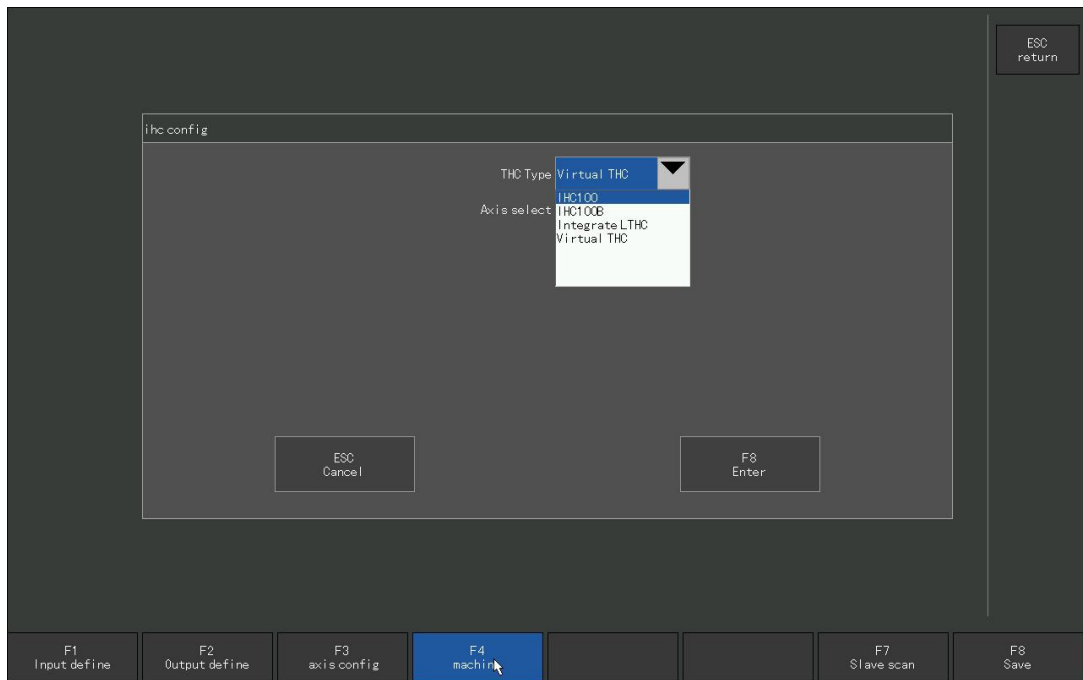
Figure 11.5 Elevator configuration

This controller can be used with the laser height controller of Fang ling. Elevator model optional iHC100 / iHC100B / integrated regulator / virtual regulator four options.

11 . 4.2 Laser configuration

To communicate and connect with the laser, these device parameters must be set in the laser configuration. In the laser configuration, the communication parameters of the laser generator can be set, as shown in Figure 11.6.
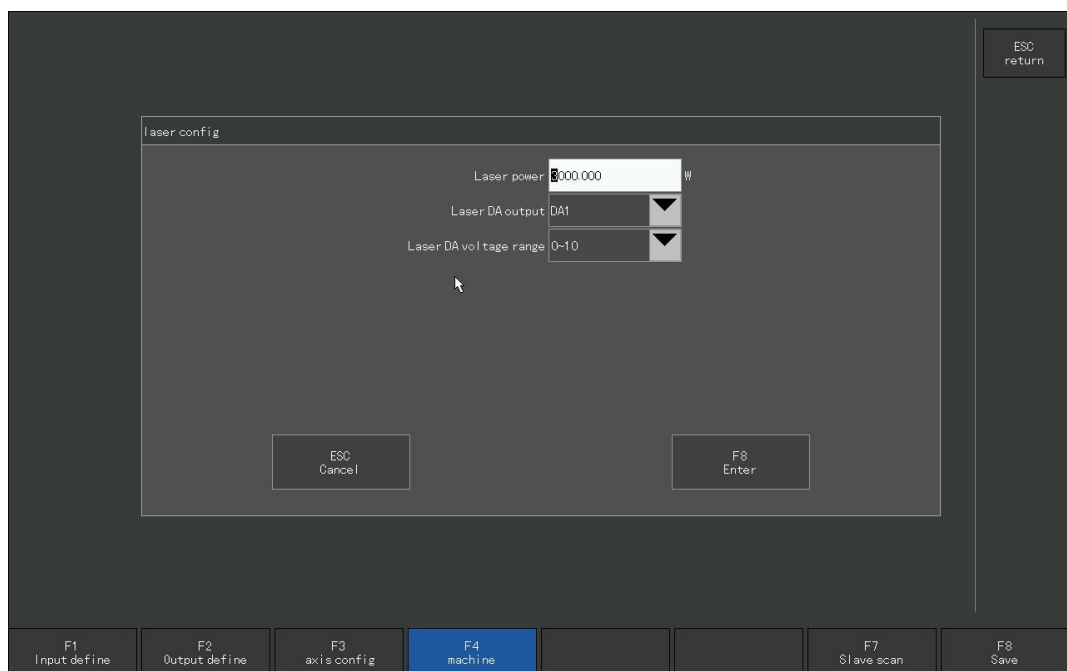
Figure 11.6 Laser configuration

Select the corresponding option according to the laser generator used. If the laser generator model used is not included in the option, select the other option, support universal DA controls the peak power of the laser generator, PWM sets the real-time power of the laser generator, and the output port controls the light switch signal of the laser generator.

- Laser power: Set the power of the laser generator.
- DA port selection: set the laser generator peak power DA output port.
- DA voltage range: 0~10V, 0~5V, and set the DA voltage output control range.
- PWM signal enable +: PWM enable output port end.
- PWM signal enable-: PWM enable output port minus end.
- Light out enable: set the optical switch output control port number of the laser generator.
- Light preparation: light preparation output port.
- Red light control: red light control output port.

Note: The yellow part needs to be configured by the output port definition.

11 . 4.3 Gas configuration

F8 platform configuration-Click the gas configuration button in the F4 machine tool parameters to enter the gas configuration interface, as shown in the figure.

Figure 11.7, Gas configuration

● **Maximum pressure of proportional valve**: set the maximum output pressure value of proportional valve.

● **DA voltage range**: 0~5V and 0~10V can be set according to the analog volume range of the proportional valve used.

● **DA output of proportional valve**: set the output port number of the solenoid for control air.

● **Pressure correction**: correct the gas with DA output.

DA gas correction can be performed only with the gas with DA output port. Click the [Gas Correction] button, and the interface shown in the figure below will pop up. Set different DA output voltages, measure the actual air pressure of the output in turn, and fill in the measured results in the table. During the cutting process, the corresponding DA voltage will be output according to the required air pressure value. If the required air pressure is not in the table, it will be obtained according to the linear relationship.

11 . 4.4 Speed planning and configuration

Reasonable setting of parameters in the speed planning configuration can effectively improve the cutting
accuracy.
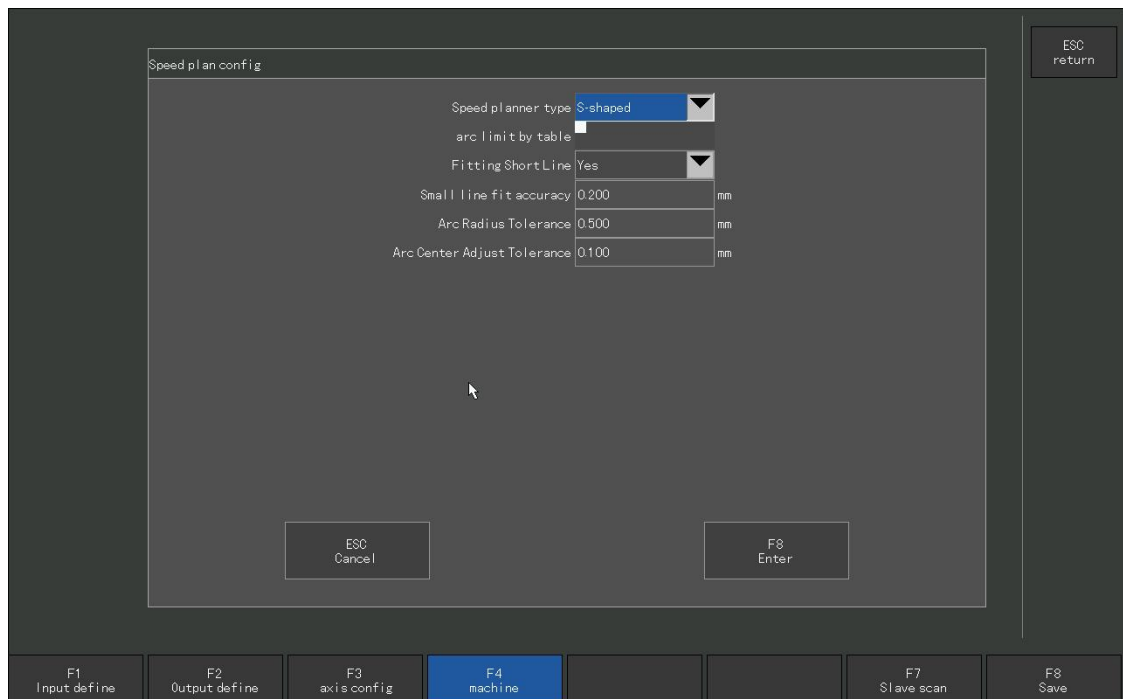
Figure 11.8 Speed Planning and Distribution

parameter	unit	remarks
Speed planning and speed limit mode		Two modes can be set up to facilitate switching when cutting different plates.
Enable small arc speed limit		After checking, the system will automatically slow down when cutting the small circle and arc.
Small line segments fit		Yes / no
Precision of small segment fitting	mm	The error range of the smooth transition of the small segment (the minimum length of the small segment in the G code, and the G code below that length is merged into a line of G code)
Arc radius tolerance	mm	The error range of the arc instruction in the G code, the error is not allowed to exceed this parameter.
The center of the circle corrects the tolerance	%	

