Fangling CNC laser cutting control system

User Manual (V1.0)

Model: LX4510H

Shanghai Fangling Computer Software Co., LTD

ShangHai FangLing Computer Software Co.,LTD.

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Version	Date	Revise content	Reviser	Verifier
Ver 1.0	2024/ 11/1 5	All, initial version	Chen Yutian	

Cautions

Read the manual

This manual is applicable to the LX4510H type CNC cutting control system produced by Shanghai Fangling Computer Software Co., LTD. Please read this manual carefully and local safety regulations before using it.

Note: Due to the continuous improvement of this product, any modifications to the technical parameters and hardware parameters mentioned in this manual will not be notified separately. If you have any other questions about this product that are not covered in this manual, please feel free to consult us. We are more than happy to answer your questions, suggestions, and criticisms. Thank you again for your companys choice and your trust.

Note: The design of this product is not suitable for on-site maintenance. If you have any maintenance needs, please return to our after-sales service center:

Address: Room 103, Building C, Feima Travel Science and Technology Park, No.154,953 Jianchuan Road, Minhang District, Shanghai

Sales: +86-21-34290970

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

E-mail:support@flcnc.comsales@flcnc.comURL: www.flcnc.com

Environmental requirements

- The working environment temperature of this CNC system is 0℃ to +50℃, relative humidity 5-95% without condensation.
- The operating voltage is DC +24V.
- This controller should be installed in the electrical cabinet of the control panel with shielded dust.
- This system is best used in a position away from high electromagnetic radiation such as high voltage and high frequency.

Maintenance

- Keep hands and feet away from the machine tool and control or manual operation can be performed through the front panel keyboard.
- When operating the machine, do not wear loose clothes and clothing with ropes to prevent being caught by the machine.
- The equipment should and can only be operated by a trained person.
- It is strictly prohibited to disassemble the CNC system by yourself without authorization from the company.
- When using, do not splash acidic, alkaline, corrosive and other items on this control system.

High voltage

- Electric shock can be fatal. Installation must be carried out in accordance with the installation steps and requirements specified in the user manual.
- Do not touch wires and cables when the power is on.
- The equipment should and can only be operated by a trained person.

catalogue

Chapter 1 Introduction to LX4510 H type control system

1.1 System Introduction

The LX4510H-type CNC system is a powerful, user-friendly, and cost-effective tube cutting controller developed by our company by integrating the advantages of various CNC systems from both domestic and international markets. This product employs multi-axis digital position control, making it suitable for laser tube cutting machines.

The control system is light and portable, easy to operate, easy to get started, all operations have menu or graphic prompts, foolproof operation. All buttons are designed with humanized design, comfortable and convenient.

The LX4510H controller uses high-performance ARM chip and large-scale programmable device FPGA, runs multi-task real-time operating system, adopts the combination of software interpolation and hardware interpolation, so as to make the high speed operation more stable, reliable and responsive.

The style of the CNC system is as follows:

graph 1.1LX4510H Front

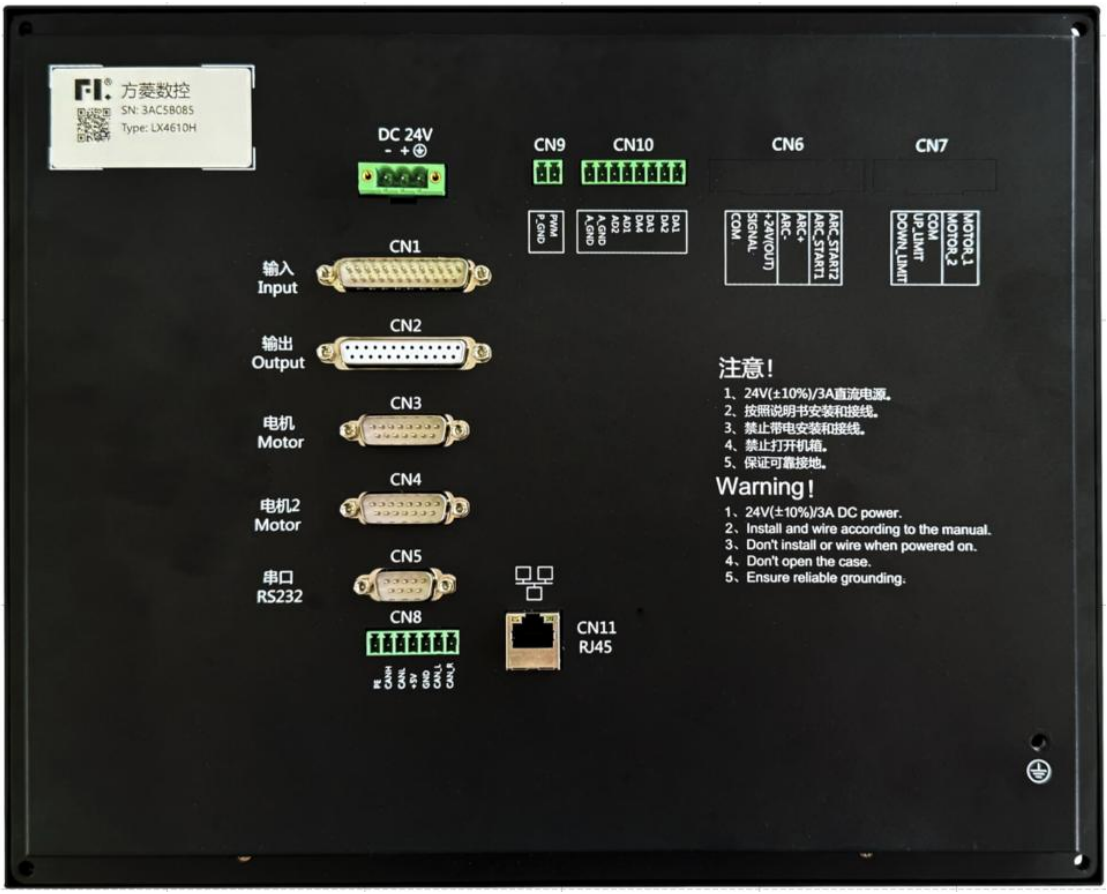


Figure 1.2 LX4510H back

1.2 System characteristics

- The system supports the cutting of round pipe, square pipe, waist round pipe and elliptical pipe. It supports the structure of drawing machine and fixed machine tool.
- There are menus in Chinese, English, Spanish, Portuguese, French, Russian, Danish, Korean and Japanese, and one-click language switching is available. In addition to Chinese and English, customers need to provide language translation files, and most languages are supported (except Thai).
- Common pipe cutting types can modify the parameters of cutting process.
- Support EIA code (G code), support suffix TXT, CNC, NC, MPG, B3 and other G code.
- Support common ESSI code commands.
- Supports laser three-level perforation process and focus adjustment.
- The integrated bus regulator control can be modified to adjust the regulator parameters and monitor the regulator status through the system, which is convenient and simplified for wiring.
- Compact keyboard design makes manual input more comprehensive.

- You can customize the type (open or closed) and number of all input and output ports.
- All IO status and button status of the self-diagnosis system are available for easy inspection and troubleshooting.
- Front U disk interface, convenient for program transmission.
- The system upgrade is carried out by USB drive, which is convenient and practical, and provides lifetime upgrade service.
- Supports system backup and system restore functions. System restore can restore only the operating system or restore to the factory state.
- All functions and processes of the whole system can be upgraded online, so as to eliminate the worries of after-sales service.
- You can import or export processing files individually or all at once.
- Parameter backup and parameter restore.
- All kinds of processing parameters are complete, which can meet different process requirements.
- FPGA high speed, high precision interpolation control, high speed operation, smooth operation, low noise.
- Different management rights and corresponding passwords can be set to protect the rights and interests of equipment manufacturers.
- Remote control with CAN interface.
- Support laser dot function.

1.3 Technical indicators

1） Control axis number: 6 axes, X (pipe diameter axis), Y (pipe length axis), B (clamp axis), F (focus axis), the remaining two axes are according to the machine tool configuration.

2） Control accuracy: ±0.001mm.

3） Coordinate range: ± 99999.99mm.

4） Maximum pulse frequency: 1 M Hz; maximum operating speed: 30 meters/min.

5） Maximum program lines: 80,000 lines.

6） Maximum single program: 4 M.

7） Time resolution: 1ms.

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

9） System working environment: temperature-10℃ to +60℃; relative humidity 0-95% no condensation.

1.4 System interface

a) DB 15-pin public motor drive interface, each motor port supports three axes.
b) DB 25 core head with 16 optical isolation outputs, maximum reverse current of 300mA.
c) DB 25-pin male connector with 20 optical isolation inputs, maximum input current 300mA.
d) The front panel has a built-in USB port for easy code cutting.
e) PWM output port; analog input/output port.
f) Optional DB9 core public port serial RS232 interface. The serial port is used to connect the extension shaft card.
g) It has a standard CAN bus five-core interface.

1.5 Hardware configuration

1. Display: 10.4-inch 800 × 600 high resolution 16 million color high brightness LCD screen.
2. Memory: 128M SD RAM.
3. User program space: 256M.
4. CPU frequency: 400MHZ system CPU frequency.
5. USB: USB1.1 interface at the front, at least 16GB USB drive is supported.
6. Keyboard: PCB film keyboard.
7. Case: fully steel structure with complete shielding, which can really achieve electromagnetic radiation protection, anti-interference and anti-static.

Chapter 2 System startup

2.1 System operation panel description

Figure 2.1 LX4510H operation interface

Button description:

[F1] - [F8]: Function keys, which have corresponding function prompts in different interfaces.

[Follow]: Press this button to follow the control tilterer in height and cut the gun down to the cutting height.

[Blow]: Open or close the blow. When operating, the corresponding indicator light on the main interface shows green (open) or red (close).

[Calibration]: To adjust the height, click [Calibration] to directly enter the calibration interface of the height regulator and set the parameters of the height regulator.

[Light gate]: Open or close the light gate.

[Spot]: Turn on or off the laser.

[General]: Close all the previously opened output ports, including [Following], [Blowing], [Calibration], [Light Gate], [Spot Shooting] and other output ports.

[PgUp]: The up page key is on the code interface and the up gun key is on the other interface.

[PgDn]: The page flip key is down in the code interface, and the gun cut down key is down in other interfaces.

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

[END]: In the code interface, it is the jump to the end of the code line key, and in other interfaces, it is the speed reduction key of the rotation axis.

[▲].....[▼]: four directional keys up, down, left and right. The main interface can control the movement of X and Y axes.

The middle hand key of the arrow key is the ALT key, which is similar to the F key and can switch between point, continuous and fixed length.

[▷]: START key, start cutting. Also known as START, START, F9 key.

[‖]: STOP key, pause cutting. Sometimes called [STOP] or [F10] key.

G, X, Y, F, M: are common letter keys. They also have multiplexing functions and can be used as special function keys. Under the main screen, the letters in front of the parameter items on the screen are shortcut key prompts that can be used for quick operations.

[1] - [9]: Number keys.

[↑]: Purple shift key. Pressing this key and the number key at the same time is equivalent to the purple letter on the number key. For example, pressing this key and [7] at the same time is equivalent to the character A.

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

[ESC]: Cancel key, also known as exit key.

[Space]: Spacebar key.

[Del]: Delete key.

[Enter]: Confirm key.

2.2 System start-up and button operation under the main interface

When the system is first powered on, it will first enter the BIOS boot screen:

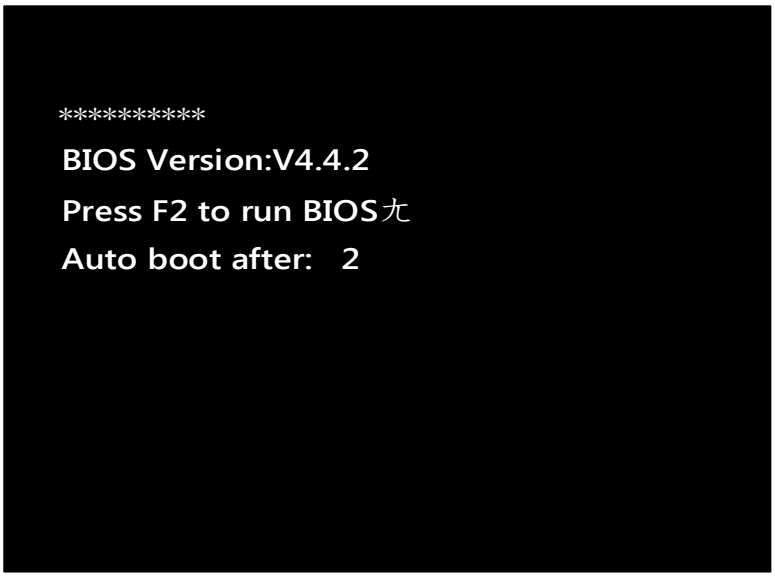


Figure 2.2 System self-check interface

During the countdown on the boot screen, if the F2 key is pressed, the system enters BIOS (refer to "Chapter Twelve BIOS Usage" for BIOS operations). If any other key is pressed, the countdown skips to the cutting software. If no key is pressed, the countdown reaches 0 and the system automatically enters the cutting software.

If there is a boot screen, the system will enter the welcome screen as shown in Figure 2.3. The user can replace this boot screen with his own picture. At this time, press any key, and the system will automatically enter the main screen as shown in Figure 2.4.

Figure 2.3, welcome interface

Figure 2.4 System main interface

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

[F1]: Shape Lib.This version only supports the function of cutting the tube.

[F2]: Files.Enter the selected hard disk files, USB disk files, search files, edit files, delete files, copy to USB disk (copy to USB disk), preview graphics and other operations.

[F3]: Part option.Code editing and graphic restoration for processed parts.

[F4]: Setups.All parameters can be set here.

[F5]: Diagnose.Keyboard diagnosis, more, date and time setting, system customization.

[F6]: Zoom in. Enlarge the graphic in full screen.

[F7]: Platform configuration.input and output configuration, axis configuration, machine tool configuration, etc.

[F8]: Ctrl Panel.Coordinate reset can be performed before or after the machine starts cutting. (Z axis reset: the height adjuster has a reset button, the system will automatically reset the Z axis before all axes reset)

[X]: Set the cutting speed.

[Y]: Set the manual speed of each axis.

[G]: Set the moving distance when setting the fixed length of the car. Note: After pressing [G] to confirm the modification of the fixed length distance, the manual moving mode will automatically switch to the fixed length mode.

[F]: Set up manual moving mode, which can be point, continuous and fixed length.

[M]: Switching cutting mode, there are two modes, demonstration mode and laser cutting mode.

[—]: minus key, observation window switch. Each press can switch one observation window. The observation window can be switched between the three windows of system status, regulator status and laser status in a cycle.

[SPACE]: Enter the cutting interface.

2.3 System main interface display description

The contents displayed under the main interface are as follows:

① Displays the cutting trajectory of the current workpiece,

② Displays the current G code being processed, showing the current line and the next line.

③ Displays the current processing speed.

④ Displays the model of the controller and program version.

⑤ Displays the name of the cutting file.

⑥ Displays the status of the cutting operation. It can be running, manual, paused, stopped, etc.

⑦ Display perforation point information: perforation number, line number.

⑧ Observing Window Area. Display Status Signal. The signal light is a green "🟢" indicating that the signal is valid or has occurred; a red "🔴" indicates that the signal is invalid or has

not occurred. When the external input signal changes, the corresponding indicator light in this area will change accordingly to observe the status of the external input signal.

⑨ Observing window area. Display the values of some common items and real-time data to facilitate the viewing of operation data.

⑩ Observing Window Area. Display IO Status. Signal Light is Green "🟢" indicating the signal is valid or has occurred; Red "🔴" indicating the signal is invalid or has not occurred. For example, when pressing the [Follow] button, the screen follows indicator light turns green, the potentiometer sends a follow command, pressing the [Follow] button again turns the indicator light red, terminating the follow action.

⑪ Cut mode switch. It can be switched according to the shortcut key operation in this area.

⑫ Coordinate display area.

⑬ Parameter display area. Quick key prompts are displayed in front of the operation items. Some commonly used parameters are displayed, and parameters can be quickly modified by pressing the quick key.

⑭ Display the name of the function key [F1]... [F8]. Different function names are displayed in different operation interfaces.

2.4 Main interface function index

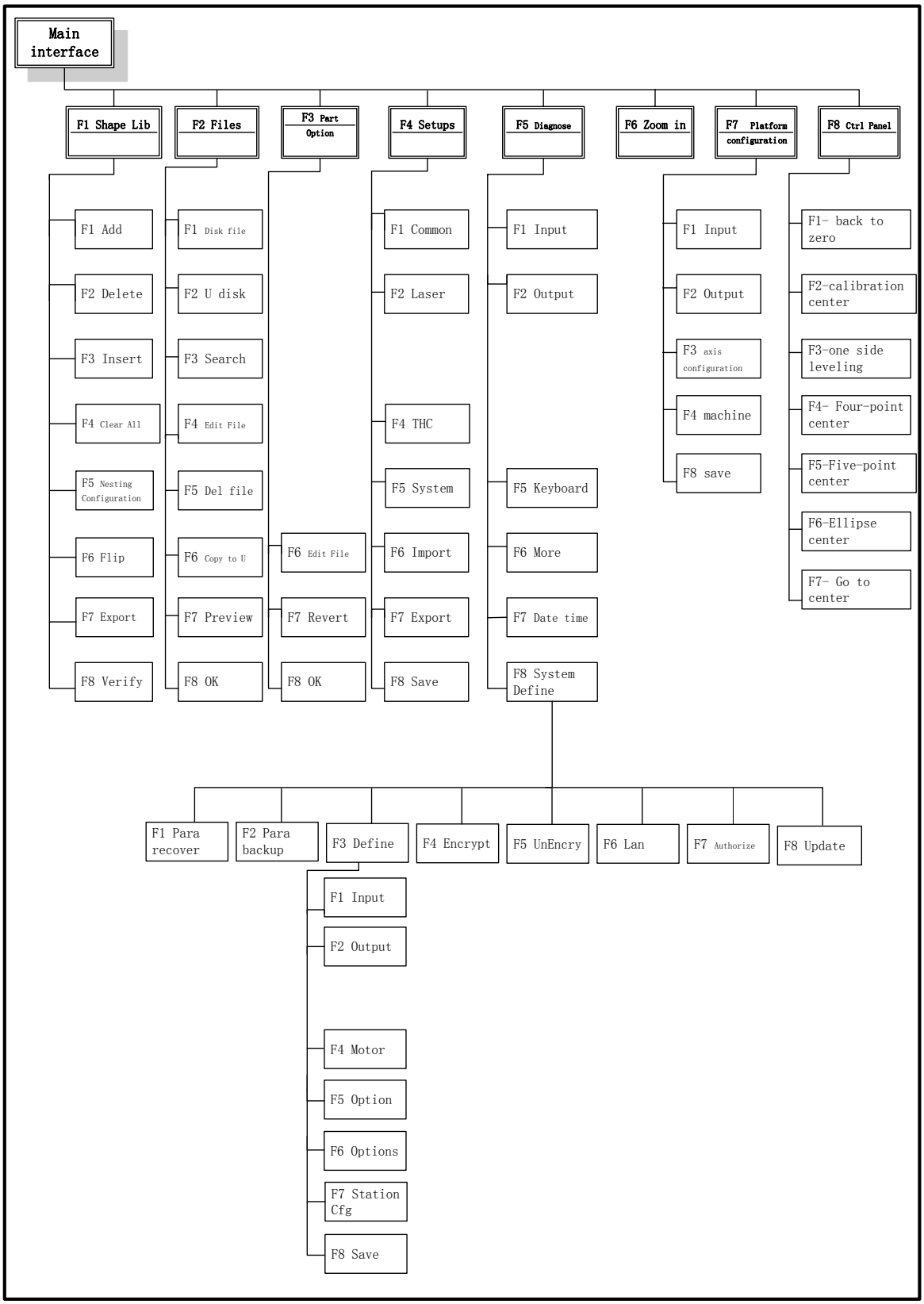


Figure 2.6 Main interface function index

Chapter 3 Cutting function

Under the main interface, press the Space key to enter the cutting interface, as shown in Figure 3.1 is the cutting function interface.

Figure 3.1, Main interface

① Displays the cutting path of the current workpiece

② Displays the G code currently being processed, displays the current line and the next line, does not display during the cutting process, and displays only after pausing.

③ X: represents the absolute X coordinate of the current cutting gun. Y: represents the absolute Y coordinate of the current cutting gun.

B: It indicates the current rotation angle of the chuck. F: represents the focal coordinates.

Z: represents the absolute coordinates of the current regulator. U: represents the rotation angle of the middle chuck.

④ Displays the current processing speed.

Enter the cutting interface as follows:

Figure 3.2 Cutting interface

- Press [X] to modify the current cutting speed.
- Press [Y] to modify the manual speed of each axis.
- Press the [F] key: change the current manual mode. It can be switched between linkage, point and fixed length.
- Press [G] to set the distance of movement when moving at a fixed length.
- Press [Z]: Before or after the cutting, press [Z] to set the cutting value.
- START key: Start cutting.
- STOP key: Stop, which can pause all actions in progress in the system.
- [F1 Retreat]: The cutting gun returns along the original trajectory (the I/O port is closed at this time), and it pauses when it encounters a perforation point.
- [F2 Forward]: The cutting gun moves forward along the cutting trajectory (I/O is closed at this time).
- [F4 deceleration]: Reduce the cutting speed by 3% for each press. Reduce the manual moving speed when manually moving the vehicle.

- [F5 Acceleration]: Increase the cutting speed by 3% for each press. Increase the manual moving speed when moving by hand.
- [F8 optional perforation point]: The system pause is the optional perforation point, and the dynamic amplification is after the operation starts.
- Up, down, left and right four direction keys: move the cutting gun manually when the gun is transparent.

3.1 Cutting operation index

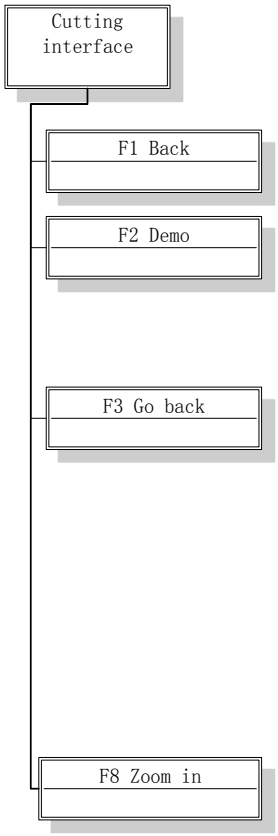


Figure 3.3 Index of cutting operations

3.2 Speed control during cutting

3.2.1 Normal speed adjustment

Speed can be adjusted in the cutting interface system during automatic operation or when the system is suspended.

After entering the cutting interface, press [F5] on the operation panel, pressing it once increases the speed by 3% on the current speed. Keep pressing [F5] without releasing it, and the speed will continuously increase until it reaches the maximum cutting speed.

Press [F4] on the operation panel. Each press of [F4] will reduce the speed by 3% from the current base. If you keep pressing [F4] without releasing, the speed will be continuously reduced to 0.5% of the maximum cutting speed.

3.3 Advancing

Press the [F2] key in the cutting interface, and the system starts to walk empty. This process does not control the opening of laser, perforation and any IO switching process, and moves the cutting gun along the cutting path. Press the [F2] key again, and the system stops running.

This function is used to check the correctness of the cutting path or code before cutting or when it is necessary to penetrate the gun during processing.If you want to stop empty travel, press the [Stop] button.

The forward/reverse speed is set separately from the cutting speed, and the "forward/reverse speed" in the common parameters is the air movement speed.

3.4 Retreat

During the processing process, if it is necessary to return along the original trajectory due to reasons such as not cutting through, the following process can be carried out:

- Press the "stop" button to put the cutter in a paused state.
- Press the [F1] key in the cutting interface, and the cutter returns along the original trajectory. When the cutting gun retreats to the position that needs to be retreated, press the [Stop] key. If it retreats too much, press [F2] at this time to move forward by empty line, and then move forward to the position that needs to be retreated.

  Note: The forward and backward functions can be repeated until the cutting gun is in the ideal position.
- During the process of retreating, press the [F1] key again, and the system stops running.

  When the cutting gun is in the ideal position, press the "Start" button again. If the current cutting code line is G01 or G02 or G03, the system will perform automatic perforation (i.e., laser perforation) before executing these programs, then continue running the current program. If the current line is not G01 or G02 or G03, the system will directly execute the current line program. The back speed and forward speed are the same speed, set separately from the cutting speed. In the commonly used parameters, the "Forward/Back Speed" is set.

3.5 Return function

When processing is suspended, if you press [F3] at this time, the system will show a prompt:

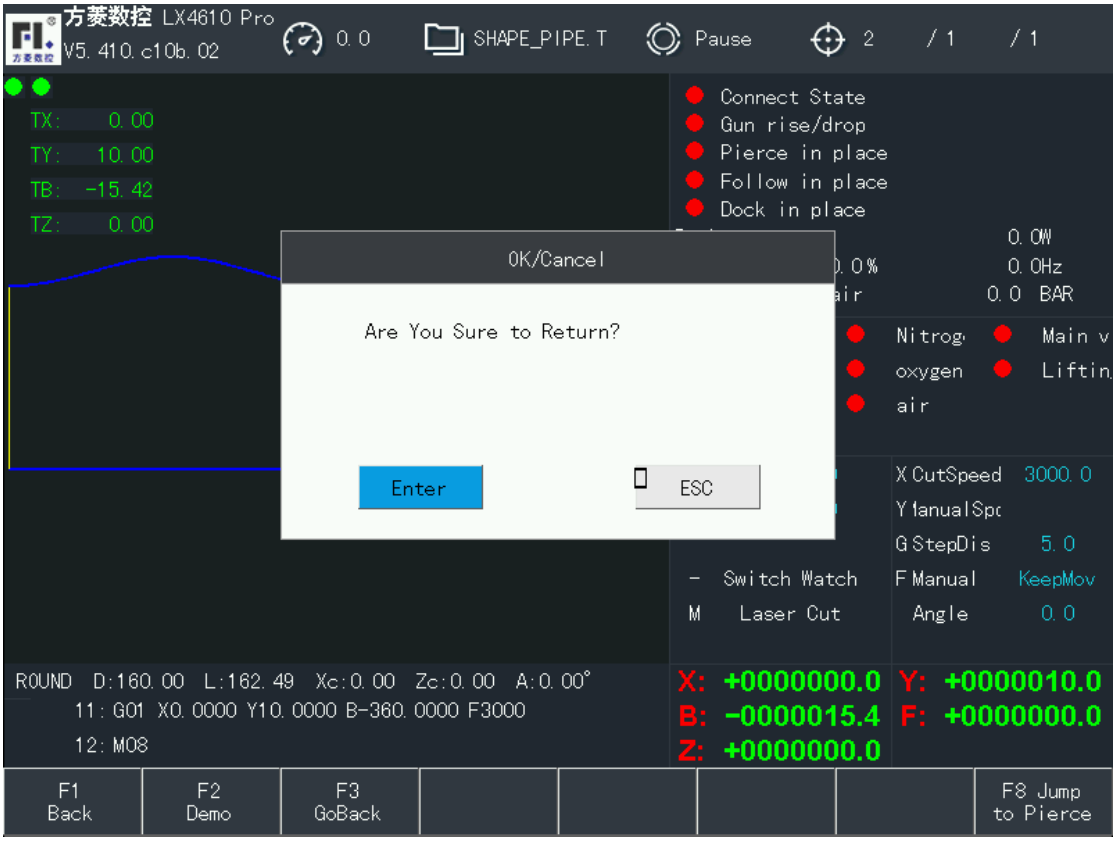


Figure 3.4, return to the prompt

During the process of returning to the reference, users can also press the [Stop] button to stop the operation. After stopping, users can continue to press the [F3] button to return to the reference operation, or press the start button to restart the cutting. There is no limit on the number of times to return to the reference.

3.6 Select perforation points

Before or during a cut, press F8 at the function key prompt to select the perforation point. Press F8 and the system will prompt:

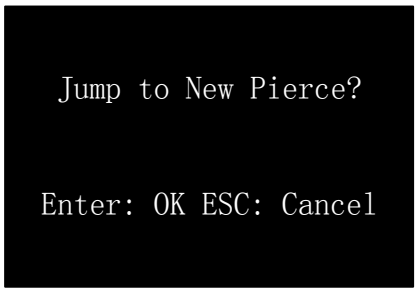


Figure 3.5, selected perforation points

If you press ESC, the system will return to the cutting interface. If you press ENTER, the system will prompt again:

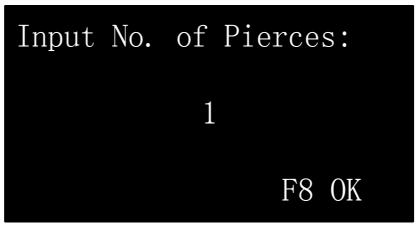


Figure 3.6, perforation indication

At this time, you can manually input the position of the perforation point. You can also press ESC to exit, do not manually input the position of the perforation point, and then press the arrow keys to select the perforation point.

3.7 Dynamic amplification

After processing starts, the cutting interface [F8] will become "dynamic zoom". At this time, press F8 key, the processing graphic will be magnified on the whole screen, and can be dynamically tracked.

Figure 3.7 Cutting interface function keys

- Press the F8 key continuously, and the system will enlarge the graph step by step.
- Press the ESC key to exit the magnified display and return to the normal cutting interface.

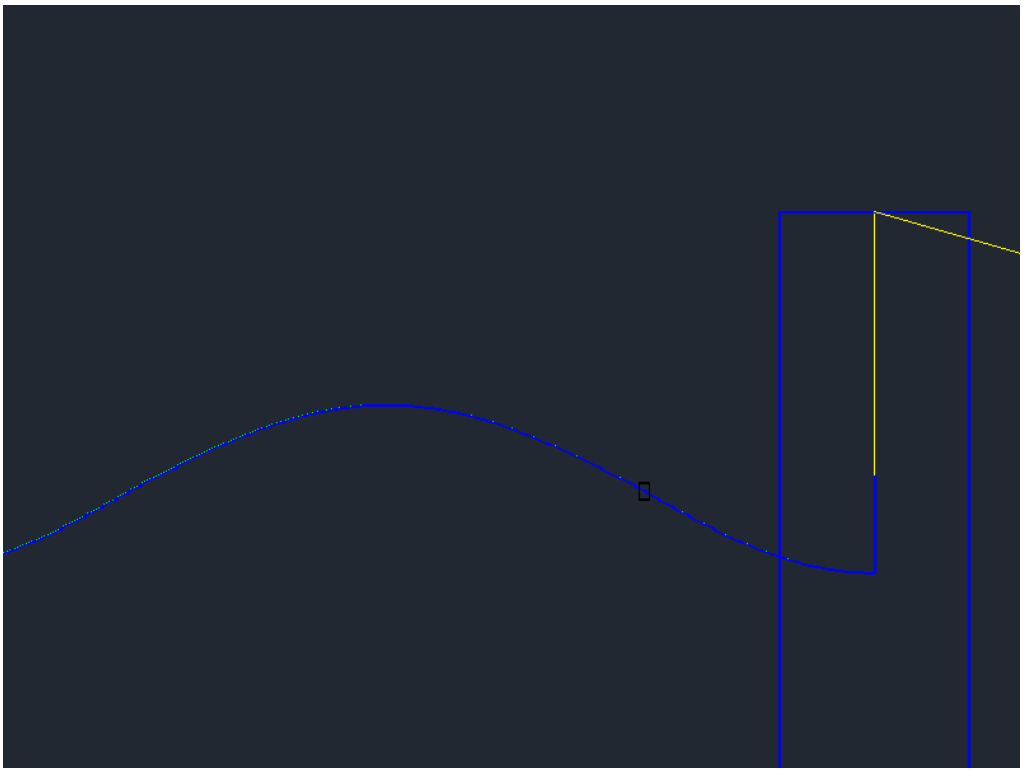


Figure 3.8 Interface during dynamic amplification

3.8 Exit cutting

When the cutting is not yet complete and the cutter is in a paused state, if you press the [Esc] key under the cutting interface, the system will prompt whether to exit the cutting. If you press [Enter] at this moment, it will exit the cutting; if you press the [Esc] key, it will not exit the cutting and you can continue cutting from where you left off in the cutting interface.

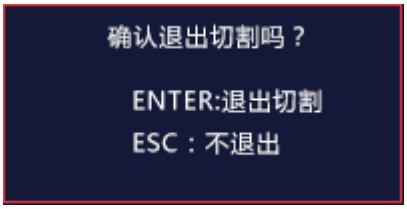


Figure 3.9 Exit cutting prompt

Chapter 4 Component Options

On the main screen, you can see that there is a "F3 component option" that can be used. Press [F3] to enter the component option menu.

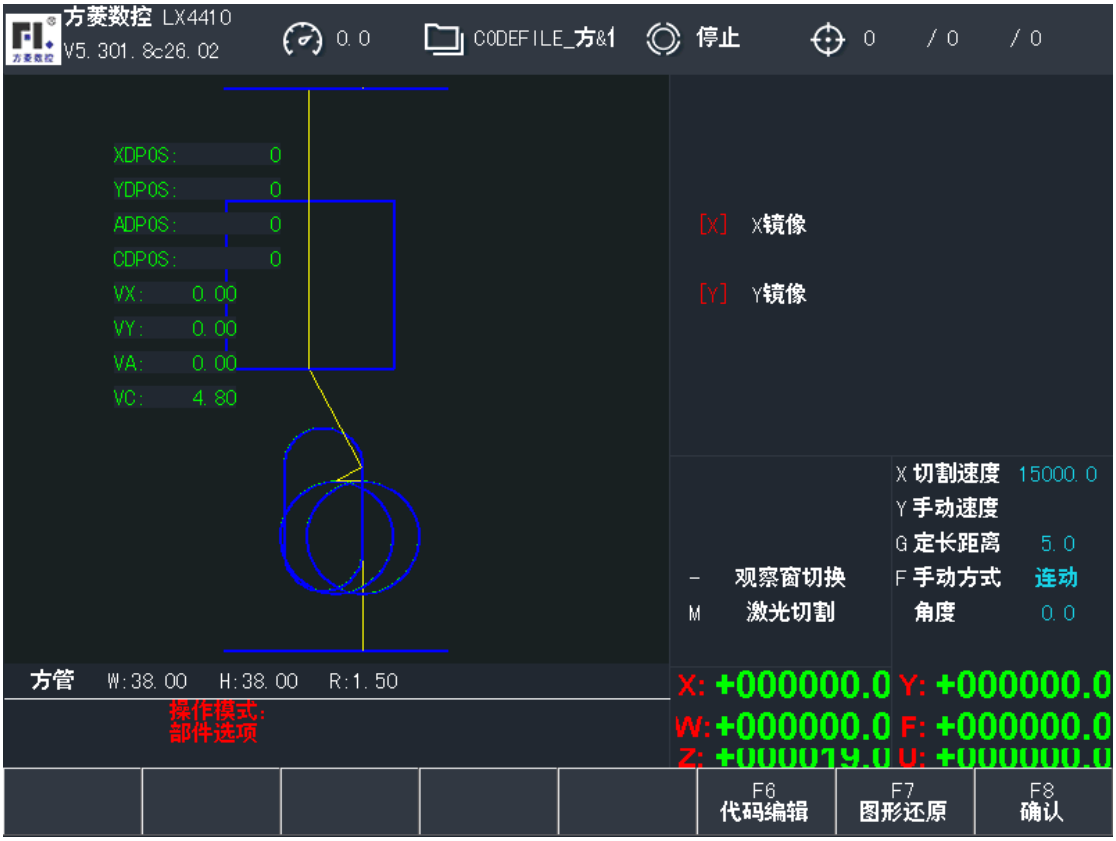


Figure 4.1 Component options interface

4.1 XY mirror image

- Perform a mirror along the X axis (X axis) as indicated by [X], that is, vertical mirror.
- Perform a mirror along the Y axis (Y axis) as indicated by [Y], that is, left and right mirror.

4.2 Code editing

Press [F7] to enter the code editing interface. See Chapter 6 File Management 6.4 for details.

Chapter 5 Manual removal of the vehicle

When you are in the main interface, press [F7] to enter the manual move car function, as shown in the figure below is the manual operation interface.

Figure 5.1 Manual interface

The speed in manual mode is controlled by the manual travel speed parameter among the commonly used parameters. When moving manually, you can press the [HOME] key to accelerate or the [END] key to decelerate, or press a number key on the manual interface, which will automatically adjust the system speed to the corresponding percentage of the number key, for example, pressing the number [3] will automatically adjust the speed to 30% of the maximum cutting speed; pressing the number [8] will automatically adjust the speed to 80% of the maximum cutting speed.

5.1 Point function

When you first enter the manual interface, the system defaults to point and click or press [F1] to select point and click function. At this time, press any direction key and hold it down, the system will move the car in that direction, release the direction key, the system stops moving.

5.2 Linking function

Press [F2] in the manual interface to enter the linkage function. At this time, press and release any direction key, the system will move in that direction, and press or stop any direction key again to stop moving.

The difference between point movement and continuous movement: when point movement is required to move the machine tool continuously, the direction key must be pressed continuously; while continuous movement requires only one press of the direction key without keeping it pressed continuously, and the machine tool can move continuously.

5.3 Fixed length movement function

Press [F3] on the manual interface to enter fixed length movement. The system prompts you to enter the fixed length distance.

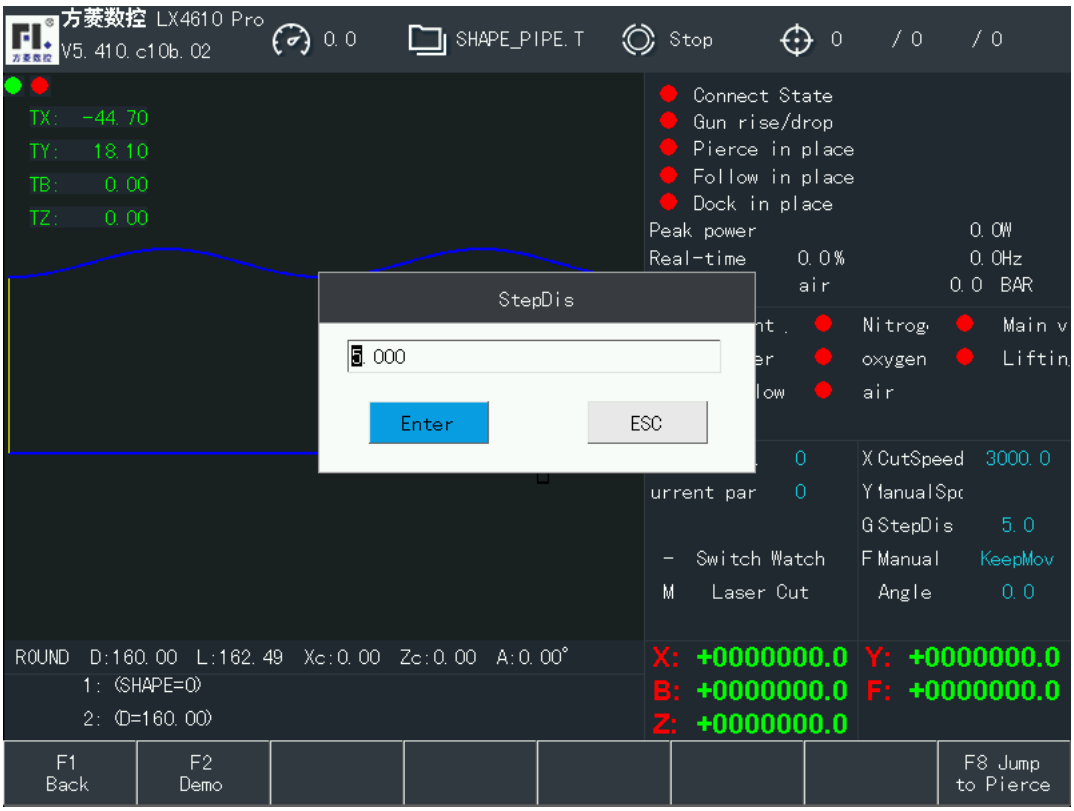


Figure 5.2 Input fixed distance

Enter a fixed distance and press ENTER. At this point, press and release any arrow key, and the system will move in that direction for a fixed distance before stopping automatically. If you press any arrow key or stop key during the move, the system will stop moving.

Chapter 6 Document management

This system supports files with extensions such as txt, CNC, NC, B3, MPG as cutting codes, the maximum size of a single G code file is 4M, and the maximum number of lines is 80,000. It can edit, compile, delete, and export internal files, as well as import files from external USB drives.

pay attention to:

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

2. The total length of the file path in the USB drive should not exceed 133 bytes. One Chinese character is counted as two bytes, and one letter and character is counted as one byte.

3. The name of the hard disk folder on this machine is 13 bytes. One letter or character counts as one byte.

4. The maximum length of a single file name is 64 bytes,

Press [F2] under the main interface to enter the file management interface, as shown in the figure below.

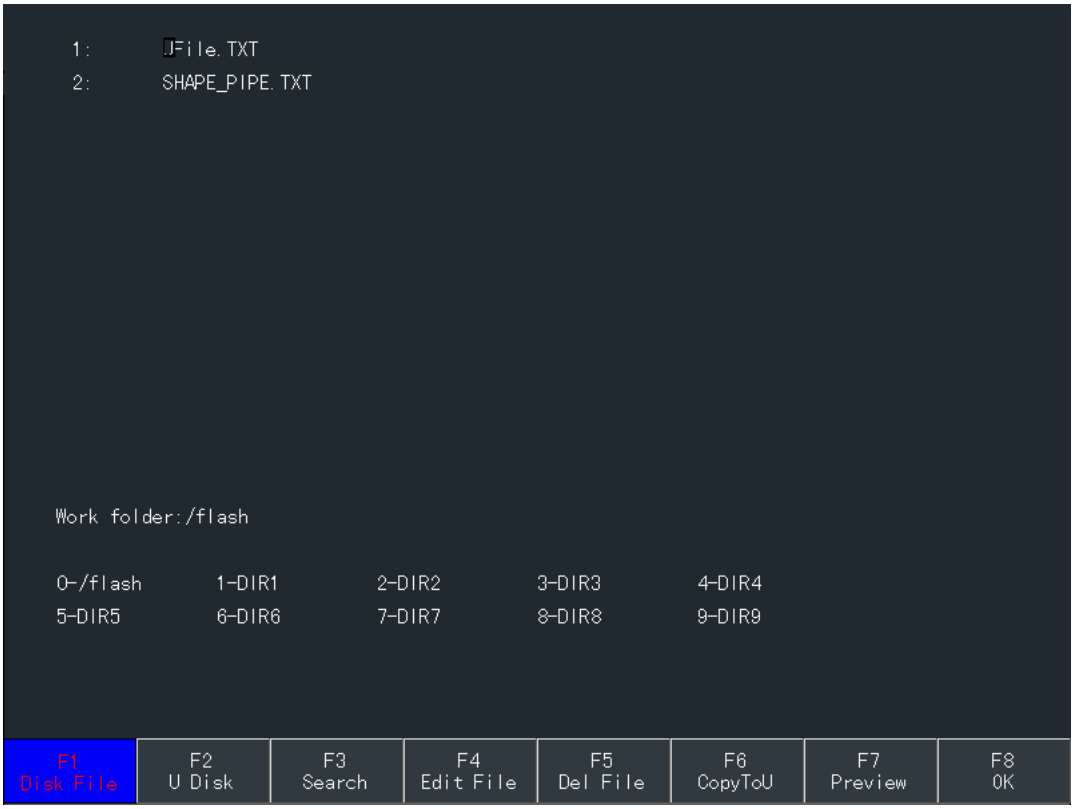


Figure 6.1 File Management Interface

6.1 Hard disk files

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

- Press [F4 to edit the file]. If the cursor is at a G code file, you can edit the file. Refer to section 6.4 for editing the file.
- Press [F5 delete file] to delete the current file.
- Press [F6 to return to USB drive]. If the current cursor is at a G code file, copy the current file to an external USB drive, provided that the USB drive is plugged into the systems USB port.
- Press [F7 Preview Graphic]. If the current cursor is at a G code file, you can preview the current graphic in the current interface.
- Press [F8 to confirm]. If the current cursor is at a G code file, the current machining file is transferred to the system, and the system automatically returns to the main interface after transferring the file.

6.2 USB disk files

In the file management interface, press [F2] to enter the USB drive file interface.

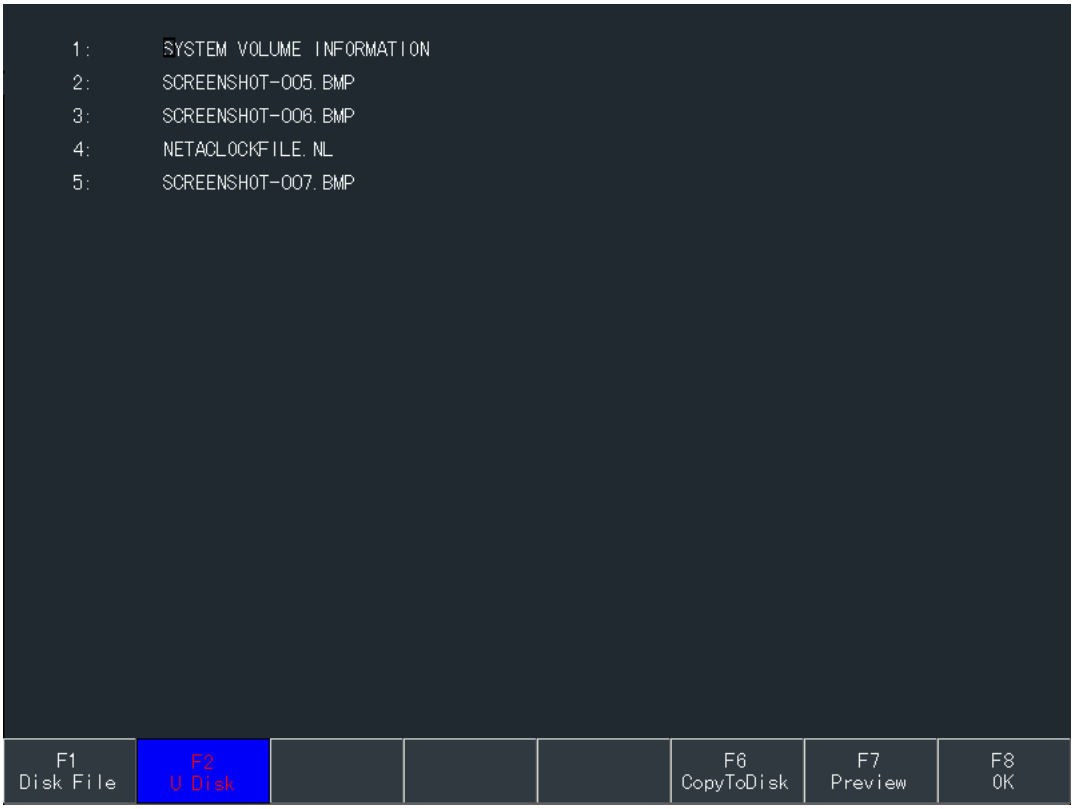


Figure 6.2, USB drive file

Under this interface, [F6] automatically changes from "Copy to USB Drive" (copy to USB drive) to "Copy to Internal Hard Drive" (copy to internal hard drive). After selecting the corresponding file, press [F6], and the system will automatically save the file to the current folder on the internal hard drive.

Note: The processable files in the USB drive can also be directly entered into the cutting interface by pressing [F8] or [ENTER] for processing.

When the files on the U disk are saved to the internal hard disk, you can save them without changing the file name, or you can save them after changing the file name in the pop-up prompt box.

When entering a file name, if you do not want to change the file name, you can press Enter directly to save; or after modifying the file name, press Enter to save. If there is already a file with the same name in the local file system, the system will prompt whether to overwrite:

Figure 6.3 Replace file name with the same name, do you want to overwrite?

If you want to replace the internal file, press Enter; if you want to change the file name again, press Esc and change the file name before saving.

6.3 Search for documents

Press [F3] in the File Management interface to find files. Enter part or all of the characters of the file name you want to search for, and press ENTER to list all files that contain the input string.

6.4 Code editing

Under the file management interface, press [F4] code editing to enter the code editing page.

When entering a character, some keys are multiplexing keys. If you press the multiplexing key directly, the character entered is the lower key of the multiplexing key

(conventional character). If you press Shift and the multiplexing key at the same time, the upper key of the multiplexing key is entered.

When editing code pressing [F2] inserts a line after the current line being edited pressing [F3] deletes the current line pressing [Home] moves the cursor to the first character of the current line being edited pressing [End] moves the cursor to the last character of the current line.

Each line of editing supports up to 128 characters.

Before cutting, you must save it first, otherwise the system cannot perform breakpoint recovery or power-off recovery.

After editing the code, press [F8] to save it.