11 . 4.5 Network configuration

IP address settings

Click the "Network Configuration" button in the [F5 diagnosis] -> [F8 system definition] -> [F4 machine tool] to open the pop-up interface of the "Network Configuration" button and set the IP address.
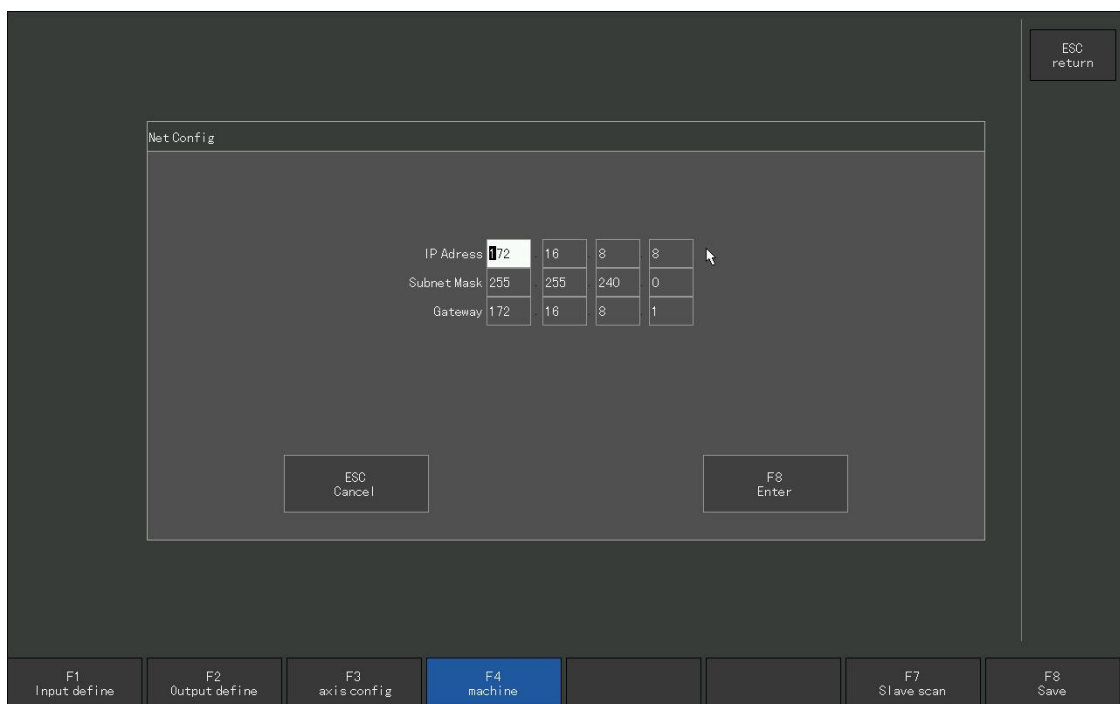
Figure 11.9, the network configuration

Here is the native IP address, set the IP address to**172.16.8.9**The IP address is:**172.16.8.8**The subnet mask is set as:**255.255.240.0**The default gateway is set as:**172.16.8.1**After the parameters are set, save them and power off and restart to make the parameters take effect.

11 . 4.6 User login

The controller can manage the user, and the user's permission can be divided into four levels. Different identities of users, can view and can modify different parameters.as shown in the figure:
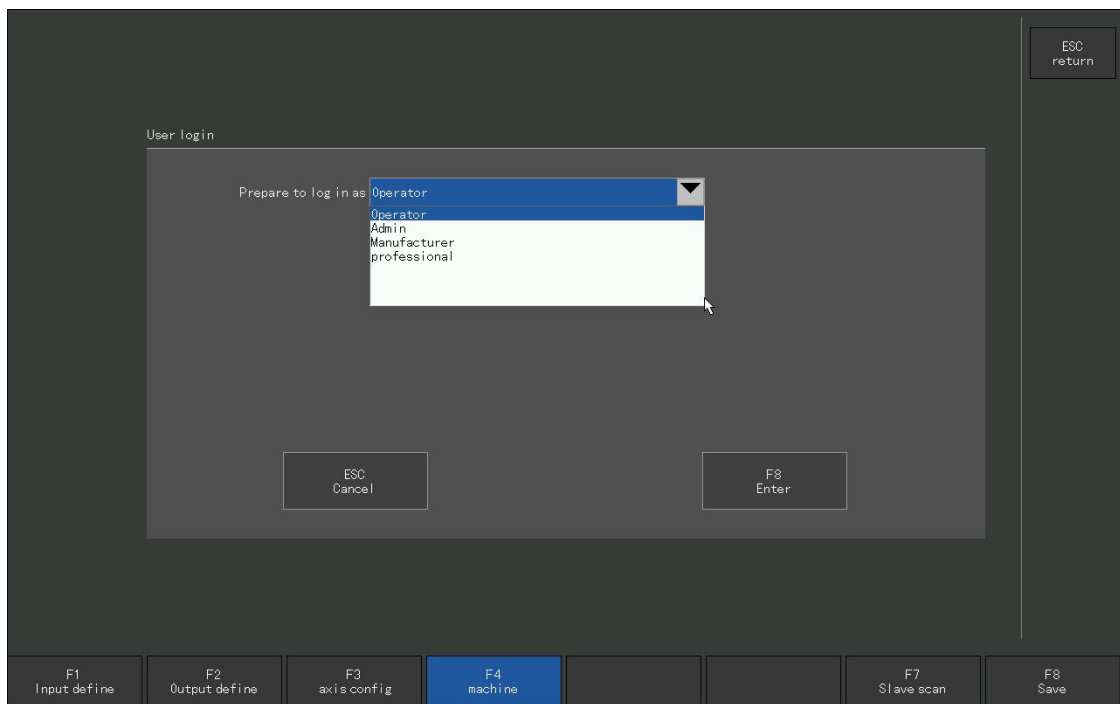
Figure 11.10 User Management

11 . 4.7 Focus axis configuration

Configure laser focus axis related parameters, whether to enable focus control, part of the cutting head is manual focus, need not use.

Focus location speed: Position to the set focus position speed.

Focus manual speed: Change speed of manually moving the focus.
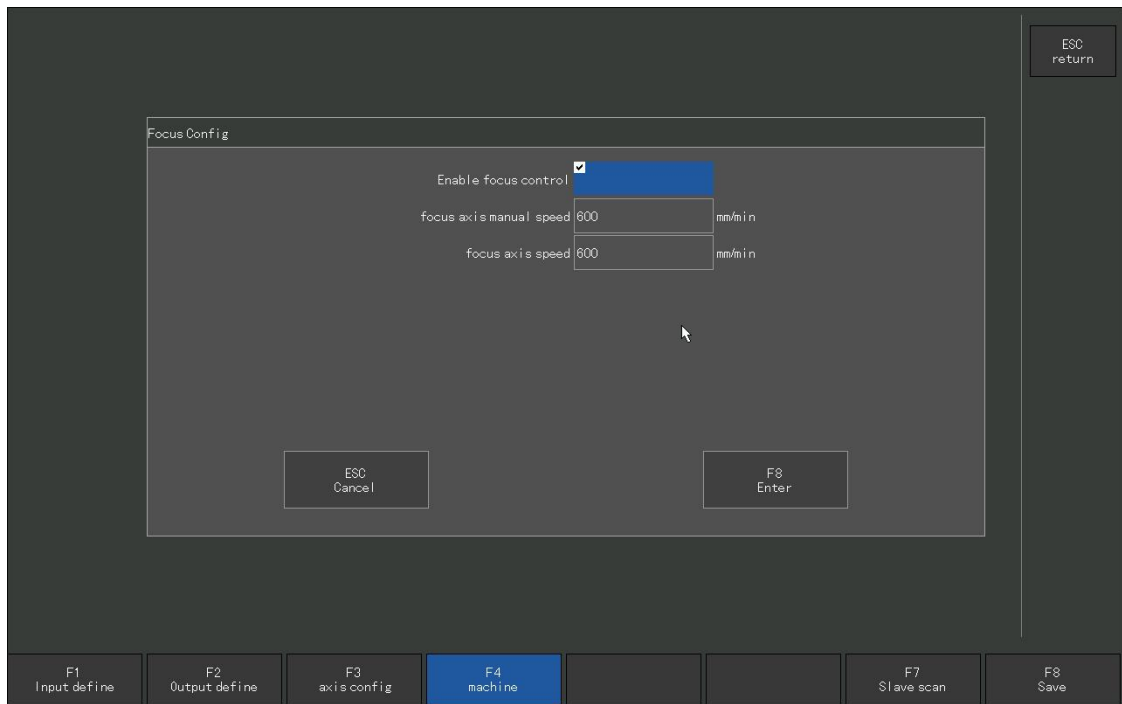
Figure 11.11 Focus axis configuration

11 . 4. 8 Station scan

Station scanning is to scan the bus servo motor. Through the Ethernet connection, the status information of the servo motor can be obtained to ensure the normal motor communication.

Before bus scan, confirm that each slave station communicates with the host through the network cable and connects without alarm; it is recommended to connect each EtherCAT slave station in series of the host X→Y→Y1→Z→Other axis;

After getting the scan result, confirm whether the number of slave stations displayed is consistent with the actual number of connections. If the sweep number is less than the actual number of connections, check whether the slave state of the missing part is normal; if the scan is successful: after correctly identifying all the slave stations, you can perform the specific parameter configuration of the next axis; if the scan fails, query the corresponding solution according to the failure prompt.
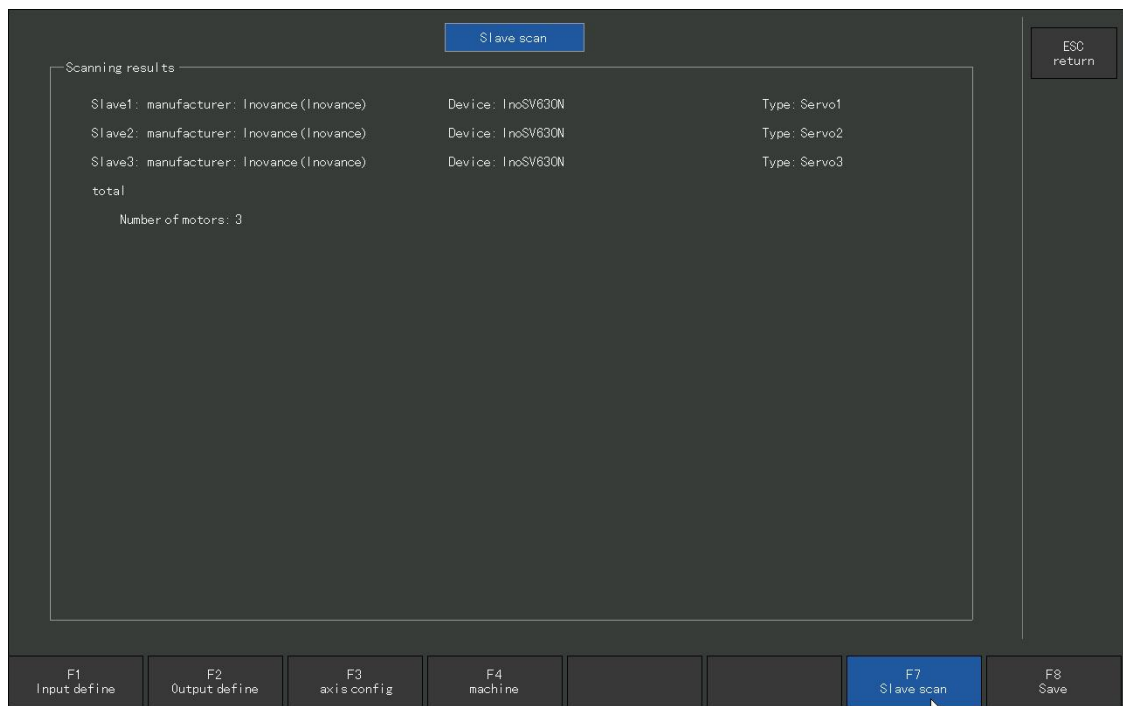
Figure 11.12 From the station scan

Chapter 12 graphic management

Under the main interface, press [F1] to enter the shapelib page, as shown in Figure 12.1.
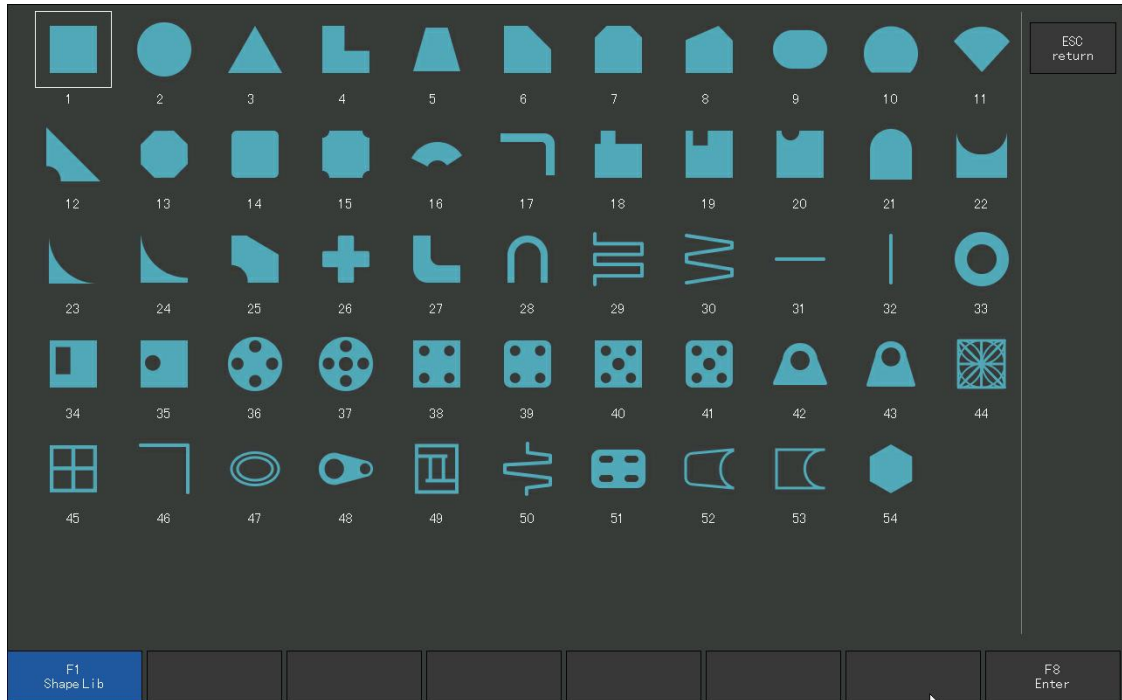
Figure 12.1, the gallery page

On this screen, press [↑], [↓], [←], and [→] to select different drawings.

12.1 Select the graphics / piece size

In plate cutting mode, after moving the cursor to the desired figure on the gallery homepage interface, press [F8] to confirm and select a gallery, as shown in Figure 12.2. For the first use, the piece size interface is displayed (the piece size refers to the cut workpiece is needed, and the hole size refers to the cut hole is needed). In later use, the previous parameter setting (piece size or hole size) will be maintained. The bottom right of the screen shows the schematic diagram of the current artifact. The modifiable parameters are represented by numbers. In the schematic diagram, it can be seen in the specific position, with length, Angle and other units. The left side of the screen shows the actual renderings of the current artifact.

[↑], [↓], [←], [→] can select the dimensions to be modified. Use the number key to modify the parameters, press [F8] to confirm, and then enter the drawing

On the cutting function interface in Figure 12.3, if there is a kerf setting, the original outline line (green line) and the kerf line (blue line) will be displayed at the same time. When cutting, the center of the torch is cut along the blue line.
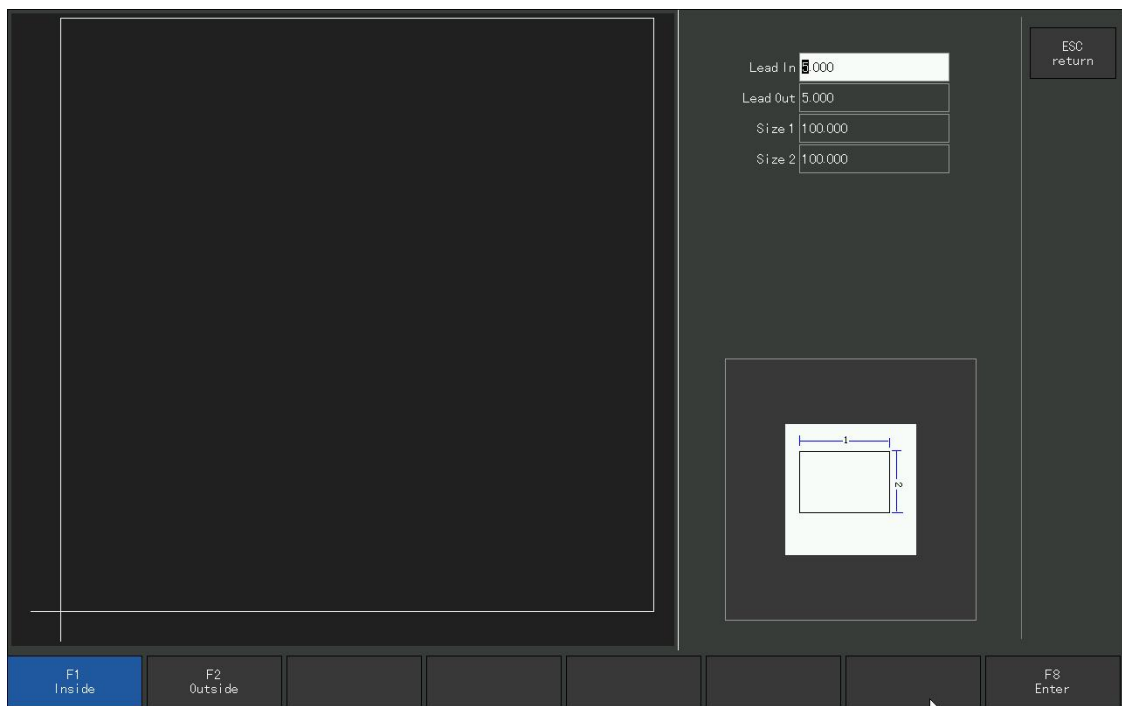
Figure 12.2 Size interface
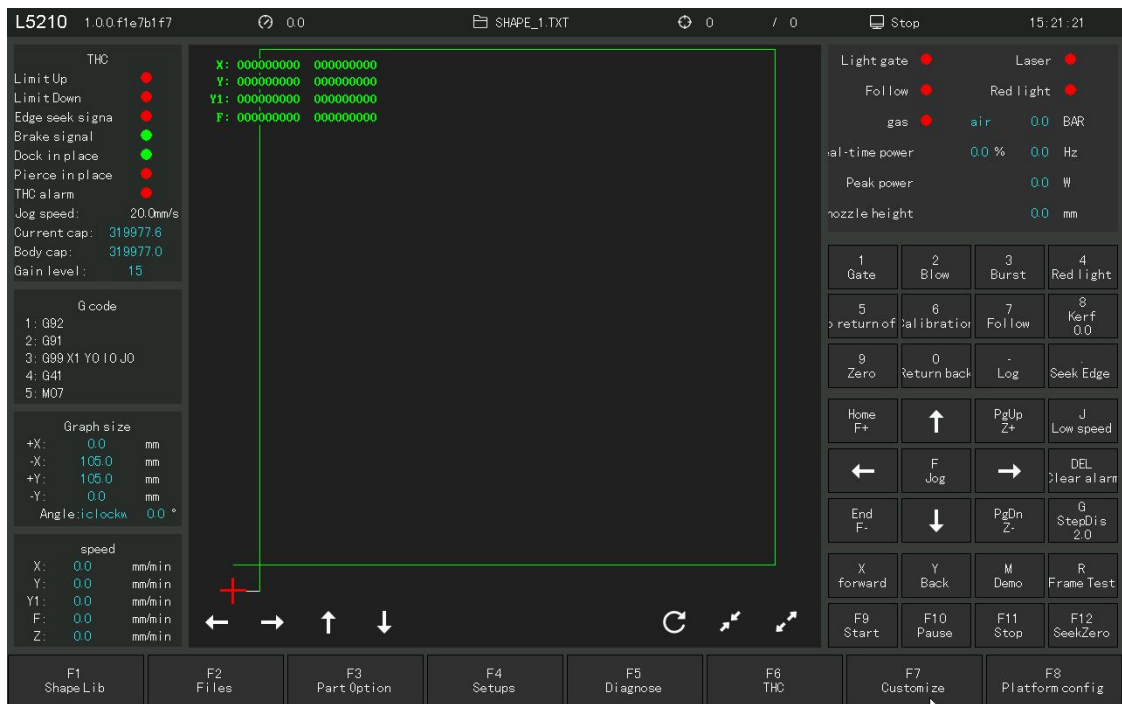
Figure 12.3 Size cutting graphic interface

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12.2-hole size

   In Figure 12.4, press [F2] to enter the hole size interface, as shown in Figure 12.4.