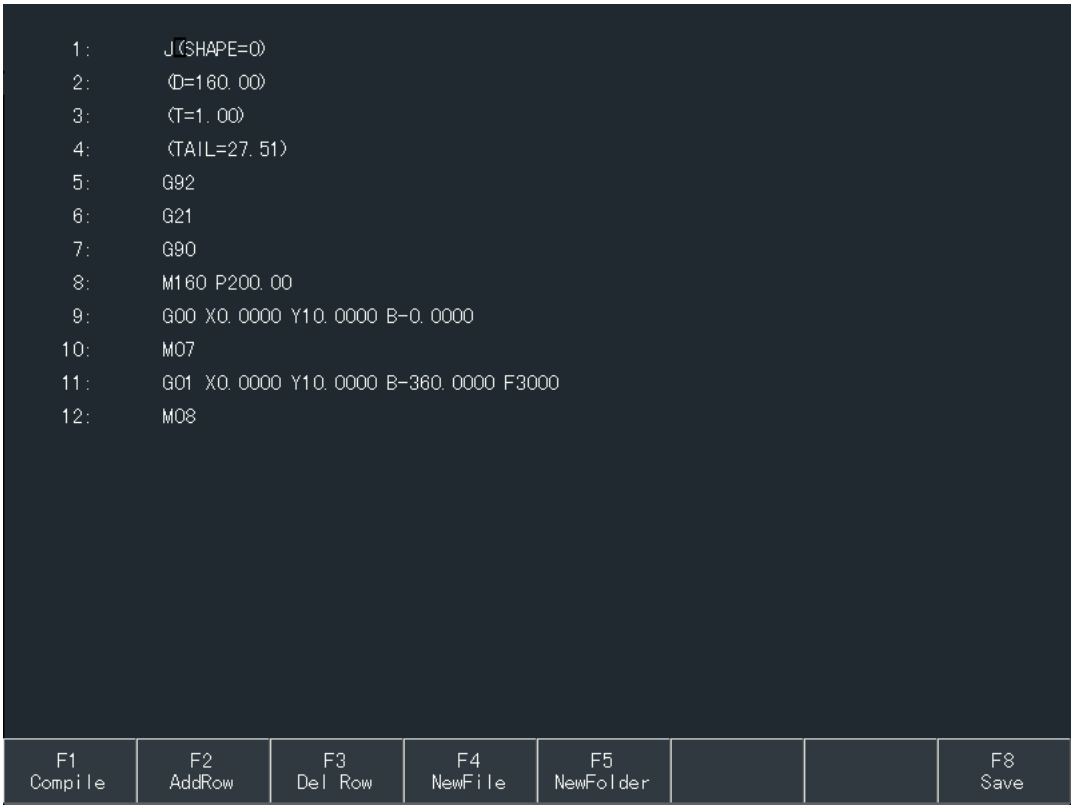


Figure 6.4, edit code

6.5 Delete files

In the file management interface, pressing [F5] to delete the file will pop up a dialog box as shown in Figure 6.5.

6.6 New documentation

In the code editing interface (see section 6.4). Press [F4] to create a new file, which can be manually created.

6.7 Compile code

After creating a new code or editing the code, if you want to know whether the current input code is valid, you can compile the code and check whether the code is correct by pressing [F1] in the editing state.

Figure 6.5, delete file

6.8 Folder management

6. 8.1 Work folder selection

Current folder: The name of the folder in which the current work is located. In Figure 6.6, the current folder is DIR1.

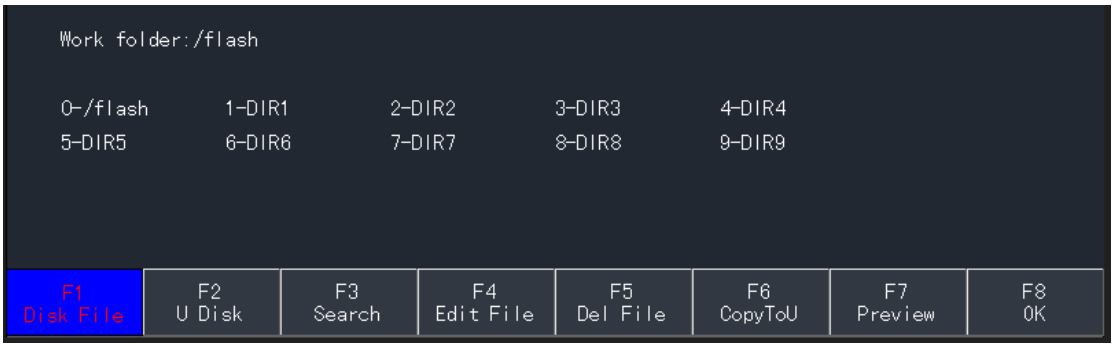


Figure 6. 6 Folder

The system supports 10 folders, as shown in Figure 6.6.

0-/flash 1-DIR1 2-DIR2 3-DIR3 4-DIR4

5-DIR5 6-DIR6 7-DIR7 8-DIR8 9-DIR9

These ten prompts are folder prompts, where the preceding number represents a shortcut key. Pressing the corresponding number switches the current working folder to the corresponding folder. For example, pressing 1 switches the folder to DIR1 as shown in Figure 6.6.

The current folder is switched to /flash/DIR1, and all supported G code files in the current directory are displayed.

6. 8.2 Create a folder

Creating a new folder is more complicated. You need to enter the editing file interface first, and then you can create a new folder.

Under the local file, move the cursor to the G code file, then press [F4 edit the file], in the function key under the editing file, press [F5 create folder], enter the folder name in the prompt box, and press Enter.

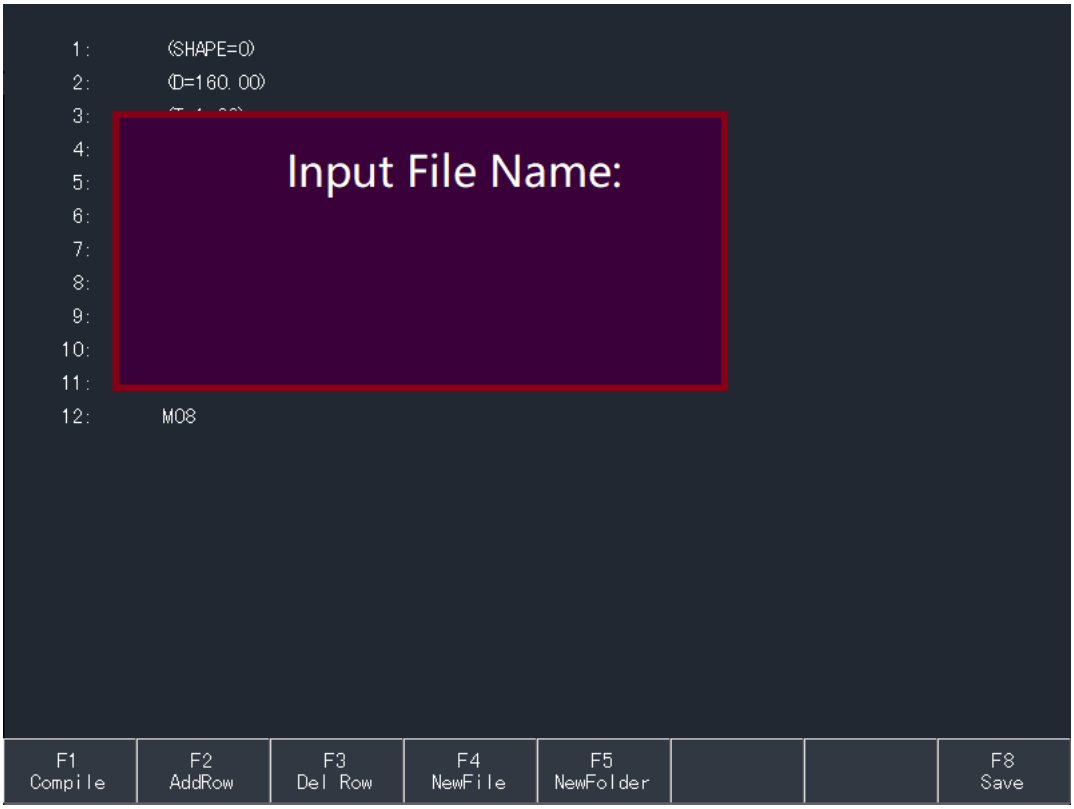


Figure 6.7 New folder

Note: This device supports 10 folders. After exceeding 10 folders, newly created folders will replace the second folder, followed by the third folder, fourth folder, etc. The first folder/flash is a reserved folder, which cannot be replaced or modified.

Chapter 7 Parameter Settings

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

Figure 7.1 Parameter interface

In the parameter interface, there are five parameters that can be set:

1) Common parameters: demonstration speed, air movement speed, peak power of point shooting, etc.
2) Laser parameters: all parameters used in laser cutting.
3) Tuner: Laser capacitor tuner parameters.
4) System parameters: setting of maximum speed limit, small arc speed limit and other parameters.

7.1 Common parameters

As shown in Figure 7.1, these are the common parameters of the system.

Table 7.1

Parameter name	unit	scope	Parameter notes

Forward/reverse speed	mm/ min		Temporarily, the speed at which the forward/Back operation is manually performed
Demonstration speed	mm/ min		Speed in demo mode.
Cut type			Laser/demonstration
Type of pipe			Round pipe / square pipe / waist round pipe / elliptical pipe
Blow gas pressure	BAR		The valve outlet pressure is controlled by DA, and the valve pressure is linearly related to DA.
Spot peak power	%		Percentage of peak power
Pulse frequency of spot shot	Hz		The number of times a signal goes from high level to low level and back to high level per second
Spot shot occupancy ratio	%		The proportion of the on time relative to the total time in a pulse cycle
The time of the point shot	ms		Press the dot key to start the countdown, which will be closed if it exceeds this time
Number of pieces			Counting of cut parts
flush			Whether the first cut is cut or not, the same head is equal to the first cut
Same position			Close to chuck / away from chuck
docking			Add one more cut before the last one to ensure that the length of the last part is the same as before
Material configuration			Material structure configuration
Material configuration			Material structure configuration

7.2 Laser parameters

As shown in Figure 7.2 and 7.3, these are laser-related parameters that are set in the laser cutting state.

When the process is not selected, the default process is used for cutting as shown in Figure 7.2. After selecting the process, cutting is performed according to the process parameters as shown in Figure 7.3.

Figure 7.2, laser parameters

Figure 7.3 Laser process parameters

Table 7.2

Parameter name	unit	scope	Parameter notes
technology			Set cutting process according to requirements, and customize process name.
cutting speed	mm/min		The speed of cutting
Nozzle height	mm		The height of the cutting gun. This value determines the distance between the cutting gun and the pipe during the cutting process, also known as the follow height or cutting height.
Types of cutting gases			You can choose oxygen, nitrogen or air.
Cut gas pressure	BAR		Gas pressure during cutting (can be controlled)
Cut peak power	%		The percentage of peak power

			during the cutting process relative to the maximum power of the laser (the duty cycle and pulse frequency form the real-time power, for example, if the maximum power of the laser is 3 000W and the cutting peak power is 5 0%, this means that the system controls the laser power range to no more than 1 500W during the cutting process, the real-time power represents the power for this second as 8 00W, and the power for the next second is controlled at 9 00W, which is the real-time value during the motion process)
Cutting duty cycle	%		The proportion of the on time relative to the total time within a pulse cycle.
Cut pulse frequency	Hz		The number of times a signal goes from high level to low level and back to high level per second.
focal position	mm		The position of the laser focus (the point of maximum energy, similar to a magnifying glass focusing on the sun, which can focus a point of maximum energy)
Cutting residence time	s		Cut gun preparation pause time before moving cutting (if this time is set, it is in the state of opening laser, delay for a period of time, if not set, it is directly cutting)
Raise the height	mm		After cutting a graphic, raise the cutter gun
Delaying gas opening	s		M 07 can be delayed for a period of time after opening
M08 is not gas			When lifting M08, the valve is not

			closed (i.e., the valve is not closed after cutting)
Guangguan Guangqian Delayed	s		When executing M 08, delay for a period of time before turning off the laser (i.e., delay turning off the laser after cutting is completed)
Start focus control			Start the control of the focal axis
Focus axis manual speed	mm/ min		The speed of manually moving the focus is controlled by the shortcut key [S HIFT]+[R] to move the focus axis up and [S HIFT]+[T] to move the focus axis down.
Focus axis positioning speed	mm/ min		During the perforation process, control the speed of the focus movement
PWM regulation enable			When enabled, the real-time power of the laser will be adjusted according to the system speed.
Perforation selection			No perforation, grade I perforation Secondary perforation, tertiary perforation
Gradual empowerment			The laser is not turned off and follows the specified position at the specified time
Types of perforating gas			Nitrogen, oxygen, air
Perforation gas pressure			The pressure of the gas during the perforation process is executed, and each level of perforation corresponds to a parameter
Progressive time	s		Progression enables the time it takes to move from one position to another
Peak power through a hole	%		The maximum power during the perforation process is a percentage

			of the peak power
Pore occupancy ratio	%		The number of times a signal goes from high level to low level and back to high level per second
Pulse frequency of perforation	Hz		The proportion of the on time relative to the total time in a pulse cycle
focal position	mm		The position of the focus in the focal axis
Puncture dwell time	s		aperture time
Stop light and blow air time	s		Turn off the laser first, then delay the valve for a while before turning it off
Nozzle height	mm		

- **Process: Select the process and enter the process setup interface.**

7.2.1 PWM regulation

PWM regulation, the parameters of PWM are adjusted according to the speed value.

If it is necessary to adjust the real-time power according to the speed, first enable "PWM Regulation Enable". Enter the "PWM Regulation" interface and set the speed, duty cycle, and frequency. Two adjacent sets of data can form a linear relationship between "speed-duty cycle" and "speed-frequency". Any speed within this range corresponds to a unique duty cycle and frequency, allowing for real-time power adjustment based on speed. (This speed refers to the relative speed between the cutter and the tube)

The CN 9 port is used for the PWM output port.

Figure 7. 4 PWM modulation

7.3 Laser equipment

The laser equipment parameters are the general relevant parameters of the laser generator. Generally, they include the maximum power of the laser generator and the maximum air pressure of the proportional valve, which are mainly configurations before cutting. Once configured, there is no need for changes. Essentially, it refers to the maximum voltage that the systems DA port can output.

Laser equipment: refers to specific equipment, mainly related to communication configuration, such as setting current, connection status and so on.

Table 7.3

Parameter name	unit	scope	Parameter notes
Laser power	W		The rated power of the laser generator.
Laser DA output port			DA output ports for laser control can be selected: None, DA1, DA2, DA3
Laser DA voltage range			The range of output voltages from the DA output port of the laser controller is available in two selectable ranges:

			0~ 5 V 0~ 10 V
Maximum air pressure of proportional valve	BAR		
Proportional valve DA output port			The DA output ports of the control proportional valve can be selected: None, DA1, DA2, DA3
Proportional valve DA voltage range			The output voltage range of the DA output port of the control proportional valve is available in two modes: 0~ 5 V 0~ 10 V
Pressure correction			If there is an error between the output voltage value and the pressure value displayed in the pressure gauge, pressure correction is required and the pressure correction operation is performed.

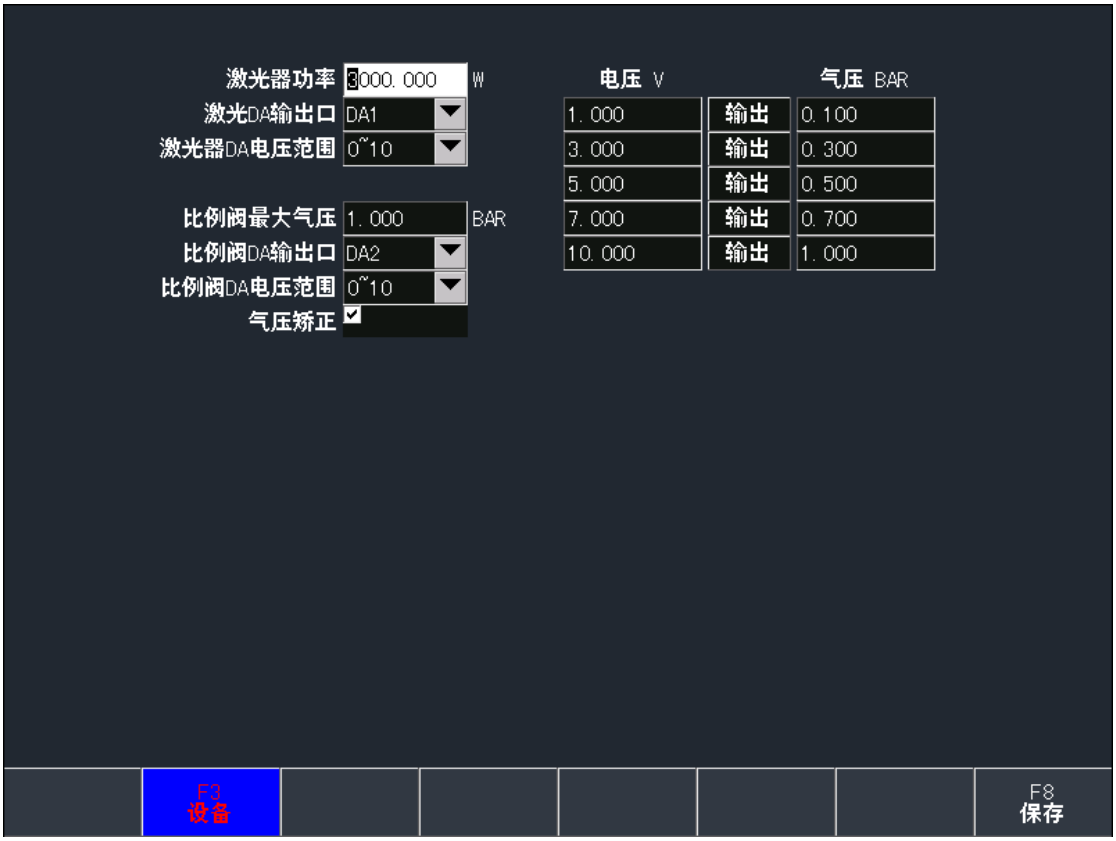


Figure 7. 5 Laser equipment

In the parameter table, the corresponding air pressure value of DA can also be calibrated.

If the system-set pressure and the pressure value displayed on the actual pressure gauge are inconsistent, pressure correction is also required. First, check the "Pressure Correction" option, then input a voltage value on the right side of the above figure, click the "Output" button, and enter the pressure value displayed by the pressure gauge into the pressure editing box. Click Save to correct the pressure value corresponding to the output voltage.

7.4, regulator

When the control system is successfully connected to the laser height adjuster, press [F4] to enter the interface for setting the parameters of the height adjuster. After the parameters of the height adjuster are set, click [F8] to save them and send them to the connected laser height adjuster.

The parameters of the regulator are divided into common parameters, system parameters, calibration, diagnosis, additional functions, etc. The following introduces the setting of each part of the parameters respectively.

7.4.1 Common parameters

After entering the parameter interface of the regulator by pressing [F4], [F1] is the commonly used parameter of the regulator. At the top of the interface, the device number, model and connection status are displayed as shown in Figure 7.6.

Equipment selection: 1 (if there are multiple devices, you can choose the device number. After selecting the device number, the modification of parameters only works for that device number).

Model: iHC 100.

Connection status: green (the green signal light indicates that the system is connected to the height adjustment network normally, red indicates that it is not connected).

The parameters listed below are all used by the height adjuster. For specific usage, refer to the user manual for the height adjuster. Here are simple descriptions of these parameters.

Table 7.4

Parameter name	unit	scope	Parameter notes
Follow height	mm		The height and size of the cutting head from the pipe surface during the following control process shall not exceed the calibration range
Dock coordinates	mm		The coordinates that are returned to zero or closed and then stopped last are also the target positions of the cutting head after the whole machining program is executed, and the size does not exceed the Z axis travel, and should not be too close to the board surface
Z axis travel	mm		Enable the maximum travel of the Z-axis protected by the soft limit (software limit) and the maximum distance that the Z-axis can be moved down from the mechanical origin
Perforation delay	s		The delay time of the perforation
Progressive speed	mm/ s		The speed during the process of

			gradually increasing the perforation height to the following height shall not be greater than (thread pitch * upper speed limit / 60)
Follow-up approach			When the control mode of the regulator is IO mode, the following mode is: ● Progressive follow-up ● First perforation
Air movement speed	mm/ s		The speed of the upper and lower movement of the gun head in a non-cutting state should not exceed (thread pitch * rotational speed limit / 60) mm/s. To improve the efficiency and stability of the height adjuster, it is recommended to set the idle speed to near the rated rotational speed of the servo motor.
accelerated speed	G		The acceleration of the cutting head during movement
Point and move at low speed	mm/ s		Not greater than (thread pitch * speed limit / 60). It must be less than point high speed.
Point to high speed	mm/ s		Not greater than (thread pitch * speed limit / 60), It must be greater than the point motion low speed.
Back to zero speed	mm/ s		The moving speed during the zero return process. The zero return speed is not recommended to be too high. It is recommended to start the test with low speed to prevent the zero return speed from exceeding the mechanical travel.
Return to zero return distance	mm		The distance between the origin of the mechanical coordinate system

			and the upper limit.
Whether the power on is back to zero			When the system is powered off and restarted, the control regulator returns to zero first
Whether to stop at zero			Whether it returns to the docking coordinates after returning to zero

Figure 7.6 Common parameters of laser height adjuster

7.4.2 System parameters

The parameters of the laser tilter system are shown in Figure 7.7.

Figure 7.7 Parameters of the laser height adjustment system

Table 7.5

Parameter name	unit	scope	Parameter notes
Screw pitch	mm	0.01-100	The distance that the screw rotates one revolution and moves the nut is also called the lead of the screw. The parameter range is that the larger the value, the faster the Z axis moves. It is recommended to use a roller screw with a lead of 5-20mm.
Maximum speed	rpm	10-6000	The maximum speed at which the servo motor can operate safely.
Speed gain	rpm/ V	10-2000	The speed of the servo motor corresponding to the 1V voltage should be consistent with the parameters in the servo driver.
Number of pulses per turn		2-60000	The number of pulses output by the encoder for each revolution of the servo motor must be consistent with

			the parameters in the servo driver.
Servo direction		Forward, reverse	The rotation direction of the servo motor can be set to forward or reverse.
Direction of encoder		Forward, reverse	The direction of the encoder pulse feedback can be set to forward or reverse.
Servo type			Panasonic, Delta, Yaskawa, Mitsubishi, Fuji, Schneider, Dongyuan, Takahashi and Hikvision are optional
Perforation bump delay	ms	0-6000	Set the bump plate for the height adjustor perforation (at this point, the capacitor is zero) to adjust the alarm detection sensitivity, the smaller the value, the more sensitive it is, and a value of 0 will trigger a shield bump plate alarm. During the height adjustor perforation process, if the workpiece lifts up or backscrap causes the gunhead to touch the bump plate, if the delay time is exceeded, the gunhead will automatically rise back to the stop position and trigger an alarm. Properly setting this parameter can effectively protect the gunhead during perforation (by reducing this value) or minimize false alarms caused by backscrap (by increasing this value).
Cutting bump delay	ms	0-6000	Set the alarm sensitivity for the bump plate during the cutter adjustment (when the capacitor is zero), the smaller the value, the

			more sensitive it is, and a value of 0 will shield the bump plate alarm. During the cutting process, if the workpiece lifts or the gun head overshoots causing the bump plate, if the delay time is exceeded, the gun head will automatically rise back to the stop position and trigger an alarm.
Air movement bump delay	ms	0-6000	Set the alarm sensitivity of the bump plate when the stopper is activated (at this point the capacitor is zero), the smaller the value, the more sensitive it is, and a value of 0 will shield the bump plate alarm. In the stoppers deactivated state, if the gun head bumps the bump plate due to moving X/Y axes or other reasons, if it exceeds the delay time, the gun head will automatically rise back to the stop position
Follow error alarm	mm	0-99	If the difference between the current height and the follow-up height is greater than the follow-up error alarm and the duration is greater than the follow-up error delay, it will trigger the excessive follow-up error alarm. Possible reasons include sudden over-exceedance of the boundary by the gun head, abnormal vibration of the material, etc., which can cause sudden changes in capacitance. The greater the follow-up error delay, the better the suppression of sudden changes in

			capacitance.
Follow-up error delay	ms	0-6000	If the difference between the current height and the follow height is greater than the follow error alarm and the duration is greater than the follow error delay, it will trigger a follow error excessive alarm. Possible reasons include sudden over-exceedance of the gun head beyond the boundary or abnormal vibration of the material causing a sudden change in capacitance. The greater the follow error delay, the better the suppression of the sudden change in capacitance.
Local capacitance change alarm value		0−9999	It is recommended that the setting be set to 10% to 20% of the valid value in the floating head calibration results
Enable real-time calibration			After enabling real-time calibration, the regulator will fine-tune the calibration curve according to the changes in the body capacitance to compensate for the effects of the cutting head on the environment or the rising cutting temperature, so as to reduce the number of manual calibration times of the regulator.
Enable active collision prevention			Predict whether the cutting head will touch the panel before the gun is followed and lift it up in time before the collision.
Enable border search			Prevent the gun from being stuck in the process of searching for the edge.

Enable vibration suppression			When cutting thin plates, due to the disturbance caused by cutting airflow, the plates will vibrate, and the cutting head will also vibrate when following, which may cause wave patterns on the cutting surface. Activating this function can effectively reduce such vibrations. The vibration suppression intensity can be controlled by adjusting the vibration suppression time.
Vibration suppression time		0-9999	When cutting thin plates, due to the disturbance of cutting airflow, the plates will vibrate, and the cutting head will also vibrate when following, which may cause the wave pattern of the cutting section. When this function is enabled, the vibration can be effectively reduced. The vibration suppression intensity can be controlled by the vibration suppression time (parameter range 0-9999).

7.4.3 Calibration

Calibration is an operation of the laser tilter, but it can also be operated in this system. This interface is used to set parameters and perform calibration operations.

When performing the calibration operation, [PgUp] and [PgDn] control the point rise and point fall respectively.

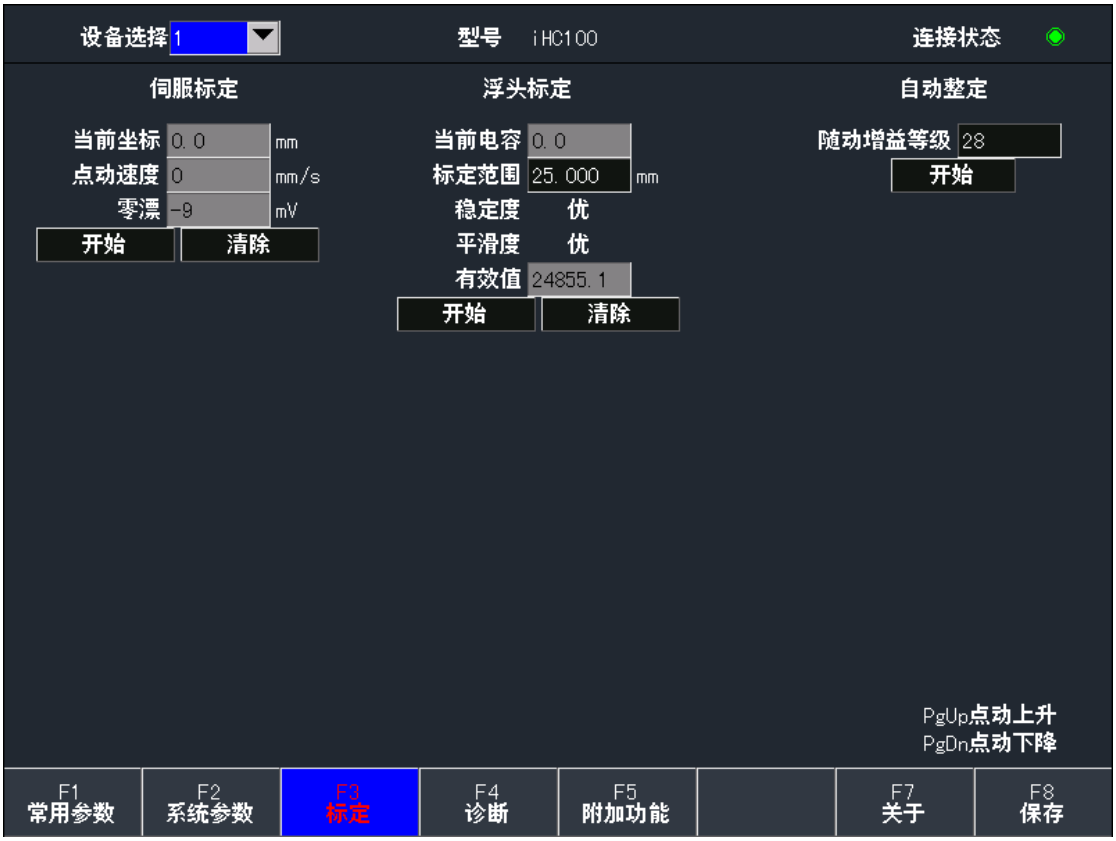


Figure 7. 8 Parameters and operation of laser height adjuster

- **Servo Calibration: When the servo motor operates in speed control mode, the phenomenon where the motor continues to rotate without input signal is called zero drift. The purpose of servo calibration is to measure the zero drift of the servo motor and compensate for it to eliminate its impact.**

  Current coordinate: Current Z axis coordinate is the distance between the cutting head and the mechanical reference point (the machine coordinate system is established after the machine returns to zero, and the downward direction is positive).

  Point speed: open-loop point speed on Z axis.

  Zero drift: zero drift of servo motor.

  [Start]: Start calibration.

  [Clear]: Clear calibration parameters.

- **Floating head calibration: Floating head calibration is to measure the capacitance and position relationship between the cutting head and the sheet.**

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

  Calibration range: the maximum height of the cutting head raised during calibration.

  Stability: Stability is the static characteristic of the capacitor. If the stability effect does not reach the level of "middle" or above, please check whether the machine tool and

board surface have vibration, whether the cutting head and board surface have accumulated ash or slag, or whether the grounding of the machine tool and amplifier is ideal.

Smoothness: It reflects the dynamic characteristics of capacitance changes during calibration.

Effective value: the change value of the capacitance from 0.5mm to infinity from the plate surface. It reflects the measurement range of the nozzle sensor. The larger the measurement range, the better the tracking accuracy and stability.

[Start]: Start calibration.

[Clear]: Clear calibration parameters.

- **Automatic tuning: Automatic tuning is the process of automatically adjusting the parameters of the pitch control system, and then determining the optimal gain level for the existing mechanical system, which can also be manually modified by the user.**

  Following Gain Level: The following gain level can adjust the speed of following, the higher the level, the faster the following speed, but in some cases vibration instability may occur. Parameter Range 1-30, default value is 11, which can be obtained through automatic setting or manually modified.

  [Start]: Start the start-up adjustment.

7.4.4 Diagnosis

Under the diagnosis interface, you can check the working state of the booster, input and output port status, etc. You can diagnose the working state of the booster and troubleshoot.

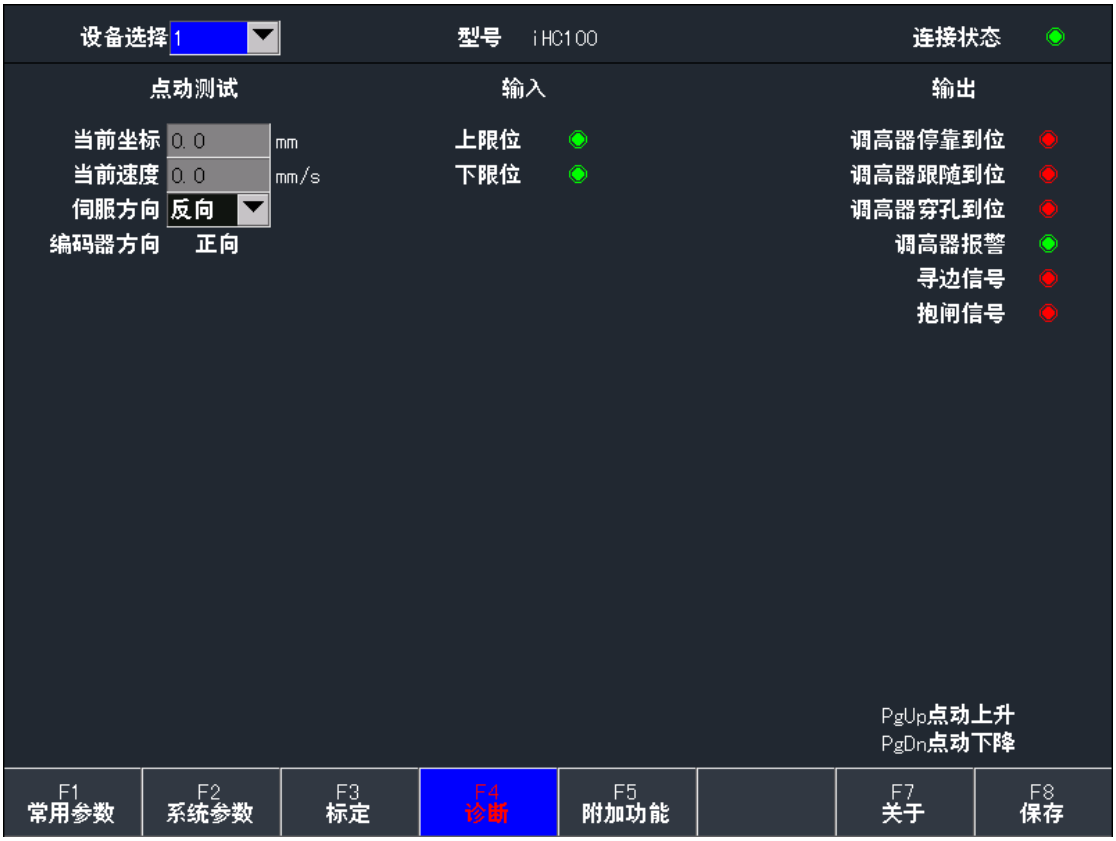


Figure 7. 9 Laser diode level detector diagnosis

- **Point test**

  Current coordinates: the current coordinate position of the regulator.

  Current speed: the current speed of the governor.

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

  Encoder direction: Display the direction of encoder pulse.

- **import**

  Upper limit: the upper limit status of the regulator. The green light indicates that the signal is valid or has occurred.

  Lower limit: Lower limit state of the regulator. Green light indicates that the signal is valid or occurs.

- **output**

The limiter is in position: current status. The green light indicates that the signal is valid or has occurred.

The limiter follows in place: current state. The green light indicates that the signal is valid or has occurred.

The dial-up hole is in place: current status. The green light indicates that the signal is valid or has occurred.

Tuner alarm: current status. Green light indicates valid signal or occurrence.

Search border signal: current status. Green light indicates that the signal is valid or occurred.

Brake signal: current status. Green light indicates that the signal is valid or has occurred.

7.4.5 Attachment functions

Under the function interface of the attachment, you can view the alarm information and calibration curve of the regulator, etc. and understand the alarm record of the regulators working history to judge whether the work is good or not.

Figure 7. 10 Laser height adjuster alarm record

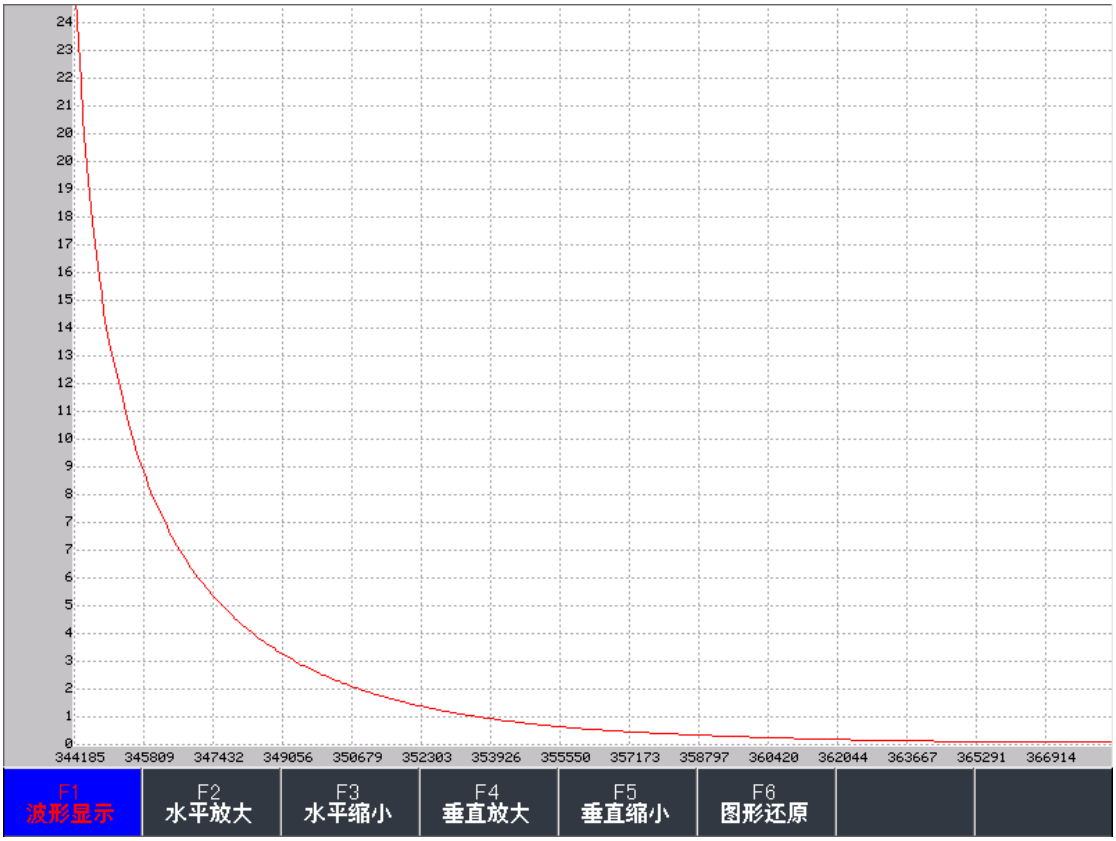


Figure 7.1 1 Laser height adjuster capacitance calibration curve

7.4.6 Regarding

As shown in Figure 7.12, in the Interface of the Height Adjuster, you can view the hardware version and program version of the Height Adjuster. You can remotely upgrade the program of the Height Adjuster through "Device Upgrade". Place the upgrade file of the Height Adjuster on a USB drive and insert it into the system. Click on Device Upgrade to select the file you want to upgrade from the USB drive, and click Confirm to upgrade via TCP.

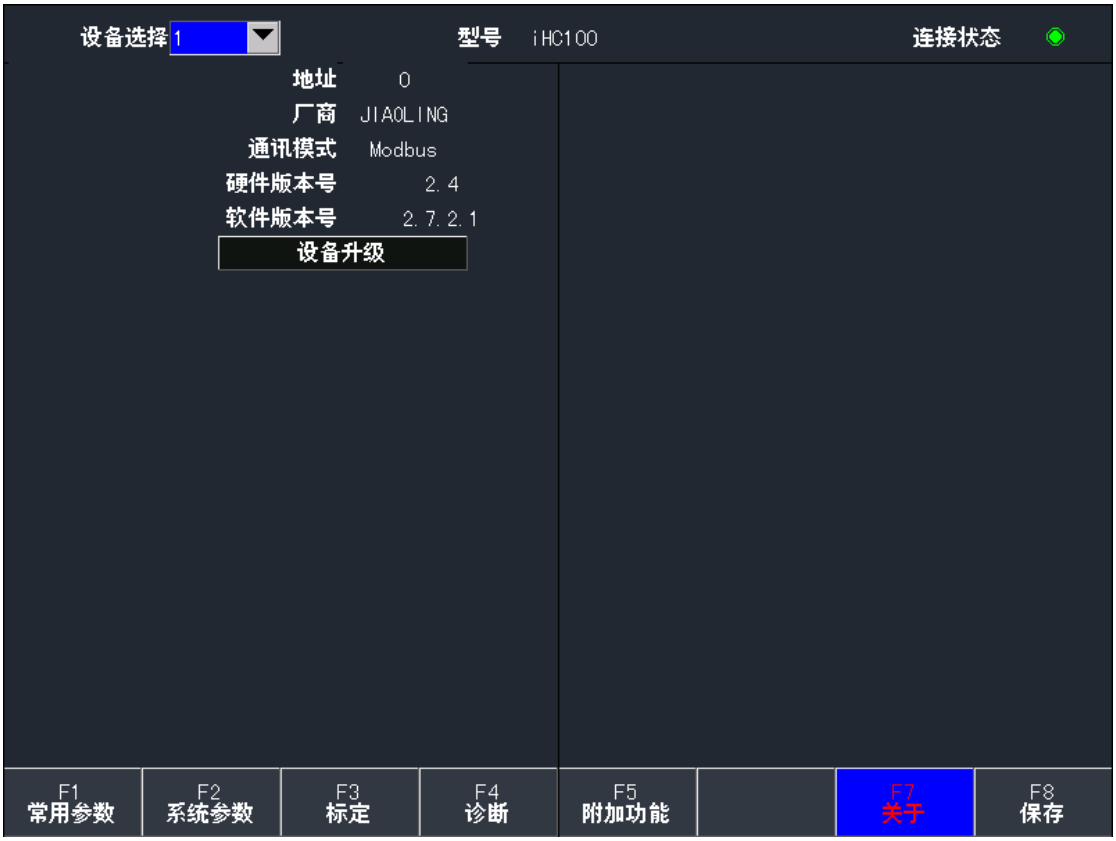


Figure 7.1 2 Laser height adjustment equipment information replacement chart

7.5 System parameters

As shown in Figure 7.13, the system parameters of the CNC system are the parameters related to the motor driver, moving axis, coordinate axis, acceleration and deceleration, chuck axis and focus axis of the cutting machine.

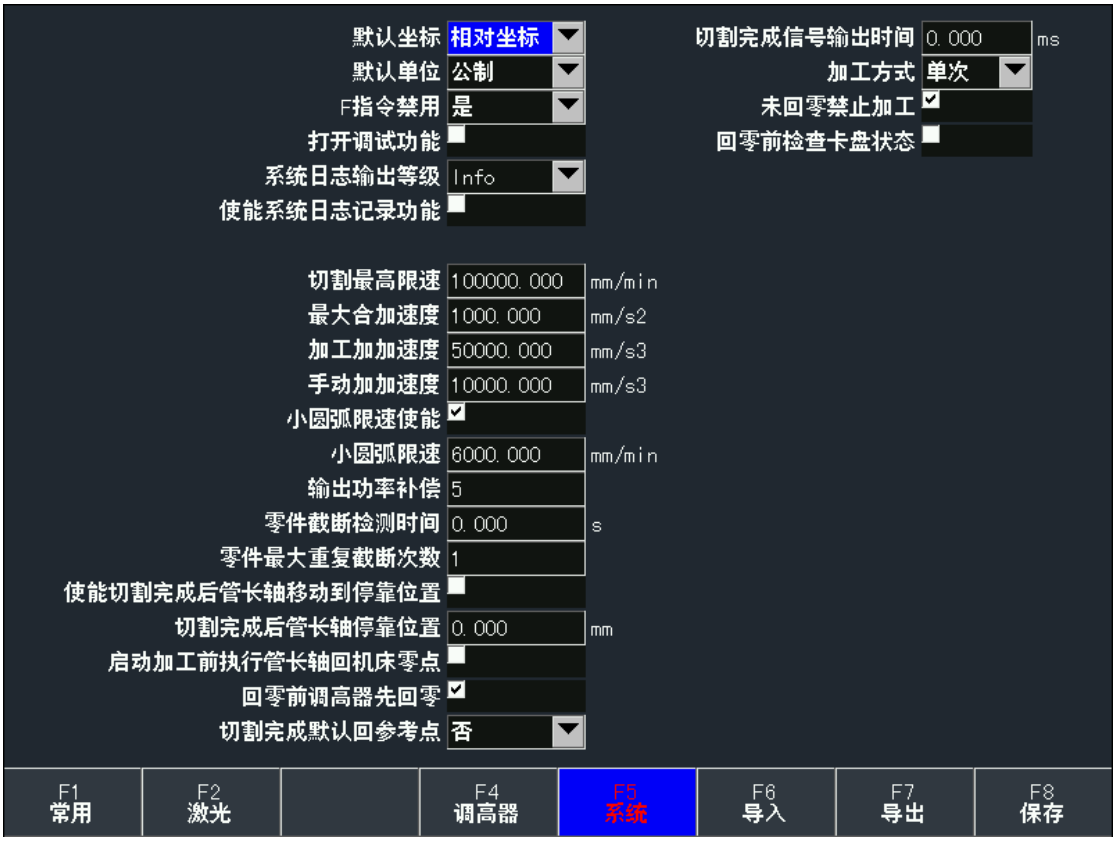


Figure 7.1 3 System parameters

Table 7.6

Parameter name	unit	scope	Parameter notes
Cut the maximum speed limit	mm/ min		Limit the maximum speed of cutting operation.
Maximum speed for air travel	mm/ min		Maximum permissible movement speed during the air trip.
Emergency stop time	s		When the machine tool encounters an emergency stop input, it reduces the speed from the current speed to 0 in the deceleration time.
toggle speed	mm/ min		The speed at which a machine tool starts directly from a stationary state is generally not required to start at 0 speed for most machine tools, as the motor allows a starting speed. However, the starting speed should not be too high, as excessive

			starting speed can lead to motor jamming.
Axis selection			X (pipe diameter axis), Y (pipe length axis), W (clamp axis), F (focus axis) can be selected
pulse count	pulse/mm		The number of pulses required to move the gun 1 mm
maximal acceleration	Mm/s*s		Set up the acceleration line
maximum speed	mm/min		Maximum speed of cutting
Manual speed	mm/min		Maximum speed for manual removal of vehicle
Soft limit enable			Enable soft limit detection after checking
Maximum soft limit			The maximum distance the cutting gun moves forward
Minimum soft limit			Maximum distance of reverse movement of the cutting gun

7.6 Import and export

After the parameter setting is completed, you can export the parameters by pressing [F7] in the parameter setting interface. You can choose to import or export the parameters.

As shown in Figure 7.1 4 Import and Export

Select parameter import by pressing [F1], as shown in Figure 7.15.

Figure 7.1 5 Introduction

Figure 7.1 6 Successful parameter import

Select parameter export by pressing [F2], as shown in Figure 7.1 7. If the file has been exported before, it will prompt whether to overwrite the previous exported file.

Figure 7.1 7 Covering export files

If no file has been exported, the export will be successful as shown in Figure 7.1 8.

Figure 7. 1 8 Parameter derivation successful

7.7 Save parameters

After modifying the parameters, press [F8] to save.

Note: After any parameter has been modified, if you want the modified parameter to take effect, you must save it; otherwise, the system will still use the original parameter.

Chapter 8 Diagnostic Functions

Press [F5] under the main interface to enter the system diagnosis interface.

Under the diagnostic interface, you can diagnose the output and input of the system, key values, and perform a self-test of the system.

8.1 Index of diagnostic interface

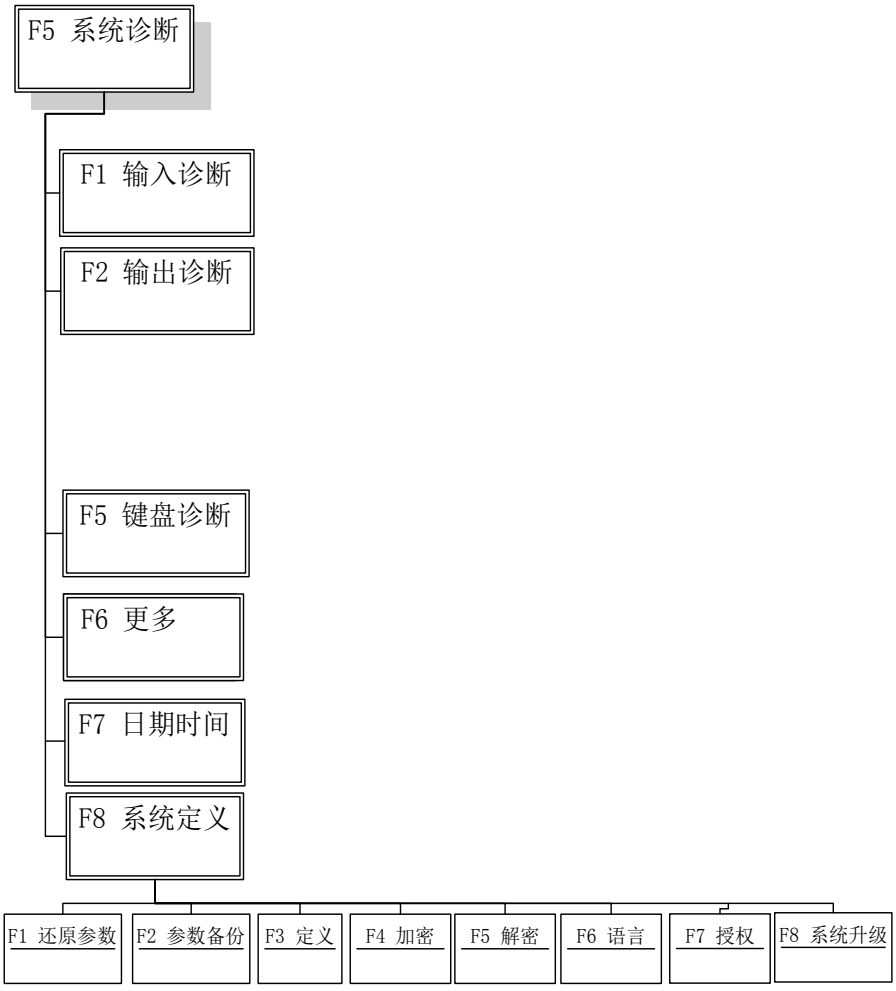


Figure 8.1 Index of diagnostic interface

8.2 Input diagnosis

In this interface, as shown in Figure 8.2, the system reads the status information of the current input IO and displays the information of the current input IO port. Green "●" indicates valid input, red "●" indicates invalid input. When external input signals change, they can be displayed here.

8.3 Output diagnosis

In the diagnostic interface, press [F2] to enter the output diagnostic interface as shown in Figure 8.2.

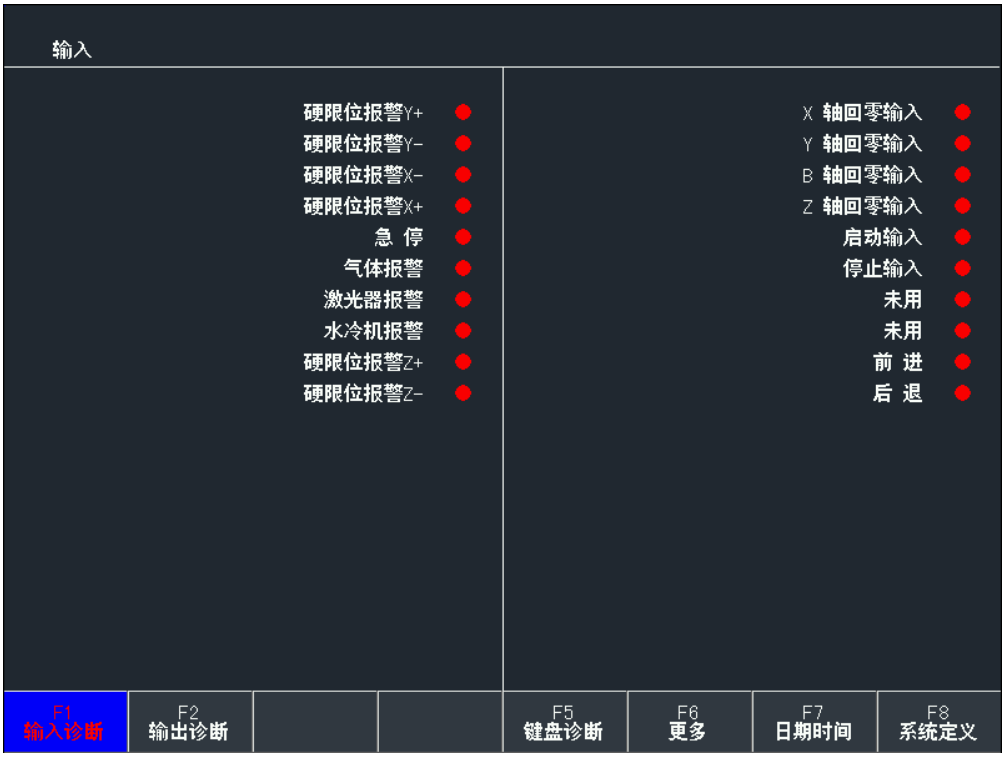


Figure 8.2 System diagnostic interface (input diagnosis)

Under the output diagnostic interface, pressing [↑], [↓], [←], [→] can move the cursor to the corresponding output port. On each output signal, pressing [F3] opens the corresponding output port, and pressing [F4] closes the corresponding output port. Green "●" indicates valid output, red "●" indicates invalid output.

Open and close the output port to drive external relays, solenoid valves and other circuits.

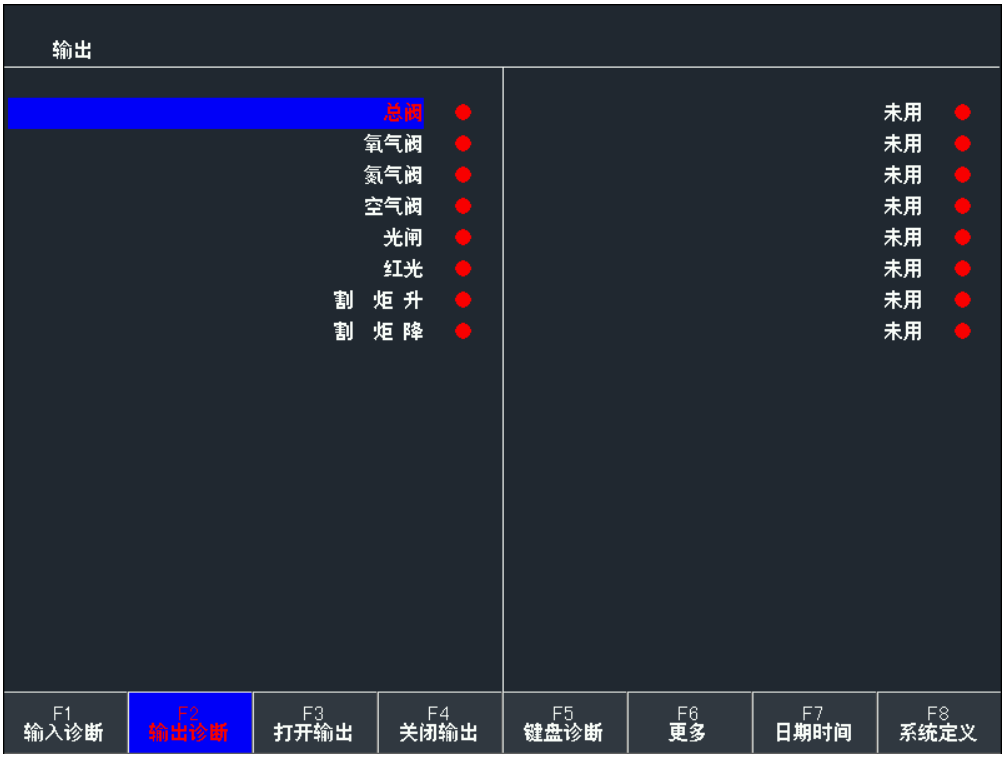


Figure 8.3 Output diagnostic interface

8.4 Keyboard diagnosis

Press [F5] to enter the keyboard diagnostic interface under the system diagnostic interface.

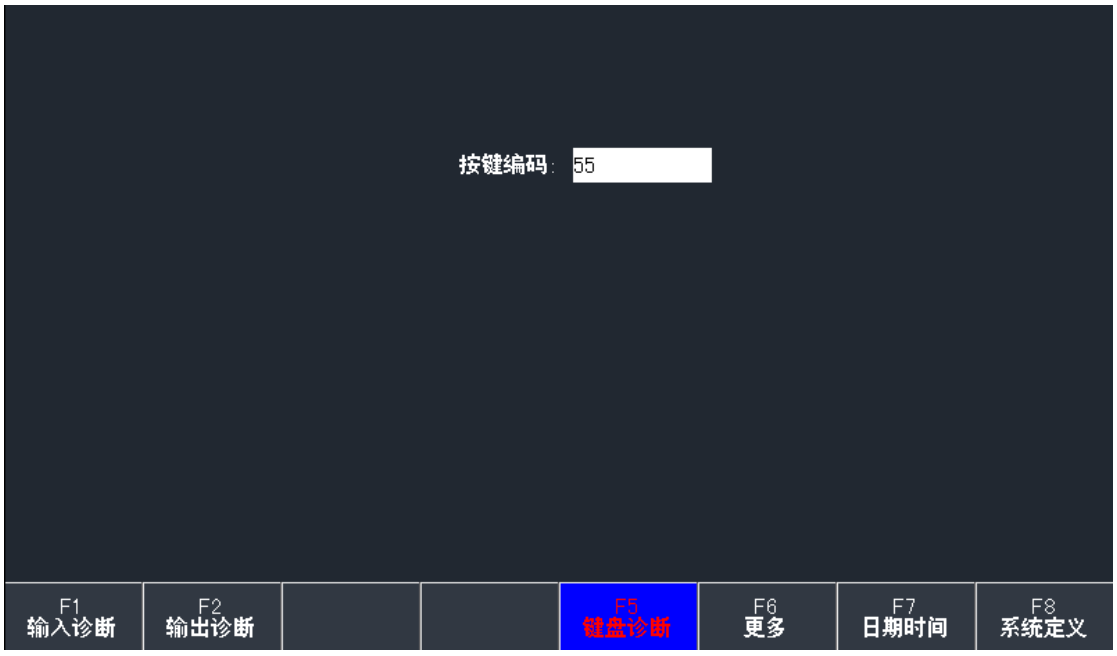


Figure 8.4 Keyboard diagnostic interface

Under this interface, press the key on the keyboard, and the keyboard code shows the key code (key value) of the key. Most keys have a code value (few function keys do not have a key code). If the corresponding code is not displayed when the key is pressed, it indicates that the key may have a fault.

L4000 keyboard value table

key	key assignments	key	key assignments	key	key assignments
G	71	0	48	+	43
X	88	1	49	—	45
Y	89	2	50	.	46
F	70	3	51	Del	127
M	77	4	52	BACK	25
Z	90	5	53	ENTER	24
A	65	6	54	SPACE	32
B	66	7	55	Pg Up	21
C	67	8	56	Pg Dn	22
D	68	9	57	HOME	15
E	69			END	16
H	72	follow	7 0	START	13
I	73	scavenging	2 6	STOP	14
J	74	demarcate	2 8	falling-rising tone	17
K	75	Find it	1 1	Next	18
L	76	optical shutter	30	the left side	19
N	78	firing in bursts	3 1	right	20
O	79	General Customs	12	SHIFT	2 3
P	80	F1		ESC	27
Q	81	F2			
R	82	F3	3		
S	83	F4	4		
T	84	F5	5		
U	85	F6			

V	86	F7	
W	87	F8	

8.5 More diagnostics

Press [F6] more to enter the more Settings interface under the system diagnosis interface.

In more settings interface, there are CAN diagnosis, extended board diagnosis, system self-test, oscilloscope and other functions.

8.5.1 CAN diagnosis

Press [F1] to enter the CAN device diagnostic interface, as shown in Figure 8.5. You can check whether the CAN device is connected. The CAN communication device can be diagnosed in terms of status.

"Device upgrade" can be carried out through CAN bus communication to upgrade the application program of CAN devices.

Figure 8.5 CAN device diagnostic interface

8.5.2 Extended board diagnosis

In more settings interface, press [F2] to enter the diagnostic interface of the expansion board device, as shown in Figure 8.6. You can view the input, output and AD sampling information of each expansion board.

First, the configuration of the expansion board needs to be carried out. In the "Options 2" interface, enter "Expansion Board Configuration", first configure the model and address of the expansion board. The models are "FCB Panel", "FCB IO" and "F CB1200PC".

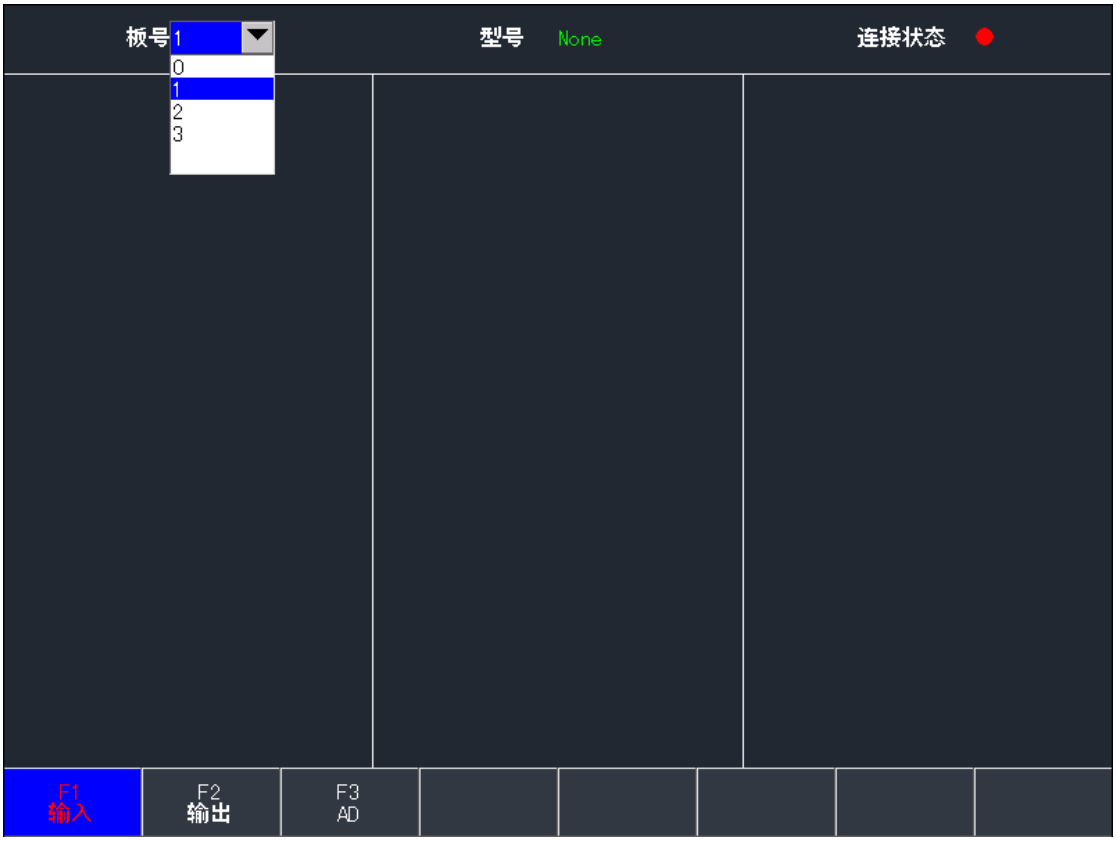


Figure 8.6 Extended board diagnostic interface

8.5.3 System self-inspection

Press [F6 System Self-Check] in more settings interface to enter the system self-check interface.

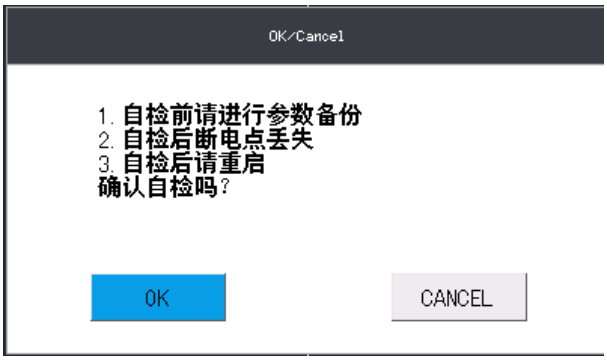


Figure 8.7, system self-test

If the self-test passes, the system will prompt:

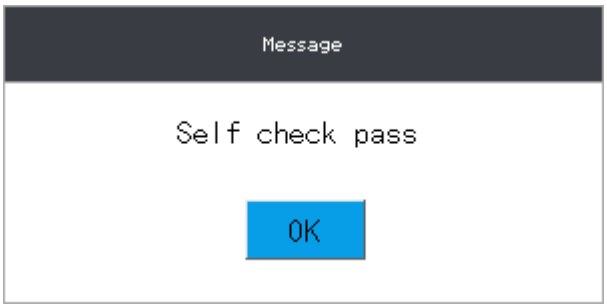


Figure 8.8 Self-inspection passed

8.5.4 Oscilloscope

Press [F7 oscilloscope] in more settings to enter the oscilloscope interface.

Under the oscilloscope interface, certain data changes over a period of time can be displayed as a two-dimensional graph, such as monitoring IO status and AD/DA values. Generally, it is used by testers for program analysis, and occasionally when customers encounter issues, it can guide customers to send the monitoring images to R&D for analysis (which requires setting up in "F7 Configuration" to see the waveform). As shown in the following figure:

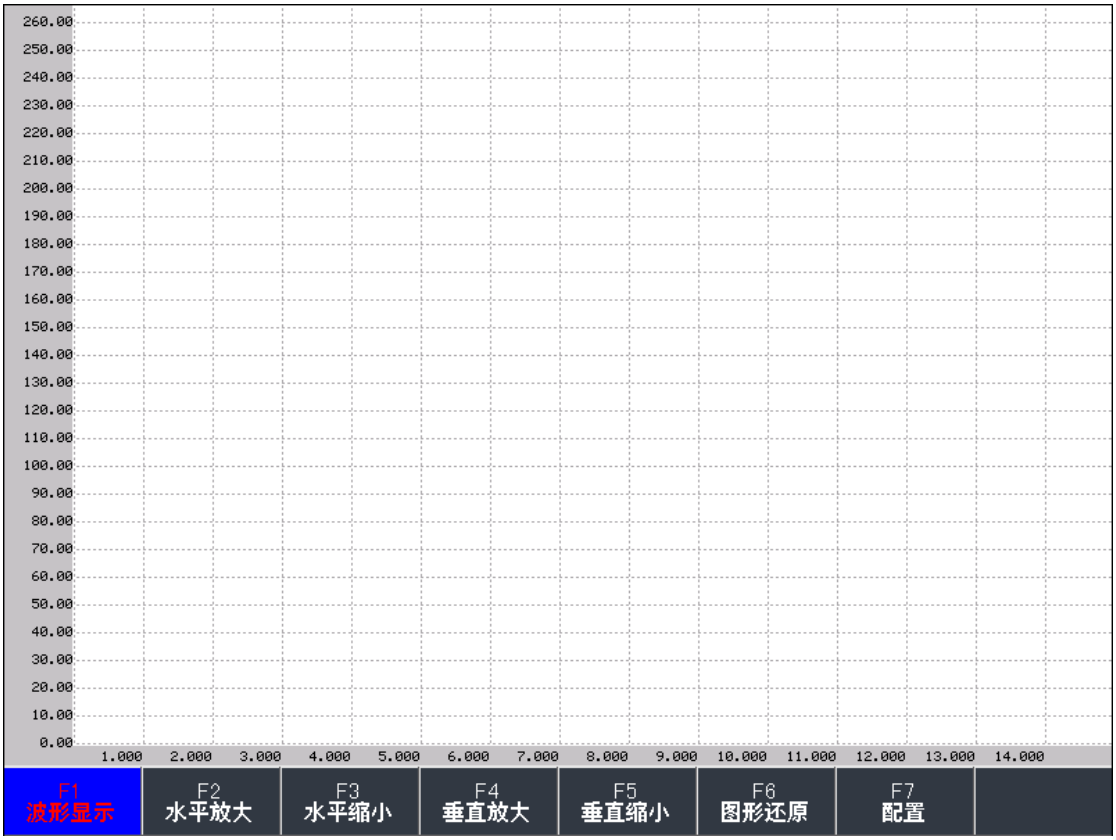


Figure 8.9 Oscilloscope interface

8.6 Date and time

Press [F7] under the system diagnosis interface to set the date and time of the system.

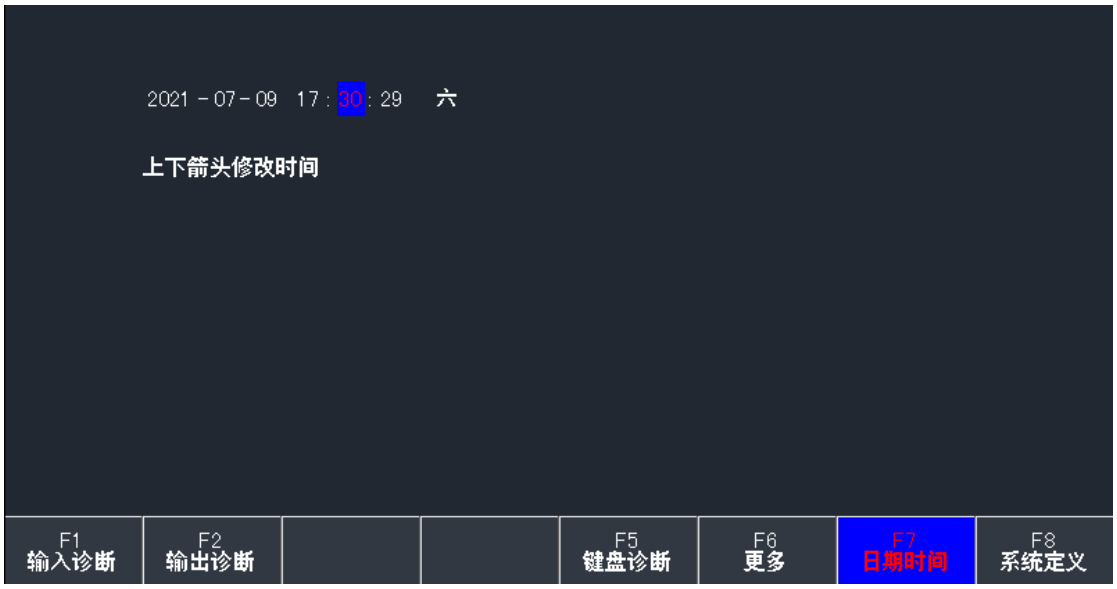


Figure 8.10 System time

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

8.7 System definition

Figure 8.11 System definition

Press [F8] in the system diagnosis interface to enter the system customization interface, where you can perform restoration parameters, parameter backup, configuration of motor drive parameters, site configuration, encryption and decryption operations, language switching, function authorization and other operations.

8.7.1 Parameter backup and restore

Parameter Backup: The process of backing up parameters involves sequentially pressing [F5] (System Diagnosis), [F8] (System Definition), [F2] (Parameter Backup) on the main interface of the system. The system prompts you to enter a password; after entering the password "1396", press the [Enter] key. The system will then back up the current parameters to the default settings and display a prompt saying "Factory Parameter Settings Successful!" Pressing the [Enter] key again will confirm this.

In the future use process, if there is an unexpected change or error modification of parameters, you can restore parameters by simply performing "Restore Parameters". The parameters are stored in the local file system of the system.

Note: After the equipment manufacturer completes the installation and commissioning of the whole set of equipment, it is necessary to do parameter backup.

Figure 8.12 Parameter backup successful

Restore Parameters: The process of restoring parameters is to sequentially press [F5] (System Diagnosis), [F8] (System Definition), [F1] (Restore Parameters) on the main interface of the system. At this time, a prompt box saying "Restore Parameters Successful!" will pop up. Press [Enter] key to confirm.

Note: After the restoration parameters are successfully restored, the system needs to be restarted.

Figure 8.13 Successful restoration parameters

8.7.2 Definitions

In the system definition interface, press [F3 definition], the system prompts you to enter the password. After entering the password "1396", press [Enter] key, and enter the system configuration definition interface.

8.7.2.1 Input port definition

This controller can change the definition of input IO ports according to user requirements including altering the sequence number of IO ports on the input terminals the open or closed type of input ports and the function definitions of the following 8 IO ports. Enter the configuration definition interface by pressing [F3] on the system definition interface and then press [F1] to enter the input definition interface as shown in Figure 8.14.

Pressing the [↑], [↓], [←], [→] buttons on the operation panel under this interface can move the cursor to the place where you need to change the type or number, positioning the cursor at the option you want to modify. Pressing the [Enter] key opens the tab for the options under the dropdown box where the cursor is located, moving the cursor using [↑], [↓] to select, and pressing [Enter] again to set the selected parameters.

Serial number: 01~10,14~2 3.

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

Functions: hard limit alarm, emergency stop, gas alarm, laser alarm, water cooler alarm on each axis.

Figure 8.14, Input port definition

8.7.2.2 Definition of output ports

According to the needs of users, this controller can change the definition of output IO ports, including changing the number of IO ports on the output terminals and the open or closed type of output ports. As shown in Figure 8.15.

Pressing the [↑], [↓], [←], [→] buttons on the operation panel under this interface can move the cursor to the place where you need to change the type or sequence number, position the cursor at the option you want to modify, press the [Enter] key to open the dropdown menu of the option card at the cursors location, move the cursor using [↑], [↓], and press [Enter] again to set the selected parameter.

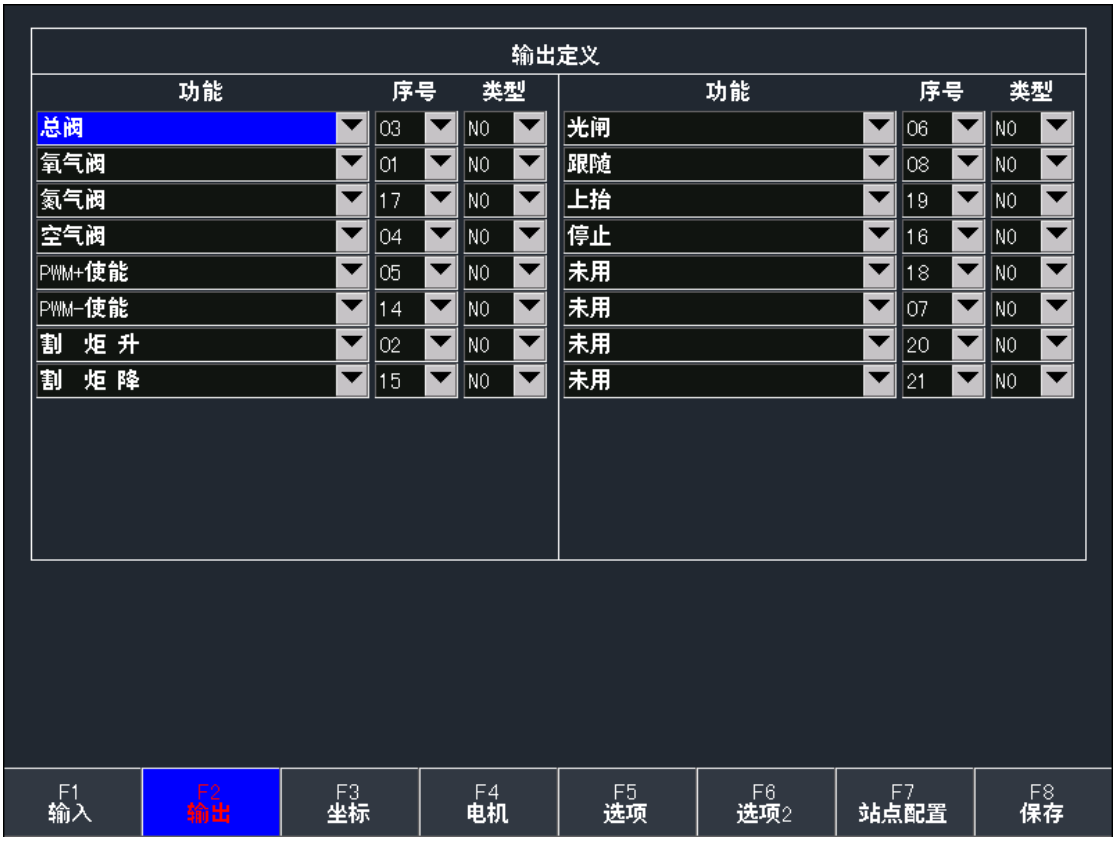


Figure 8.15, Export definitions

The output type is all three pole open output type.

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

8.7.2.3 Motor

Under this interface, press the arrow keys up and down to switch to the items that need to be modified.

Figure 8.1 Direction of motor 6

8.7.2.4 Option

- **Remote control type: optional remote control connected by No or P2P method. Refer to the remote control input chapter.**
- **Default coordinate: optional relative coordinate or absolute coordinate. If the G code specifies G90 (absolute coordinate) or G91 (relative coordinate), then the specified G code shall prevail. If the G code does not specify coordinates, then this configuration item shall prevail. By default, it is relative coordinate.**
- **Arc IJ coordinates: If there is no G02/G03 in the G code, then this configuration shall be taken as standard. If there is, then in the G code, whether the subsequent I or J parameters of G02 or G03 are relative coordinates or absolute coordinates is determined by default. In most cases, the IJ coordinates of arcs are relative coordinates, with only a few types of G codes having absolute coordinates for arc IJ coordinates.**
- **F instruction disable: If selected, the F instruction is disabled and the F instruction following the G code (i.e., the speed limit instruction) is ignored.**
- **The default unit is metric and imperial, but metric is generally used.**
- **Turn on the debugging function: When the debugging function is turned on, the system will print out some debugging information. After a fault occurs at the customer site, first enter the manufacturer mode, then go to the [Options] interface, at the bottom there will be a "System Log Output Level" option, select "Info", and enable the "Enable System Log Function". After the fault occurs, enter the "F5 System Diagnosis" interface, press SHIFT+L to save the log, which will save the system log to a USB drive for technical personnel to analyze the issue.**

- **System output log level: There are four options to choose from, O FF, ERROR, WARNING, I NFO, D BG.**
- **Enable system logging function: check to enable the system logging output function.**
- **Floating coordinate system: Check to use the floating coordinate system.**
- **Automatic zero return after startup: the candidate coordinates are returned to zero each time they start.**

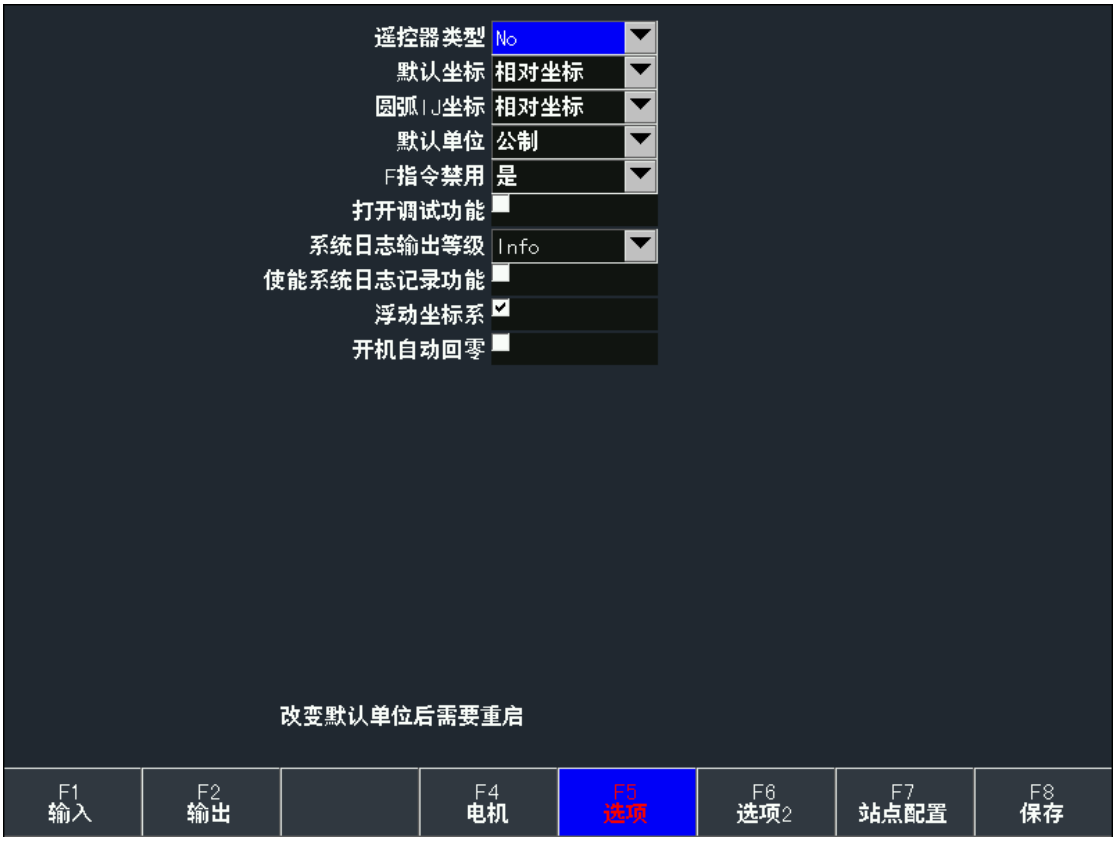


Figure 8.1 Option Settings 7

8.7.2.5 Option 2

- **Axis selection: Select X (pipe diameter axis), Y (pipe length axis), B (clamp axis) or F (focus axis). Set the corresponding parameters as follows.**
- **Back zero sequence: the back zero sequence of the selected axis at present. For example, if it is set to 1, it means that when back zero is performed, the first selected axis will back zero first, and then other axes will back zero.**
- **Zero return enable: If this item is selected, the current shaft will be returned to zero; otherwise, when the zero return operation is performed, the current shaft will not be returned to zero.**
- **Back to zero direction positive: if it is set to be true, the current axis will go back to zero in the positive direction, otherwise it will go back to zero in the negative direction.**
- **First return to zero speed: the speed at which the current shaft first looks for the return to zero switch. At this time, only the approximate range of the return to zero switch is found, so this speed can be slightly higher.**
- **Second return to zero speed: The speed of the current shaft when it is searching for the return to zero switch for the second time. At this time, the range of the return to zero**

switch has been determined, so the speed needs to be smaller to improve the accuracy of return to zero.

- **Zero Point Bias: The actual machine tool zero point relative to the position of the zero return switch. If the position of the zero return switch is not the position of the machine tool zero point, this parameter is required to set the position of the machine tool zero point.**
- **Machine tool docking position: the coordinate position that the current axis needs to dock after zero return.**
- **Machine coordinate processing: use machine fixed coordinates for processing.**
- **The zero return limiter returns to zero first: After enabling, the zero return limiter returns to zero before the XYZABC and other axes.**

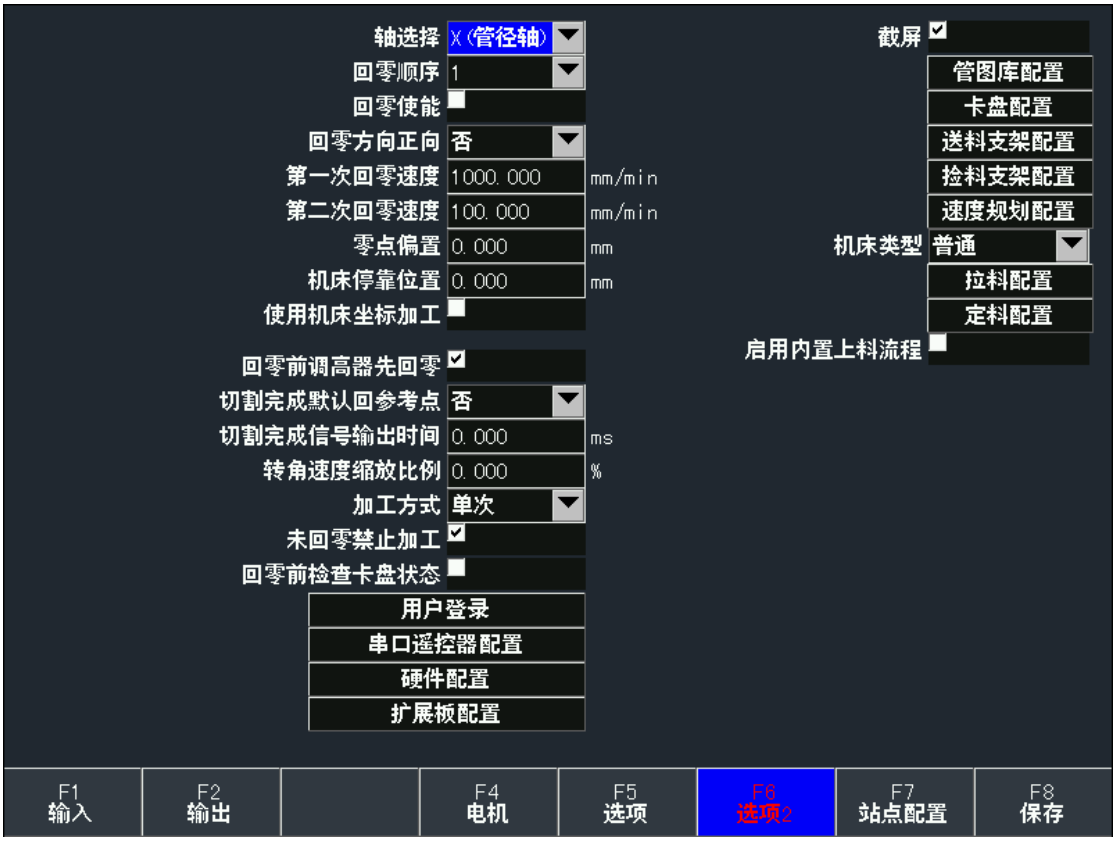


Figure 8.1 Option 2 Settings

- **After cutting is completed, it defaults to returning to the reference point: whether to automatically return to the reference point after cutting is completed (the reference point is the starting point for cutting, which becomes the reference point after the F8 coordinate is reset); if selected, a prompt window will pop up indicating the need to return to the reference point after cutting is completed.**
- **Output time of cutting completion signal: The duration of output of cutting completion signal when cutting is completed. The unit is milliseconds.**
- **Ramp-up speed scaling ratio: This parameter can adjust the corner speed during cutting, with the actual corner speed being the system-specified corner speed multiplied by this percentage value. For example, if this value is set to 2,00, the actual corner speed is twice**

the system-specified corner speed; if this parameter is set to zero, the corner speed is the systems default planned speed.

- **Processing mode: single/cycle.**
- **Do not process if not back to zero: After selecting, check whether the enable back to zero axis is back to zero before processing. A prompt will be given for the axis that has not been back to zero.**
- **Check the chuck status before zeroing: If the chuck is not loosened before zeroing, the error will be reported. Otherwise, the chuck status will not be checked before zeroing.**
- **User login: according to different login levels, use different function permissions.**
- **Serial port remote control configuration: generally not used, ignore.**
- **Hardware configuration: see section 8.7.2.7.**
- **Extended configuration: see section 8.5.2.**
- **Pipe library configuration: see section 8.7.2.8.**

8.7.2.6 Site configuration

To communicate with the laser tilter and laser, you must set the parameters for these devices in the site configuration.

In the site configuration, the communication parameters of the laser modulator and laser generator can be set, as shown in Figure 8.20.

This controller can be used in conjunction with the Jiaoling laser height adjuster. When the Jiaoling height adjuster is selected, the height adjuster model can be selected as iHC 100 or iHC 100B.

This CNC system is connected to the height regulator through a network. The IP address of the height regulator is filled in. For specific usage, please refer to section 1 3.2.

Figure 8. 19 Laser height adjuster connection setup

8.7.2.8 Pipe library configuration

The pipe library configuration function can be used to adapt to different machine tool structures.

Figure 8. 20 tube library

- **Enable the pipe library: only by checking it, F 1 graphic management will have the pipe cutting graphic element.**
- **Enable Layout: When enabled, there are parameters such as "shared edge", "part gap", "pipe length", and "allow reverse layout" in graphic management-layout configuration. When not enabled, only the "pipe length" parameter can be set.**
- **XYBZ (Axis) Direction: When set to reverse, the value corresponding to the axis direction in the G code of the graphic library is set to a negative value when added again.**
- **G code output Angle/Length Accuracy: Angle axis accuracy refers to the angle that the chuck shaft rotates each time, G codes will generate code lines according to this accuracy, that is, one line of G codes per certain angle. The linear axis sets one line of G codes per unit length.**
- **Limit machining distance: When the value is set to 0, the function of opening holes near the chuck is not enabled. When it is set to 100, it means that the hole is opened at a distance of 100mm from the chuck (100 means that the hole will not exceed 100mm).**
- **Multiple parts for single pull: Check to enable this function**
- **Other parameters: The automatic feed machine tool needs to be used when PLC is needed, and the conventional machine tool does not need to be set.**

8.7.3 Encryption

In the main interface, press [F5 System Diagnosis], [F8 System Definition], and press [F4 Encryption]. The system can be encrypted. Encryption is divided into time encryption and frequency encryption.

If the system has time or frequency encryption, when the encryption expires, the system will not be usable and must be decrypted before it can be used again.

8.7.2.7 Hardware configuration

In the hardware configuration, this controller can set F LCAN configuration, Modbus communication parameters, network communication parameters.

1) The FLCAN configuration and parameter description are as follows.

CNC node address: CNC node address on the F LCAN bus, which is generally defaulted to 6 5.

The timeout time for the PDO of C NC monitoring equipment: If C NC monitors the periodic PDO of the device, and C NC does not receive the PDO message within the multiple of the PDO cycle specified by this parameter, C NC will consider the device offline. For example, if this parameter is 3.5 and the PDO cycle is 1 0ms, if C NC does not receive the PDO message within 3.5ms, it will also consider the device offline.

SDO error retransmission times: the maximum number of times that SDO communication errors can be retransmitted.

SDO response timeout time: the maximum time for SDO communication to wait for a response, in ms.

The number of SDO errors retransmitted when the device is online: The maximum number of SDO communications that can be retransmitted during the initialization process of the device online.

SDO response timeout time when the device is online: The maximum waiting time for SDO communication to receive a response during the initialization process of the device, in ms.

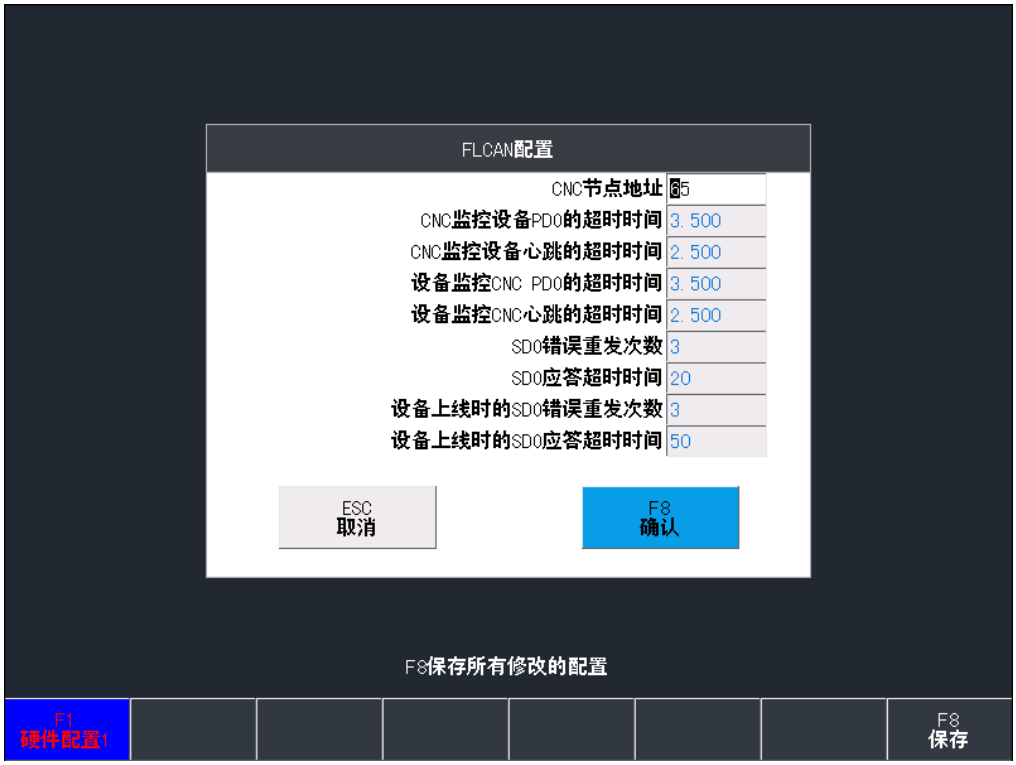


Figure 8.2 1 FLCAN configuration

2) Modbus configure

Modbus Protocol communication requires setting parameters such as port, baud rate and parity check. The system can be connected with other devices through serial port.

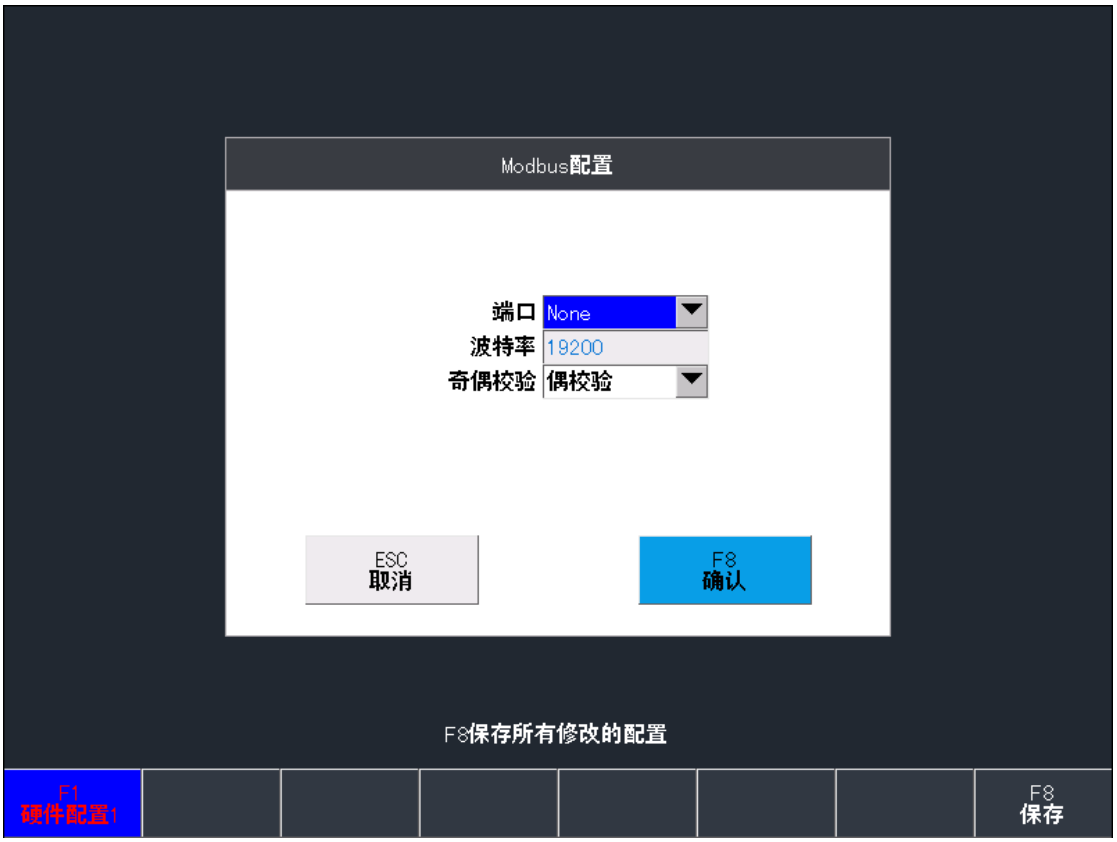


Figure 8.2 2 ModBus configuration

3) line configuration

Here, the network configuration is set up with the local IP address and other information. The network parameters are set up by connecting with the laser tuner through the network. Please refer to section 13.2 for the network parameters.

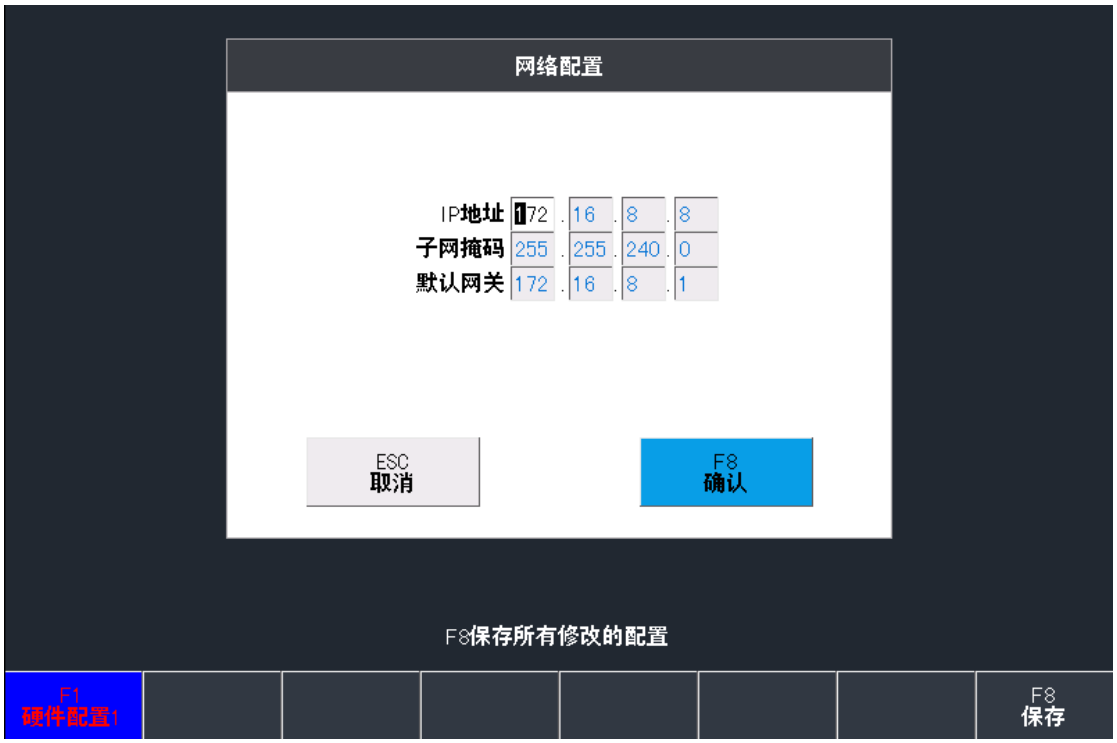


Figure 8.2 3 Network configuration

8.7.4 Decryption

In the main interface, press [F5 System Diagnosis], [F8 System Definition], and press [F5 Decryption]. The system can be decrypted.

8.7.5 Language switching

On the main interface press [F5 System Diagnosis] [F8 System Definition] and press [F6 Language]. You can switch between multiple languages until you select the language you need. After pressing the [ESC] key to exit the interface language will switch to the selected language.

8.7.6 Add language files

After obtaining the language pack file (****.lan) from the company, copy the language pack file to a USB drive and store it in the lan folder under the USB drive. Insert the USB drive into the systems USB port. Move the cursor up and down to "Add Language File" on this interface (Figure 8.2.4) and press Enter. There will be a prompt indicating whether the import was successful or failed.

This system can support most countries language files, and can also customize language files. Please contact our company when you need them.

Figure 8.2 4 Add language files

Figure 8.2 5 When importing language files, make sure that there are language files in the USB drive

8.7.7 Clearing of documents

Press F5 System Diagnosis and F8 System Definition on the main interface, then press ↓ to move the cursor to the "Clear File" button, and press ENTER. After clearing, all the cut code files under the hard disk file are cleared.