The parameter modification mode is the same as the piece size mode. After the modification, [F8] confirms that the main cutting interface can be entered. Figure 12.5 is the hole size cutting interface.
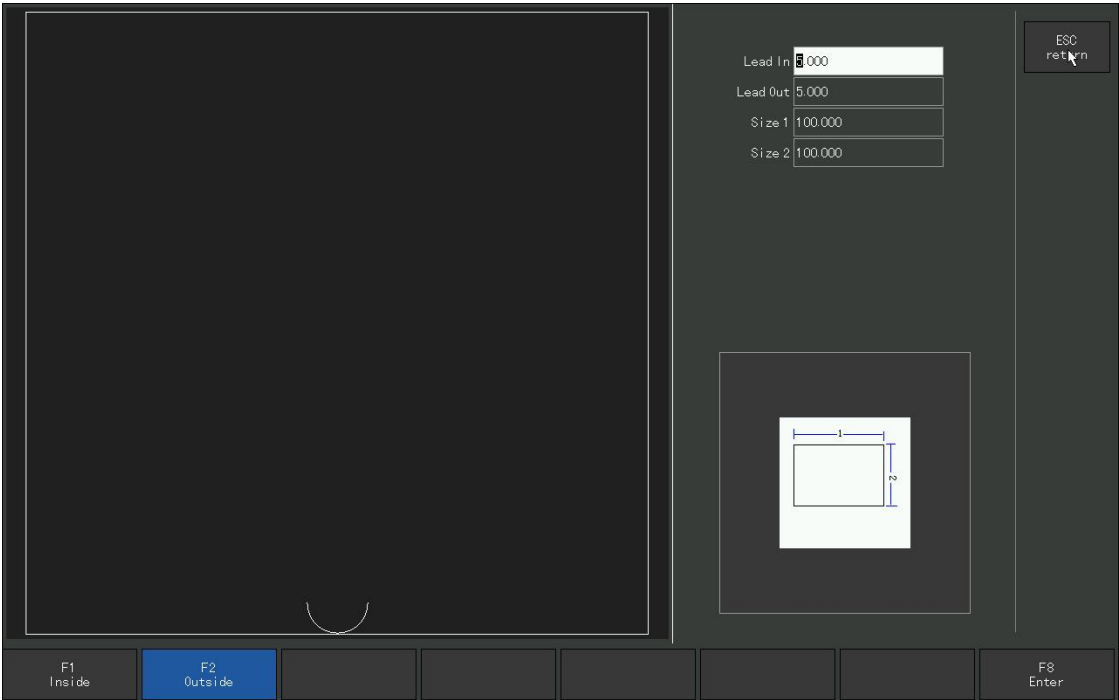
Figure 12.4
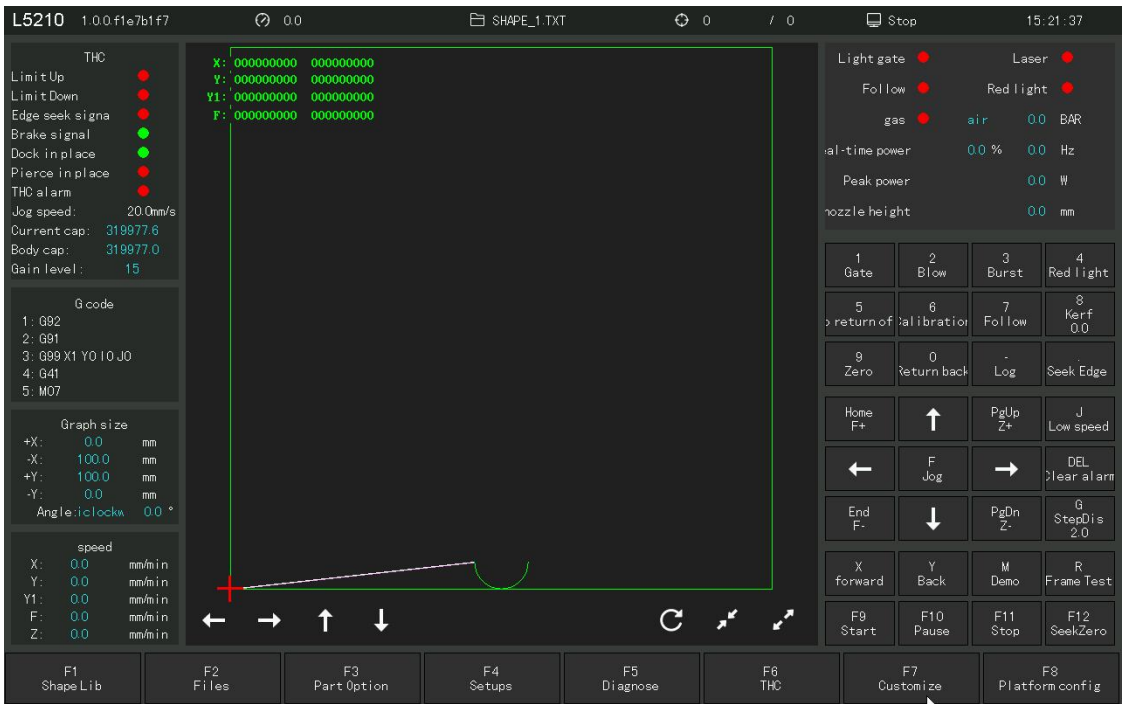
Figure 12.5-hole size cutting graphic interface

Chapter 13 Code description

13.1 Programming symbols and instructions

✟   In the cutting machine programming, generally used in the following programming symbols, programming symbols followed by the corresponding parameters.

Table 1 3.1 Description of the programming symbols

Programming symbol	function declaration
N	Program segment serial number
G	Prepare code
M	additional function
X	X-axis relative or absolute coordinates
Y	Y-axis relative or absolute coordinates
U	The X-axis relative coordinates
V	The Y-axis relative coordinates
I	The X-axis coordinate difference of the center relative to the beginning of the arc
J	The Y-axis coordinate difference of the circle relative to the beginning of the arc
R	Radius of the arc, with positive value less than 180° arc and negative value greater than 180° arc.
F	Cutting speed, used for G01, G02, G03.

13.2 coordinate system

By default adopts the right-handed Cartesian coordinate system, as shown in Figure 10.1.
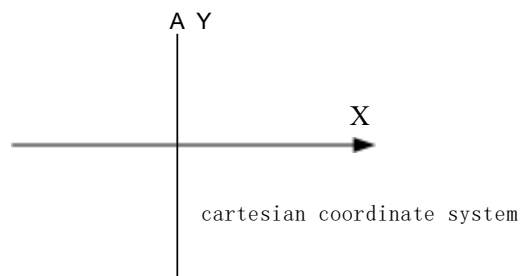
Figure 1 3.1 The Cartesian coordinate system

Of course, the system can also be defined by the user himself.

13.3 G Code description

The G codes supported by this system are shown in Table 1 3.2.

Table 1 3.2 Commonly used G, code table

G99	Parameters: X / UY / VIJ	Part option parameters
G92	parameter:XY	Reference Point Settings
G91 / G90	No parameters	Relative / absolute coordinates
G20 / G21	No parameters	British / metric
G41 / G42	No parameters	Left / right kerf compensation
G40	No parameters	Cancel kerf compensation
G00	Parameters: X / UY / V	Fast straight movement (empty)
G01	Parameters: X / UY / V	Straight cutting
G02	Parameters: X / UY / VIJ	clockwise, circular arc cutting
G03	Parameters: X / UY / VIJ	Counterclockwise circular arc cutting
G04	parameter:P	delay

1. G92 reference point setting

form:

G92[Xn][Yn]

Parameter meaning:

[Xn] [Yn] represents the absolute coordinates of the set reference point, and is also the absolute coordinates of the machine tool back. If there is no parameter after G92, the default reference point coordinate is (0,0). Generally, machine tools in (0,0) as the reference point, this code can be omitted.

Note:

After the code is transferred, the reference point coordinates set by G92 will be automatically saved. Before the new cut code, the reference point coordinate will be valid, whether power off or not. After a new cut code is added, if the new code has G92 instruction, the new reference point coordinate is the content after G92. If there is no G92, the reference point is by default (0,0). A G92 can only appear once in a code file.

example:

a.G92 X0 Y0

With (0,0) as the reference coordinate, when the "back" function key is pressed, the machine returns to the (0,0) coordinate point.

b.G92 X20 Y0

With (20,0) as the reference coordinate, when the "back" function key is pressed, the machine goes back to the (20,0) coordinate point.

2.G90/G91

form:

G90/G91

The G90 means absolute coordinates. X Y appearing in the code indicate the absolute coordinate and UV indicates the relative sitting value.

G91 means relative coordinates. X Y appearing in the code indicate the relative coordinate , and UV also indicates the relative coordinate values.

example:

G92　X0 Y0 G90
G00 X20 Y0
M07
G01 X120 Y100
M08
M02

// Reference point (0,0) // absolute coordinates
// Fast moving torch to (20,0) //
perforation cycle
// Cut to (120,100)
// off cut cycle

(120,100)

(20,0)
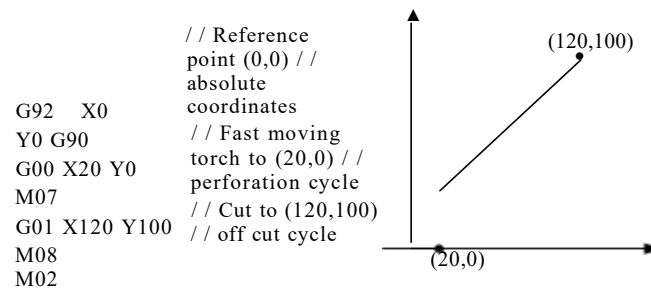
Figure 1 3.2 G90 usage

The b.G91 usage

G92 X0 Y0 // Reference point (0,0)
G91 // relative coordinates
G00 X20 Y0 // fast move to (20,0)
M07 // perforation cycle
G01 X120 Y100 // Cut to (120,100)
M08 // off cut cycle
M02

(140,100)

(20,0)
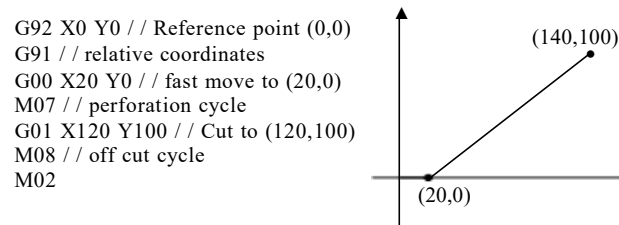
Figure 1 3.3 G91 usage

3. G20/G21

form:

G20/G21

G20 British units. All the X, Y, I, J, R, U, and V that appear after the G20 are British units.

G21 Metric units. All the X, Y, I, J, R, U, and V that appear after G21 are metric units.

Note:

If G20 / G21 does not appear in the code, the default unit is the metric. The conversion

formula of the British system and the metric
system is: 1-inch ≈ 25.4mm.

4.G00 empty movement

This code indicates that the torch moves quickly to the specified position,
and the system moves quickly from the starting point to the specified position
at the speed of "empty moving speed * rate".

form:

G00 X/Un Y/Vn[Fn]

Parameter meaning:

The Fn empty-range speed limit.

Un - The displacement of the end point X
coordinate relative to the starting point of the
current segment

Vn - The displacement of the end point Y
coordinate relative to the starting point of the
current segment

(In the relative coordinate system)

Xn - The displacement of the end point X coordinate
relative to the starting point of the workpiece

Yn - The displacement of the end point Y coordinate
relative to the starting point of the workpiece

example:

G92 X0 Y0 // Reference point (0,0)
G91 // relative coordinates
G00 X100 Y100 // Quick move to (100,100) M02

(100,100)
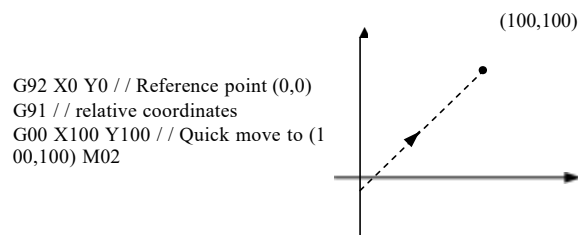
Figure 1 3.4 G00 usage

5. G01 straight-line cutting

This code indicates straightly cut to the specified position, and the system
cuts from the starting point of the current segment to the specified position at
the speed of "cutting speed * rate".

form:

G01 X/Un Y/Vn[Fn]

Parameter meaning:

The same as G00 code, the difference is that G00 means the empty walking in a straight line (i. e., the output port is all closed), and G01 means the straight cutting.

6. G02 round

This code means that the arc (clockwise) cuts to the specified position, and the system cuts from the start of the current segment to the specified position at the speed of "cutting speed * rate".

form:

G02 X / UnY / VnIn Jn [Fn] or G02 X / UnY / VnR [-] n [Fn]

Parameter meaning:

Fn to cut at the speed limit.

Un - The displacement of the end point X coordinate relative to the starting point of the current arc. Unit: mm;

Vn - The displacement of the end point Y coordinate relative to the starting point of the current arc. Unit: mm;

In - The displacement of the X coordinate of the circle center relative to the starting point of the current segment, Unit: mm.

Jn - The displacement of the Y coordinate of the circle center relative to the starting point of the current segment, Unit: mm.

R [-] n - The radius of the arc, when the arc is less than or equal to 180 degrees, R is positive, and vice versa is negative, unit mm ; (in the relative coordinate system)

Xn - The displacement of the end point X coordinate relative to the starting point of the workpiece. Unit: mm.

Yn - The displacement of the end point Y coordinate relative to the starting point of the workpiece. Unit: mm.

example:

Example 1, from B- -> A
G92 X0 Y0 // Reference point (0,0)
G91 // relative coordinates
G00 X60 Y100 // Quick moving torch to point B G02 X-40 Y-40 I0 J-40 // arc 1
OR (G02 X-40 Y-40 R-40)
M02
Example 2.
Starting from A-> B   // Reference point (0,0) //
G92 X0 Y0   relative coordinates
G91   // Quickly move the torch to point A
G00 X20 Y60
G02 X40 Y40 I40 J0 // Arc 2 or (G02 X40 Y40 R40)
M02
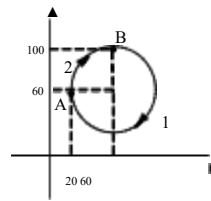
Figure 1 3.5 G02 usage

7. G03 inverse circle

Same like G02, difference is that G02 is circular (clockwise arc) and G03 is inverse circle (counterclockwise arc).

8. G42 / G41 and G40, kerf compensation

These functions are the cut kerf compensation function. When the cut path represented by the code is only the actual size of the workpiece, because the flame cutting / plasma cutting will always have the cut kerf, the actual cut workpiece is not the required size without considering the influence of the cut kerf. After setting the cut compensation, the system will automatically calculate the impact of the cut and cut the actual size workpiece.

G41 / G42 and G40 must be paired and used. If G41 / G42 is omitted, the default cut kerf compensation value is zero; if G40 is omitted, the default cut compensation is effective

9. G99 ratio, rotation, and mirror image

form:

G99 Xn YnIn Jn

Parameter meaning:

X-Scale factor, 0.001 to 1000 can be set.

Y-Rotation angle, -360° to 360° can be
set.

I - X axis mirror, mirror along the X axis, 1 means mirror, 0
means no mirror

J - Y axis mirror, mirror along the Y axis, 1 means mirror, 0
means no mirror

Note:

For a code, there can be either a G99 or no G99. If there is a G99, the following parameters X, Y, I, and J cannot be omitted.

Both the mirror image and the rotation take the origin of the Cartesian coordinates (0,0) as the reference point.

10. G04 time delay

form:

G04 Pn Parameter meaning:

P delay time, the following parameter is 0.01 seconds, such as P100 means the delay of 1 second.

11. Programming considerations

●The programming must contain G92 (reference point setting) and M02 (End of program) instructions.

●G41 / G42 and G40 must be paired and used. If G41 / G42 is omitted, the default is zero; if G40 is omitted, the default is valid.

●G00, G01, G02, G03 can be abbreviated as: G0, G1, G2, G3.

●Continuous G00 (or G01, G02, G03), G 00 (or G01, G02, G03) can be omitted.

1 3.4 M code description

Table 1 3.6 Common M codes

M07	No parameters	Perforated fixation cycle
M08	No parameters	End cutting fixation cycle
M11	No parameters	Establish spray powder offset
M12	No parameters	Cancel the spray powder offset
M09	No parameters	Open the spray powder

M10	No parameters	Turn off the spray powder
M00	No parameters	pause instruction
M02/M30	No parameters	end of program

◆M07 perforated fixation cycle

Refer to Appendix 2 F4207V Series NC System IO timing chart.

◆M08 ends the cutting and fixation cycle

Refer to Appendix 2 F4207V Series NC System IO timing chart.

◆M00 pause

During the cutting process, the system will stop the machine tool when encountering such instructions and wait for further operation.

◆M02 / M30 program ended

Chapter 14 Interface Description

The back interface diagram of this system, as shown in Figure Figure 11.1,

➢ **CN1 for the 3-core green terminal for the DC 24V power supply port**

➢ **CN2 and CN3 are the input ports**

➢ **CN4 and CN5 are the output ports**

➢ **CN6 is an eight-core analog input and output port**

➢ **The CN7 is a two-core PWM output port**

➢ **A1, A2, A 3 and A4 are motor interfaces with standard DB15 male heads**

➢ **CN8 is the serial port interface of RS232**

➢ **CN9 is the high-frequency line interface of the height controller**

➢ The system contains Ethernet and Ether CAT network ports

➢ Front / rear with two USB ports

Figure 1 4.1 Back interface diagram

◆ 24V and 0V are connected to the positive and negative poles of 24V switching power supply; FG shall be reliably connected to the earth

Requirements are as short and thick as possible.

◆ All terminals can only be plugged, wiring can not pull off terminals.

1 4.1 Description of the power supply interface

Power input interface DC_24V, power supply requirements DC 24V, 3A. As shown in Table 14.1.

Table 14.1 Description of the power supply interface

Power interface pin	Signal name	remarks
1	ground	ground stud
2	24V positive	Direct current 24V power supply is positive
3	24V negative	DC 24V power supply ground
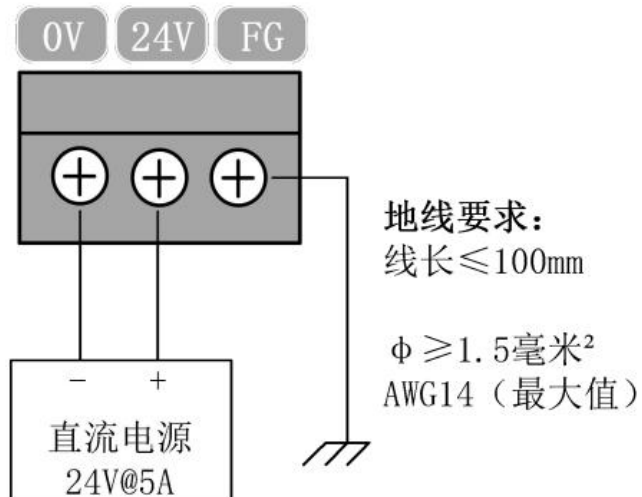
Figure 14.2, Power supply wiring diagram

1 4.2 Input interface

◆ The input port is photoelectric isolated input with low efficiency. The input signal can be mechanical contact switch, or photoelectric switch, support often open and closed input. The common end of the external switch is 24 VGND and the other end is connected to the corresponding input port. The schematic diagram of the input port internal circuit is shown in Figure 14.3.