8.7.8 System upgrade

On the main interface, press [F5 System Diagnosis], [F8 System Definition], and then [F8 System Upgrade] to perform a program upgrade. At this point, ensure that the USB drive is inserted into the systems USB port; otherwise, a prompt will appear reminding you to "Please insert the USB drive!" If the USB drive is already inserted, when you press [F8 System Upgrade], a dialog box will pop up as shown in Figure 8.27. Click the OK button or press [ENTER] to confirm, and a prompt for the upgrade will appear as shown in Figure 8.2 6.

Figure 8.2 6 Confirmation of upgrade

Figure 8.2 7 Upgrade options

[F1] Function upgrade: Press [F1] to perform function upgrade. The corresponding file for function upgrade is F 2000V5.upg.

[F2]Interface Upgrade: Press [F2] to perform the interface upgrade, the corresponding upgrade file name is WELCOME.bmp (8-bit depth map) or welcome.jpg, with a resolution of 800×600, place this file in the root directory of the USB drive. The interface refers to the boot screen that appears upon first boot after turning on the computer, as shown in Figure 2.3. For more information on creating the welcome screen, please contact our company.

[F4]Factory Settings: After pressing [F4], the system will perform a reset, and the system will be completely restored to its pre-factory state, including parameters, IO port configuration, coordinate direction definitions, etc., all will be restored to their pre-factory state. Generally, please do not use this function to reset the system.

Chapter 9 Graphic Management

Under the main interface, press [F1] to enter the image library page,

9.1 Circular pipe library

Press [F1] to enter the graphic management page, that is, the pipe library page.

There are 1 6 pipe cutting elements in the circular tube library, which can be combined in various ways.

Figure 9.1 Pipe cutting library interface I

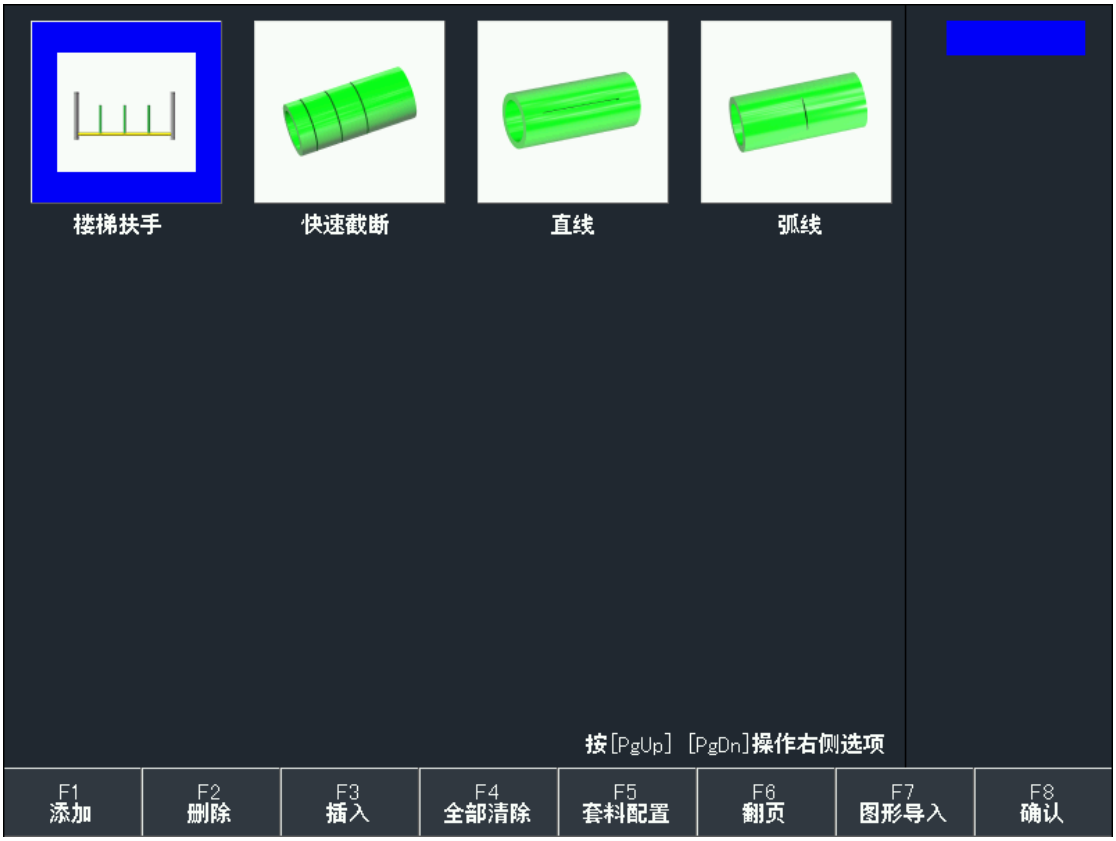


Figure 9. 2 Pipe cutting library interface II

On the right side of the pipe library page, pipe cutting elements can be added from top to bottom. After selecting each element, its dimensional parameters can be set. For the topmost element, once the pipe diameter and wall thickness are set, no changes can be made to the pipe diameter and wall thickness when adding more elements below; only other parameters can be modified. After all element parameters are set, a cutting combination is formed.

[F1 Add] can add a graphic element, or select it and use ENTER to edit the parameters;

[F2 delete] can delete the graphic element in the pull-down box under the current blue background;

[F3 Insert] insert a graphic element downwards;

[F4 All Clear] can clear all the graphics in the right drop-down box;

[F5 Material Configuration] The material parameters can be set (enabled by checking the box).

[F8 confirmation] After the parameter setting is completed, the code is generated and the graphic is cut.

Figure 9. 3 Tube cutting element combination and setting parameters

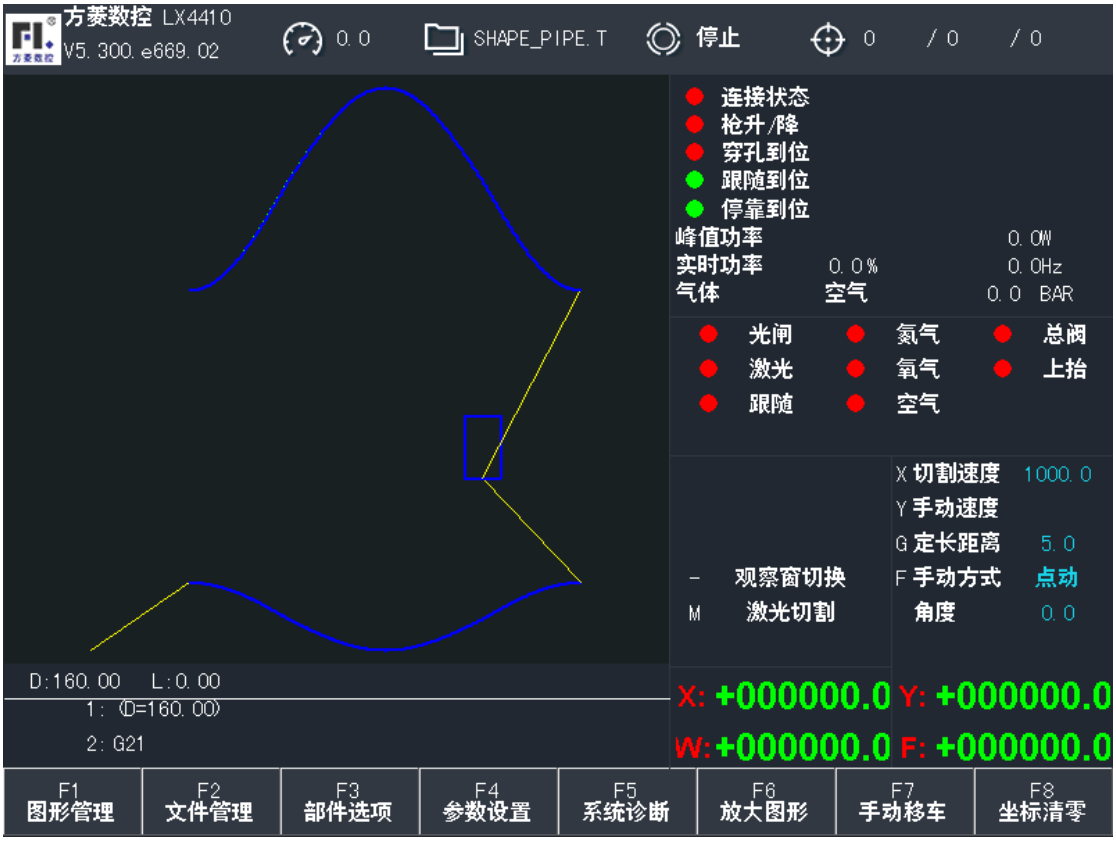


Figure 9. 4 Tube cutting graphic interface

Figure 9.2 shows the combination of three pixels. After the parameters are set, confirm to display as shown in Figure 9.3

9.2 Circular pipe cutting diagram

9.2.1 Terminal cutting

The first end cutting is to cut off the first end of the round pipe, and the remaining part at the tail side is the required workpiece. The tail end cutting is opposite to the first end cutting.

Figure 9. Interface for cutting parameters at the end

Diameter A: diameter of the pipe, unit mm.

Tube wall thickness B: tube wall thickness of circular tube. Unit mm.

Cut-off Angle C: the acute angle formed between the axis and the cutting plane. Unit: degree.

Axis distance P: This parameter refers to the distance between the intersection of the current section of the graphic and the centerline of the tube to the gun point when the graphic combination starts cutting. Unit: mm.

Screw Rotation Angle: The angle the chuck needs to rotate relative to the positioning point before cutting. The set angle is positive when viewed from the pipe head towards the chuck, counterclockwise. Unit: Degrees. (Effective when combined, meaningless individually)

Introduction line length: unit: mm.

Lead length: unit: mm.

9.2.2 Tail saddle

The tail saddle is cut off at the end of the round tube, and the remaining part on the front side is the workpiece needed. The cutting is made at the joint part of the branch tube. In Figure 9.6, the gray tube is the mother tube, and the green tube part is the branch tube.

Diameter A of this tube: the outer diameter of the tube to be cut, A in the schematic diagram. This parameter can only be set in the first drop-down box of the end type selected in Figure 9.6. Unit: mm.

Tube wall thickness B: the wall thickness of the tube being cut, as shown in the figure. This parameter can only be set in the first drop-down box of the end type selected in Figure 9.6. Unit: mm.

Diameter C of the saddle mouth: the diameter of the parent tube of the intersecting tube to be cut, C in the figure, unit: mm.

D: wall thickness of the pipe section, unit: mm, as shown in the figure.

E: Angle between branch pipe and main pipe, E in the figure, unit: degree.

F: Eccentricity F: The centerline of the branch pipe and the centerline of the main pipe may not be in the same plane. This parameter represents the perpendicular distance between the centerline of the branch pipe and the centerline of the main pipe. Unit: mm.

Axis distance P: This parameter refers to the distance between the intersection of the current section of the graphic and the centerline of the tube and the gun point when the graphic combination starts cutting. Unit: mm.

Screw Rotation Angle: The angle the chuck needs to rotate relative to the positioning point before cutting. The set angle is positive when viewed from the pipe head towards the chuck, counterclockwise. Unit: Degrees. (Effective when combined, meaningless individually)

Introduction line length: unit: mm.

Lead length: unit: mm.

Takeover mode (Ride 0/Insert 1): The parameter selects the way of connection, and the parameter value can be input 0 or 1 to switch between riding and inserting takeover modes.

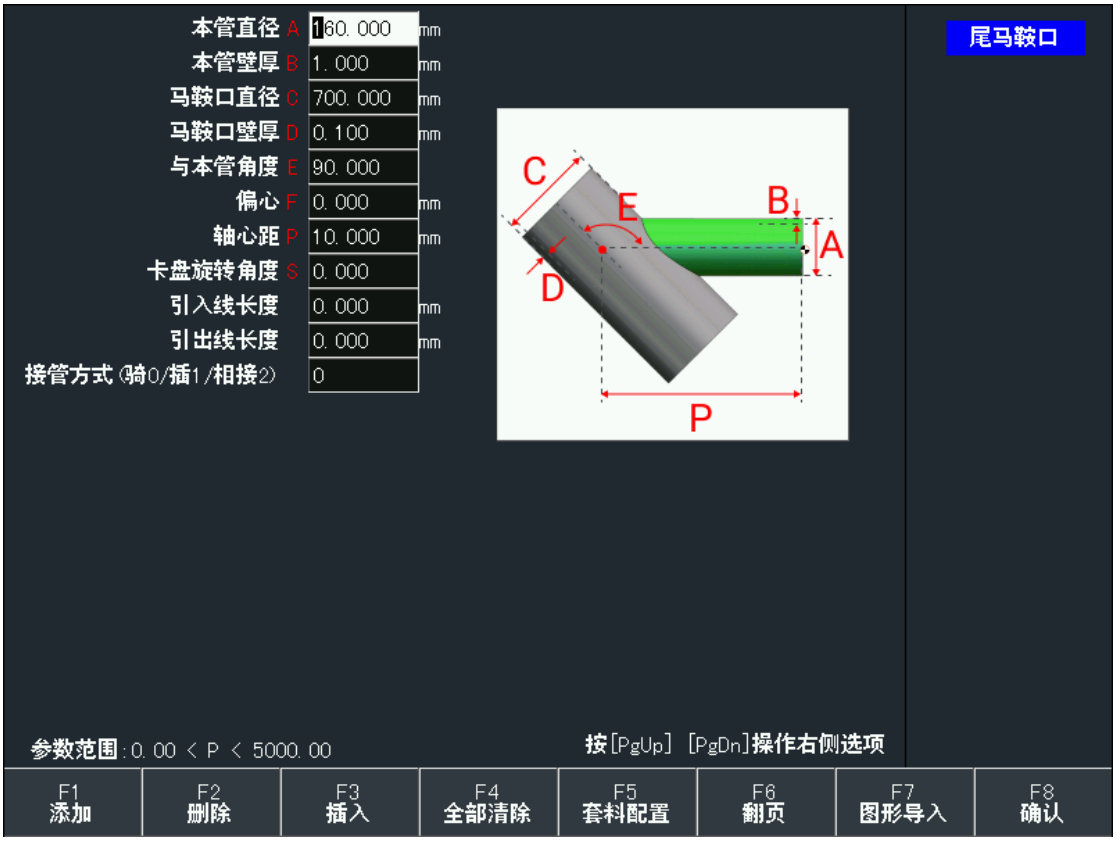


Figure 9.6 Tail saddle parameters interface

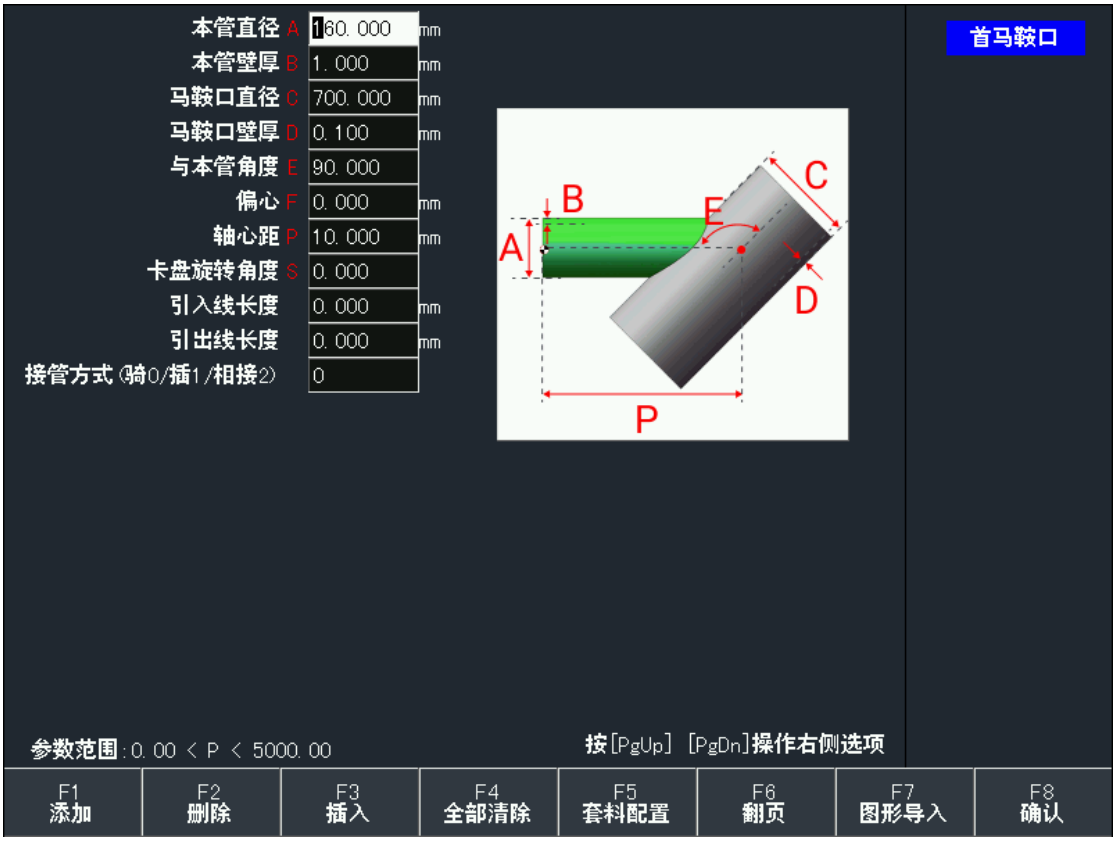


Figure 9.7 First saddle mouth parameter interface

9.2.3 Open the hole

The opening of the round hole is the position where the branch pipe is inserted on the round pipe mother pipe. In Figure 9.8, the green pipe is the mother pipe and the gray pipe is the branch pipe. (The same parameters are not introduced)

Hole type (0:YW/1:XY): When it is 0, it is YB hole and feed axis + chuck hole; when it is 1, XY hole and feed axis + cross axis, similar to plane hole.

Piercing (yes/no 0): If it is 0, no through hole will be opened; if it is 1, a through hole will be opened on the opposite side.

Enable array (0: disable / 1: enable): 0 for no array, 1 for array.

Number of holes in the direction of the tube length: the number of holes in the X-axis direction array, excluding the first hole.

L: the spacing of the direction hole of the pipe, L on the schematic diagram. Unit: mm.

Number of rotation direction holes: the number of arrays in the B-axis rotation direction, excluding the first hole.

Rotational Direction Hole Spacing V: Angle spacing of the rotational array, V on the schematic diagram. Unit: degrees.

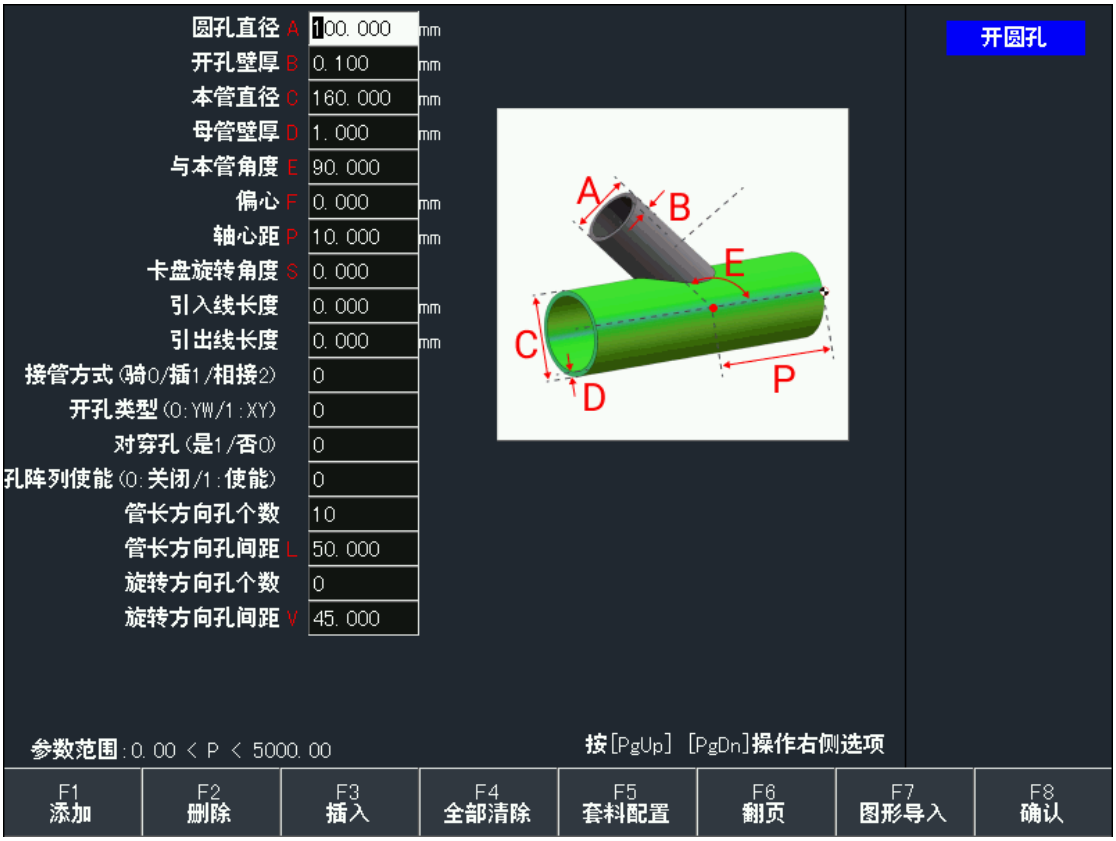


Figure 9.8 Open hole parameter interface

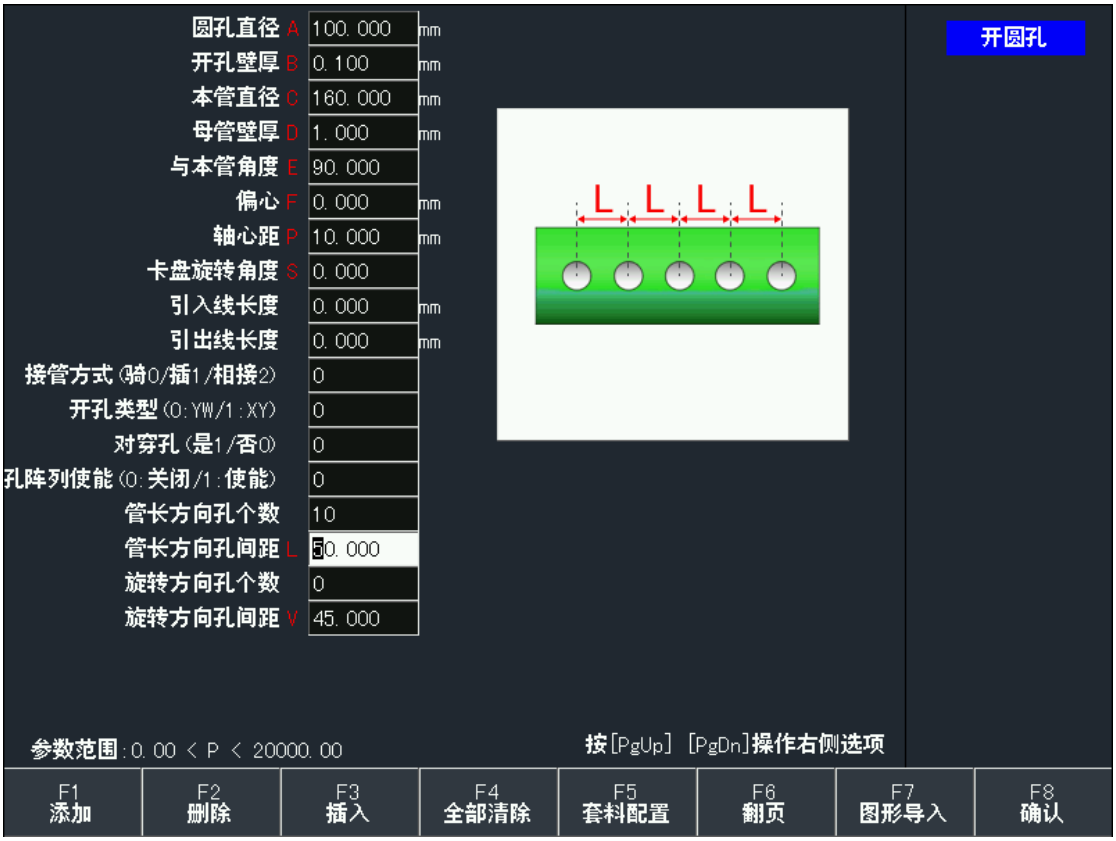


Figure 9. 9 Open hole tube array

Figure 9. 10-hole rotating array

9.2.4 Fissure

The square hole is a square hole opened on the wall of the round tube mother pipe. In Figure 9.11, the green part is the mother pipe view, and the gray part is the opened hole, which is square in the view. (The same parameters are not introduced)

Radial width C: the width of the hole in the direction of the diameter of the mother tube, C on the schematic diagram, unit: mm.

Axial width D: the width of the hole in the direction of the axis of the mother tube, D on the schematic diagram, unit: mm.

Opening chamfer radius R2: the inner chamfer of the cut square hole, R2 on the schematic diagram.

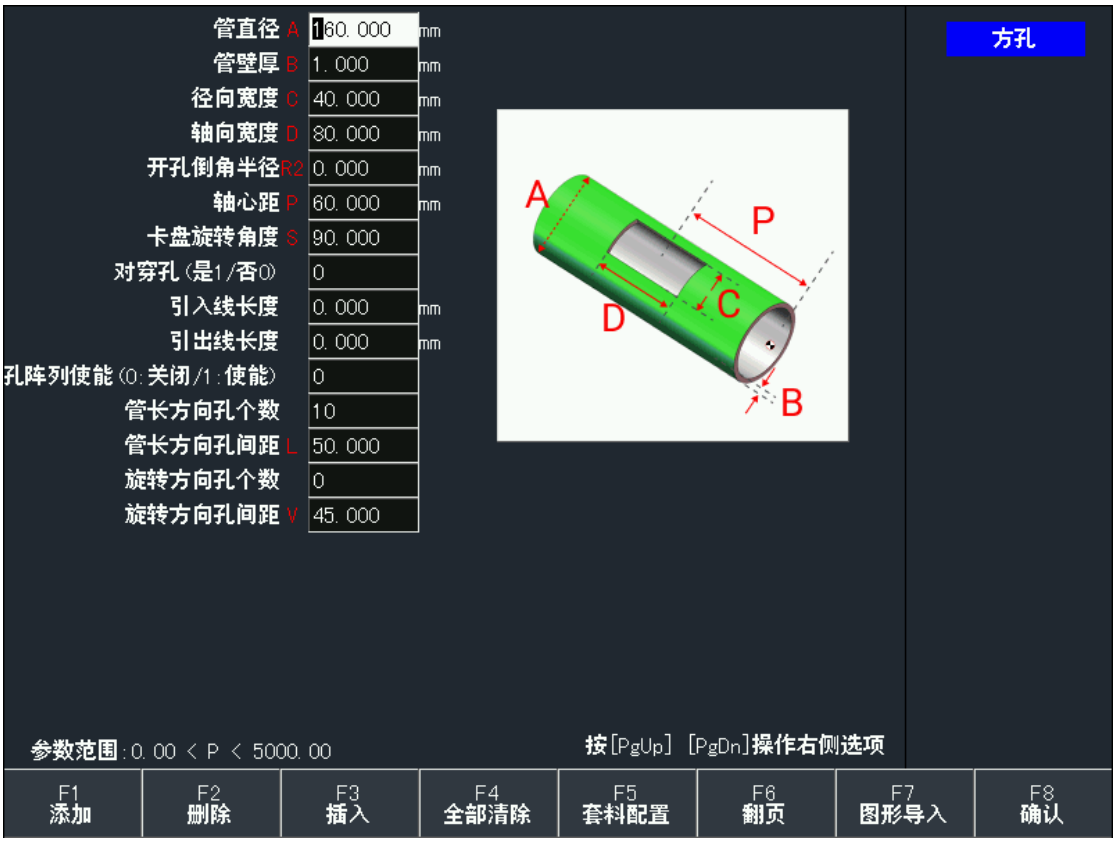


Figure 9. Interface of 11 hole parameters

9.2.5 Bends

Bend pipe is the process of cutting a round pipe at different angles and finally connecting it into a section of bend pipe (the same parameters are not introduced).

Bend Angle C: the overall angle of bending of the bent part of the pipe, C in the schematic diagram, unit: degree.

Bend radius D: the radius of the arc formed by the bending part of the bend pipe, D in the schematic diagram, unit: mm.

Extension E: the length of straight pipe that needs to be left on the side of the bend before bending, E in the figure, unit: mm.

Extension F: the length of straight pipe that needs to be left on one side after bending the pipe, F on the schematic diagram, unit: mm.

Axis distance P: meaningless, no need to set.

Number of bends: the number of cut pipes that make up the bending part of the bent pipe.

Whether the edges are common: 0 means no common edge cutting, and the lead can be set; 1 means common edge cutting, and the lead cannot be set.

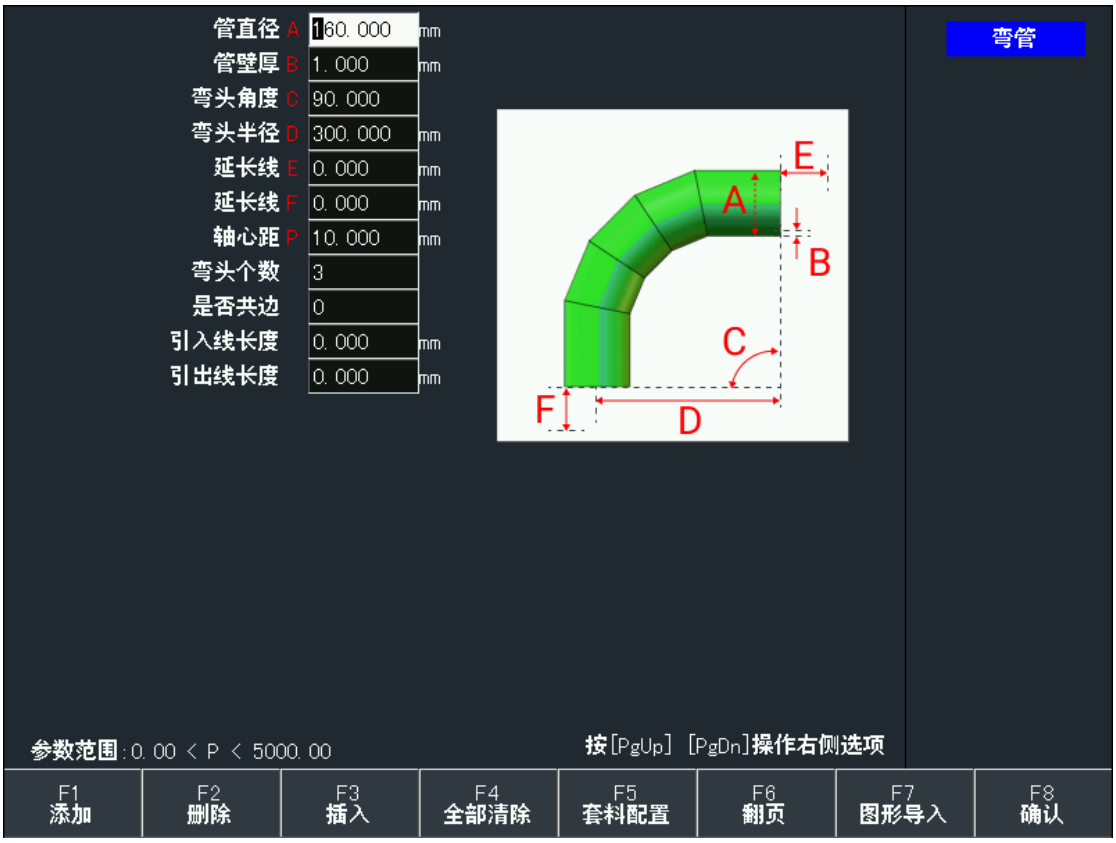


Figure 9.1 2-bend pipe parameter interface

9.2.6 Lumbar foramen

The waist round hole is a round hole cut out of the wall of a round tube. In Figure 9.13, the green part is the top view of the mother tube, and the gray part is the hole that has been cut out, which is waist round in the top view. (The same parameters are not introduced)

Waist width C: the waist width of the cut waist hole, C in the schematic diagram, unit: mm.

Waist length D: the waist length of the cut waist hole, D in the schematic diagram, unit: mm.

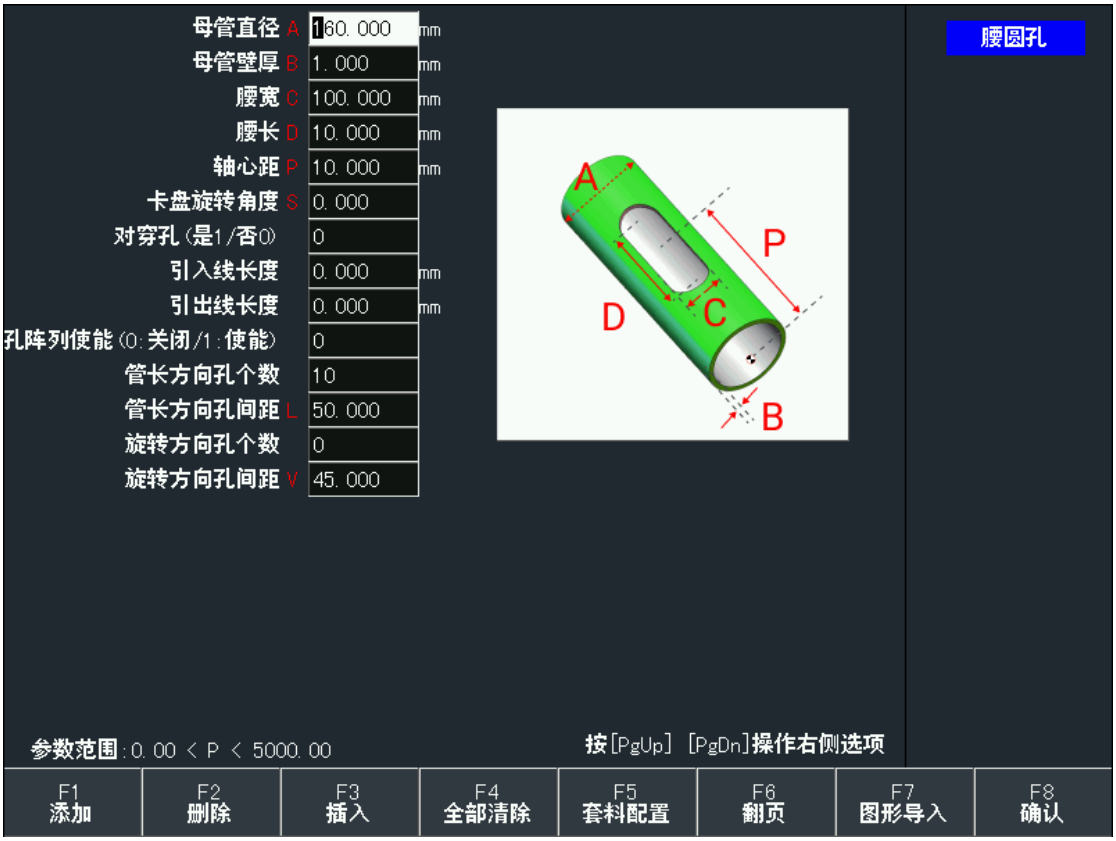


Figure 9.1 3 Waist hole parameter interface

9.2.7 Mother pipe-double branch pipe

The mother pipe-double branch pipe is the opening on the round mother pipe that opens up two branch pipes, used to connect two branch pipes. In Figure 9.1 4, the green pipe is the mother pipe and the gray pipe is the branch pipe. (Same parameters are not introduced)

Diameter A of branch pipe 1: outer diameter of the first branch pipe, A in the schematic diagram, unit: mm.

Diameter B of branch pipe 2: outer diameter of the second branch pipe, B in the schematic diagram, unit: mm.

Diameter C of the mother pipe: the diameter of the mother pipe intersecting with the cut tube, represented by C in the figure, unit: mm.

Wall thickness D1 of branch pipe 1: wall thickness of branch pipe 1, unit: mm.

D2: wall thickness of branch pipe 2, unit: mm.

E1: Angle between the rotating direction of branch pipe 1 and main pipe, E in the figure, unit: degree.

E 2: Angle between branch pipe 2 and main pipe in the positive direction, unit: degree.

G: the wall thickness of the mother pipe, which is the intersection of the cut pipe and the mother pipe, unit: mm.

Branch pipe 1 chuck rotation angle H 1: Branch pipe 1, the angle that the chuck needs to rotate relative to the positioning point before cutting. The set angle is positive when viewed from the pipe head towards the chuck, counterclockwise. Unit: degrees.

Branch 2 chuck rotation angle H2: Branch 2, the angle that the chuck needs to rotate relative to the positioning point before cutting. The set angle, viewed from the pipe head towards the chuck, is positive when counterclockwise. Unit: degrees.

F: the distance between the centerline of branch pipe 1 and the centerline of mother pipe. Unit: mm.

F: The distance between the centerline of branch pipe 2 and the centerline of main pipe. Unit: mm.

P: the distance between the intersection of the axis of branch 1 and the axis of mother pipe and the point of opposite gun.

P: the distance between the intersection of the axis of the branch pipe 2 and the axis of the main pipe and the point of the opposite gun.

Figure 9.1 4 Main pipe-double branch pipe parameter interface

Figure 9.1 Rotation Angle of 5 Main Pipe-Double Branches

Figure 9.1 6 Main pipe-double branch eccentric

9.2.8 Single branch-double branch

Branch-tube-dual-branch-tube involves cutting the end of a round tube to create a branch tube, and one operation can only cut one branch tube, so for the interface shown in Figure 9.1.7, the end of branch tube 1 is being cut. When it is necessary to cut the end of another branch tube, the parameters of the branch tubes need to be reset according to the existing parameters (branch tube 1 and branch tube 2 need to be swapped).

The specific parameters are the same as those of the main pipe and double branch pipe.

Figure 9.1 Parameter interface for 7 branch-tube and 2 branch-tube

9.2.9 Head end slot

The head slot is opened at the end of the pipe, while the tail slot is opened at the end of the pipe.

Channel width W: length in the direction of pipe diameter, W on the schematic diagram, unit: mm.

H: length in the direction of the tube length, H on the schematic diagram, unit: mm.

R1/R2 of U-shaped slot: the internal and external chamfer of the slot cut, R1 and R2 on the schematic diagram, unit: mm.

Number of permutations: the number of permutations in the direction of rotation.

Arrangement Angle: the arrangement Angle of the rotation direction, V on the schematic diagram, unit: degree.

Figure 9.1 Interface for parameters of the 8 terminal slots

Figure 9.1 Chamfer inside and outside of the 9 slots

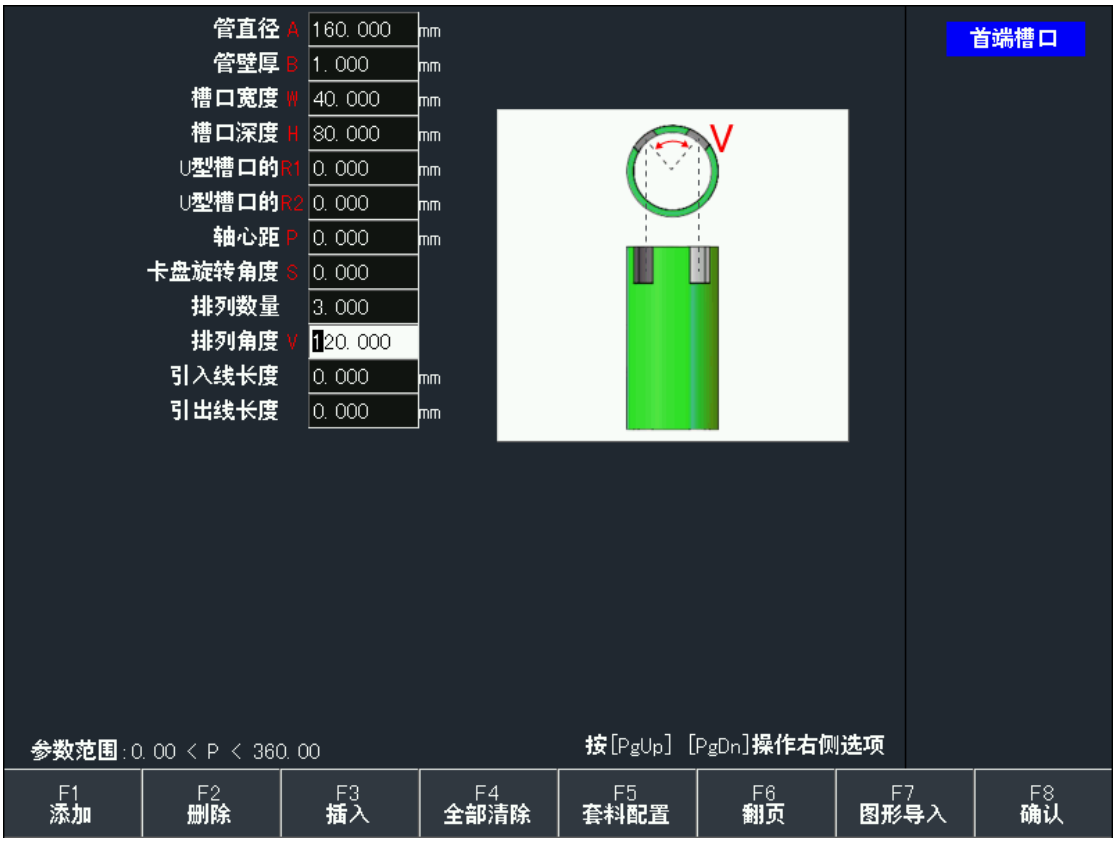


Figure 9. Angle of slot arrangement

9.2.10 Stair railings

The stair rail is used to cut holes in the green tube and cut both ends of the head and tail in Figure 9.21. The distance or number of cuts can be selected according to the type you want.

Tube length A: the length of the sectioned circular tube, A in the figure, in mm.

Diameter B: the diameter of the sectioned circular tube, B in the figure, unit mm.

Wall thickness C: wall thickness of the sectioned circular tube, C in the figure, unit mm.

Diameter of the mother pipe: The diameter of the mother pipe of the intersecting saddle mouth in the figure is shown in gray, with D as the unit in the schematic diagram.

Angle E: Angle between the sectioned green pipe and the intersecting saddle mouth and opening. The saddle mouth mother pipe is parallel to the opening branch pipe, that is, the large gray pipe in the figure, E, unit: degree.

Diameter F of branch pipe: the diameter of the small branch pipe with the opening in the figure, F in the schematic diagram, unit: mm.

Arrangement mode (0: distance/1 quantity): When it is 0, the number of holes is calculated according to the set spacing. When it is 1, the spacing is calculated according to the number of holes.

Distance L: When the arrangement mode is 0, this value is valid. When the length of the pipe is fixed, the number of holes is calculated according to the distance L. Since the number of holes cannot be a fraction, the distance between the last hole and the tail saddle is not necessarily exactly equal, so it needs to be calculated accurately.

Number of branches: When the arrangement mode is 1, this value is valid. When the length of the tube is fixed, the length is evenly divided according to the number of holes.

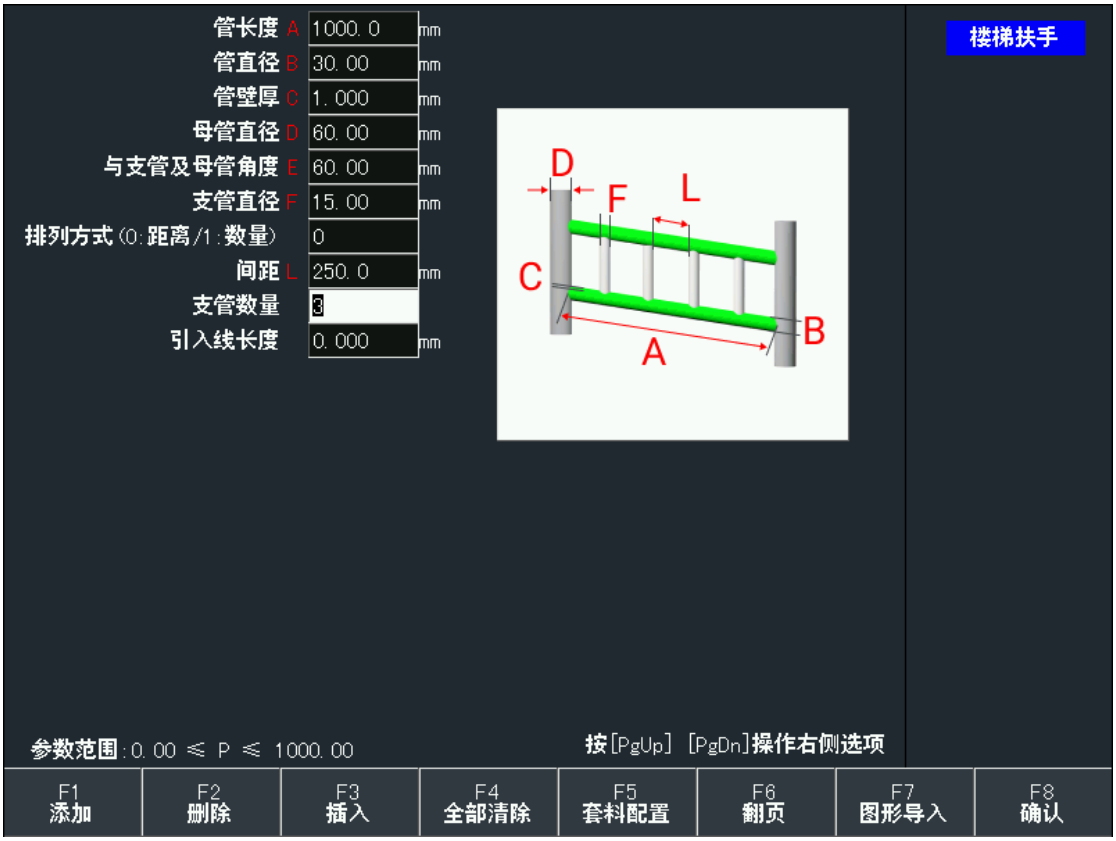


Figure 9. 21 Stair handrail parameter interface

9.2.11 Rapid cutoff

The rapid sectioning involves segmenting the green tube in Figure 9.22 to obtain different quantities and lengths.

Cut length 1-5: the length of each section of the vertical cut of a circular pipe, as shown in figure 1, 2, 3, 4 and 5, in mm.

Cut-off quantity 1-5: the number required for each cut-off.

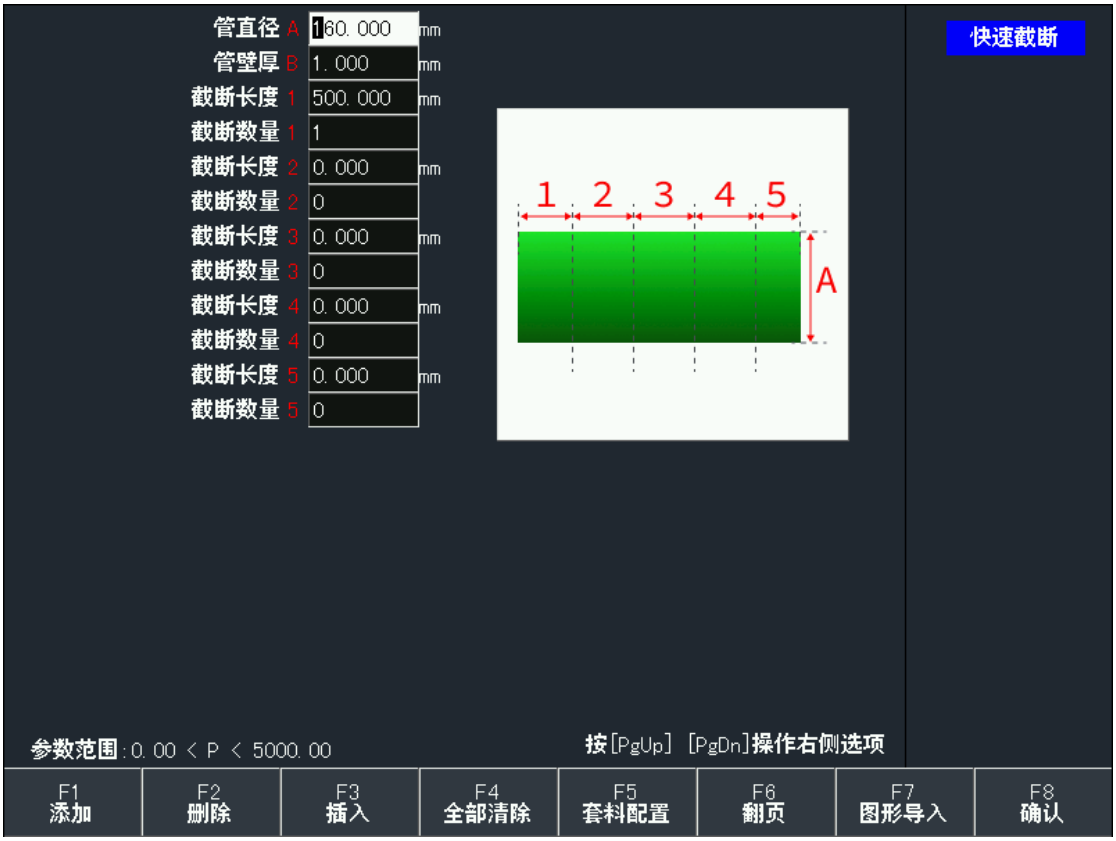


Figure 9. 22 Quick cut-off parameter interface

9.2.12 Straight line

The straight line is a line cutting in the direction of the length of the green pipe in Figure 9.23.