◆ A total of 16 input ports.

◆ The input signal pin definition can be modified.

◆ Input signals are defined by default as described in Table 1 4.2.
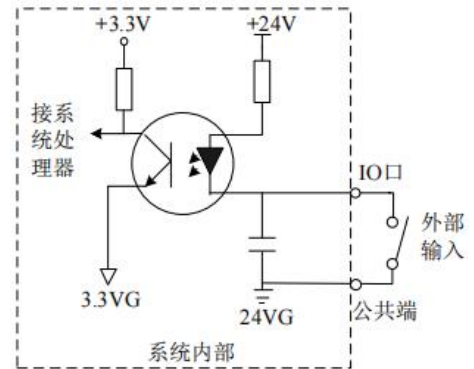
Figure 14.3 Schematic diagram of the input interface circuit

There are 16 universal input ports, and all input port functions support customization. Each axis of the limit, zero and emergency stop functions, support serial number customization.

Table 1 4.2 Input port definitions

order number	function	explain	remarks

1	X-axis positive limit	Limit of the machine tool	Low effective
2	X-axis negative limit		Low effective
3	Positive limit of Y axis		Low effective
4	Negative limit of Y axis		Low effective
5	Focus axis positive limit		Low effective
6	Negative limit of focus axis		Low effective
7	Upper limit of Z axis		Low effective
8	Lower limit of Z axis		Low effective
9	Laser alarm	Connect to the alarm output port input of the laser	Low effective
10	Water cooler alarm	Connect to the alarm output port of the water cooler	Low effective
11	Gas alarm		Low effective
12	The torch head alarm		Low effective
13	Oxygen alarm	Connect to the gas alarm output port	Low effective
14	Nitrogen alarm		Low effective
15	Air alarm		Low effective
16	Zero input of X axis gyrus		Low effective
17	Y-axis gyrus zero input		Low effective
18	jerk	System emergency stop signal	Low effective

1 4.3 Output interface

◆The output port is 24V high level output;

　　Can directly drive 24V DC equipment.

◆The output bears the maximum load current

of 300 mA.

◆The output signal pin definition can be

modified.

◆A total of 16 output ports.

◆The output signal is defined by default as described in Table 14.3.

Figure 14.4 Schematic diagram of the output interface circuit

Table 1 4.3 Definition of output ports

order number	function	explain	remarks
1	Total gas valve	The main air valve controls the output port and requires the transfer relay	High effective output
2	Oxygen valve	The oxygen valve controls the output and requires the relay	High effective output
3	Nitrogen valve	Nitrogen valve control output, require transfer relay	High effective output
4	air valve	The air valve controls the output and requires the relay	High effective output
5	PWM+ enable	Can not use, PWM output has been added relay isolation	High effective output
6	PWM-enable		High effective output
7	Z axis lock output		High effective output
8	Focus is sent back to the origin of the output		High effective output
9	optical shutter	Connect to the optical switch enabling end of the laser, it needs to add a relay for control.	High effective output
10	follow		High effective output
11	Up		High effective output
12	cease		High effective output
13	glow		High effective output
14	Cut finished		High effective output
15	Cut operation		High effective output
16	Cut enabling		High effective output
17	Alarm output		High effective output
18	Standby output		High effective output

19	Processing output		High effective output
else	Unused		

14.4 PWM output

L5210H Outputs a 2-channel PWM pulse width modulation signal, which can be used to control the real-time power of the fiber laser. The PWM signal level passes through an internal jumper and can be configured as 5V or 24V (default 24V) with a duty ratio of 0% to 100% adjustable.

Table 14.4 Definition of the PWM interface

The PWM interface pin number	Signal name	explain
1	PWM1	PWM+
2	PWM2	PWM+
3	A GND	PWM-

14.5 Analog quantity DA output port

L5210H There are 4 analog DA output signals, all being 0~10V. The DA output can be used to control the peak power of the laser and the control signal of the proportional valve, which can be customized in the platform configuration.

Table 14.5

Analog quantity interface pin number	Signal name	explain
1	DA1	Analog volume output port
2	DA2	Analog volume output port
3	DA3	Analog volume output port
4	DA4	Analog volume output port
5	A GND	Analog volume is a common ground line

Chapter 15 The Use of the BIOS

The function of system upgrade and system restoration needs to enter the BIOS interface through the following steps. When the system is just powered on, the system appears in Figure 15.1.

```
**********
BIOS Version:V4.5.0
Press F 2 to run BIOS …
Auto bootafter:3
```
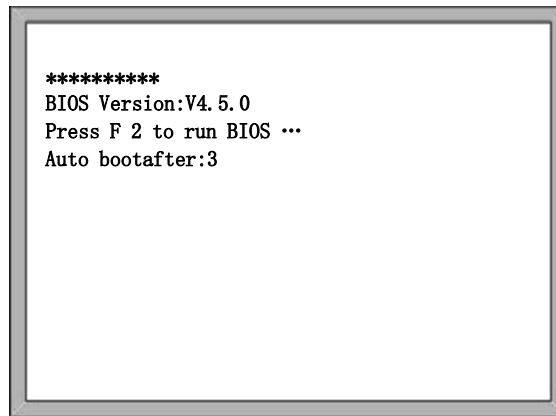
Figure 15.1, boot prompt

When the prompt in Figure 1 5. 1 appears, before the countdown to 0, if the [F2] key is pressed, the system enters the BIOS interface. If any other keys are pressed, the system ends the countdown and enters the system.

```
F1-系统升级(System Software update)

F4-系统备份(System backup)

F5-系统还原(System recovery)

F6-启动系统(Start system)

F8-BIOS升级（Bios upgrade）
```
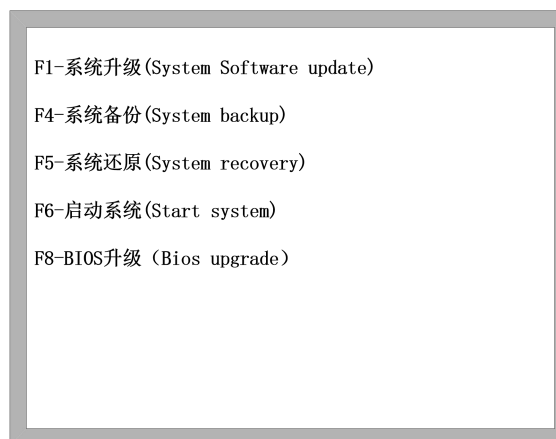
Figure 15.2 The BIOS Interface

15.1, and the system upgrade

After entering BIOS, the system can be upgraded by [F1] and the following conditions shall be met before upgrading:

◆The U disk is inserted in the system USB interface

◆The upgrade file L5000. upg is located in the root directory of the U disk

If the above two conditions are met at the same time, the system can be upgraded after pressing F1. After the upgrade, the system can be started by pressing [F6].

15.2, and the system backup

After entering BIOS, the system can be backed up by [F4]. The system backup only backs up the operating system, not backup parameters, IO port configuration, coordinate configuration and other information.

15.3, and the system reduction

After entering BIOS, restore the previously backed up system according to [F5]. The restored system restored here does not affect the users parameters, IO port configuration, coordinate system configuration, etc., so it is recommended to use the restore system function here.

15.4, start the system

After entering the BIOS, press [F6] to start the system. After the system upgrade, there is no need to power off, you can directly press [F6] to start the system, the system will jump out of bios and enter the main cutting interface.

15.5 A BIOS upgrade

After entering the BIOS, press [F8] to upgrade the system biOS. In general, users do not need to upgrade to bios. This product may later with hardware upgrades to support more features, when a bios upgrade may be required. Copy the bios program to the root directory of the U disk, insert the U disk into the system, press [F2] − −> [F8], and upgrade the bios according to the prompts.

Chapter 16: Installation and Commissioning

16.1 Setting of transverse / longitudinal pulse number

◆Setting of the transverse / longitudinal pulse number

The number of transverse / longitudinal pulses here is the number of transverse and longitudinal pulses in section 7.4. The setting of transverse (longitudinal) pulse number is actually very simple. Before drawing the line, assume a transverse pulse number X Pls and a longitudinal pulse number YPls, and set these two parameters, save. Then enter the manual interface, move forward, assuming that the point moving distance is Amm (the coordinate value of the screen is moved Amm), first move Amm along the transverse point, then the actual length of the torch line Bmm (B and A

Can not be equal), at this time you can calculate the exact number of transverse pulses, the calculation formula is: XPls to calculate this formula $\dfrac{A}{B}$,

RESULTS Replace the original XPls and then (take up to three decimal places). Similarly, moving the Cmm distance along the longitudinal point, the actual line length

The degree is Dmm, then the actual number of longitudinal pulses is YPls.
$\dfrac{C}{D}$

For example, assuming that XPls is initially set to 1000, indicating that 1000 pulses are required to move 1mm. Assuming A=10mm, the actual measurement torch moves B=20mm. Since the mechanical structure is fixed and the distance of each pulse is fixed, the proposed actual moving distance = the proposed moving distance. Therefore, XPls (exact value) = XPls (assuming initial value) (A / B) =1000 (10 / 20) =500. Change the XPls setting value to 500, and then if you plan to move 10mm, you will actually move 10mm.