Length L: the length cut along the direction of the pipe. L in the figure, unit: mm.

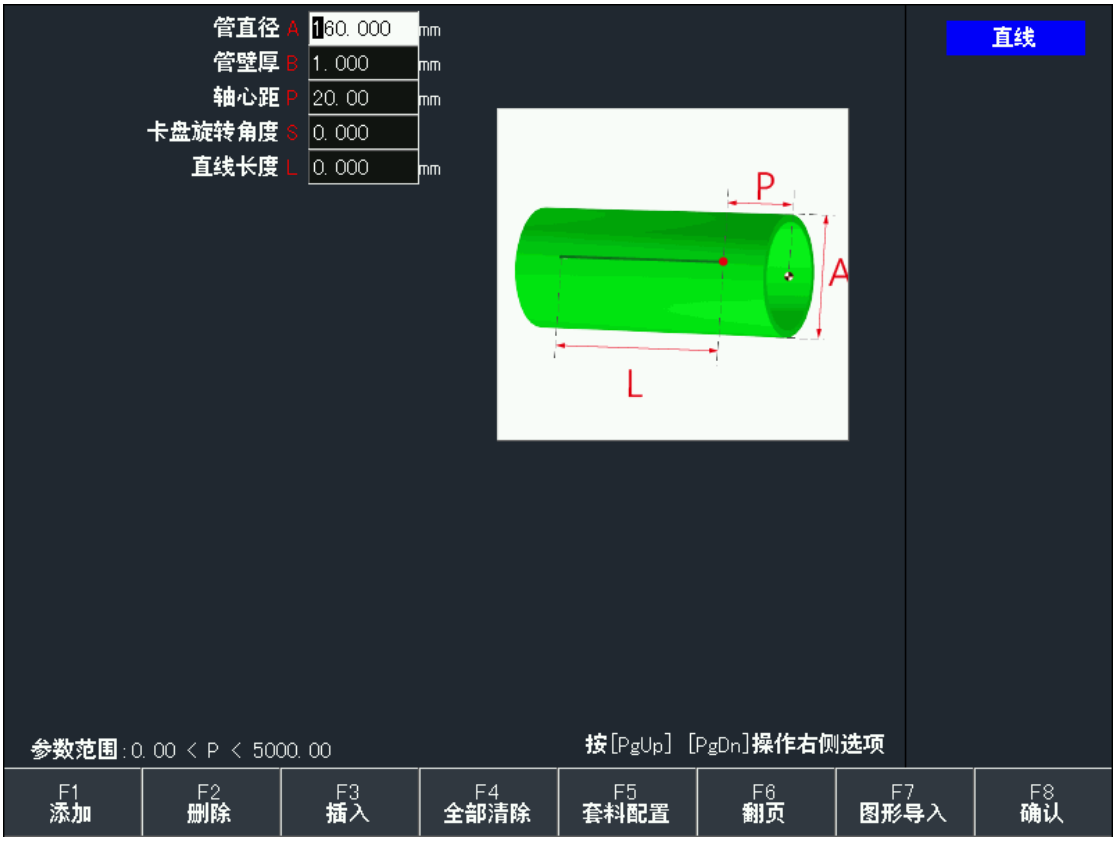


Figure 9. 23 Linear parameter interface

9.2.13 Arc

Arc is a line cutting with fixed length for fixing the direction of rotation of the green pipe in Figure 9.24.

Arc end Angle V: The length cut along the pipe direction, V in the figure, unit: degree.

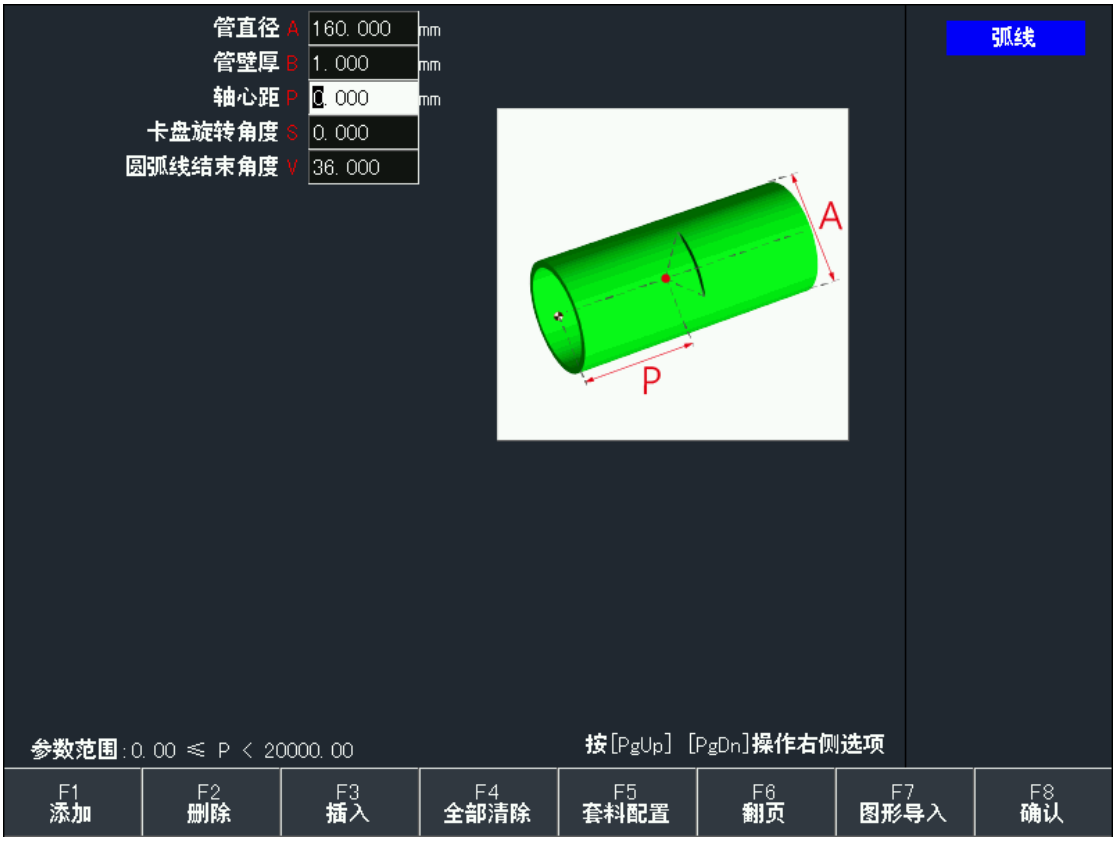


Figure 9. 24 Arc parameters interface

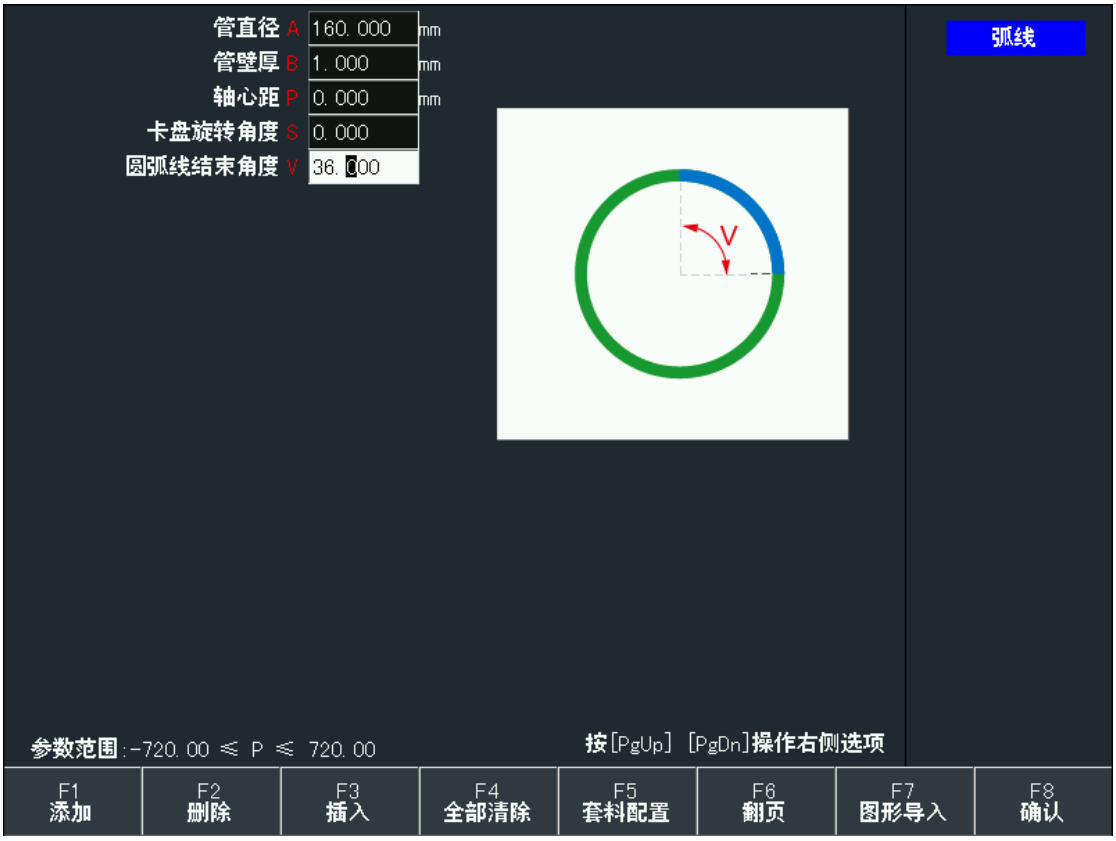


Figure 9. 25 arc length

9. 3 Pipe library

Press [F1] to enter the graphic management page, that is, the pipe library page.

There are 9 types of pipe cutting elements in the circular tube library, which can be combined in various ways.

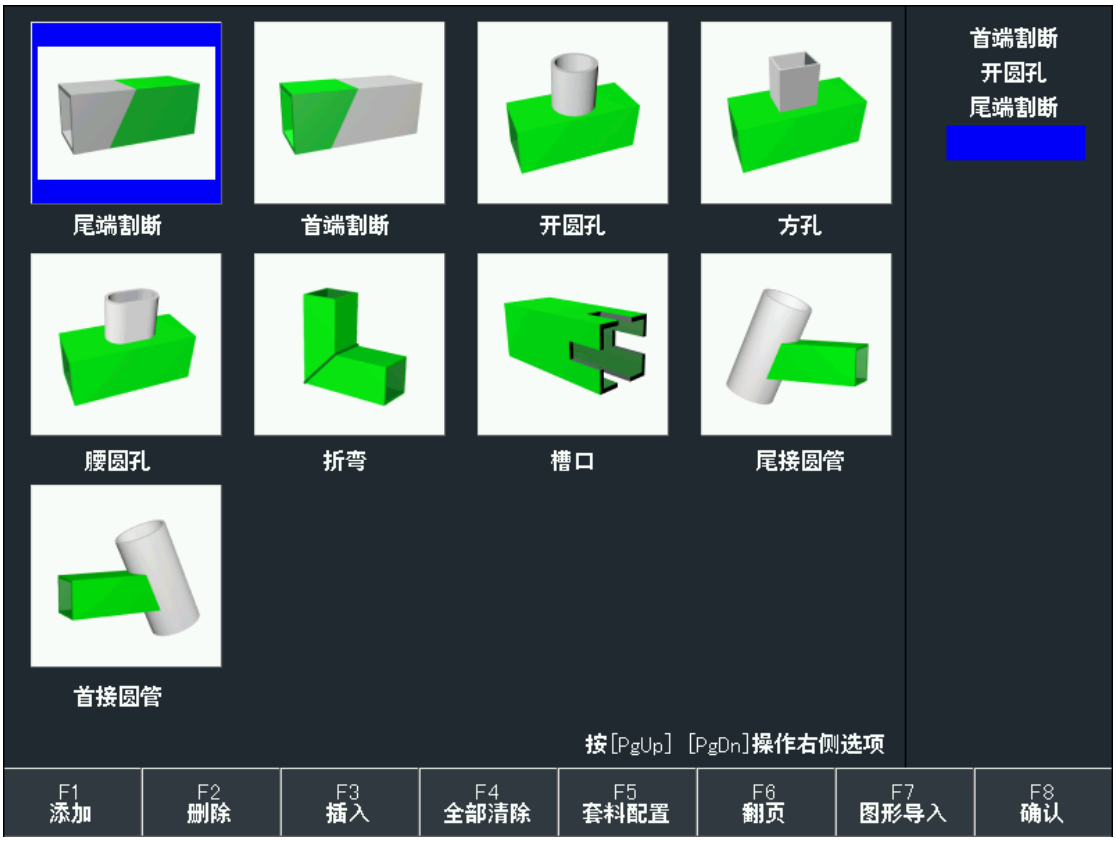


Figure 9. 26 Square tube library

9. 4 Square pipe cutting diagram

9.4.1 Tail break

The end cut is an angled cut of the green pipe in Figure 9.27, with the retained part being the green part, in the opposite direction to the head cut.

Mother pipe width W: the width of the sectioned square pipe, W in the schematic diagram, unit: mm.

Mother pipe height W: the height of the sectioned square pipe, H in the figure, unit: mm.

Radius of the corner C: the radius of the corner of the sectioned square pipe, C in the figure, unit: mm.

D: wall thickness of the mother pipe, D in the figure, unit: mm.

Axial distance P: the length of the section from the head to the tail end of the pipe (the intersection point of the central axis and the central axis), P, unit: mm.

Rotational Angle S: the angle of the intercepted figure relative to the starting point, S in the figure, unit: degree. (Effective when combined)

Cut-off mode (0 Angle/1 Distance): Angle cut-off when 0, distance cut-off when 1.

Inclined Angle G: The angle of the sectioned pipe. In the schematic diagram, G is effective when the cutting mode is 0. Unit: degree.

Slope distance N: the distance of the sectioned square pipe. The diagram shows that it is effective when G is cut in the way of 1, and the unit is degree.

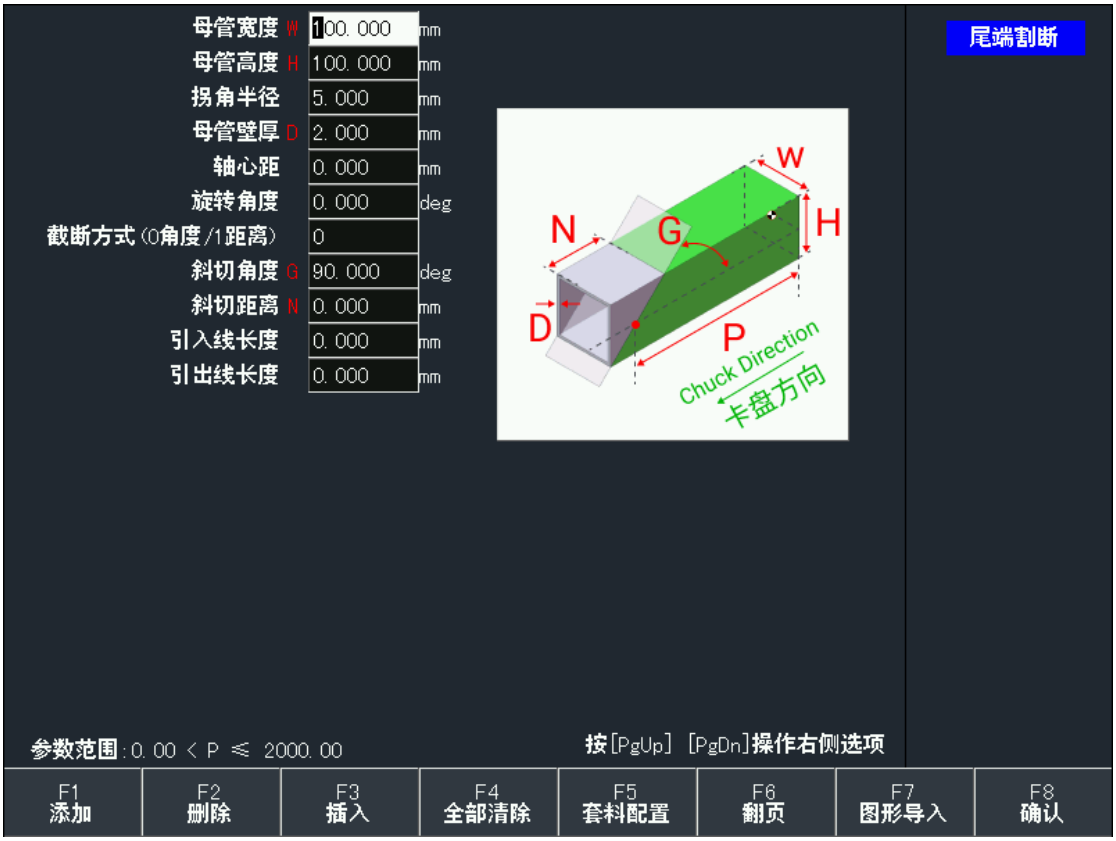


Figure 9. Interface for tail cutting parameters

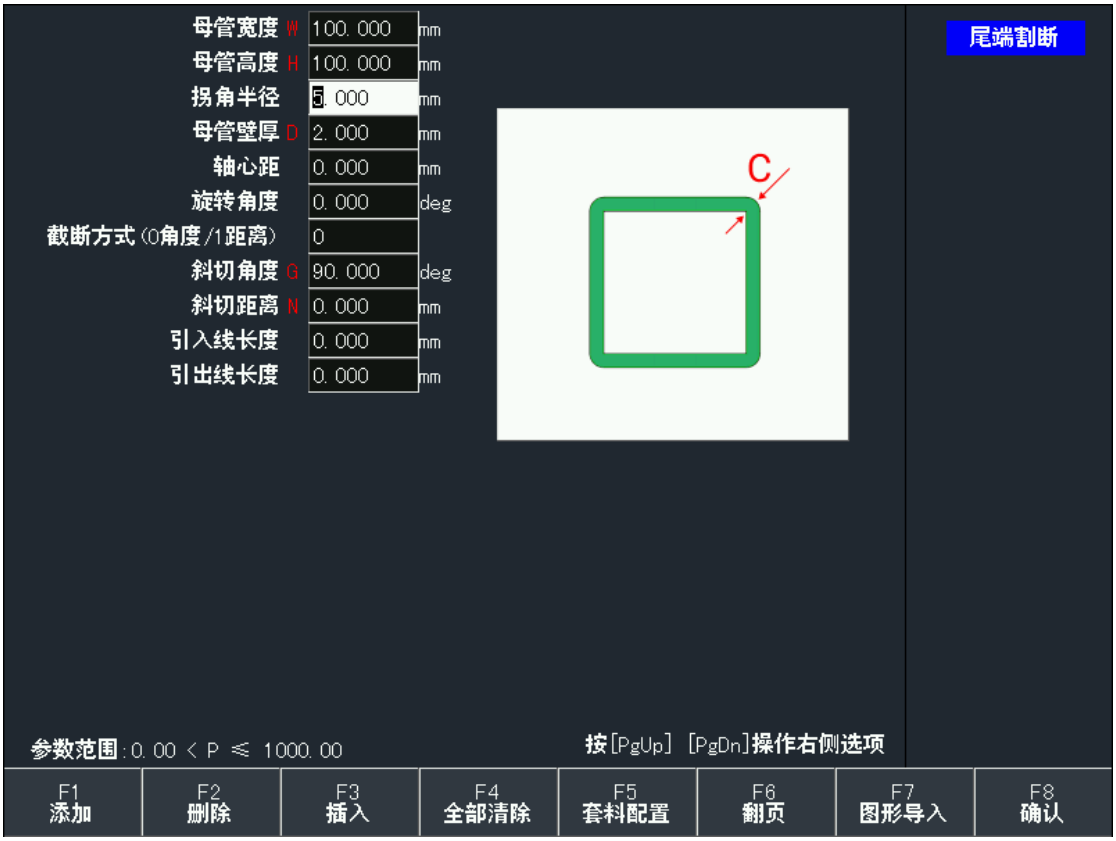


Figure 9. 28 Corner radius

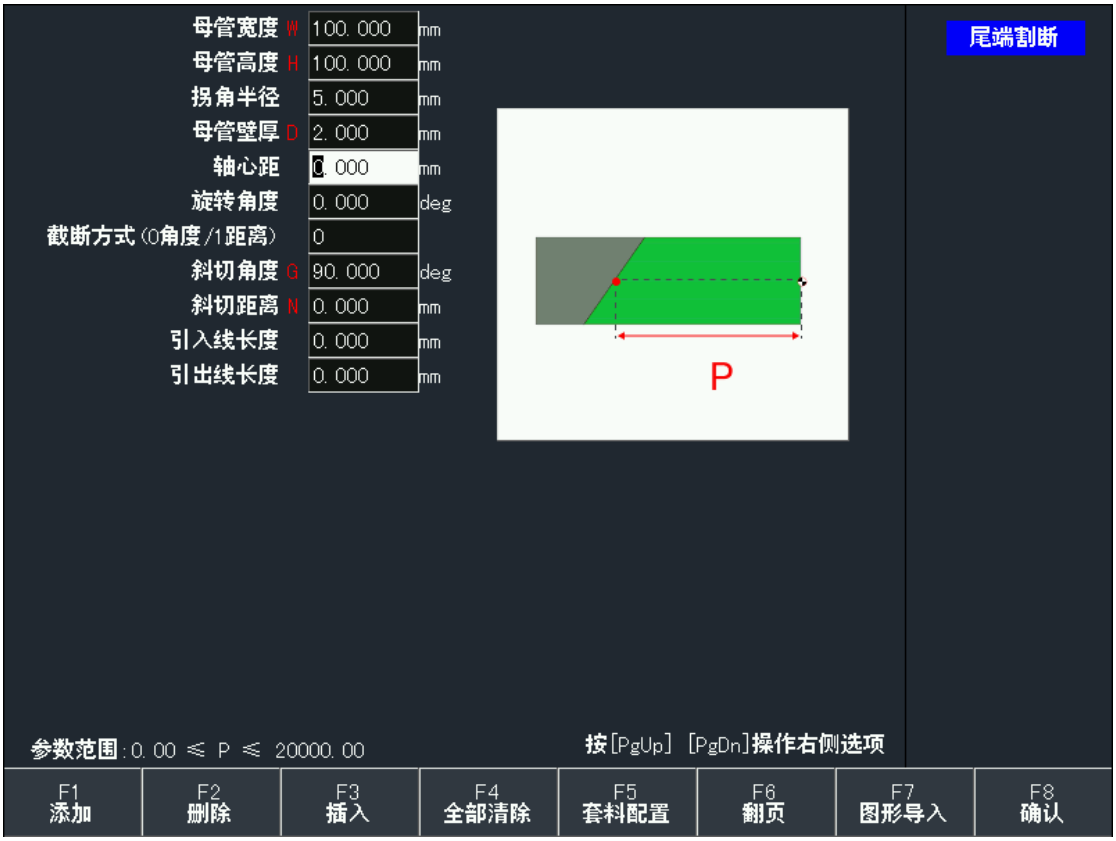


Figure 9. Axial distance of end-cut 29

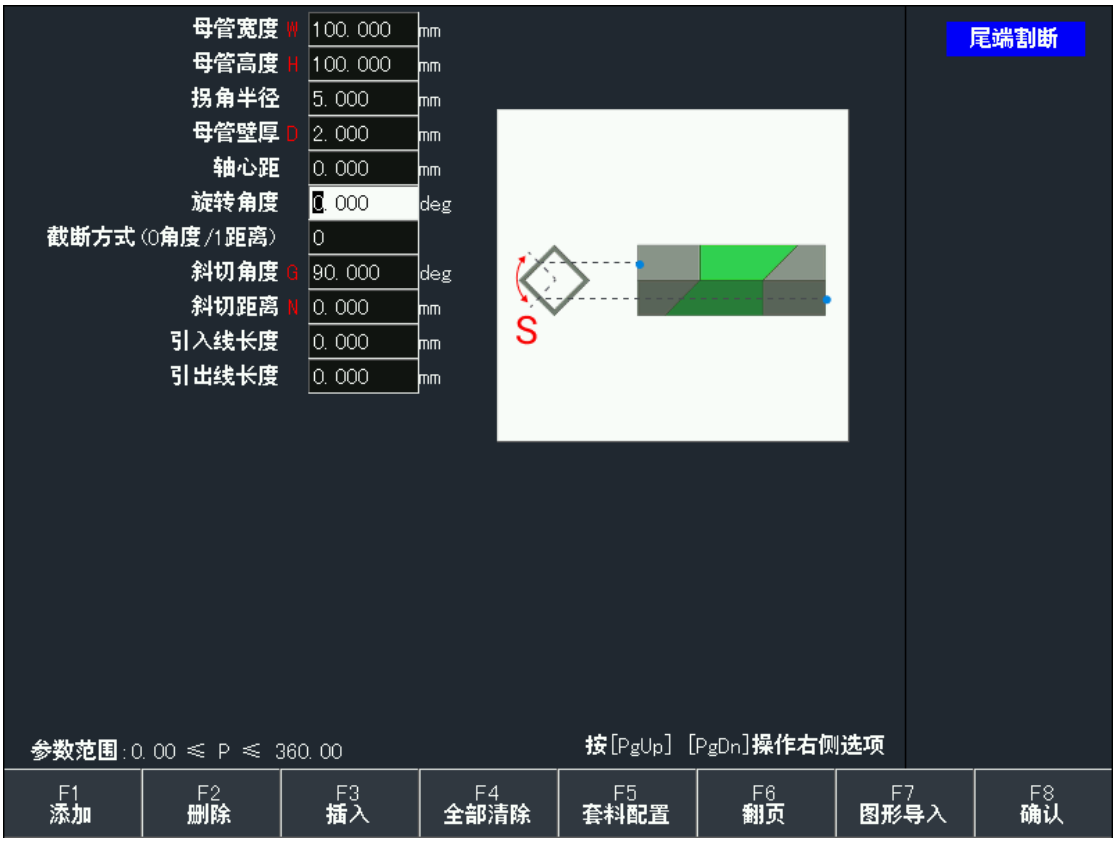


Figure 9. 30 rotation Angle

9.4.2 Open the hole

The square pipe opening is to open the green pipe with an angle as shown in Figure 9.31.

Diameter of hole A: opening diameter, A in the figure, unit: mm.

Pore wall thickness: the wall thickness of the gray pipe in the figure, unit: mm.

Axial distance P: the length from the head of the square pipe to the opening surface (the intersection point of the central axis) is shown in the figure P, unit: mm.

Rotational Angle S: Angle between the plane where the hole is located and the first part. S in the figure, unit: degree (effective when combined).

Cut Angle E: the angle of the opening between the branch pipe and the square pipe. E in the figure, unit: degree.

X eccentric distance F1: when the opening is in the X plane, the distance of deviation to the left and right of the pipe diameter direction, shown in the figure F1, unit: mm.

Z eccentric distance F2: the distance of vertical displacement in the height direction when the hole is in the Z plane, F2 in the figure, unit: mm.

Piercing (yes/no 0): If it is 0, no through hole is opened; if it is 1, a through hole is opened on the opposite side.

Enable array (0: disable / 1: enable): 0 means no array, 1 means array.

Number of holes in the direction of the tube length: the number of holes in the Y-axis direction array, excluding the first hole.

L1: the spacing of the holes in the direction of the pipe length, L1 on the schematic diagram. Unit: mm.

Number of holes in the pipe diameter direction: the number of arrays in the X axis direction, excluding the first hole.

L2: The spacing between holes in the pipe diameter direction for the X-direction array, L2 on the schematic diagram. Unit: mm.

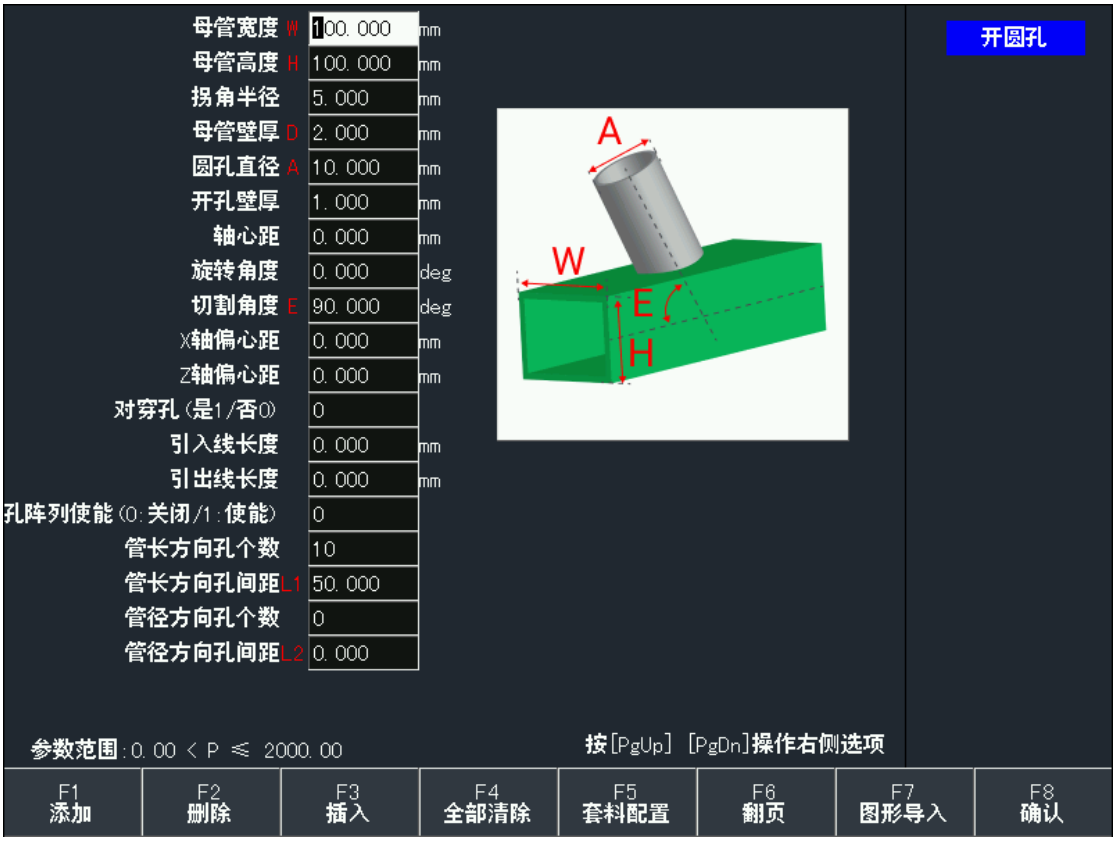


Figure 9. Interface of parameters for opening holes in 31 square tubes

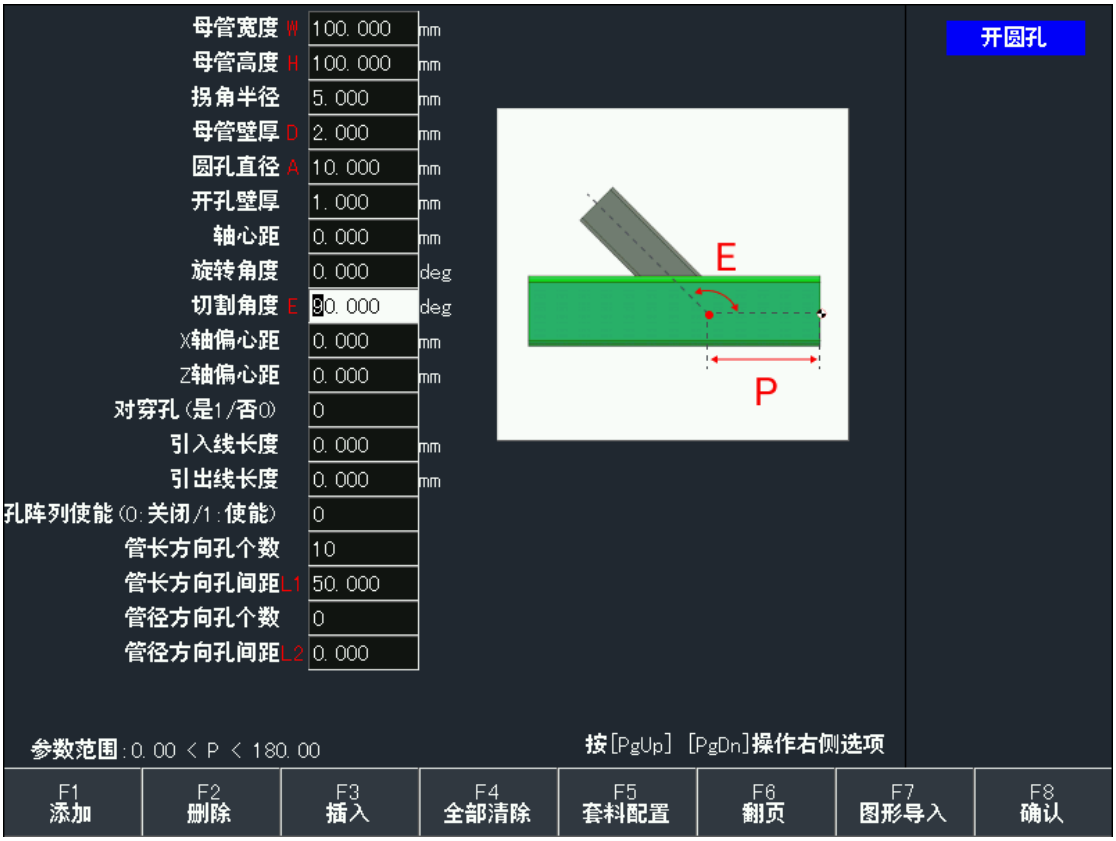


Figure 9. Angle of 32 openings

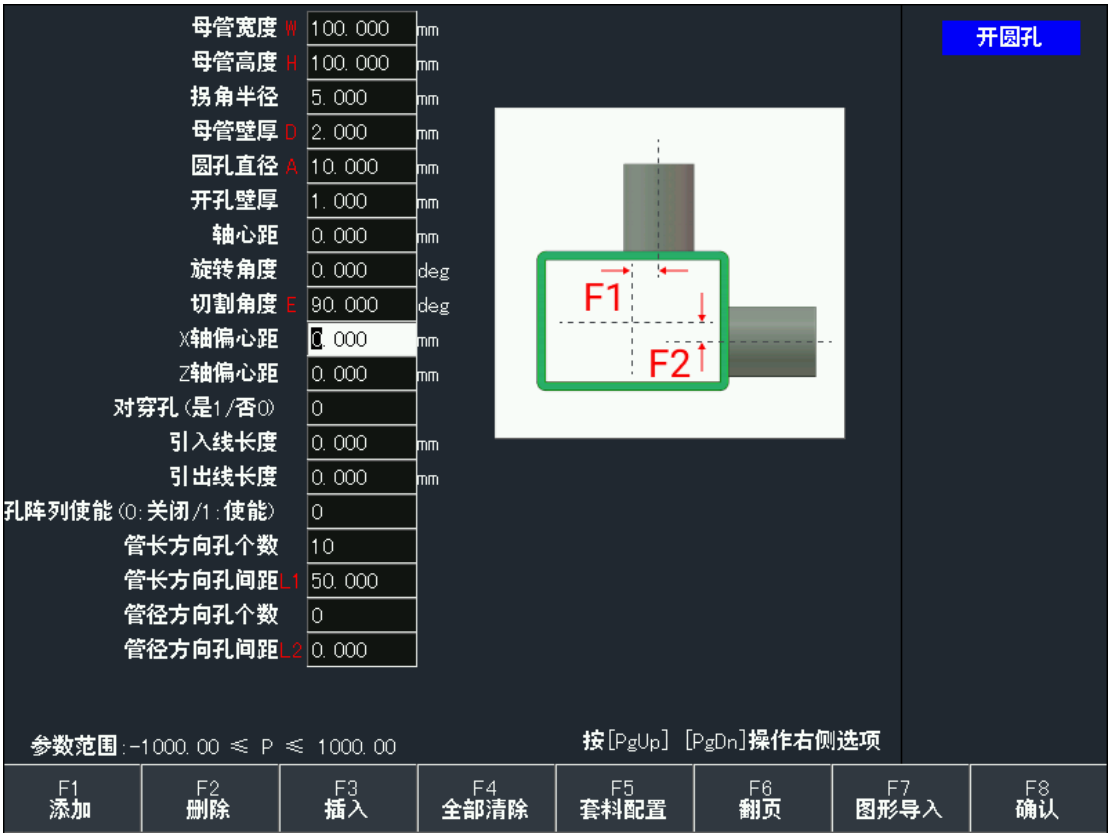


Figure 9. 33X/Z eccentric distance

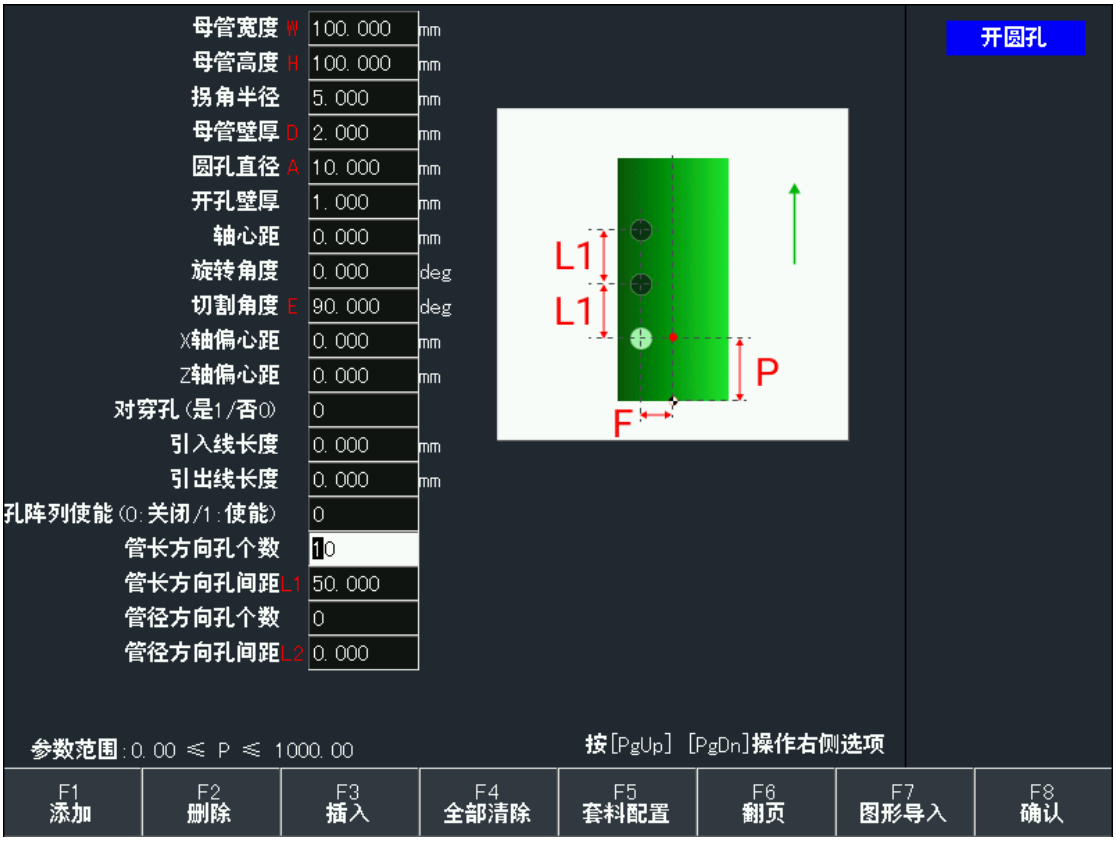


Figure 9. 34 tube length array distance

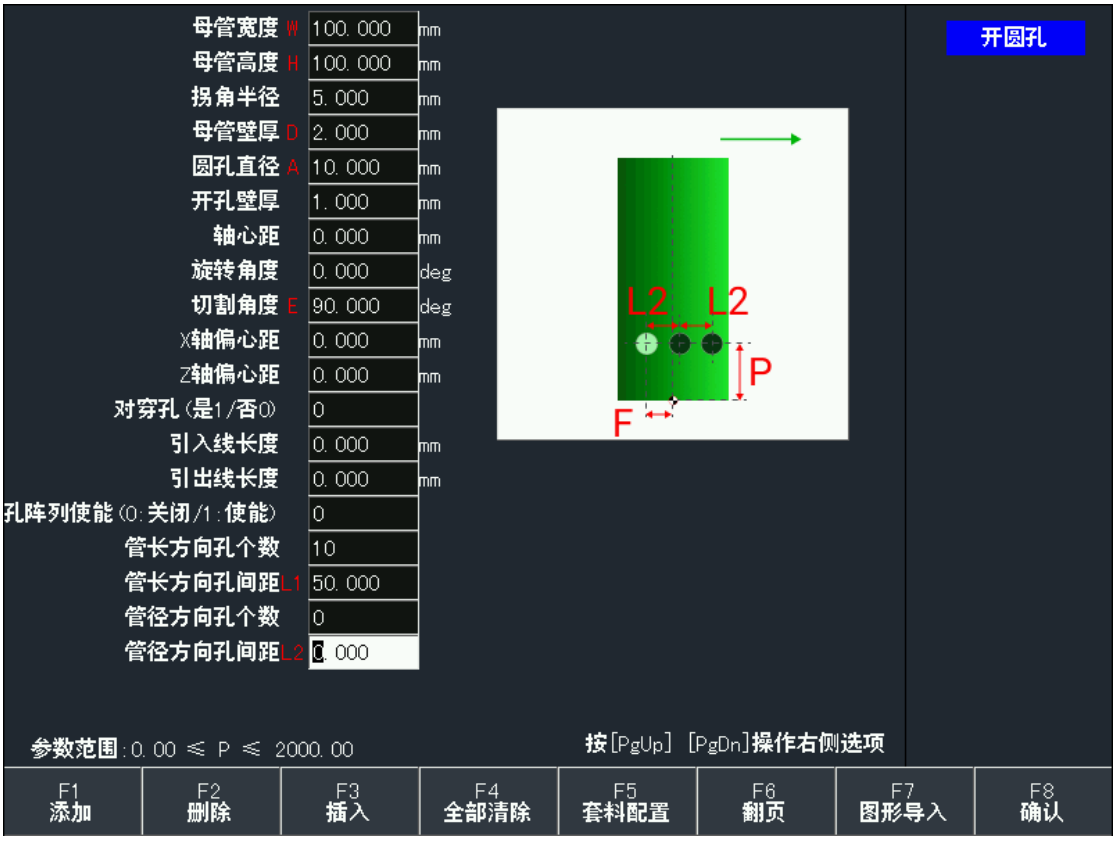


Figure 9. Array distance for 35 tubes

9.4.3 Square hole

The square hole of the square pipe is to open the square hole of the green pipe in Figure 9.36 with an angle.

Axial distance B: the length in the long direction of the square hole pipe, B in the figure, unit: mm.

Radial distance C: the radial length of the square hole, C in the figure, unit: mm.

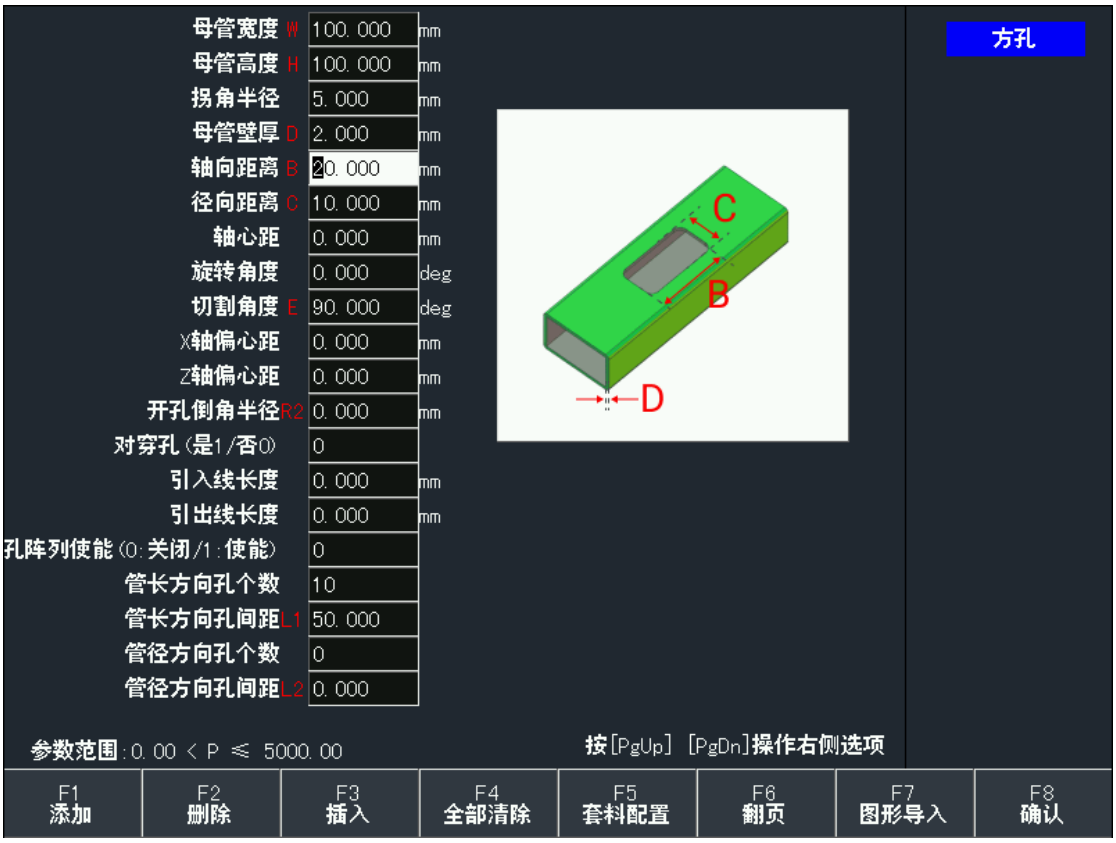


Figure 9. Interface for opening holes in 36 square tubes

9.4.4 Waist hole

The round hole in the square tube is an angle-cut round hole for the green tube in Figure 9.37.

Axial distance B: the length of the pipe in the direction of the waist round hole, B in the figure, unit: mm.

Diameter C: length of the radial length of the square hole, C in the figure, unit: mm.

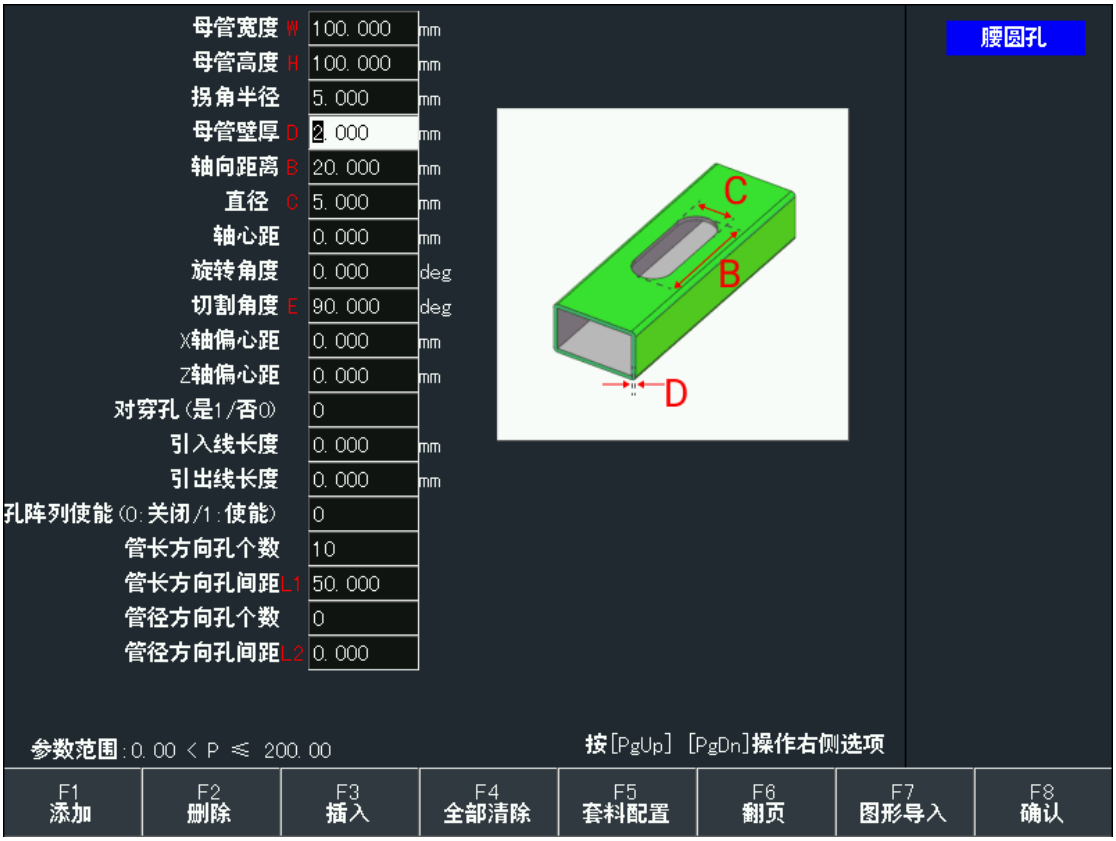


Figure 9. Interface of parameters of the round hole in the waist of a 37 square tube

9.4.5 Bending

The square pipe bending is to open a round hole with an angle on the green pipe in Figure 9.38.

Opening Angle A1: When the bending type is 0 or 2, the Angle of V opening, shown in the figure as A1, unit: degree.