◆Pulse number requirements:

The maximum frequency of the output pulse of the system is 160 kHz. Beyond 160 kHz, the pulse waveform may distort, and the servo driver cannot respond correctly and cannot run at the required speed. Assuming the number of pulses is XPls and the maximum speed is Mv (unit mm / min), then (Mv * XPls / 60) should be less than 160000.

For example, if the pulse number is XPls = 2000 and the maximum speed is Mv = 12000 (mm / min), then Mv * XPls / 60= 12000 * 2 000 / 60 / 60 = 12000 (mm / min). If XPls is set to 500, Mv * XPls / 60 = 12000 * 500 / 60 = 100000 <160000, which can run at the maximum speed of 12000mm / min.

Although in principle, the number of pulses can be set to a large value, it is recommended to set between 150 and 1200. This is because when the frequency is too

high, some drivers can not work well, and the motor will lose step due to the pulse. In addition, the anti-interference performance is poor, and the high frequency interference generated externally is also strong.

Note: The most reasonable number of pulses for this machine is between 150 and 1200. Beyond this range, please refer to the instructions of the drive to change the fine fraction of the step drive or the denominator of the servo drive.

16.2 Connect the built-in elevation regulator

This controller has built-in standard modulator based on EtherCAT bus. Before use, set the relevant parameters of the modulator connection. Includes the site configuration and the axis parameter settings.
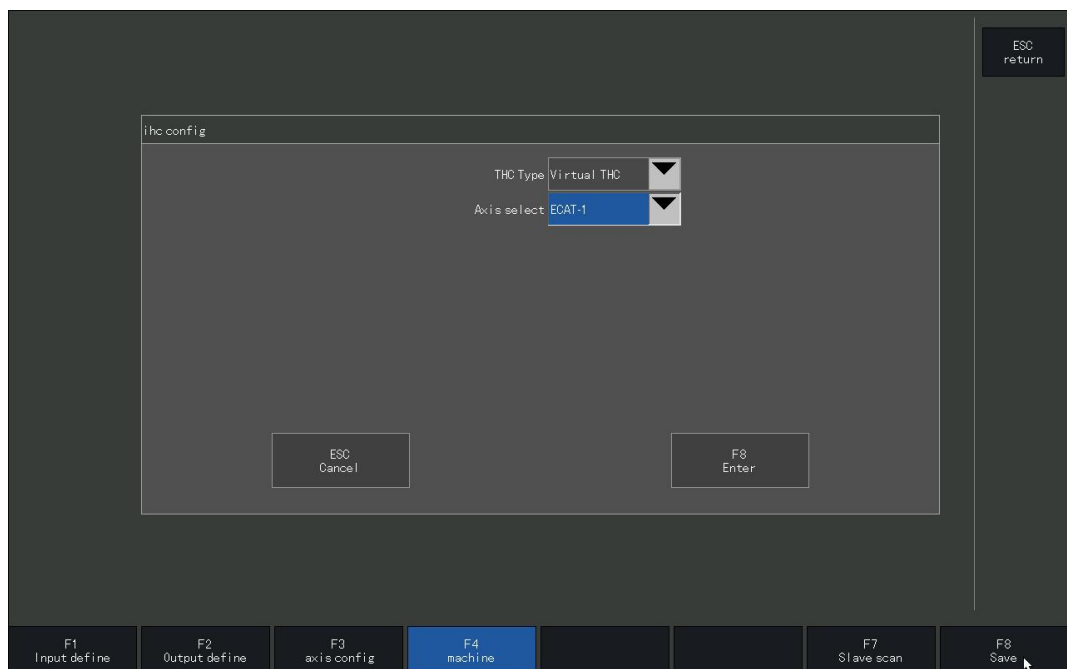
Figure 16.1 Elevator configuration

1) Site configuration

After setting the IP address, enter the password in [F 8 platform configuration] -> the password: 1396) -> [F4 machine] -> Select the "Elevator" button, press the [ENTER] button, and two parameter settings will pop up. In the elevator model, the elevator type will jump, including four options of iHC100 / iHC100B / integrated / virtual adjustment, as shown in Figure 13.5, the elevator model is: integrated adjustment, axis number optional ECAT 1-ECAT 6.

After both settings are completed, the controller is power off to restart. If the communication is normal, the controller will connect with the elevation ator.

16.3 Connect to the iR 15 31 remote control

This controller is equipped with an optional company iR 15 31 remote controller. The CNC system is connected to the iR 15 31 remote control via the USB interface. Connect the USB connection well later. Remote control operation can be performed.

USB interface of the receiving end (USB socket of the access system host), the remote control distance can reach 30M, can be directly used by hot plug, support 6 custom function buttons, frequency modulation communication, strong anti-interference ability.

Figure 16.2 iR1531 Remote control

16.4 Connect the laser

Select the corresponding option according to the laser generator used. If the laser generator model used is not included in the option, select the other option, support universal DA controls the peak power of the laser generator, PWM sets the real-time power of the laser generator, and the output port controls the light switch signal of the laser generator.
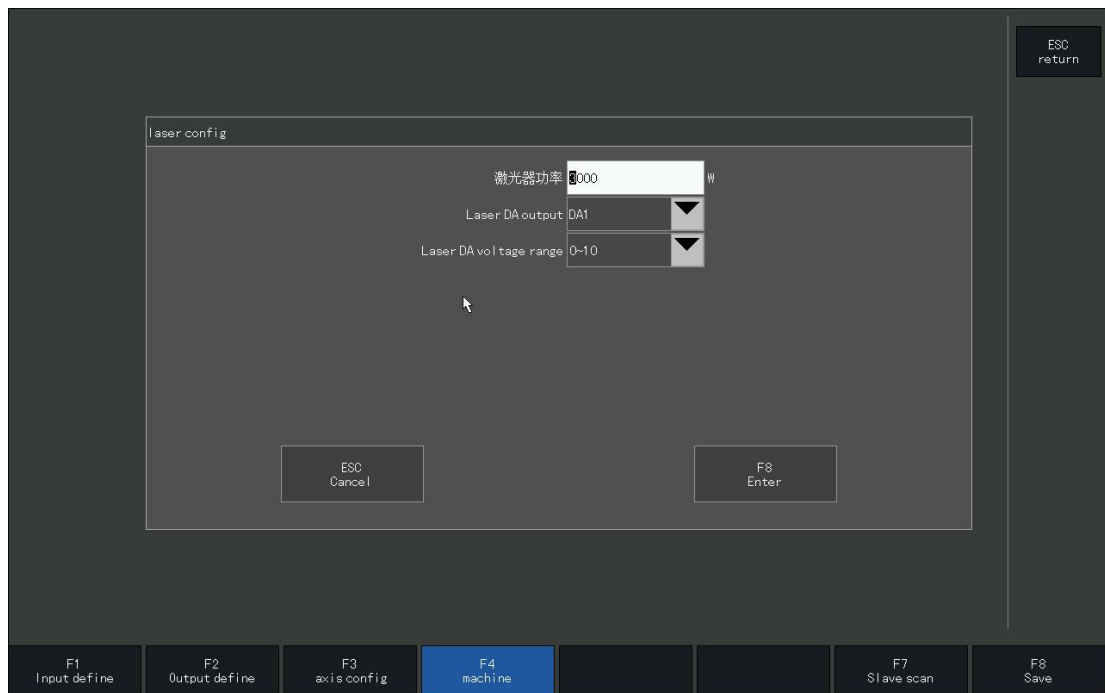
Figure 16.3 iR1531 Remote control

1) Site configuration:

Under the [F 8 platform configuration] -> [F 4 machine tool] -> [laser] interface, under the "laser configuration" option box, input the laser power used by the current machine tool, input the DA port of the laser and the DA voltage range of the laser. After the communication line is normal and the parameters are set correctly, you can communicate with the laser.

16.5 Cutting and working process

After connecting with other equipment, the parameters can be set and cut. Cutting workflow:

```
            ┌─────────────┐
            │  System     │
            │  on elec    │
            └─────────────┘
                  │
                  ▼
            ┌─────────────┐
            │ Enter the   │
            │ gallery or  │
            │ enter the users │
            │ cut file    │
            └─────────────┘
                  │
                  ▼
            ┌─────────────┐
            │ Press Start and │
            │  confirm to │
            │  start the  │
            │    cut      │
            └─────────────┘
                  │
                  ▼
            ┌─────────────┐
            │ Find the edge and │
            │ locate it before │
            │ cutting     │
            └─────────────┘
                  │
                  ▼
            ┌─────────────┐
            │ Openvalve,O │
            │ penlaserper │
            │ foration    │
            └─────────────┘
                  │
                  ▼
            ┌─────────────┐
            │ Machine tool │
            │ cutting forward │
            └─────────────┘
                  │
                  ▼
            ┌─────────────┐
            │ Cut a       │
            │ drawing     │
            │ is          │
            │ finished    │
            └─────────────┘
                  │
                  ▼
            ┌─────────────┐
            │ Turn off the gas │
            │ valveClose the │
            │ laser       │
            │ Lift thcutting │
            │ gun back to the │
            │ dockingpositio │
            │ n           │
            └─────────────┘
                  │
                  ▼
            ┌─────────────┐
            │ Return to   │
            │ origin      │
            └─────────────┘
                  │
                  ▼
            (  finish  )
```
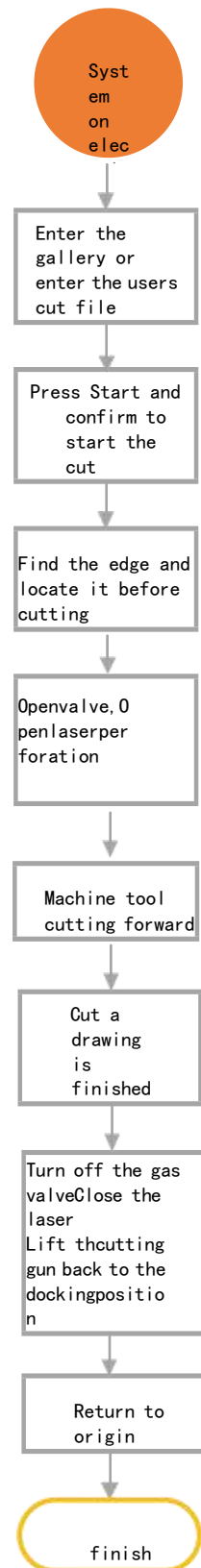
Figure 16.4 Cutting Workflow