Opening Angle A2: When the bending type is 2, the Angle of V opening, shown in the figure as A2, unit: degree.

Distance from bottom edge N1: when the bending type is 0 or 2, the distance from the vertex V to the bottom edge, shown in the figure as N1, unit: mm.

Distance from bottom edge N2: when the bending type is 2, the distance between vertex V and bottom edge, shown in the figure as N2, unit: mm.

Tubular bending types (0,1,2): When 0, single V-slot is used, parameters A1 and N1 are required, other parameters are invalid; when 1, U-shaped slot is used, automatic slotting is performed based on tube width and height, other parameters are invalid; when 2, double V-slot is used, parameters A1 and N1 control V1 slot, parameters A2 and N2 control V2 slot.

Access Orientation (0 top, 1 left, 2 bottom, 3 right): Facing the pipe head, looking towards the chuck, 0 is for slotting the top of the square pipe (when the rotation angle is 0),1 is for slotting the left side (when the rotation angle is-90°), 2 is for slotting the bottom (when the rotation

angle is 180°), 3 is for slotting the right side (when the rotation angle is 90°). This parameter is similar to the chuck rotation angle and is used to select the relative position of the slotting side.

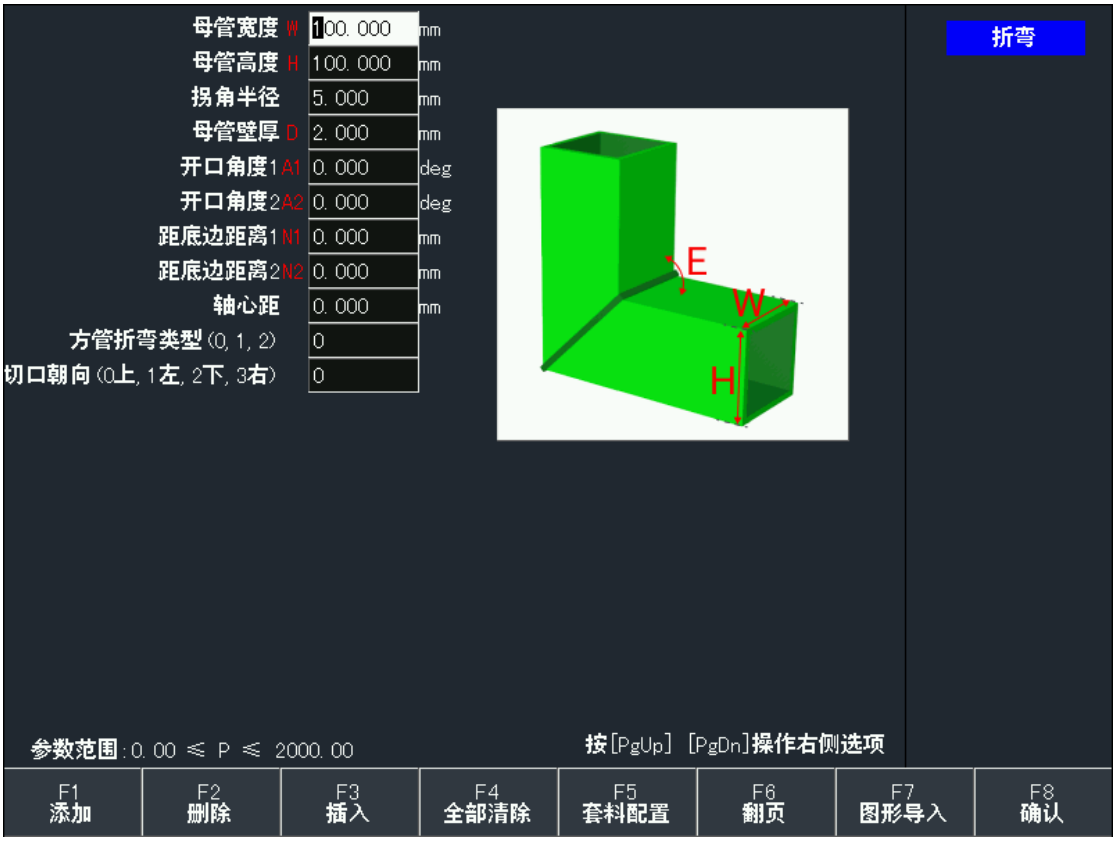


Figure 9. 38 Square pipe bending parameter interface

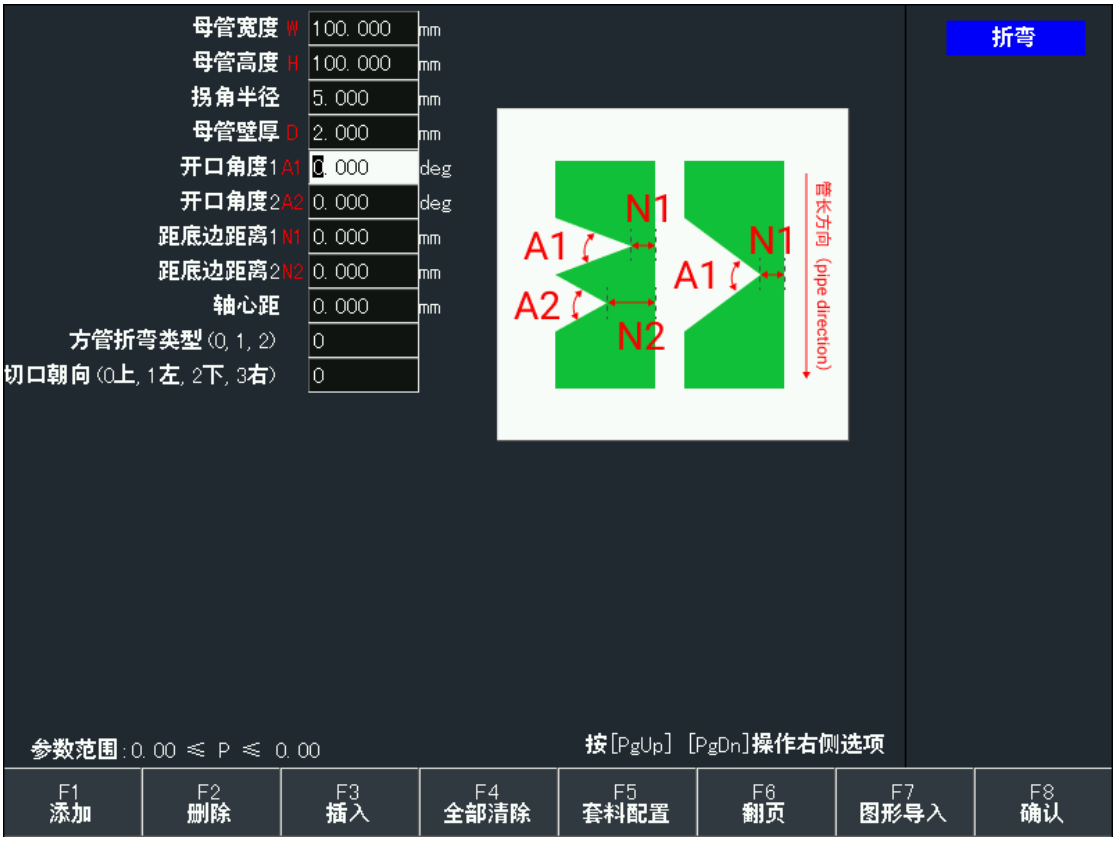


Figure 9. 39 bending parameters

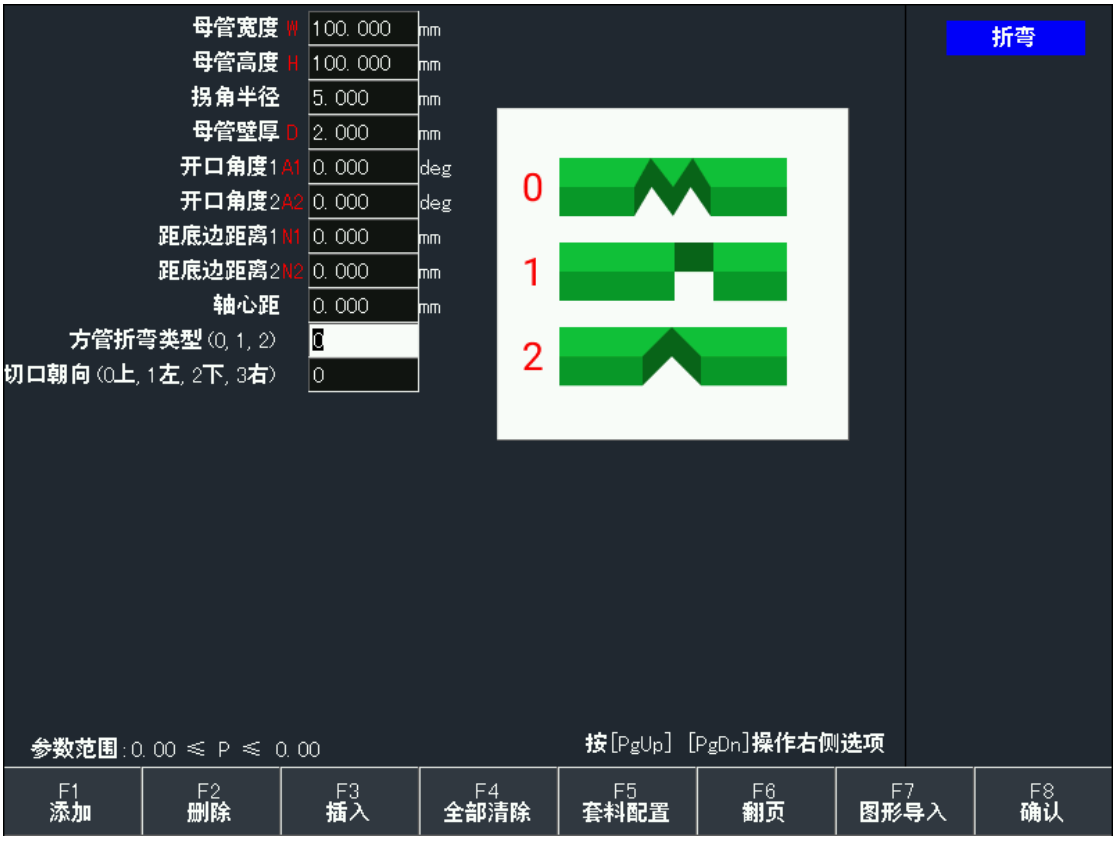


Figure 9. Types of 40 bends

9.4.6 Chute

The square pipe slot is to cut the green pipe in Figure 9.38.

Slot width W: the width in the direction of slot diameter, W in figure 9.42, unit: mm.

H: length in the direction of the pipe length of the slot opening, H in figure 9.42, unit: mm.

R1 and R2 of the U-shaped groove: R1 is the inner chamfer of the groove, and R2 is the outer chamfer of the groove. The units are mm as shown in Figure 9.42.

Axial distance: the distance from the head of the tube to the face of the groove, unit: mm, as shown in Figure 9.42, P.

Slot direction: when it is 1, the slot is opened at the front end; when it is-1, the slot is opened at the rear end, as shown in Figure 9.44.

Number of upper, lower, left and right slots: corresponding to the number of slots, see figure 9.44, and set the number of slots as needed.

Upper, lower, left and right slot spacing: The spacing between two slots is I in Figure 9.42, unit: mm.

offset: the offset of the slot opening relative to the central axis line in Figure 9.45, unit: mm.

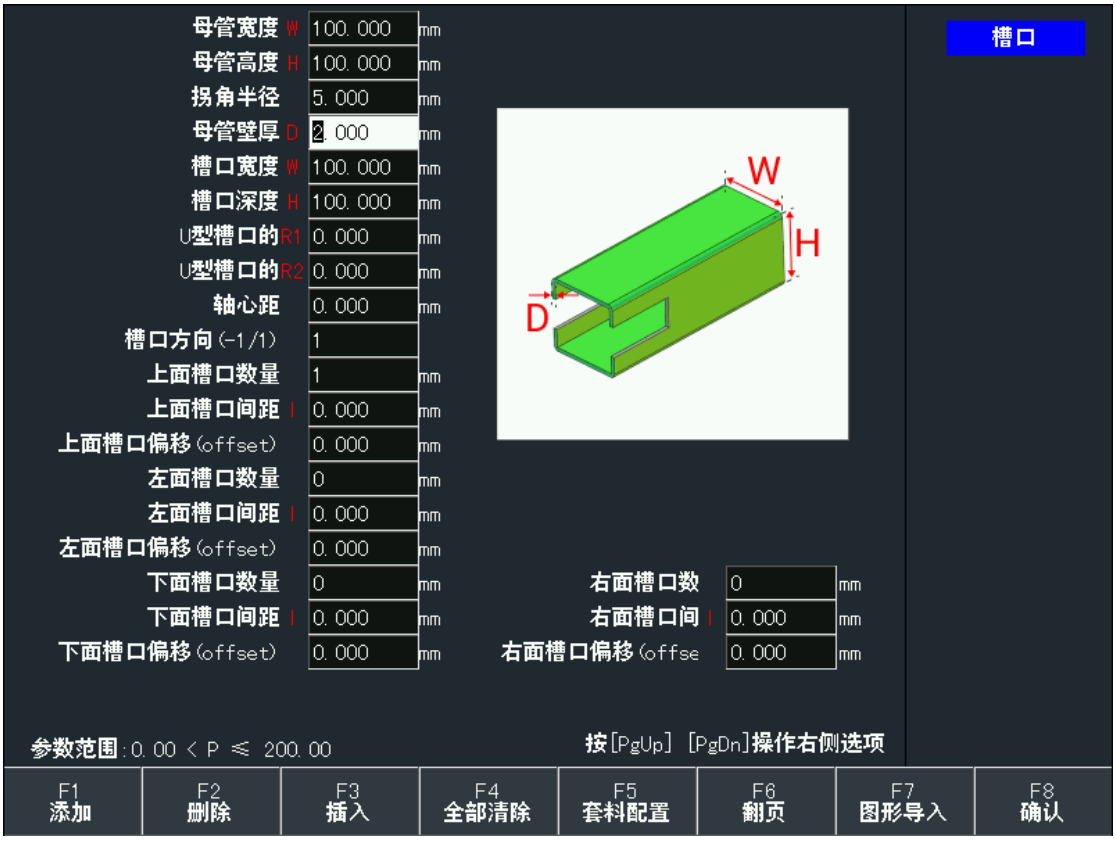


Figure 9. 41 slot parameters interface

Figure 9. 42 slot width and depth

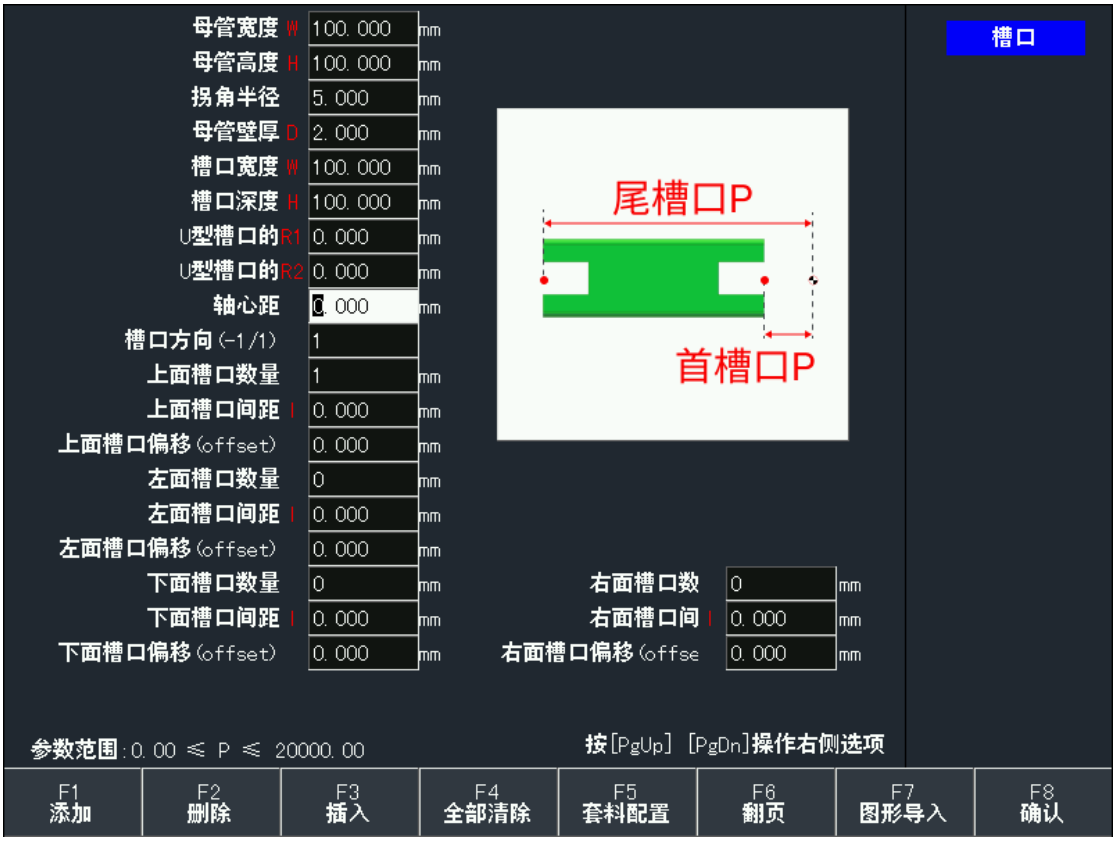


Figure 9. 43 slot axis distance

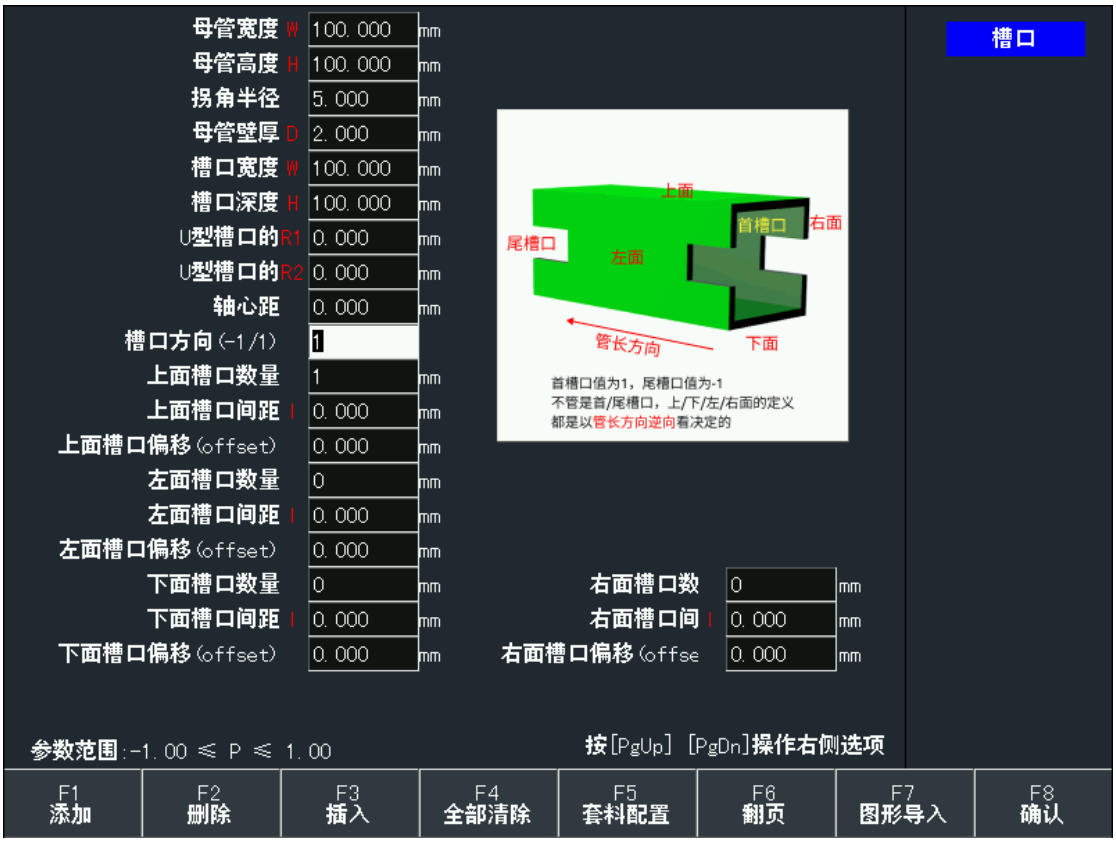


Figure 9. Direction of the 44 slots

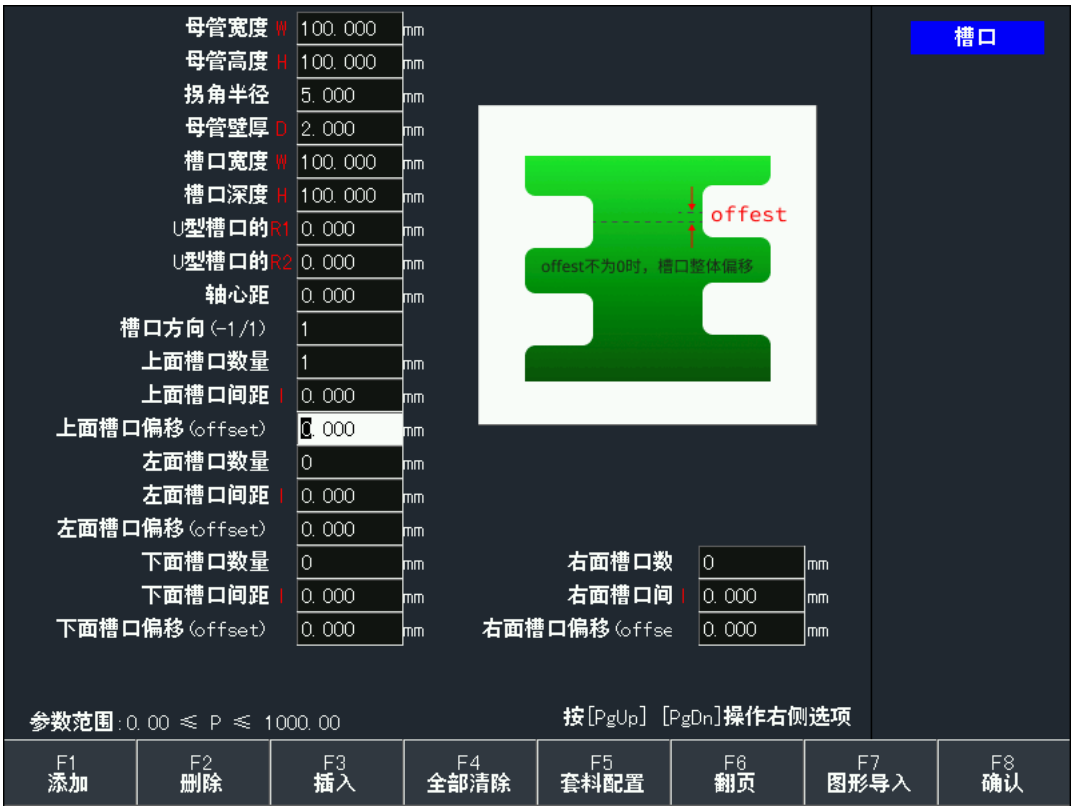


Figure 9. 45 slot offset

9.4.7 Connection to circular tube

The square pipe is connected to the round pipe at the head or tail end of the green pipe in Figure 9.46.

Axial distance: the distance between the head of the square pipe and the intersection of the centerline of the round pipe and the centerline of the square pipe. In the schematic diagram, P, unit: mm.

Diameter A of the circular tube: the diameter of the circular tube connected to the square tube, shown in the figure as A, unit: mm.

From the perspective of supervisor E: Angle between circular pipe and square pipe, diagram E, unit: degree.

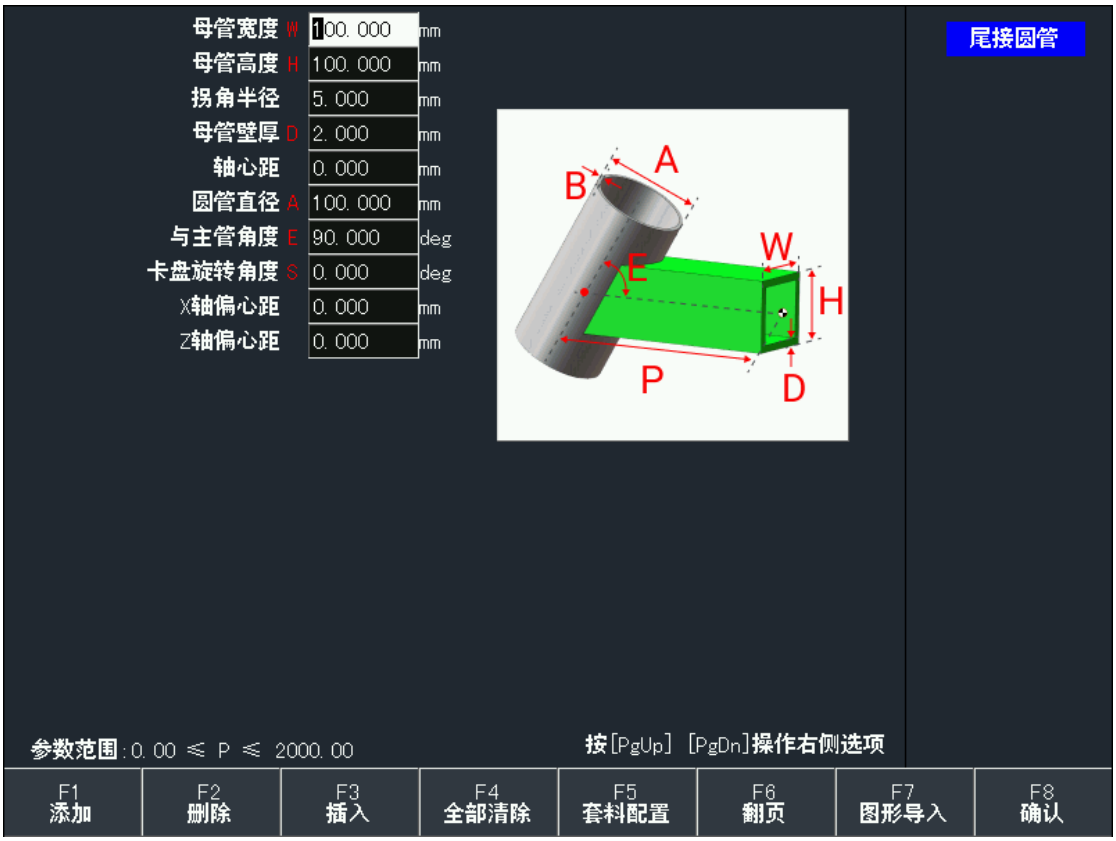


Figure 9. 46-tail connected round pipe

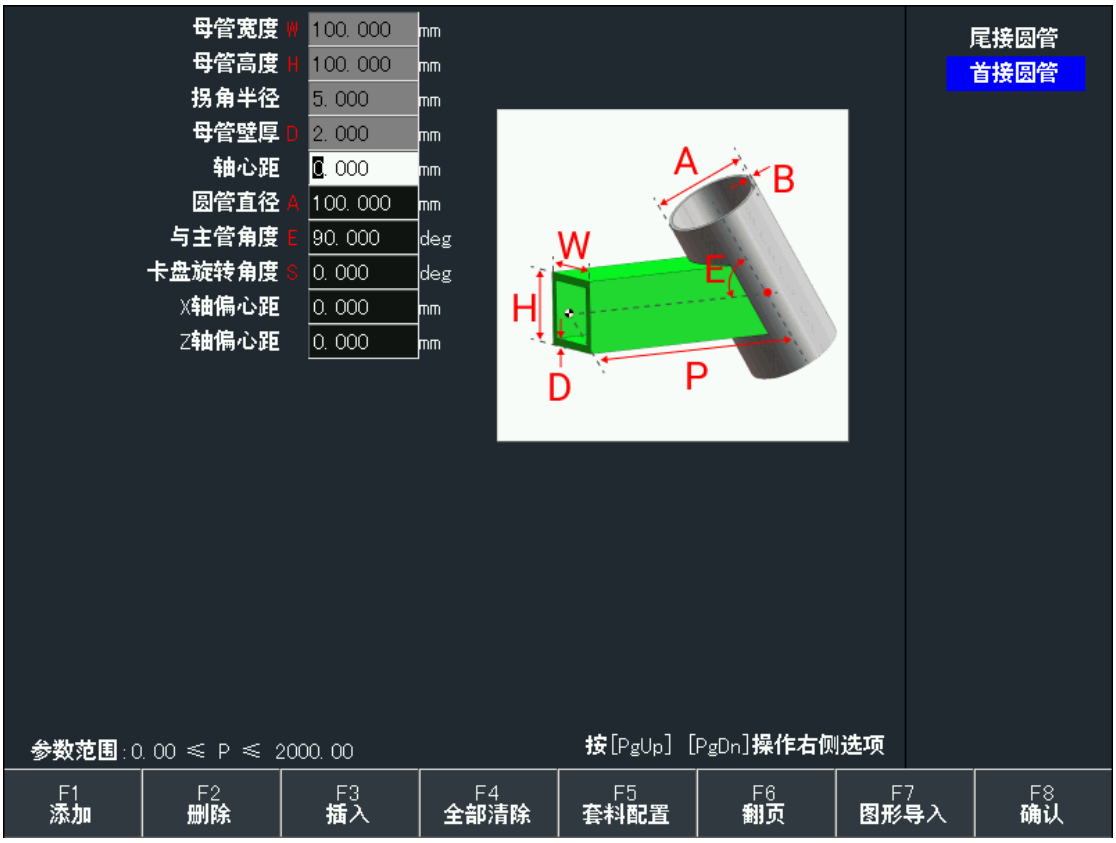


Figure 9. 47 first round tubes

9. 5 sets of material configuration

In the graphic selection interface, parts combination can be carried out. After the parts parameters are set, the parts can be fitted by pressing F5 for fitting configuration. Fitting configuration: fitting information options are valid for both round and square tubes:

① The configuration of the pipe library will be effective only if the material is enabled. The total length of the pipe can be set. The material will not work when enabled, but will only work when enabled.

② Arrangement mode: Part length, part quantity, length mode is automatically generated according to the set pipe length value to generate the maximum number of nesting, and part number is directly defined.

③ If the two adjacent workpieces have no gap and are not shared, they can be shared with one cut.

④ Part clearance is the spacing between two adjacent parts.

⑤ Whether reverse discharge is allowed. Suppose that the cutting of a part is AB two cuts, and the result of reverse discharge is ABBAABBAABBA....

Figure 9. 48 Layout according to part length

Figure 9. 49 Set of parts by number of parts

9.6 Graphic import

9.6.1 Graphic memory generation

[F 7]Graphic Import: Used to save the customers cutting parameters. When users combine or use individual graphics, in addition to generating a G code file name as shown in Figure 9.50, they will also be prompted to generate a DAT file with a parameter name as shown in Figure 9.51. After confirming the name, the file is saved to the hard drive, allowing users to use F7 Graphic Import to find the previously set combined graphics, reconfigure other dimensions for easier cutting.

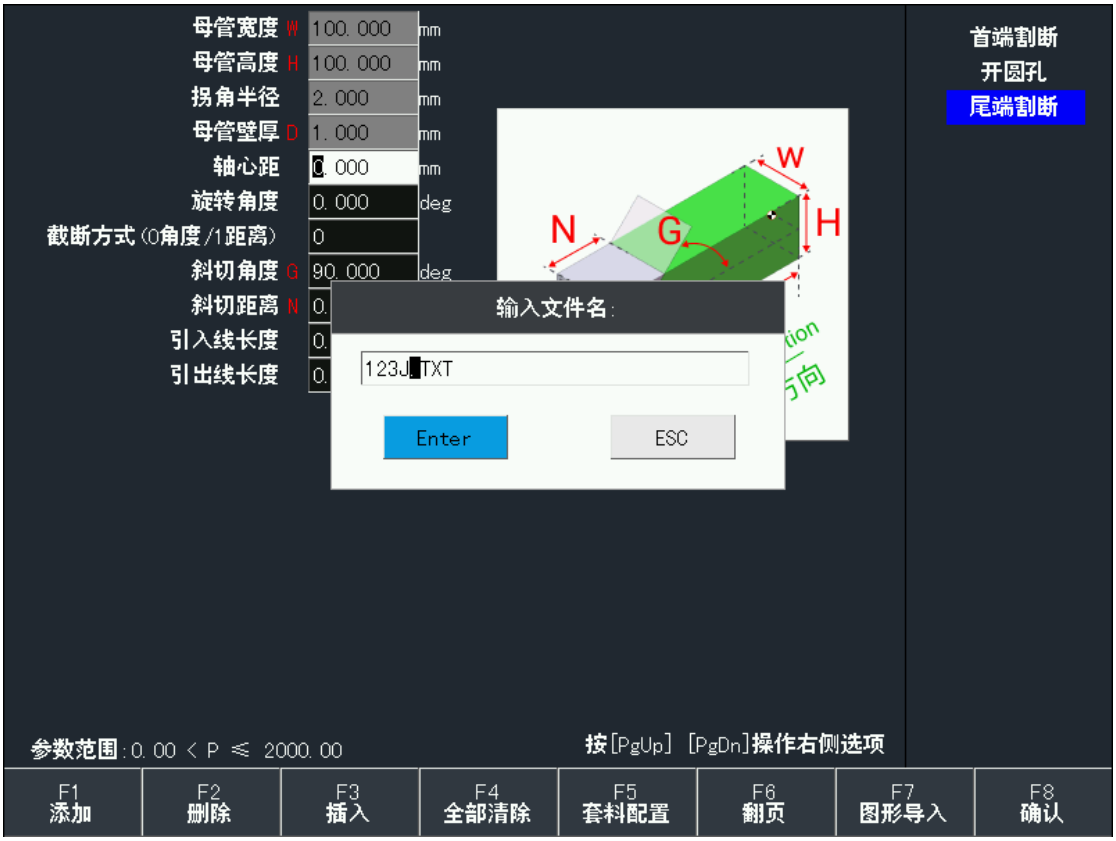


Figure 9. 50G code file name Figure 9. 51 memory DAT file name

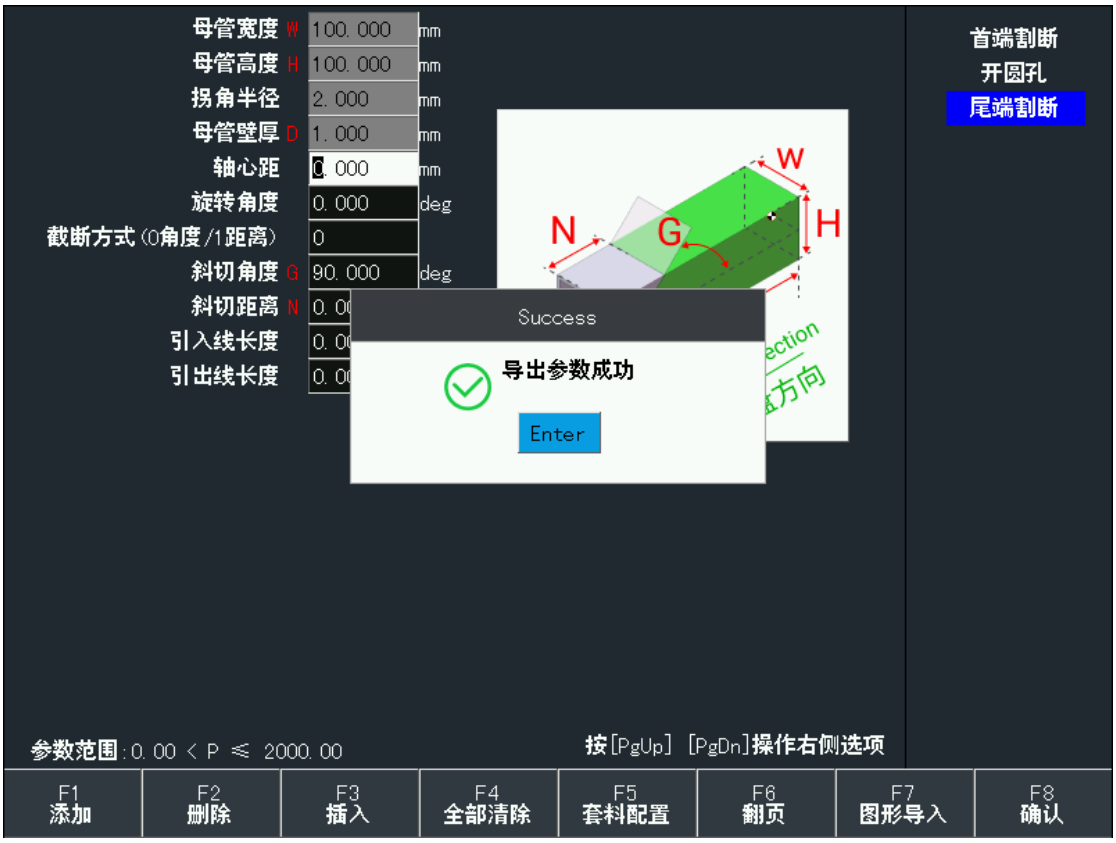


Figure 9. 52 Memory DAT file exported to hard disk successfully

9.6.2 Memory file storage and modification

There can be multiple DAT files under the hard disk file. Users can find the corresponding parameters according to their own defined names and call them. They can also export them to the USB drive, modify their names with the computer, and then import them, such as hole, terminal and other names.

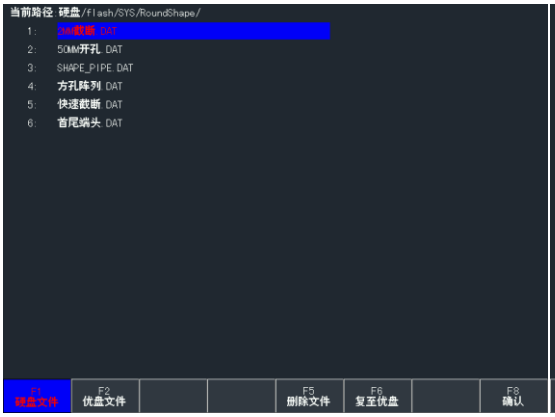


Figure 9. 53 Memory DAT hard disk file Figure 9. 54 Memory DAT USB drive file

9.6.2 Memory file read

Find the graphic DAT file that needs to be retrieved in the file stored on the hard disk memory, confirm it by pressing F8, and read it successfully as shown in Figure 9.55.

You can modify parameters on the composite graphic after reading, or use the graphic after reading directly. This function is very convenient, and the graphic combination memory of both pipe and circular pipe is supported.

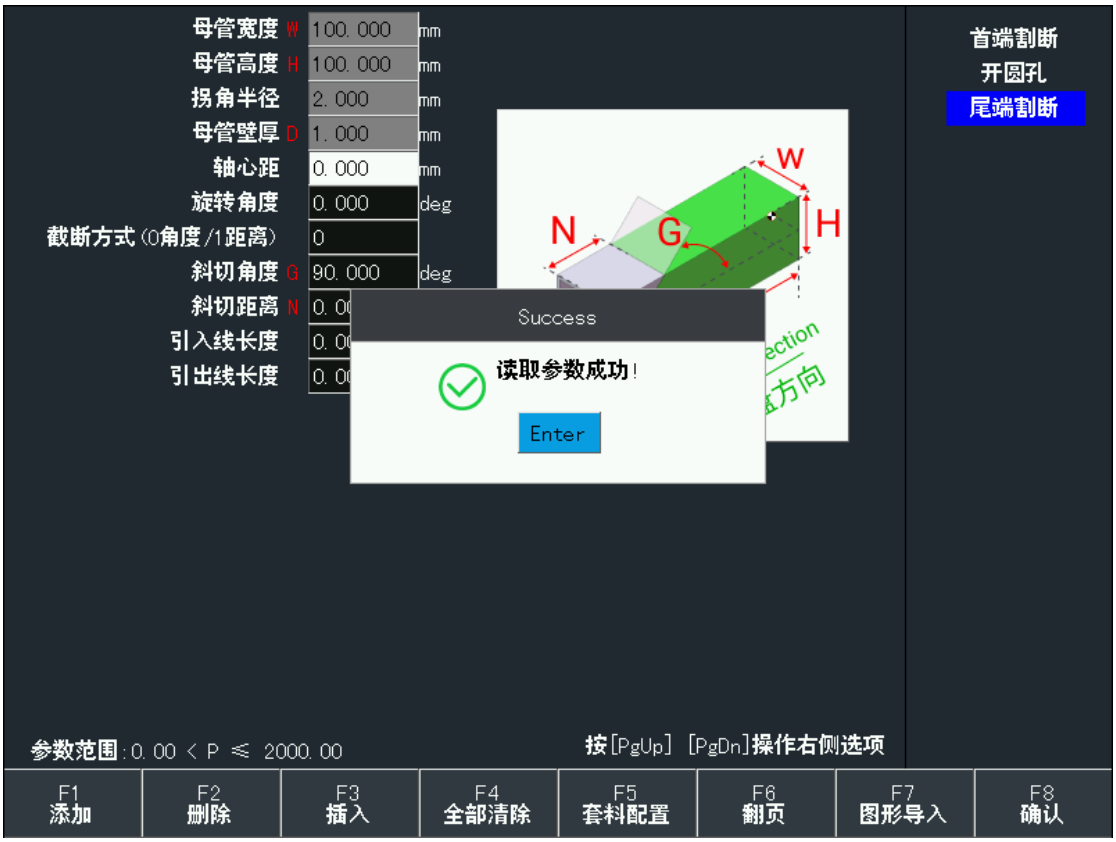


Figure 9.55 Memory file read successful

Chapter 10 Code Description

10.1 Programming symbols and descriptions

◆ In the programming of the cutter, the following programming symbols are generally used, and the programming symbols are followed by the corresponding parameters.

Table 10.1 Programming symbol description

Programming symbols	function declaration
N	Program segment number
G	Prepare the code
M	additional function
X	Relative or absolute coordinates of the X axis
Y	Relative or absolute coordinates of the Y axis
U	Relative coordinates of the X axis
V	Relative coordinates on the Y axis
I	The difference between the X-coordinate of the center relative to the starting point of the arc
J	The difference between the Y-coordinate of the center relative to the starting point of the arc
R	The radius of the arc is positive for arcs less than 180° and negative for arcs greater than 180°.
F	Cutting speed, used for G01, G02, G03.

◆ In the following content, any occurrence of the "/" symbol represents an OR relationship, for example, X/U indicates that either X or U can occur, but not both simultaneously. n represents the parameter value, for example, Xn indicates a parameter following X. [] represents optional content, which can or cannot be included.

10.2, Coordinate system

The system uses the right-handed Cartesian coordinate system by default, as shown in Figure 10.1.

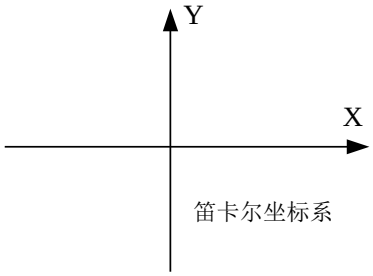


Figure 10.1 Cartesian coordinate system

Of course, the system can also be defined by the user himself, see"8.7.2.3 Coordinate definition".

10.3 G code description

The G codes supported by this system are shown in Table 10.2.

Table 10.2 Common G Code Table

G99	Parameter: X/U Y/V I J	Component option parameters
G92	parameter:XY	Reference point Settings
G91 / G90	No parameters	Relative / absolute coordinates
G20 / G21	No parameters	Imperial / Metric
G41 / G42	No parameters	Left / right suture compensation
G40	No parameters	Cancel the cut compensation
G00	Parameter: X/U Y/V	Straight rapid movement (empty car)
G01	Parameter: X/U Y/V	Straight cutting
G02	Parameter: X/U Y/V I J	Circular cutting in a clockwise direction
G03	Parameter: X/U Y/V I J	Counterclockwise arc cutting
G04	parameter:P	delayed

1. G92 Examination site setting

form:

G92 [Xn] [Yn]

Parameter meaning:

[Xn] [Yn] represents the absolute coordinates of the set reference point, which is also the absolute coordinate for machine tool return. If there are no parameters after G92, the default reference point coordinates are (0,0). Generally, when a machine tool uses (0,0) as the reference point, this line of code can be omitted.

pay attention to:

After the code is loaded, the reference point coordinates set by G92 will be automatically saved and remain valid until a new cutting code is loaded, regardless of whether the machine is turned off or not. If a new cutting code is loaded and contains a G92 command, the reference point coordinates will be the content after G92; if there is no G92, the reference point coordinates will default to (0,0). In a single code file, the G92 command can only appear once.

example:

a. G92 X0 Y0

It indicates that (0,0) is the reference coordinate. When the "Reset" function key is pressed, the machine tool returns to the (0,0) coordinate point.

b. G92 X20 Y0

It indicates that (20,0) is the reference coordinate. When the "Reset" function key is pressed, the machine tool returns to the (20,0) coordinate point.

2. G90/G91

form:

G90/G91

G90 absolute coordinates. In the code, X and Y represent the absolute coordinate values, and U and V represent the relative coordinate values.

G91 Relative coordinates. In the code, X and Y represent relative coordinate values, and U and V also represent relative coordinate values.

example:

a. Usage of G90

```
G92  X0 Y0        // 参考点(0,0)
G90               // 绝对坐标
G00 X20 Y0        //快速移枪到(20,0)
M07               //穿孔固定循环
G01 X120 Y100     //切割到(120,100)
M08               //关切割固定循环
M02
```

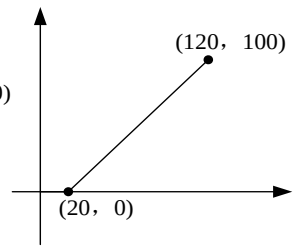


Figure 10.2 G90 usage

b. Usage of G91

```
G92  X0 Y0       // 参考点(0,0)
G91              // 相对坐标
G00 X20 Y0       //快速移枪到(20,0)
M07              //穿孔固定循环
G01 X120 Y100 //切割到(120,100)
M08              //关切割固定循环
M02
```

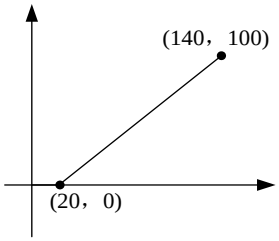


Figure 10.3 G91 Usage

3. G20/G21

form:

G20/G21

All X, Y, I, J, R, U, V that appeared after G20 are imperial units.

All X, Y, I, J, R, U, V after G21 are metric units.

pay attention to:

If G20/G21 is not present in the code, it is defaulted to metric units.

The conversion formula between imperial and metric system is: 1 inch ≈ 25.4mm.

4. G00 Air movement

This instruction indicates that the gun is quickly moved to the designated position. The system moves from the starting point to the designated position at a speed of "empty range moving speed * rate".

form:

G00 X/Un Y/Vn [Fn]

Parameter meaning:

Fn-Airspeed limit.

Un-the displacement of the X coordinate of the final point relative to the starting point of the current segment;

Vn-The displacement of the terminal Y coordinate relative to the current segments starting point.

(In a relative coordinate system)

Xn-The displacement of the X coordinate of the terminal point relative to the starting point of the current segment;

Yn-The displacement of the terminal Y coordinate relative to the current sections starting point.

(In an absolute coordinate system)

Xn-the displacement of the X coordinate of the terminal X relative to the starting point of the workpiece;

Yn-Terminal y coordinate displacement relative to the starting point of the workpiece.

example:

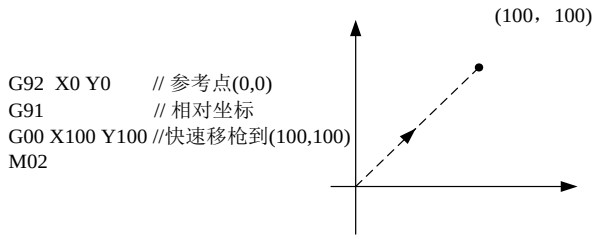


Figure 10.4 G00 Usage

5. G01 Linear cutting

This instruction indicates that the straight line is cut to the specified position, and the system cuts from the starting point of the current section to the specified position at the speed of "cutting speed * rate".

form:

G01 X/Un Y/Vn [Fn]

Parameter meaning:

The only difference between G00 and G01 is that G00 represents the straight line travel of an empty car (i.e., all the output ports are closed), and G01 represents the straight line cutting.

6. G02 Circular interpolation

This instruction indicates that the clockwise arc (clockwise interpolation) is cut to the specified position, and the system cuts from the starting point of the current section to the specified position at the speed of "cutting speed * rate".

form:

G02 X/Un Y/Vn In Jn [Fn] or G02 X/Un Y/Vn R[-]n [Fn]

Parameter meaning:

Fn-Cutting speed limit.

Un-The displacement of the X-coordinate of the final point relative to the starting point of the current section, in mm;

Vn-The displacement of the terminal Y coordinate relative to the current section starting point, in mm.

In-The displacement of the X coordinate of the center relative to the starting point of the current section, unit mm;

Jn-The displacement of the center Y coordinate relative to the starting point of the current section, in mm.

R[-]n--radius of the arc, R is positive when the arc is less than or equal to 180 degrees, and negative otherwise, unit mm;

(In a relative coordinate system)

Xn-The displacement of the X coordinate of the terminal point relative to the starting point of the current section, unit mm;

Yn-The displacement of the terminal Y coordinate relative to the current section starting point, in mm.

(In an absolute coordinate system)

Xn-The displacement of the terminal X coordinate relative to the starting point of the workpiece, unit mm;

Yn--Terminal y coordinate displacement relative to the workpiece origin, in mm.

example:

```
例1. 从B->A
G92  X0 Y0       // 参考点(0,0)
G91              // 相对坐标
G00 X60 Y100     //快速移枪到B点
G02 X-40 Y-40 I0 J-40 //圆弧1
或(G02 X-40 Y-40 R-40)
M02
例2. 从A->B
G92  X0 Y0       // 参考点(0,0)
G91              // 相对坐标
G00 X20 Y60      //快速移枪到A点
G02 X40 Y40 I40 J0 //圆弧2
或(G02 X40 Y40 R40)
M02
```

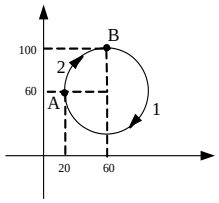


Figure 10.5 G02 Usage

7. G03 Inverse circular interpolation

The same as G02, but G02 is a clockwise circle (clockwise arc) and G03 is a counterclockwise circle (counterclockwise arc).

8. G42/G41 and G40 seam compensation

These functions are the cut seam compensation function when the cutting path represented by the code is merely the actual size of the workpiece since flame cutting/plasma cutting will inevitably have cut seams if the influence of cut seams is not considered the actual workpiece produced will not be the required size After setting up cut seam compensation the system will automatically calculate the impact of cut seams and produce workpieces of the actual size.

G41/G42 and G40 must be used in pairs. If G41/G42 is omitted, the default seam compensation value is zero; if G40 is omitted, the default seam compensation is valid.

form:

G41 // Left cut compensation

..... // Cut code

G40 // Cancel left cut compensation

G42 // Right cut compensation

..... // Cut code

G40 // Remove right cut compensation

example:

(Convex Roof Trapezoid w/ Hole)

G21 /* The metric unit is */

G91 /* Relative coordinate */

G99 X1 Y0 I0 J0 /* Proportion factor is 1, rotation Angle is 0, no mirror*/

G00 X44.45 Y41.275 /* Empty car walk */

G41 /* Left cutaneous flap compensation */

M07 /* Cutting starts at */

G03 X0 Y0 I19.05 J0 /* Cut a circle */ counterclockwise

M08 /* Cutting ends */

G40 /* Cancel the left cut compensation */

G00 X-44.45 Y-41.275 /* Empty car walk */

G4 2 /* Right incision suture compensation */

M07 /* Cutting starts at */

G01 X25.779438 Y58.031634 /* Straight cut */

G02 X75.441125 Y0 I37.720562 J-16.756634 /* Cut a circle */ in a clockwise direction

G01 X25.779438 Y-58.031634 /* Straight cut */

G01 X-127 Y0 /* Straight cut */

M08 /* Cutting ends */

G40 /* Cancel right cut compensation */

M02 /* The program ends */

Note: The cutting compensation value should be half of the actual cutting width.

9. G99 Scaling, Rotation, Mirror

form:

G99 Xn Yn In Jn

Parameter meaning:

X-Proportion 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 indicates mirror and 0 indicates no mirror

J-Y axis mirror, mirror along the Y axis, 1 indicates mirror and 0 indicates no mirror

pay attention to:

For a code, there can be G99 or not. If there is G99, the parameters X, Y, I, J at the back cannot be omitted.

Mirroring and rotation are both referenced to the origin of the Cartesian coordinate system (0,0).

10. G04 Delay

form:

G 04 P n

Parameter meaning:

P--Delay time, followed by parameters in seconds, such as P100 for a delay of 1 second.

11. Programming notes

- The program must include the G92 (reference point setting) and M02 (program end) commands.
- G41/G42 and G40 must be used in pairs. If G41/G42 is omitted, the default seam compensation value is zero; if G40 is omitted, the default seam compensation is valid.
- When the G20 / G21 is omitted, the system defaults to G21 (metric units).
- When the G90 / G91 is omitted, the system defaults to G91 (relative coordinates).
- The M07 and M08 commands cannot be omitted.
- If any of the parameters in G00, G01, G02 and G03 is omitted, if the parameter is absolute coordinate, the system defaults to the coordinate value of the previous line G code; if it is relative coordinate, the system defaults to zero.
- G00, G01, G02 and G03 can be abbreviated as: G0, G1, G2 and G3.
- G00 (or G01, G02, G03) can be omitted if it is followed by a continuous G00 (or G01, G02, G03).

10.4 M Code description

Table 10.3 Common M codes

M07	No parameters	Perforation fixation cycle
M08	No parameters	End the cutting and fixing cycle
M 11	No parameters	Establish powder shift
M 12	No parameters	Cancel powder shift

M 09	No parameters	Turn on the powder
M 10	No parameters	Turn off powder spray
M00	No parameters	pause instruction
M02/M30	No parameters	end of program

- M07 Punching fixation cycle

  Please refer to Appendix 2 F4207V series CNC system IO timing chart.

- M08 ends the cutting and fixing cycle

  Please refer to Appendix 2 F4207V series CNC system IO timing chart.

- M00 suspended

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

- M02/M30 program ends

Chapter 11 Interface Description

The back interface diagram of this system is shown in Figure 11.1

CN1 is the input pin and standard DB25 socket

CN2 is the output pin and standard DB25 mother head

CN3 and CN4 are motor interfaces with standard DB15 sockets

CN5 is the RS232 serial port interface, which connects to the extended shaft card

The CN8 is a five-core CAN interface and connects to the F1522 remote control

CN9 is a two-core PWM output port

CN10 is an eight-core analog input/output port

The CN11 provides RJ45 network interface to connect the laser height adjuster

The 3-pin green terminal in the upper left corner is a DC24V power supply port

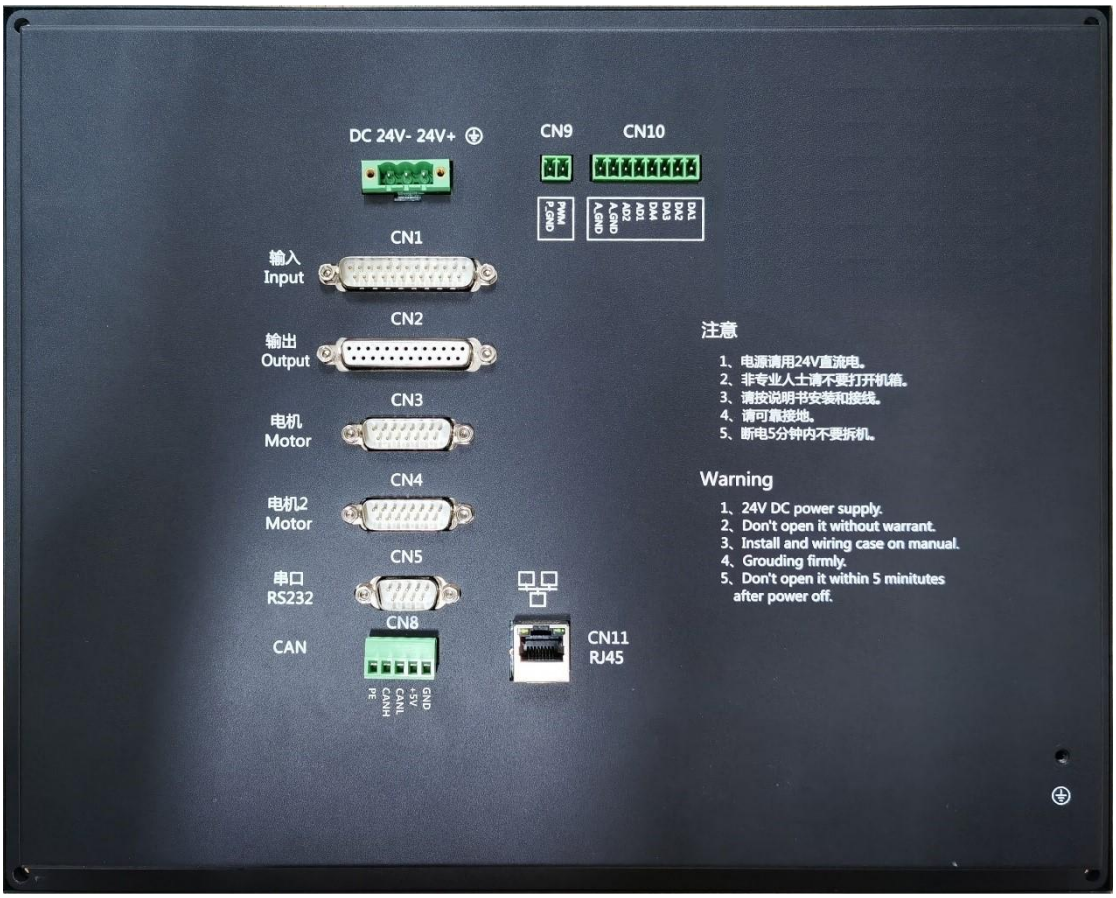


Figure 11.1, back interface diagram

The overall wiring diagram of the system is as follows (the input and output ports are only for example, not for reference):

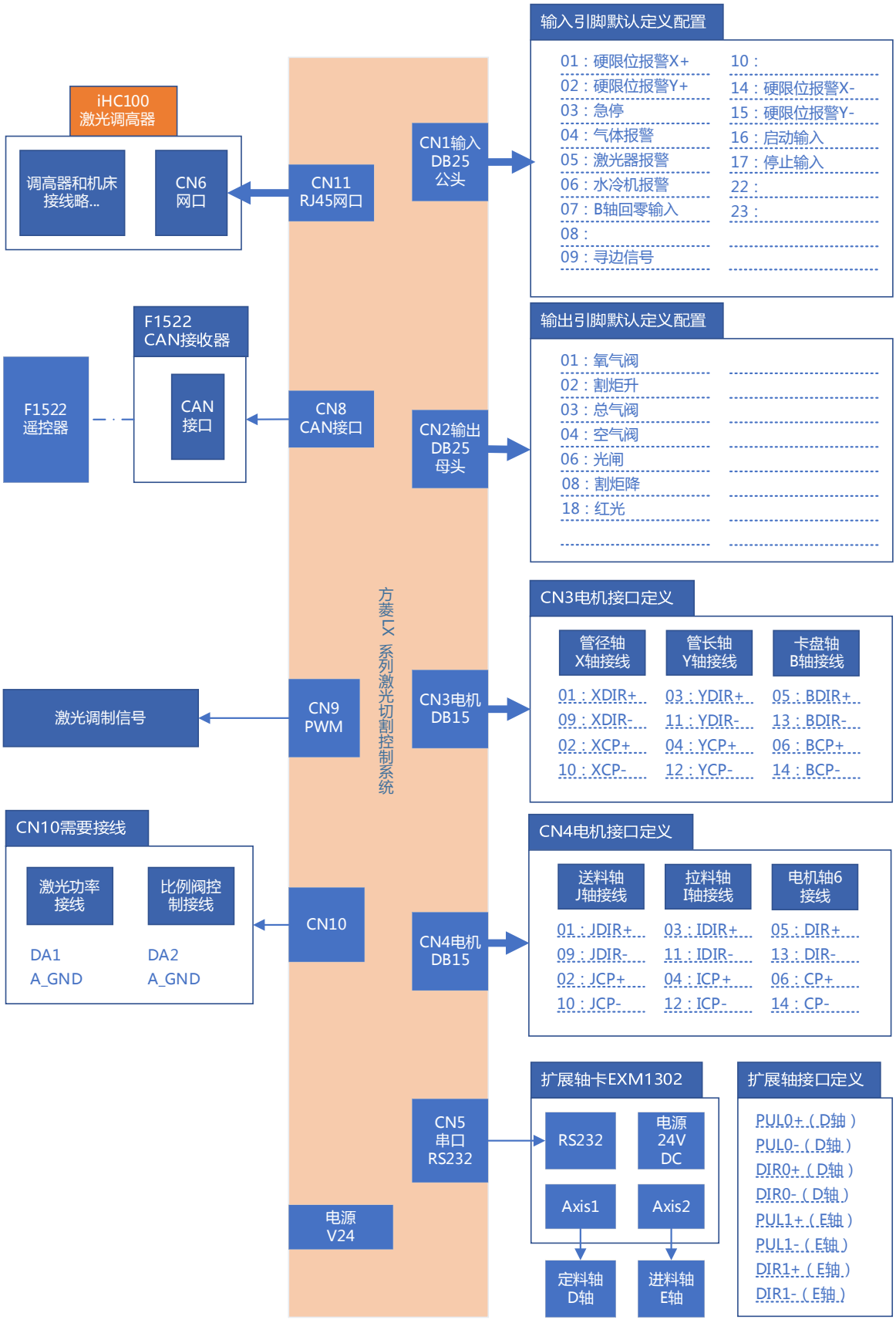
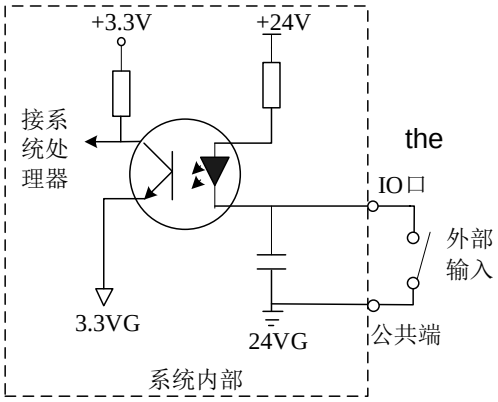


Figure 11. System overall wiring diagram

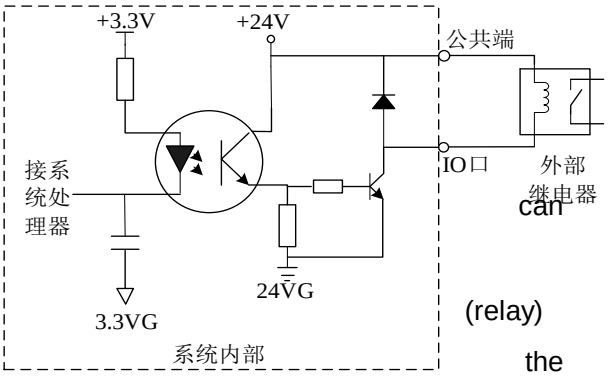
11.1 Input interface principle



- The input signal can be connected to a mechanical contact switch, both open and closed types are supported. Under normal circumstances, the port is shorted to 24VVG for a valid signal (i.e., low-level valid), and the signal is invalid when the port is open or connected to 24V. The common terminal of the external switch is connected to 24VVG, and the other end of the external switch is connected to the corresponding IO port.
- There are 20 input ports in total.
- The definition of the input signal pin can be modified.
- The default definition of input signal is shown in Table 1.1.

Figure 11.3 Input interface circuit principle

11.2 Output interface principle



- Output voltage 24V, low level effective; the common terminal of the external relay coil is connected to 24V+ (it can also be connected to The 24V+ power supply for the system (relay) The other end of the coil is connected to the corresponding IO port.
- Output withstands maximum load current of 3 00mA.
- The output signal pin definition can be modified.
- There are 16 output ports in total.
- The default definition of the output signal is shown in Table 1.12.

Figure 11.4 Schematic diagram of output interface circuit

11.3 Definition of output

11.3.1 Input port definition

Pin number	function	explain	remarks
0 2	Hard limit alarm Y+		Low effectiveness
1 5	Hard limit alarm Y-		Low effectiveness
1 4	Hard limit alarm X-		Low effectiveness
0 1	Hard limit alarm X +		Low effectiveness
0 3	jerk		Low effectiveness
0 4	Gas alarm	Connect to the gas alarm output port	Low effectiveness
0 5	Laser alarm	Connect the alarm output port of the laser to the input	Low effectiveness
0 6	Water cooler alarm	Connect the alarm output port of the water cooler	Low effectiveness
07	L/I axis limit +		Low effectiveness
0 8	L/I axis limit		Low effectiveness
09	B axis zero input		Low efficiency
1 4	Find the edge signal		Low effectiveness
1 2,2 4	+ 24V	+ 24V/3A power output	
13,2 5	2 4VGND	Ground for +24V power supply	
1 5	Hard limit alarm F +	If the focus axis is not used, the positive and negative limits of the focus can be	Low effectivenes

		ignored	s
1 6	Hard limit alarm F-		Low effectivenes s
1 7	enable input		Low effectivenes s
1 8	Stop input		
11	forbidden		

Figure 11.5 External input wiring

11.3.2 Definition of output ports

Pin number	function	explain	remarks
0 1	Main valve	The total valve control output port requires a relay	Low effective output
0 2	Oxygen valve	The oxygen valve controls the outlet and requires a relay	Low effective output
0 3	Nitrogen valve	The nitrogen valve control outlet needs to be connected to a relay	Low effective output
0 4	air valve	Air valve control outlet requires relay	Low effective output
0 5	optical shutter	The enable end of the optical shutter of the receiver laser needs to be controlled by a relay, which can only output low level.	Low effective output
0 6	glow		Low effective output
0 7	Clamping of the chuck		Low effective output
12,2 4	+ 24V	+ 24V/3A power output	
13,2 5	2 4VGND	Ground for +24V power supply	
11,09,10, 22,2 3	disabled		
other	reserve		

Note: For the power supply of the relay used externally, take the positive output of the 24V power supply from pin 12/24 of DB25 (CN2), and take the ground of the 24V power supply from pin 13/25.

Figure 11.6, Output wiring diagram

11.4, motor interface

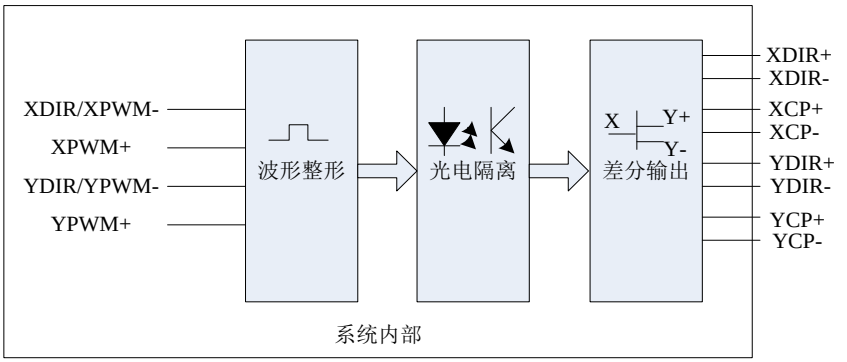


Figure 11.7 Schematic diagram of motor interface

- CN3 and CN4 signal definitions table

CN3 is motor port 1.

CN4 is motor port 2.

The CN3 motor port 1 provides control pulses for the following three axes:

X axis (pipe diameter axis)

Y axis (pipe length axis)

B axis (clamp axis)

CN 4 motor port 2 provides control pulses for the following three axes:

Axis I (pulling shaft)

J axis (feed shaft)

Other axes (axes that users can define according to their needs)

The laser height controller provides control pulses for the Z axis (up and down axis).

Table 11.3 CN3 motor pin definitions

CN 3 1 5-core motor interface pin number	Signal name	remarks
1	XDIR+	The X axis is positive
9	XDIR-	Negative in the X direction
2	XCP+	X-axis pulse positive
1 0	XCP-	Negative X-axis pulse
3	YDIR+	The Y axis is positive
1 1	YDIR-	Negative in the Y direction
4	YCP+	Y axis pulse positive
1 2	YCP-	Negative Y axis pulse
5	BDIR+	The B axis is positive
1 3	BDIR-	Negative in the B axis

		direction
6	BCP+	B axis pulse is positive
1 4	BCP-	Negative B axis pulse
7	+ 5V	+5V 500mA power output
15,8	5VG	5V power ground

Table 11.4 CN 4 motor pin definition

CN 4 1 5-core motor interface pin number	Signal name	remarks
1	XDIR+	The I-axis direction is positive
9	XDIR-	Negative in the I axis direction
2	XCP+	Pulse on axis I
1 0	XCP-	Negative pulse on axis I
3	YDIR+	The J axis is positive
1 1	YDIR-	Negative in the J axis direction
4	YCP+	J-axis pulse is positive
1 2	YCP-	Negative J-axis pulse
5	DIR+	The axis is straight
1 3	DIR-	Negative in the axial direction
6	CP+	Axis pulse positive
1 4	CP-	Axial pulse negative
7	+ 5V	+5V 500mA power output
15,8	5VG	5V power ground

11.3.1 Typical wiring diagram of motor interface

11.3.1.1 Panasonic servo driver connection

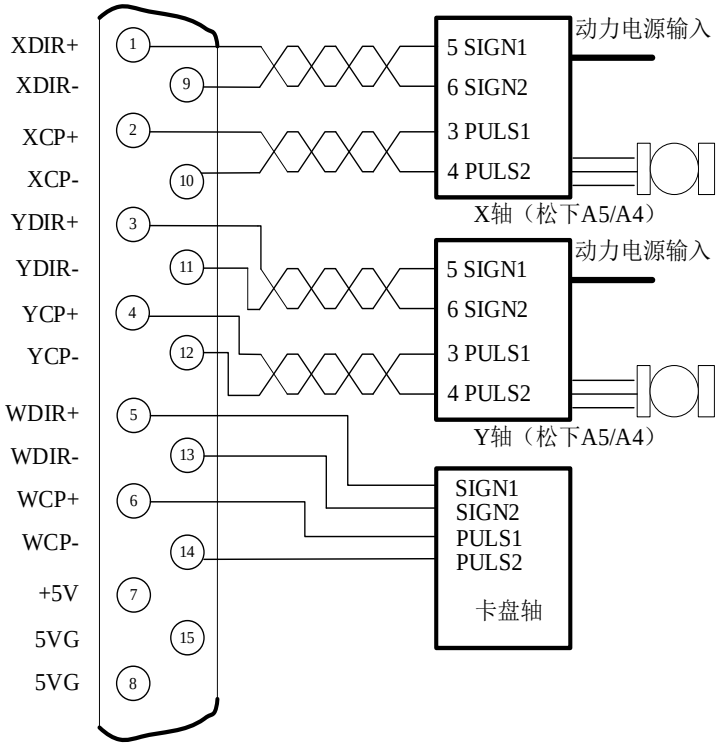


Figure 11.8 Panasonic servo driver low speed pulse port connection

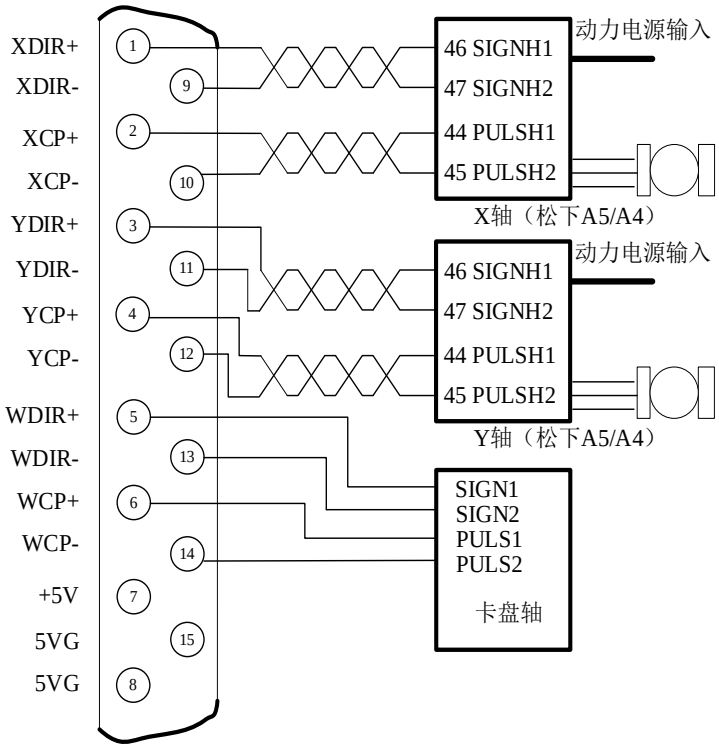


Figure 11.9 Panasonic servo driver high speed pulse port connection

Table 11.4 Basic parameter Settings of Panasonic A5 Series Servo Drives

Parameter number	Parameter name	set value	parameter declaration
Pr 0.01	Control mode setting	0	Position control method
Pr 0.07	Instruction pulse input mode selection	3	Select "direction + pulse" mode
Pr 0.05	Instruction pulse input selection	0/ 1	When high-speed pulse wiring mode is used, the parameter is set to 1; when low-speed pulse wiring mode is used, the parameter is set to 0.

11.3.1.2 Wiring of Yaskawa servo drive

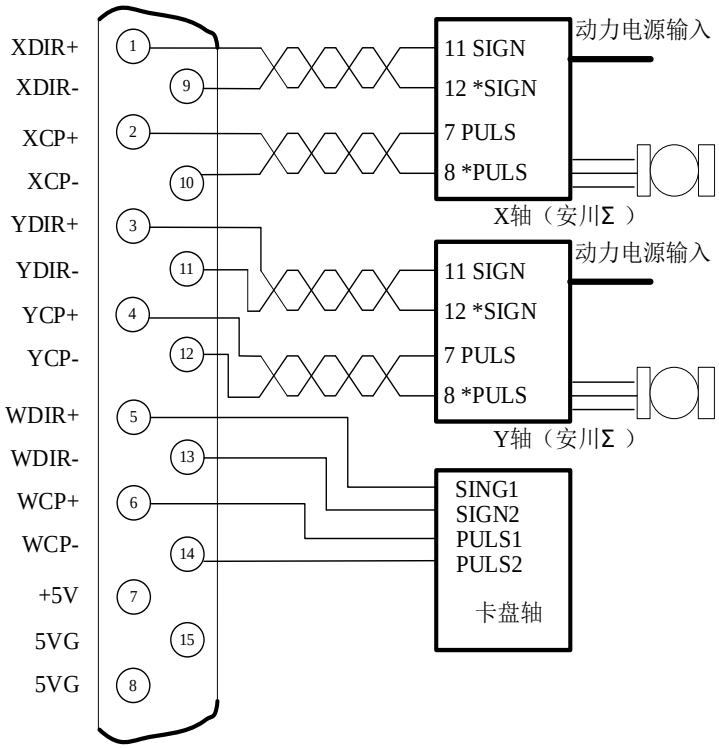


Figure 11.10 Wiring of the Yaskawa Σ series servo drive

Table 11.5 Basic Settings of Yaskawa Series

parameter type	Recommended values	explain
Pn000	0 01X	Set to location mode
Pn00B	not have	When the single-phase power input is changed to 0 100
Pn200	2 000H	Positive logic: pulse + direction; 2005H negative logic: pulse + direction When the pulse frequency is below 1Mpps, select mode 0 000H When the pulse frequency reaches 1Mpps to 4Mpps, select 2 000H

Pn50A	8 100	Positive side can be driven
Pn50B	6 548	The reverse side is driveable

11.3.1.3 Connection method of Taida A series servo driver

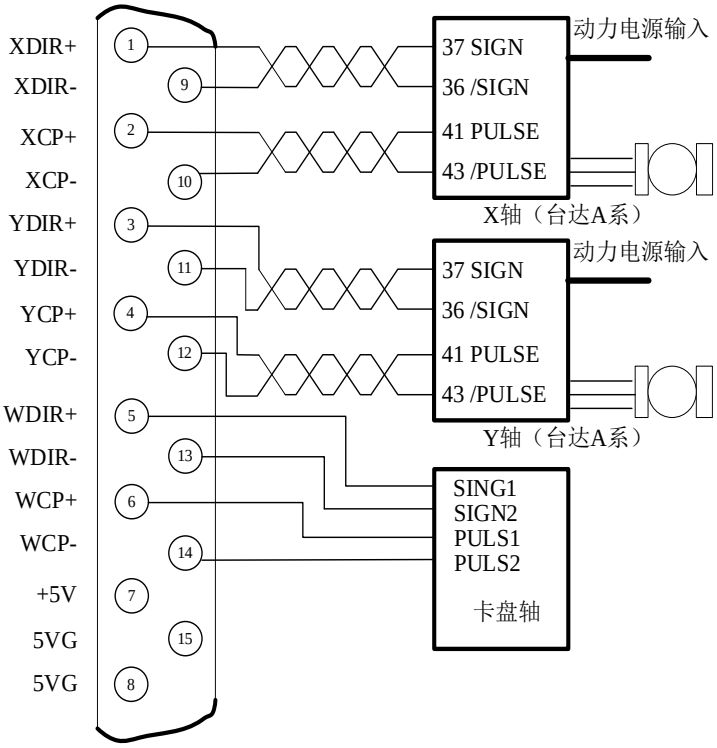


Figure 11.11 Low speed pulse connection of Teda A series servo driver

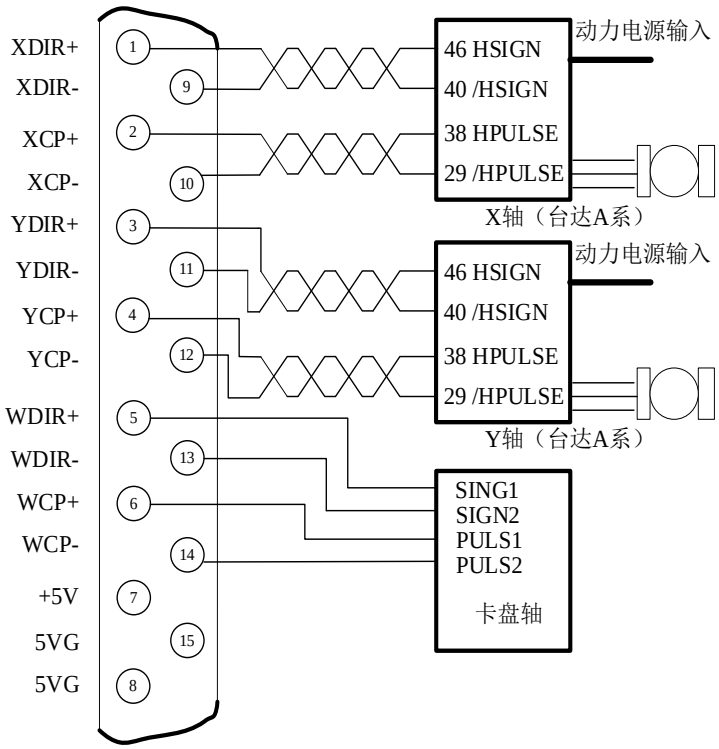


Figure 11.12 High speed pulse connection of Teda A series servo driver

Table 11.6 Basic parameter Settings of Taida A Series

parameter type	Recommended values	parameter declaration
P 1-00	1 102H	Control mode, position control mode negative logic pulse + direction. Set parameters 1102H to open high speed differential signal, and the best pulse frequency is 4Mpps; Set the parameter 0102H to turn on the low-speed pulse signal, preferably with a pulse frequency of 5 00K.
P 1-01	0 0	Select the location mode for external instruction control
P2-10	1 01	DI1 is set to SON servo enable, and the logic is open
P2-22	007	DO5 is set to ALRM servo alarm function, and the logic is normally closed
P 2-14	1 02	DI5 is set to ARST to clear the alarm function, and the logic is normally on

11.3.2 Extension shaft card motor interface wiring diagram

LX4510H Controller, in addition to its own input and output ports, also extends the input, output and motor ports through the extended axis card EXM1302, increasing the number of signal ports and the control of the motion axis.

The LX4510H controller is connected to the extended shaft card EXM1302 through CN5 (RS232 serial port) and communicates through this serial port.

The extended shaft card provides control pulses for the following two axes:

D axis (holding shaft)

E axis (feed shaft)

Table 11.7 Extended shaft card EXM1302 motor interface definition

Motor interface pin number	Signal name	remarks
PUL0+	DCP+	D axis (holding shaft) pulse is positive
PUL0-	DCP-	D axis (fixed material axis) pulse negative
DIR0+	DDIR+	The D axis (feed axis) is in the positive direction
DIR0-	DDIR-	Negative direction of D axis (feed axis)
PUL1+	ECP+	E axis (feed shaft) pulse is positive
PUL1-	ECP-	Negative pulse on the E axis (feed axis)
DIR 1+	EDIR+	The E axis (feed axis) is in the positive direction
DIR 1-	EDIR-	Negative in the direction of the E axis (feed shaft)

The definition of the extended shaft card terminal is shown in Figure 1.13:

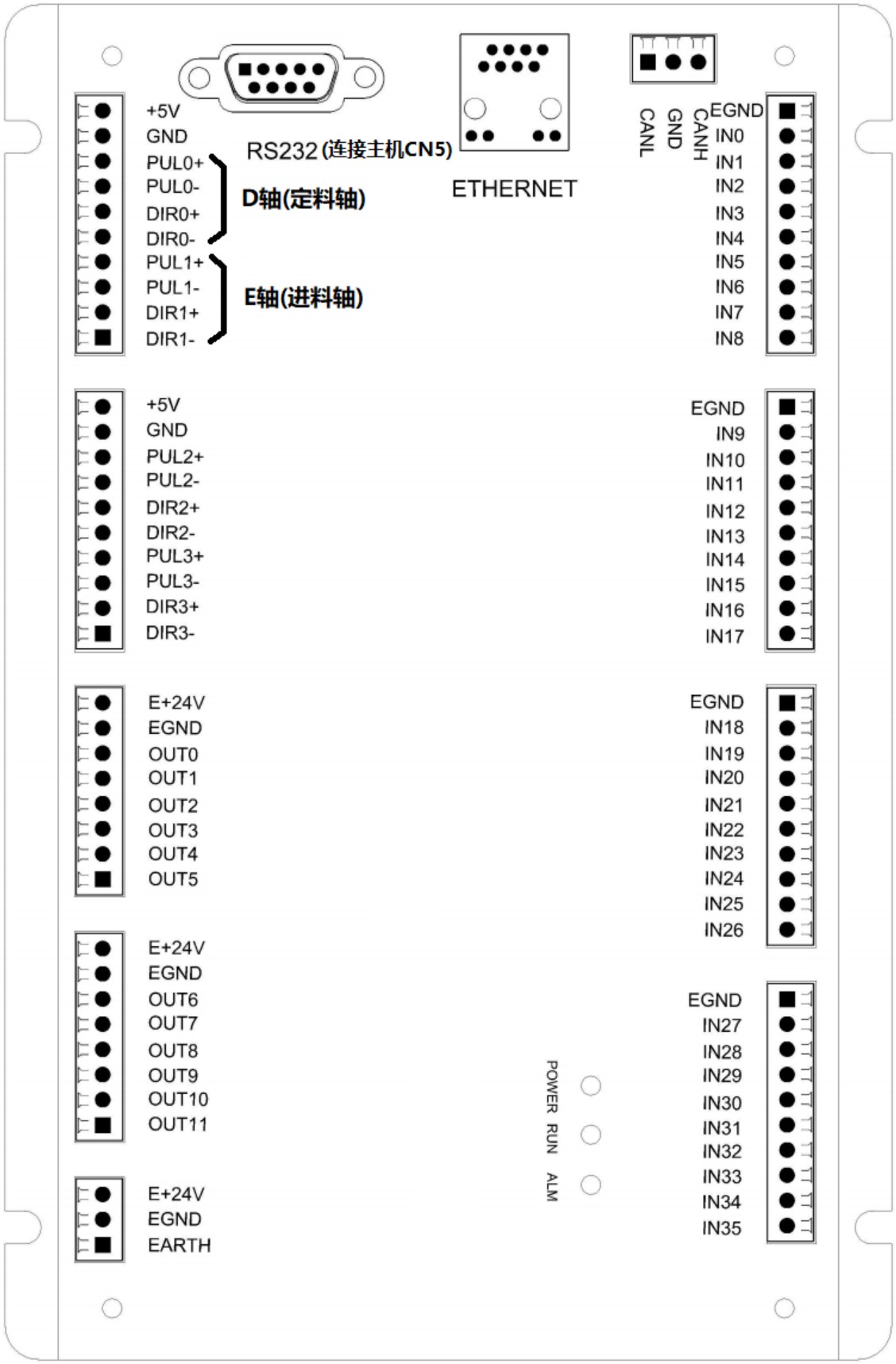


Figure 11.13 Extended shaft card EXM1302 terminal definition

11.5 RS 232 serial port (CN5) interface

LX4510H provides an RS232 serial port communication interface (CN 5) for connecting to the extended axis card.

The CNC system uses DB-9 connector, which has 4 pins, with pins ④ and ⑤ providing external power supply at a voltage of 5V. Pin ② is for receiving signals, while pin ③ is for transmitting signals, hence a cross connection method is adopted.

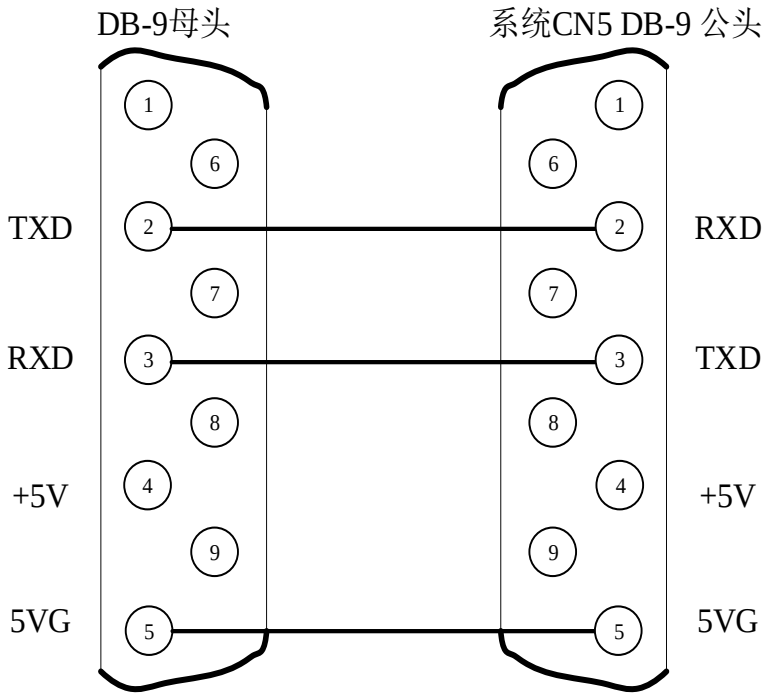


Figure 11.17 Serial port definition

Table 1 1.9 Definition Table of CN5-RS232

CN5 interface pin	Signal name	remarks
2	RXD	Signal reception
3	TXD	Signal
4	+5V	+5V power supply
5	5VG	5VG supplies

11.6 CAN bus interface

LX4510H Provides a five-core CAN bus interface (CN8) to connect a F152 2 remote control that supports CAN communication.

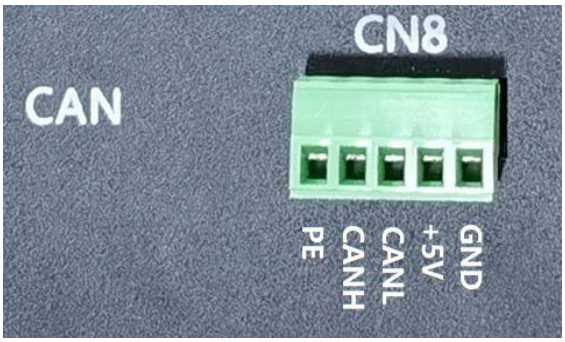


Figure 11.1 4 Back interface diagram

The receiver of the F1522 remote control adopts CAN bus communication mode, under the condition that the antenna and power supply are correctly connected, the connection with the system only requires directly connecting the CAN_H and CAN_L ports of the receiver to the CAN_H and CAN_L interfaces of the systems CAN interface, and connecting a 24V power supply at +24V and GND is sufficient for operation. As shown in Figure 11.15, the receiver interface of the remote control.

Note: The CAN communication terminal needs to be connected with 120Ω matching resistor

Figure 11.1 Backside interface of receiver 5F1522

F152 2 CAN connection diagram of receiver and system:

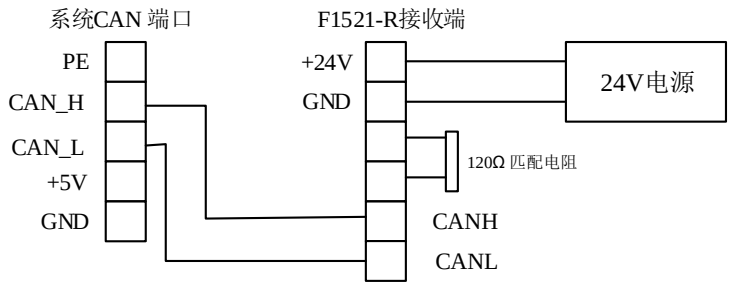


Figure 11.1 Connection between the remote receiver and the CAN interface of the system

Note: If you need to use CAN port to continue connecting other devices, after connecting CAN_H and CAN_L to the receiving end of the remote control, you can draw two additional lines from CAN_H and CAN_L at the system end to the CAN_H and CAN_L of other devices.

11.7 PWM output ports, analog input ports

LX4510H provides two-core PWM output port (CN9) and eight-core analog input/output port (CN10). The PWM output port is used to output PWM pulse to control the laser generator.

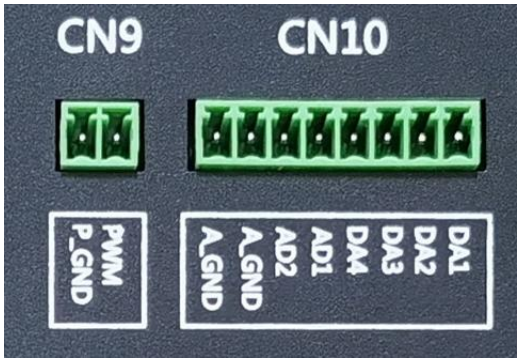


Figure 11.17 Two-core PWM output port and analog input/output port

Table 11.8 PWM Output Definition:

definition	function	remarks
PWM	Receive the modulation + signal of the laser	24V output
P_GND	Receive the modulation-signal of the laser	

Table 11.9 Definitions of AD and DA outputs

definition	function	remarks
DA 1	0~10V analog output port Laser peak power control Proportional valve control	Functions can be configured in the system
DA 2		
DA 3		
DA 4		
AD 1	0~10V analog input port	Automatic edge search
AD 2		
A_ GND	In analog, if a proportional valve is used, the power ground of the proportional valve needs to be shorted	
A_ GND		

11.8 Network communication port (CN11)

LX4510H provides an RJ45 network communication interface (CN 11) for communication with the laser modulator over the network cable.

11.9 Power port (Power In) description

Power port (Power In) input pin 24V-, 24V+, PE.

Figure 11.18 Power interface

Table 11.10 Power port signal definition table

Pin number of 3-core	Signal name	remarks
1	24V-	24V power
2	24V+	24V power
3	PE	

Note: PE should be connected to the ground stake through a grounding cable with a large cross section. The ground stake should be buried deep in the underground with good conductivity.

Chapter 12 BIOS Usage

The functions related to system upgrade and system restore can also refer to section 8.7.10 System Upgrade, which is similar to section 8.7.10. When the system is powered on, the system shows Figure 12.1.

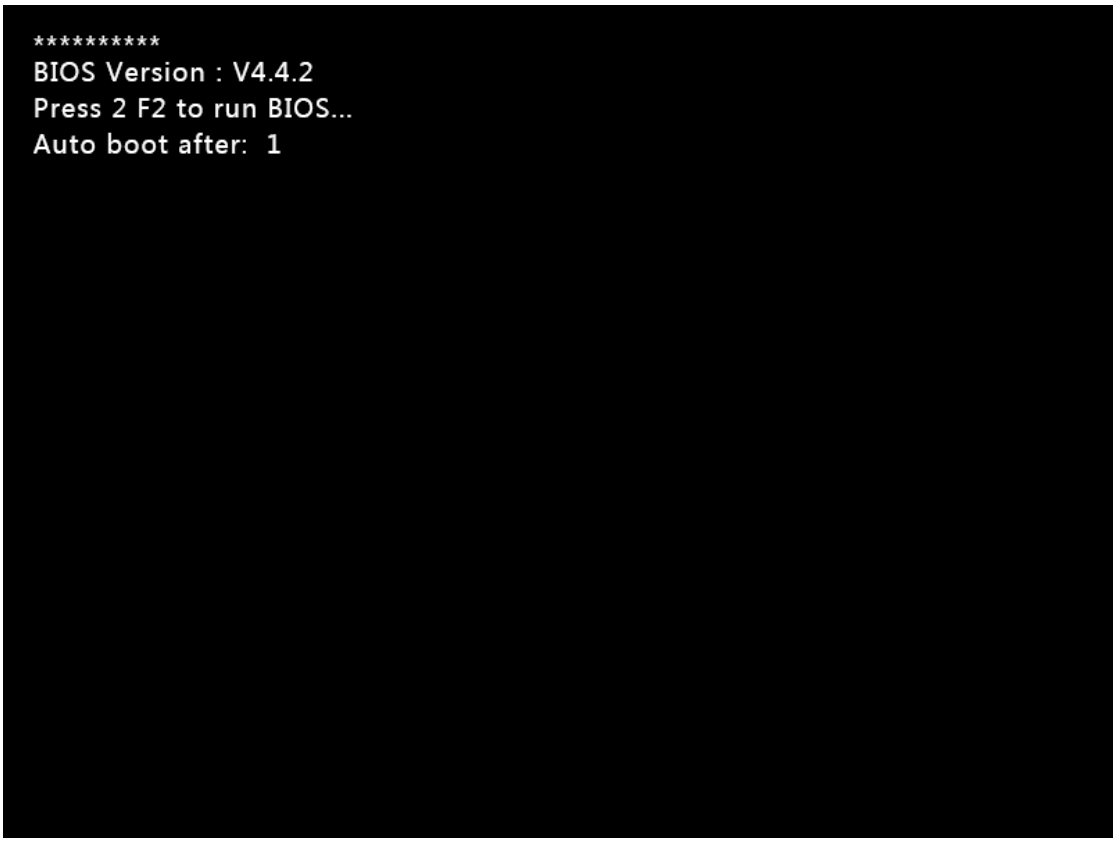


Figure 12.1, boot-up prompt

When the prompt in Figure 12.1 appears, if you press the [F2] key before the countdown reaches 0, the system enters the BIOS interface. If you press any other key, the countdown ends and the system enters the system.

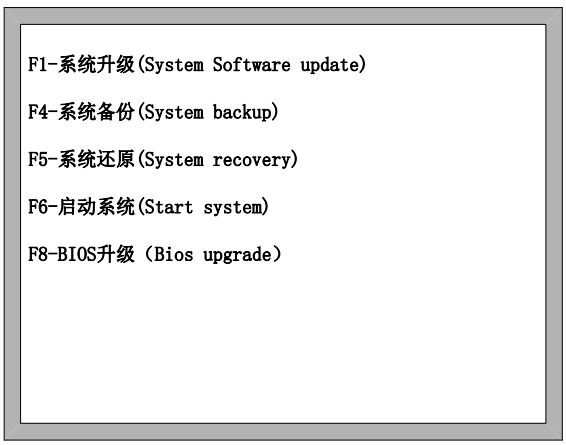


Figure 12.2 BIOS interface

12.1 System upgrade

After entering BIOS, press [F1] to upgrade the system. The following conditions must be met before upgrading:

- The USB drive is plugged into the system USB port
- The root directory of the USB drive contains the upgrade file F2000 V5. upg

In the case of meeting the above two conditions at the same time, the system can be upgraded after F1. After the upgrade is completed, the system can be started by pressing [F6].

12.2 System backup

After entering BIOS, press [F4] to back up the system. The system backup only backs up the operating system, but does not back up parameters, IO port configuration, coordinate configuration and other information.

12.3 System restoration

After entering BIOS, press [F5] to restore the system that has been backed up before. The restored system does not affect the users parameters, IO port configuration, coordinate system configuration, etc., and it is recommended to use the restored system function here.

12.4, Start the system

After entering BIOS, press [F6] to start the system. After the system upgrade is completed, you do not need to power off, you can directly press [F6] to start the system, and the system will pop up BIOS and enter the cutting main interface.

12.5 BIOS upgrade

After entering BIOS, press [F8] to perform a system BIOS upgrade. In most cases, users do not need to upgrade the BIOS. This product may require hardware upgrades in the future to support more functions, which may necessitate a BIOS upgrade. Copy the BIOS program to the root directory of a USB drive, insert the USB drive into the system, and after booting, press [F2] - [F8] to follow the prompts to upgrade the BIOS.

Chapter 13 Installation and commissioning

13.1 Cross/longitudinal pulse number setting

◆ Horizontal/vertical pulse number setting

The number of horizontal/vertical pulses here is the same as the horizontal pulse number and vertical pulse number in Section 7.4 of the system parameters. The setting of horizontal (vertical) pulse numbers is actually quite simple: before drawing the line, first assume a horizontal pulse number XPls and a vertical pulse number YPls. After setting these two parameters, save them. Then enter the manual interface, click forward, assuming the forward distance is Amm (the screen displays the coordinate value moves Amm). First, move horizontally by Amm, at this point the actual line length Bmm (B and A may not be equal) can be calculated. The formula for calculating the horizontal pulse number accurately is:, replace the original XPls with the result calculated by this formula (rounded to three decimal places). Similarly, move vertically by Cmm distance, the actual line length is Dmm, then the actual vertical pulse number is. $XPls \bullet \frac{A}{B}$ $YPls \bullet \frac{C}{D}$

For example, assuming that XPls is initially set to 1 000, indicating that moving 1mm requires sending 1 000 pulses. Assuming the intended movement A=1 0mm, and the actual measurement shows that the torch moves B=20mm. Since the mechanical structure is fixed and the distance each pulse travels is fixed, only half of the pulses need to be sent to ensure that the intended actual movement distance = intended movement distance. Therefore, XPls (actual value) = XPls (initial assumed value) × (A/B) = 1 000 × (1 0/20) = 5 00. If the XPls setting is changed to 5 00, then moving 1 0mm will also result in an actual movement of 1 0mm.