Appendix 1 G, M code quick access

order number	instruct	function
1	G99	Rotation, scale, and mirror image
2	G92	reference coordinate
3	G91	relative coordinate
4	G90	absolute coordinate
5	G20	English unit
6	G21	metric unit
7	G26	The X-axis quickly returns to the reference point
8	G27	The Y-axis quickly returns to the reference point
9	G28	X, the Y-axis quickly returns to the reference point
10	G41	Left slit compensation
11	G42	Right slit compensation
12	G40	Cancel slit compensation
13	G00	quick travel
14	G01	Straight line processing
15	G02	Shun round processing
16	G03	Inverse round processing
17	G04	Program delay
18	M07	Ignition cycle
19	M08	Turn off the cutting cycle
20	M11	Establish spray powder offset
21	M12	Cancel the spray powder offset
22	M09	Open the spray powder
23	M10	Turn off the spray powder
24	M00	suspend
25	M02	end of program

Appendix 2 IO timing diagram of L5210H series CNC system

A2.1 Time sequence diagram of laser direct perforation process

Timing diagram of laser direct perforation process

M07 M08 M02

The

spacing

follows

the dock

optical shutter) (effective output

foll
ow

Set the
focus

PWM / laser
DA PWM +
enables
PWM-enable
s

Gas valve /

Start positioning the cut and lifting it back
Until stay G01, G02, G03 (system stop
Time-delay judgment

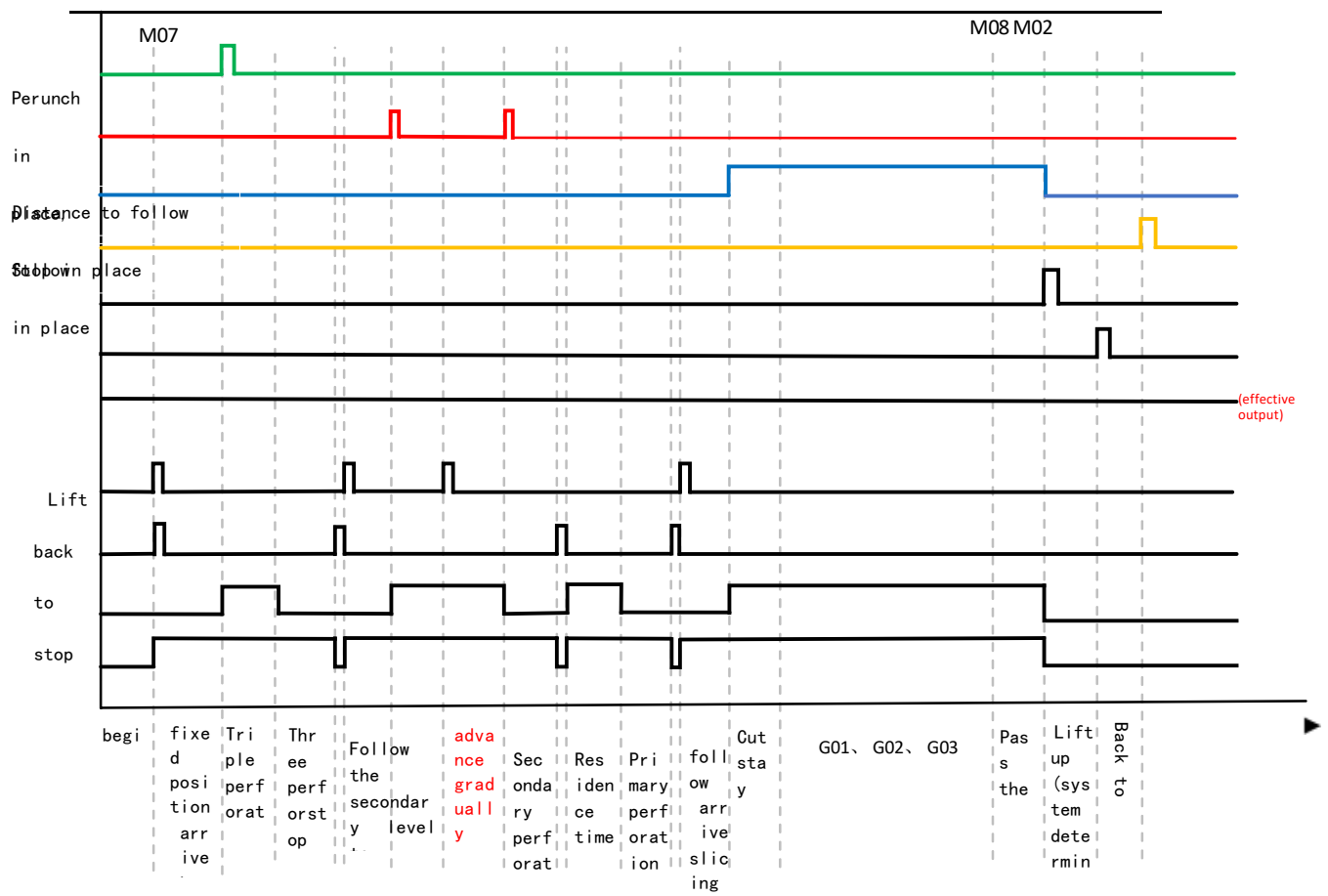Cut
nozz
le
heig
ht
(hol
d

le
Whether to reach the position
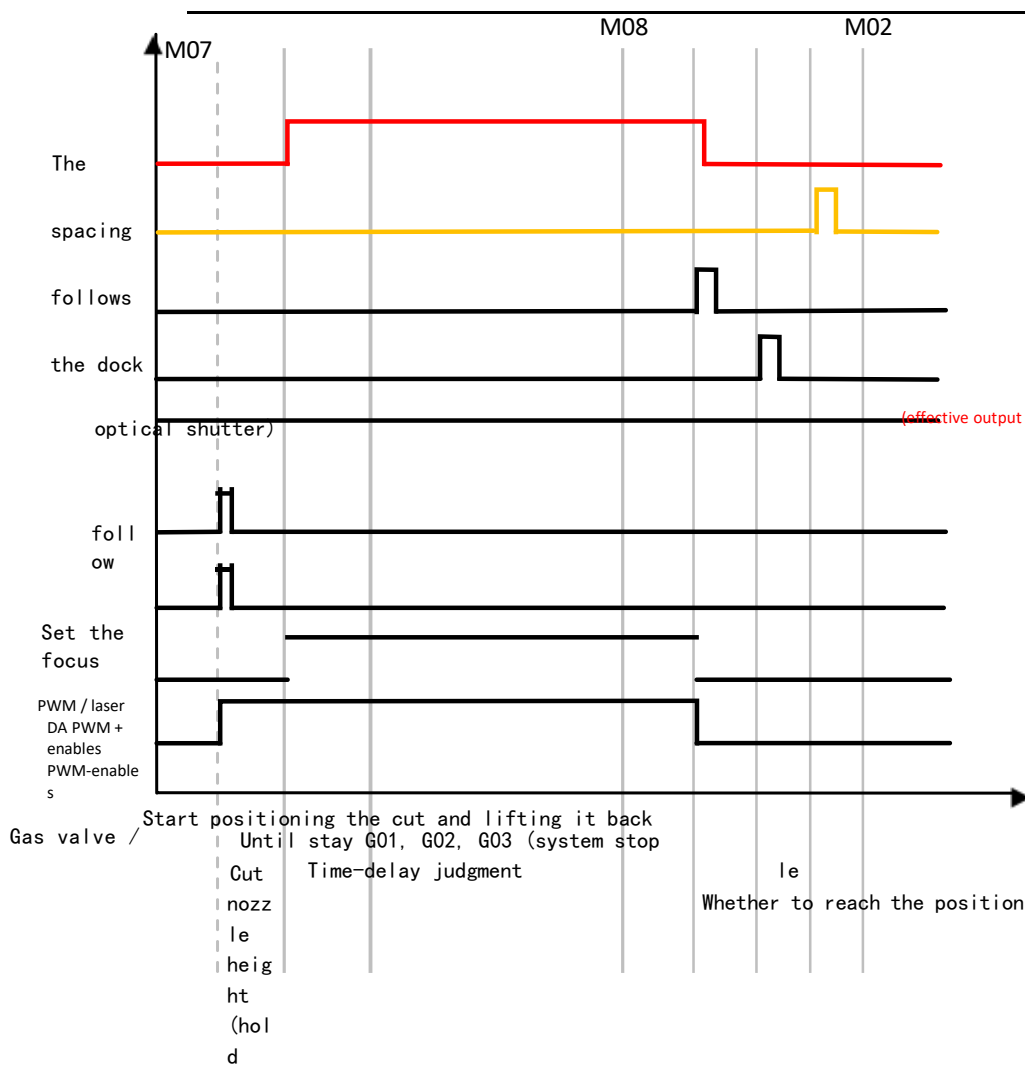
pour:

1) The Y-axis black line segment represents the system output command;

2) Other colors represent the system input command;

3) Spacing following: refers to the cutting gun to always keep a certain distance from the plate, that is, the following state;

4) Follow in place: the system controls the elevation regulator to reach a certain position, not necessarily keeping the following state. Lift up, dock back, and follow instructions all require feedback signals.

A2.2 Time diagram of laser three-stage perforation process

Time iming diagram of laser tertiary perforation process
(Secondary

M07

M08 M02

Perunch

in

Distance to follow
Place

Stop in place
down

in place

(effective output)

Lift

back

to

stop

begi | fixe d posi tion arr ive | Tri ple perf orat | Thr ee perf orst op | Follow the secondar y level | advance grad uall y | Sec onda ry perf orat | Res iden ce time | Pri mary perf orat ion | foll ow arr ive slic ing | Cut sta y | G01、G02、G03 | Pas s the | Lift up (sys tem dete rmin | Back to

144

Appendix 3. Installation dimensions of the L5210H series system