◆ Pulse count requirements:

The maximum frequency of the system output pulse is 160 kHz. Above 160 kHz, it may lead to distortion of the pulse waveform, preventing the servo driver from responding correctly and operating 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 since Mv*XPls/60 = 12000*2000/60=400000> 160000, the speed cannot reach

12000 (mm/min). If XPls is set to 500, then Mv*XPls/60 = 12000*500/60 = 100000 <160000, and the maximum speed of 12000 mm/min can be achieved.

Although in principle the pulse count can be set to a large value, it is recommended to set it between 150 and 1200, because when the frequency is too high, some drives cannot work well, motors will often lose step due to missing pulses, and the anti-interference performance is also poor, producing strong high-frequency interference externally.

Note: The most reasonable number of pulses set in this machine is between 150 and 1200. For pulses outside this range, please refer to the drivers instructions and change the number of steps in the stepper driver or the denominator in the servo driver.

13.2 Connect the iHC100/ iHC 100B regulator

13.2.1 Parameter Settings

This controller can be used in conjunction with the companys iHC100/ iHC 100B type laser height adjuster. Before using it, the relevant parameters of the height adjuster connection need to be set up, including the network configuration and site configuration of this machine.

1） IP address Settings

In the parameter interface of [F5 Diagnosis]->[F8 System Definition]->[F3 Definition]->(Enter password: 1 396)->[F6 Option 2], open the parameter of "Hardware Configuration", in the pop-up interface, open "Network Configuration", in the pop-up interface, set the IP address.

This is the local IP address, which is in the same network segment as the booster IP address, but cannot be repeated. For example:

The IP address of the height adjuster is: 1 72.16.8.9

The local IP address is 1 72.16.8.8

The subnet mask is set to 2 55.255.240.0

The default gateway is set to 172.16.8.1

After setting the parameters, save them and power off to restart them so that the parameters take effect.

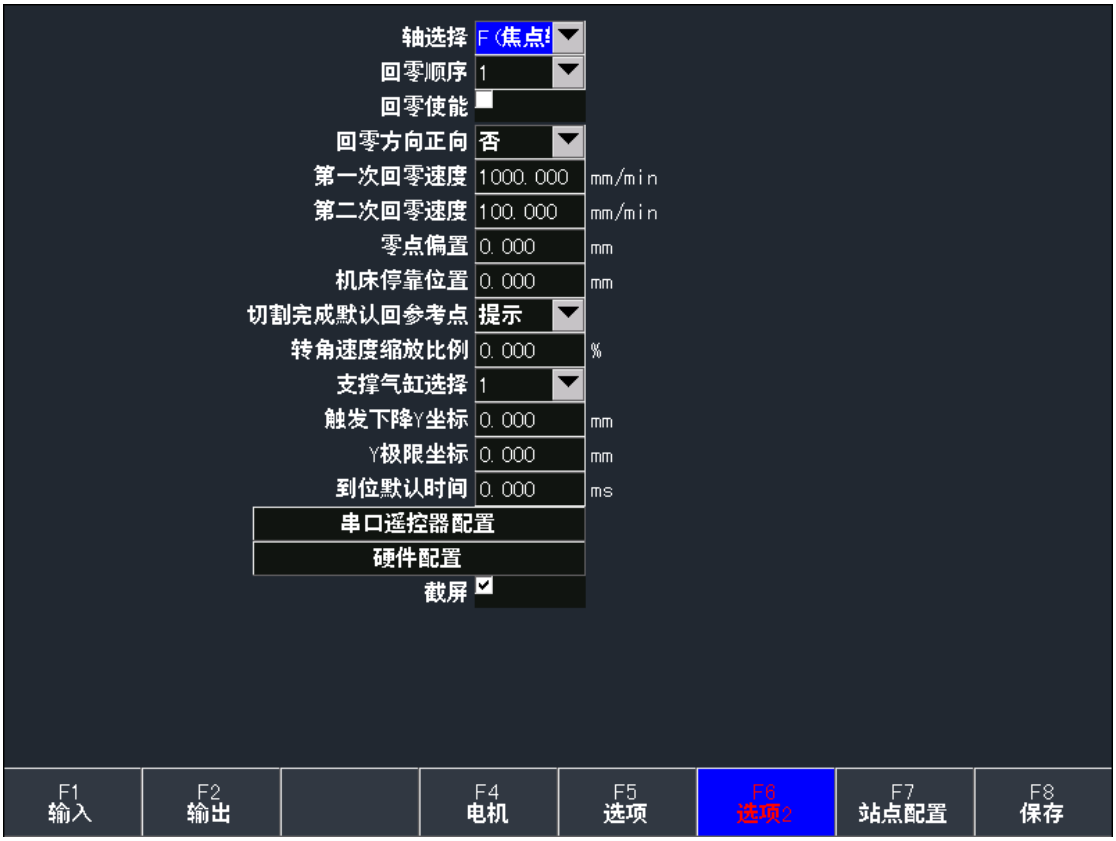


Figure 13.1 Hardware configuration in Option 2 of F6

Figure 13.2 Network configuration in hardware configuration of Option 2 of F6

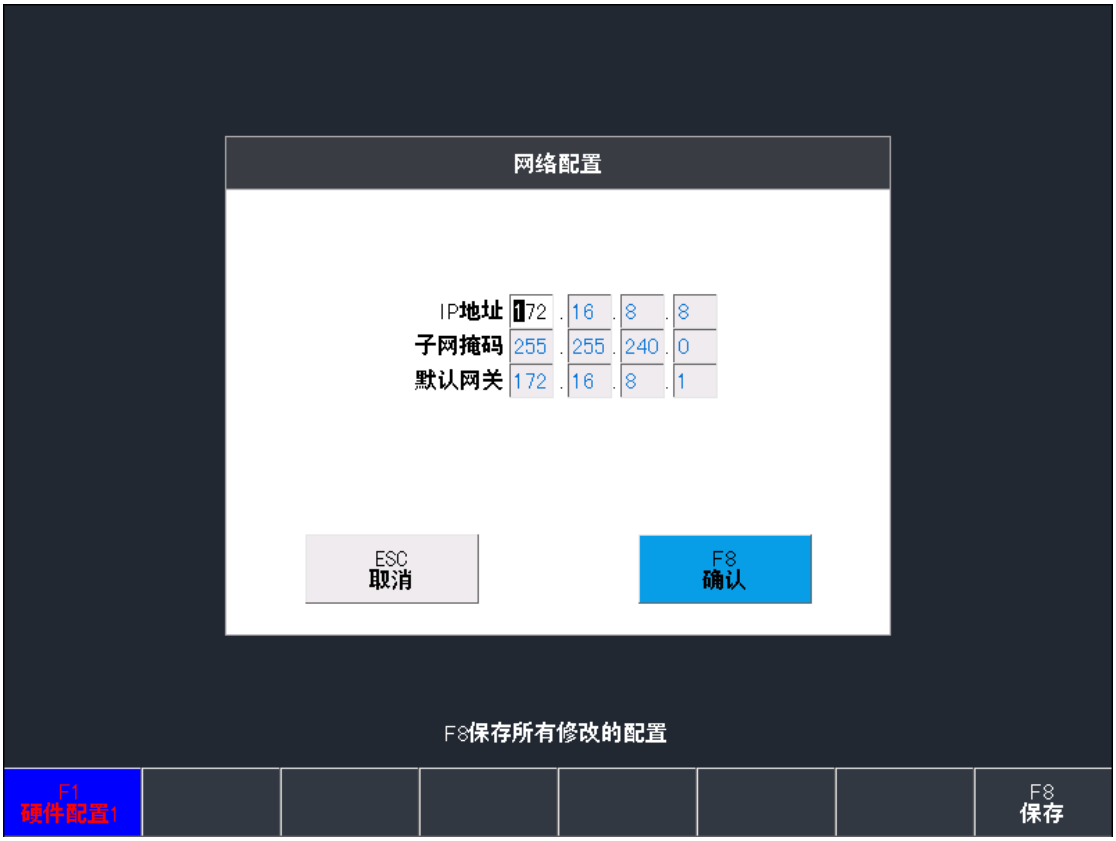


Figure 13.3 IP Address Settings in Network Configuration

2） Site configuration

After setting the IP address, under the interface of [F5 Diagnosis]->[F8 System Definition]->[F3 Definition]->(Enter password: 1 396)->[F7 Site Configuration]->[F6 Laser Height Adjuster], in the "Laser Height Adjuster Manufacturer" option box, select "JIAOLING", press the [ENTER]key, then select a laser height adjuster model in the laser height adjuster model selection box, a laser height adjuster IP address interface will pop up, enter the IP address of the laser height adjuster to be connected. The port number is: 50 2. As shown in Figure 1 3.5, the laser height adjuster model is: iHC 100, IP address is 1 72.16.8.9, and the port number is 50 2.

Figure 13.4 Select the JIAOLING tone regulator

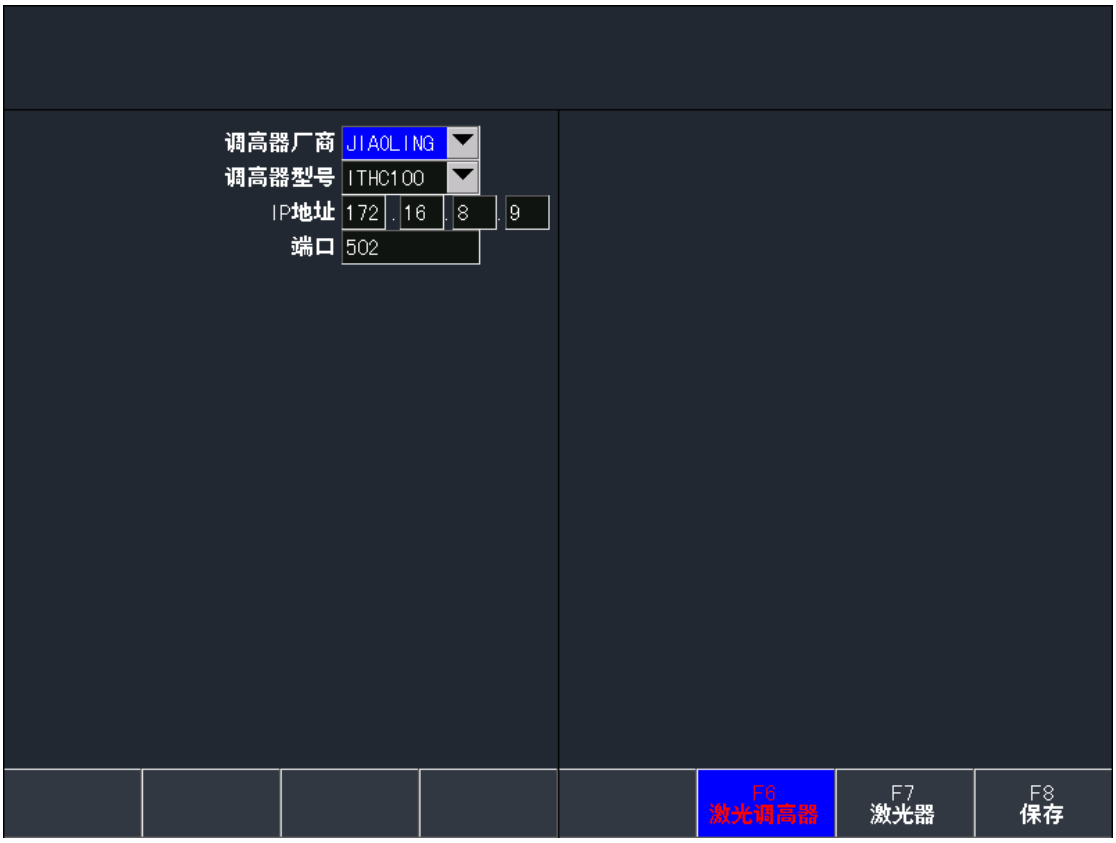


Figure 13.5 IP address setting of the regulator

13.2.2 Connection status

After the two settings are completed, the controller will be powered off and restarted. If the network cable connection is normal, the controller and the regulator will be connected. At this time, the "connection status" indicator light on the main interface will be green, indicating that the connection is normal.

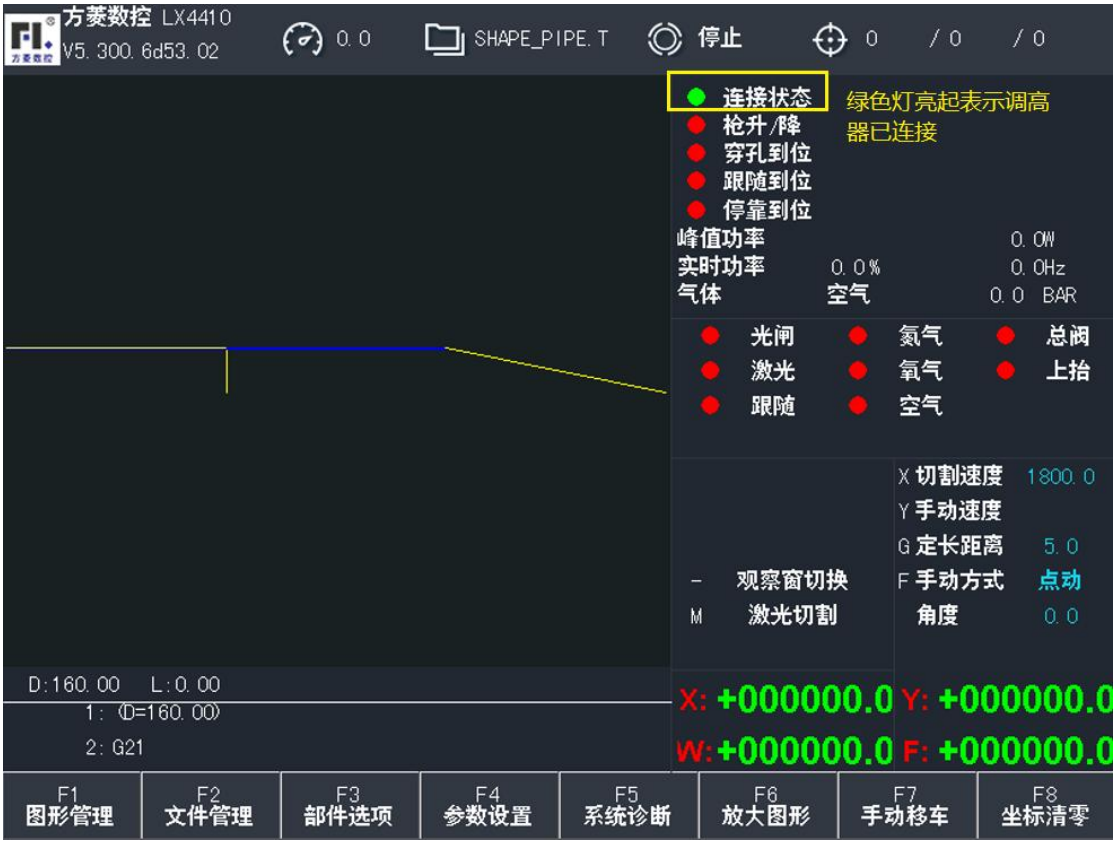


Figure 13.6 The green light indicates that the regulator is connected

13.3 Connect the F1522 remote control

The controller can be optionally equipped with the companys F1522 remote control. The CNC system is connected to the F1522 remote control via the CAN interface. Please refer to section 1.1.5 for wiring.

After the CAN connection is completed, remote control can be performed.

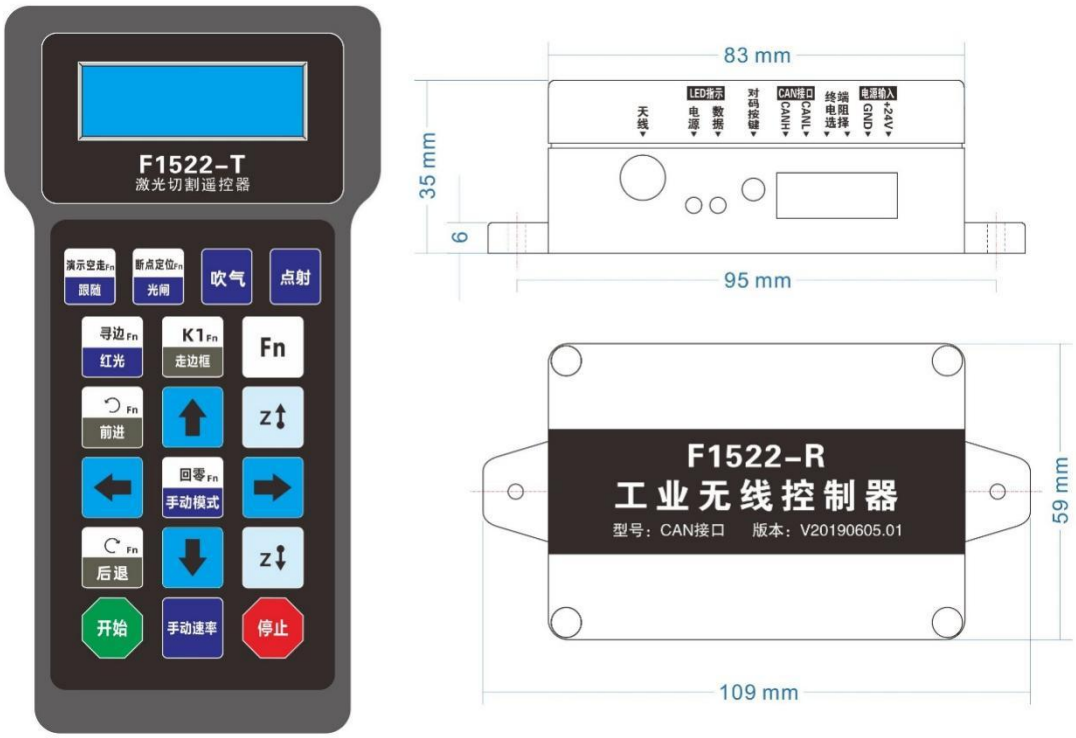


Figure 13.7 F1522 Remote control

13.4 Connect the fly-by laser

This controller can communicate with the Feibo laser, and the parameters of the Feibo laser can be set after the successful connection. The CNC system is connected with the Feibo laser through the RS232 interface.

After the serial cable is connected, you need to set the modbus communication parameters and site configuration parameters

1） Modbus Configuration:

Refer to section 8.7.2.11, set the modbus communication parameters in the modbus configuration interface.

Modbus Main station:

enable:

port:

Baud rate:

even-odd check:

Save after setting up.

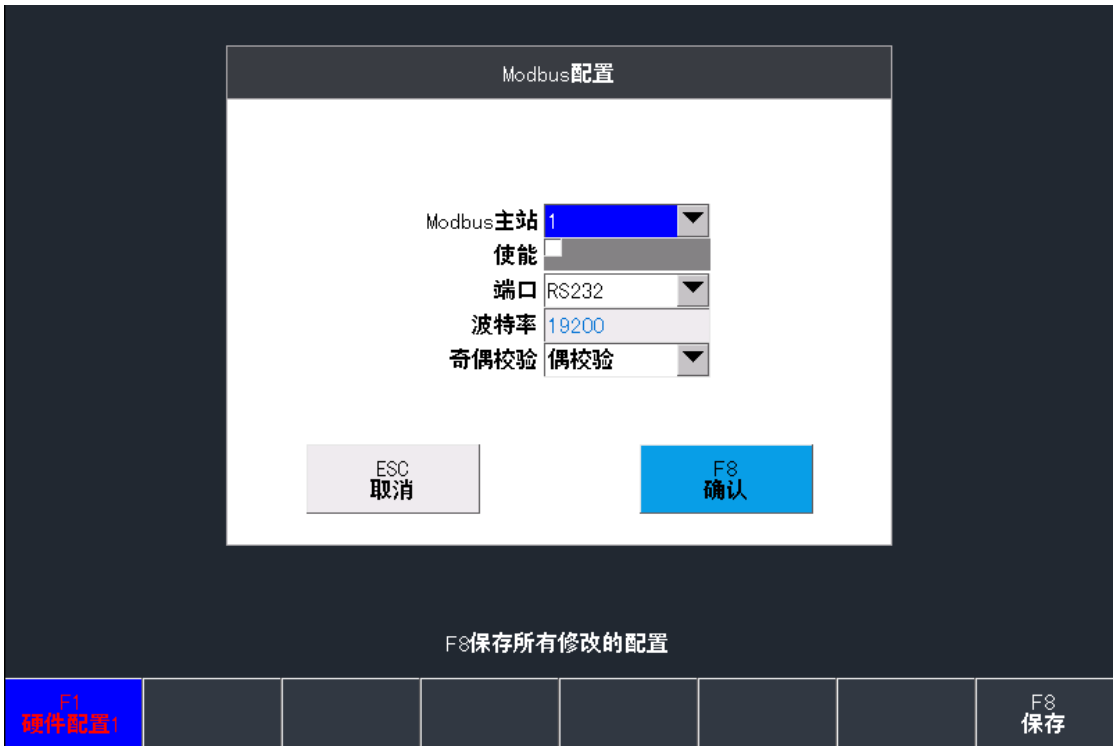


Figure 13.8 Set Modbus configuration parameters

2） Site configuration:

After setting the Modbus communication parameters, under the interface of [F5 Diagnosis]->[F8 System Definition]->[F3 Definition]->(Enter password: 1 396) ->[F7 Site Configuration]->[F7 Laser], in the "Laser Manufacturer" option box, select "FEIBO", press the [ENTER]key, then select a laser model in the laser model selection box, and choose "RS232" for the serial port. After the communication line connection is normal and the parameters are correctly set, communication with the laser can be established.

After the successful communication of the laser, the laser parameters can be set up, refer to section 7.2.2.

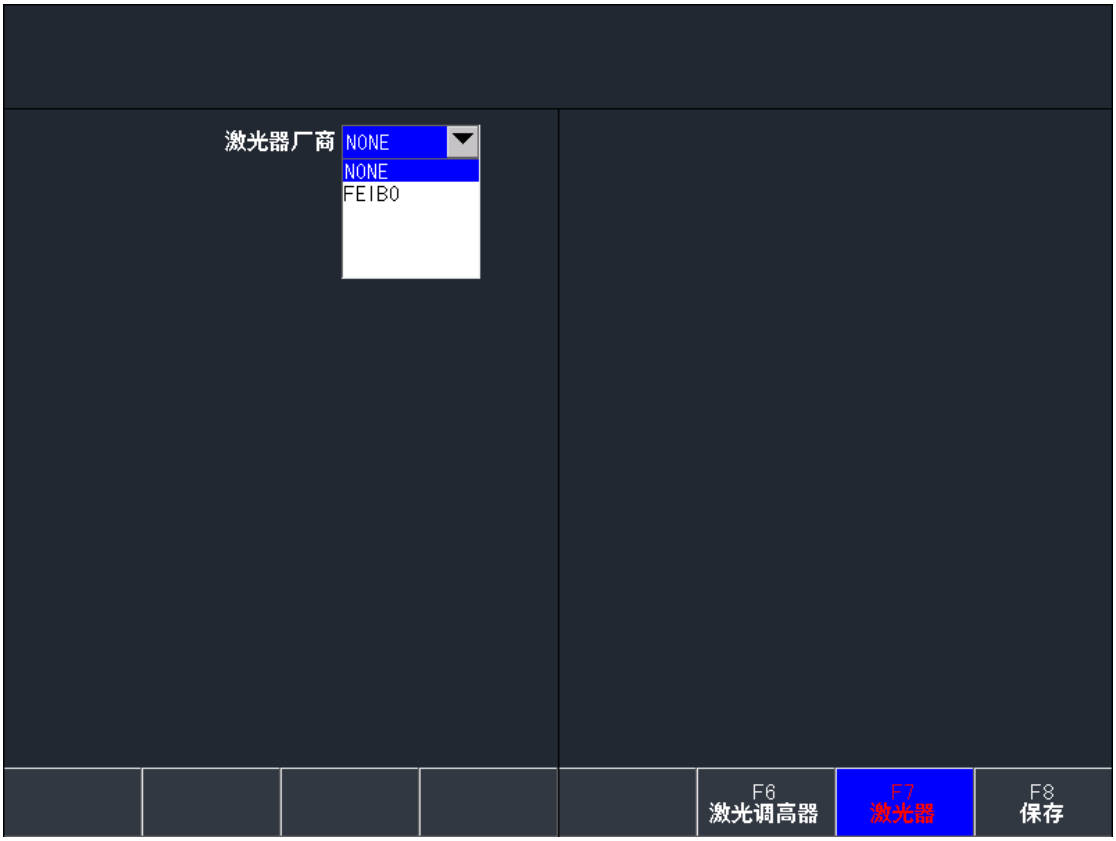


Figure 13.9 Selecting the FEIBO laser

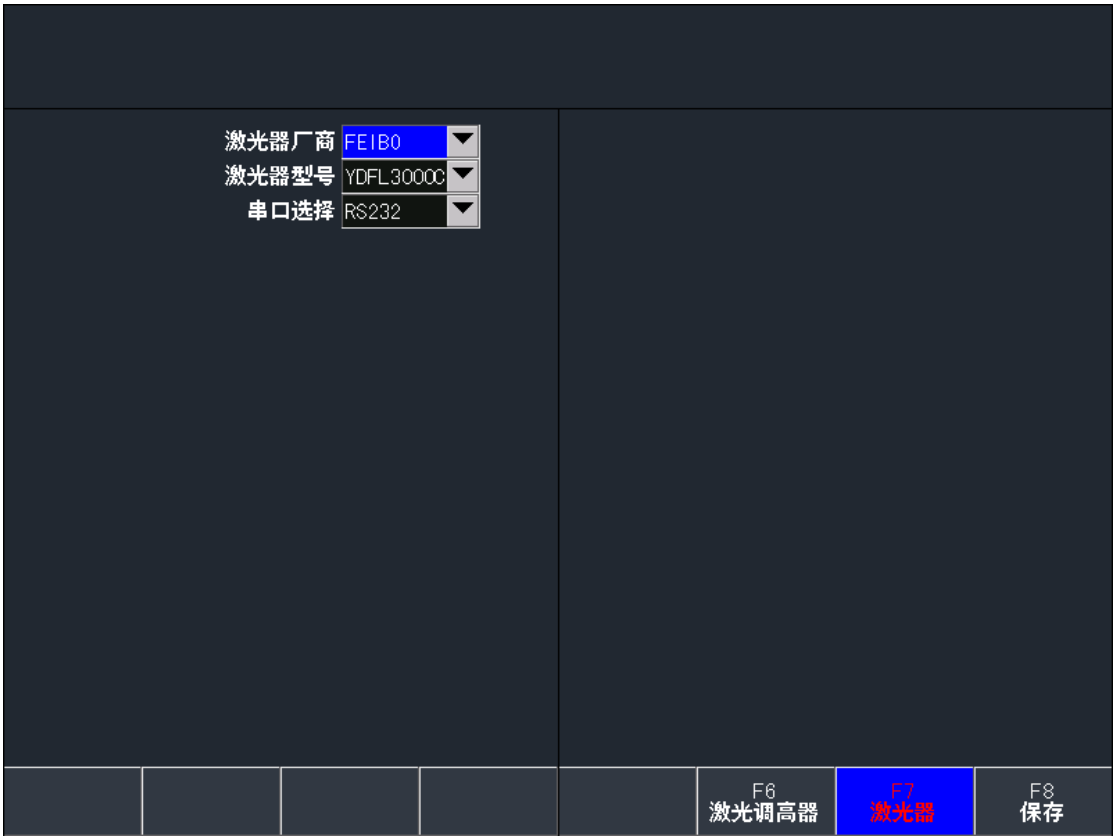


Figure 13.10 Set up the serial communication of the Feibo laser

13.5 Cutting process

After connecting with other equipment and completing the setting of each parameter, cutting can be carried out.

Cutting workflow:

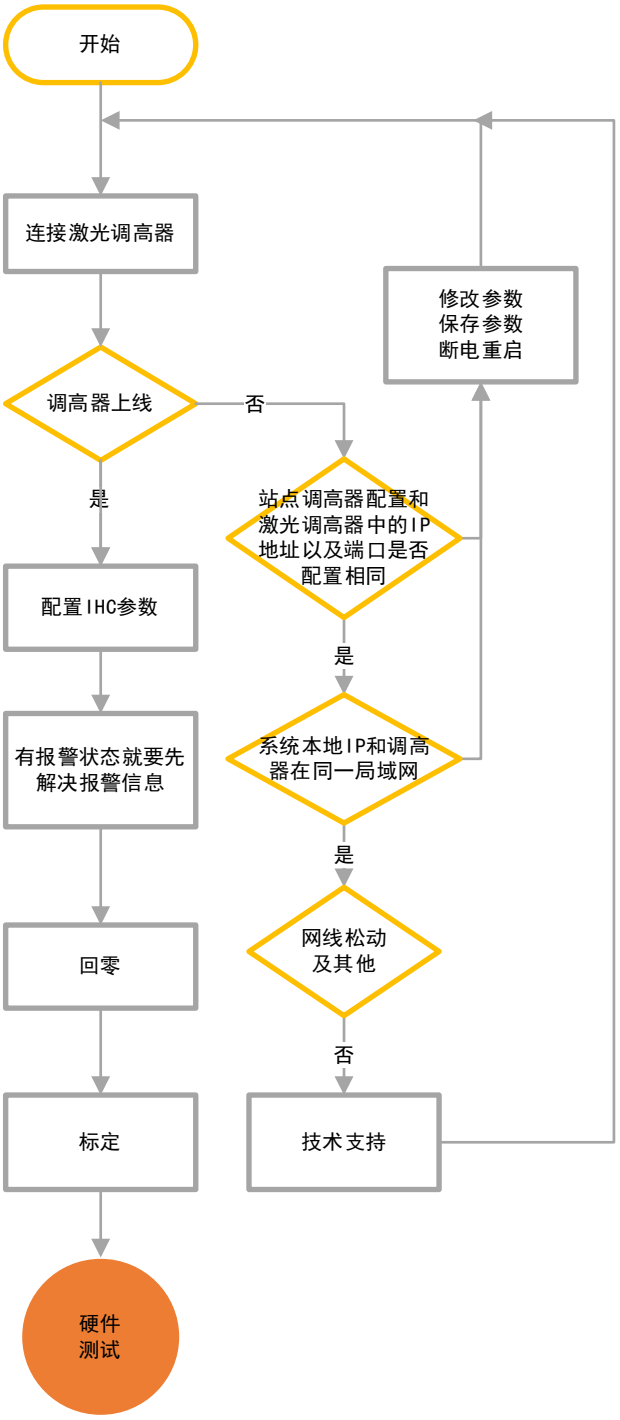


Figure 13.11 Pre-cutting preparations

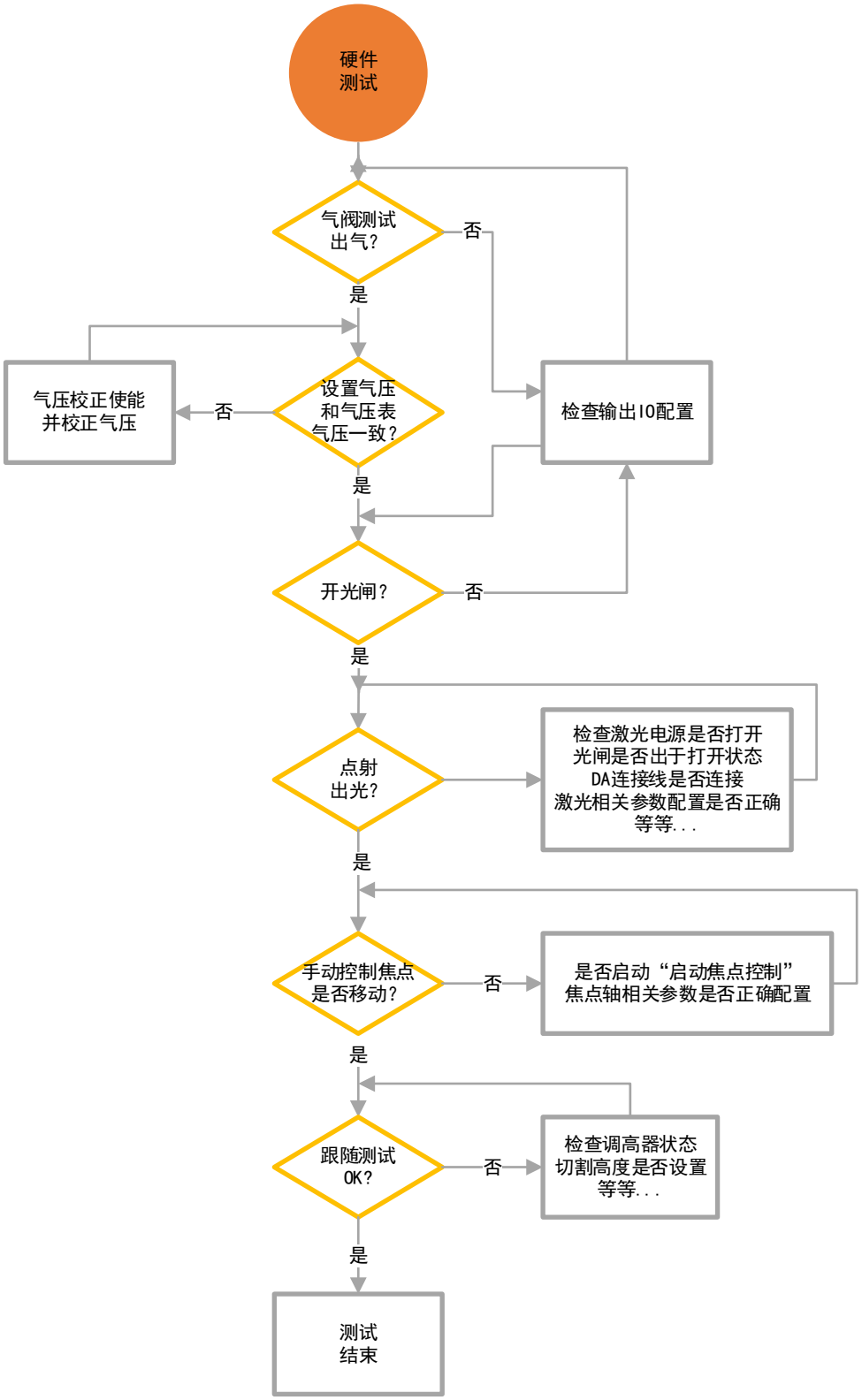


Figure 13.12 Test work

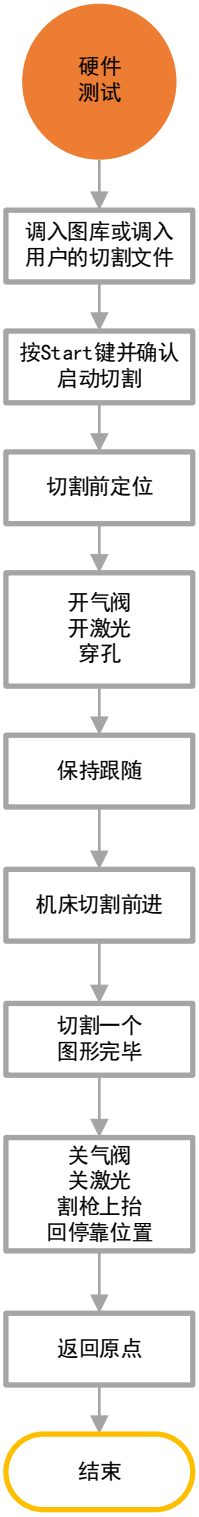


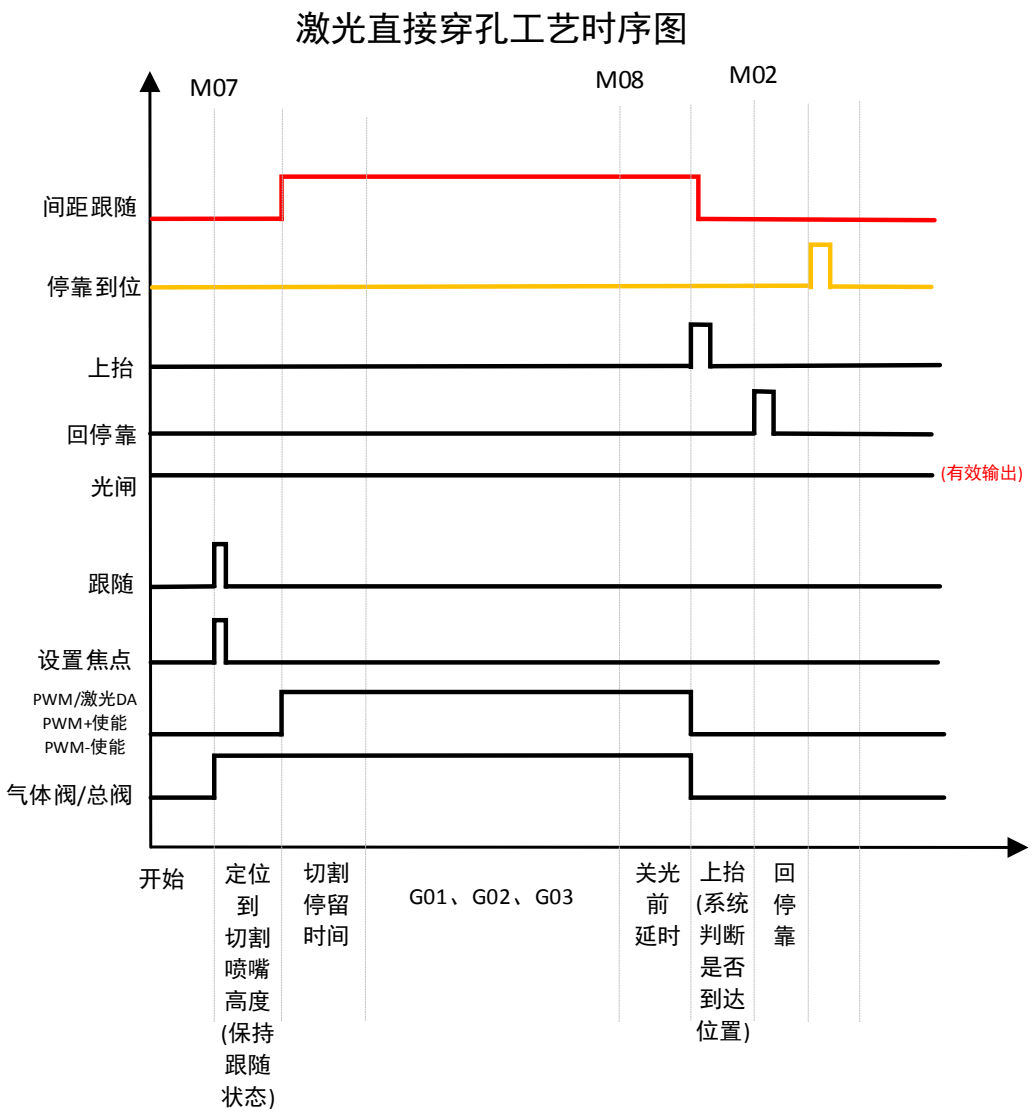
Figure 13.13 Cutting workflow

Appendix 1 Quick reference to G and M codes

order number	instruct	function
1	G99	Rotate, scale, mirror
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 and Y axes quickly return to the reference point
10	G41	Left incision compensation
11	G42	Right incision suture compensation
12	G40	Cancel the cut compensation
13	G00	quick travel
14	G01	Straight-line processing
15	G02	Smooth processing
16	G03	Reverse circle processing
17	G04	Program delay
18	M07	Ignition cycle
19	M08	Cut the loop
20	M 1 1	Establish powder shift
21	M12	Cancel powder shift
22	M 09	Turn on the powder
23	M 10	Turn off the powder spray
24	M00	suspend
2 5	M02	end of program

Appendix 2 IO timing diagram of LX4510 H series CNC system

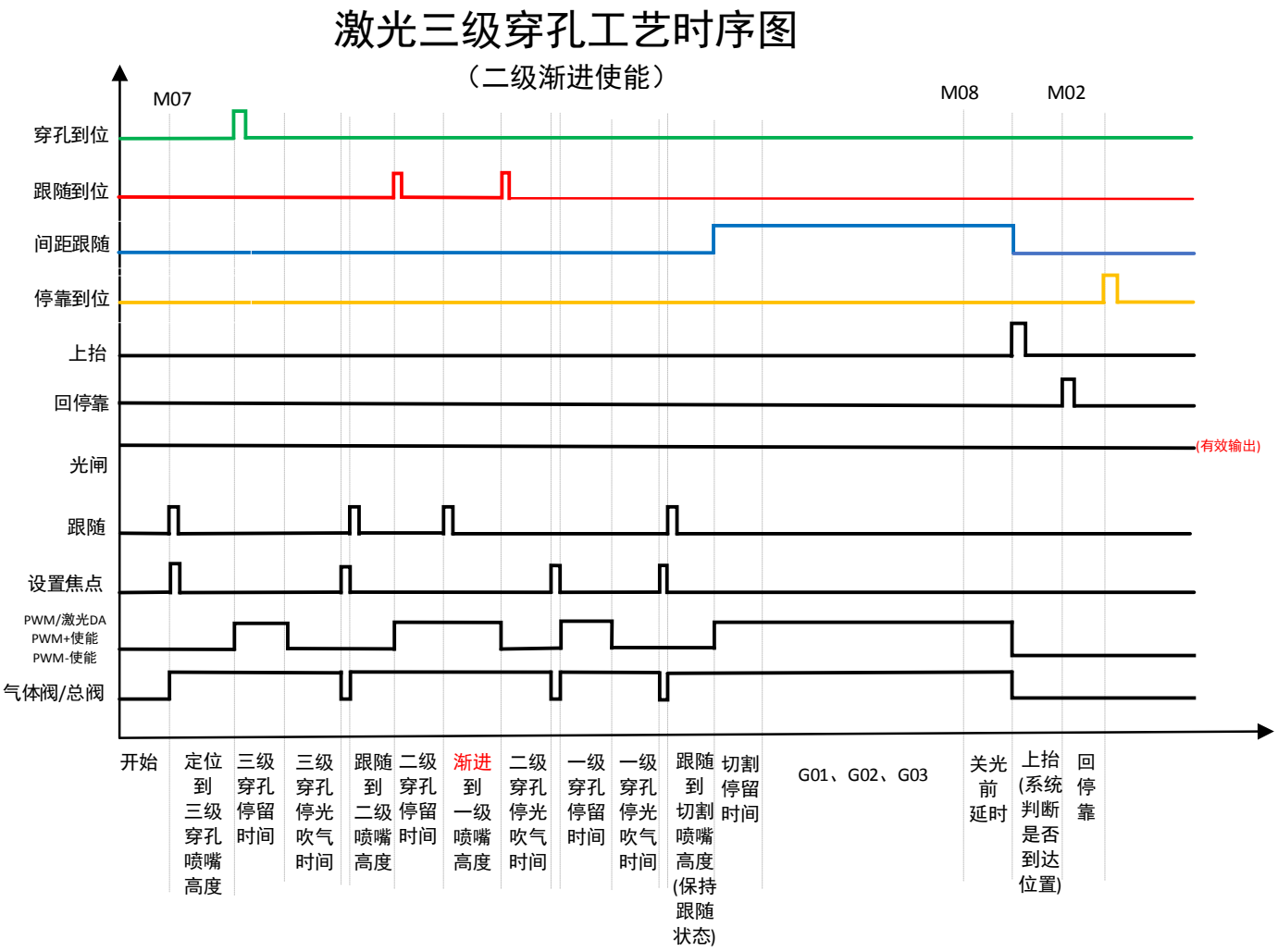
A2.1 Laser direct perforation process timing chart



pour:

1) The black line segment on the Y axis represents the system output command;
2) Other colors represent system input commands;
3) Distance following: it means that the cutting gun and the sheet always keep a certain distance, that is, the following state;
4) Follow in place: refers to the system control of the tilter reaching a certain position, which does not necessarily maintain the follow state. The lift, return to stop and follow commands all require feedback signals.

A2.2 Laser three-level perforation process timing chart



Appendix 3 Installation dimensions of the LX4510 H series system

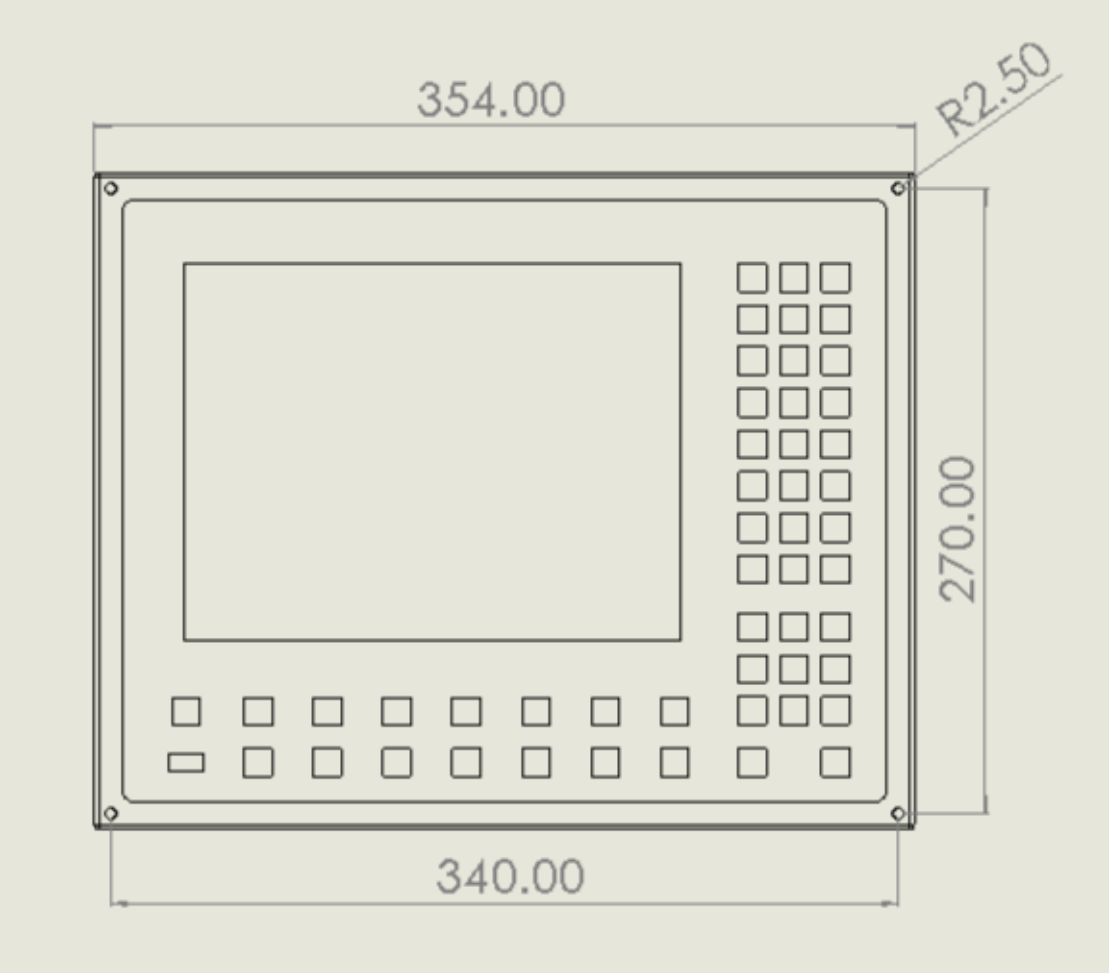


Figure 4.1 Installation dimensions of LX4510 H (front view)

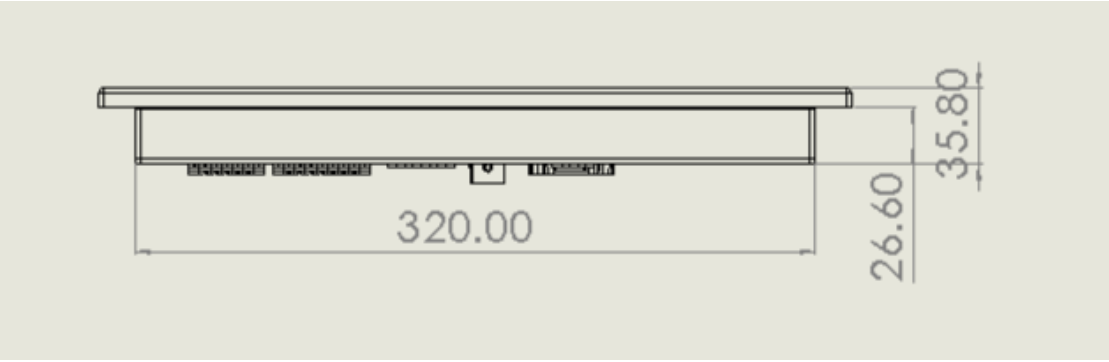


Figure 4.2 Installation dimensions of LX4510 H (bottom view)

Figure 4.3 LX4510 H installation dimensions (side view)

Appendix 4 FAQ

Alarm code	fault phenomenon	cause	processing method
not have	The X/Y axis motor does not rotate	1. wiring error 2. Motor chip is bad	1. Testing wiring 2. See A 4.1 for details
not have	The X/Y axis move in opposite directions	1. wiring error 2. The parameter setting in the system definition is wrong	1. Check external wiring 2. See section 8.7.2.4, change the direction of the motor
not have	The X/Y axis moves in only one direction	1. wiring error 2. The servo parameters are set incorrectly 3. Motor chip bad	1. Testing wiring 2. Check whether the servo parameter "motor control mode" is "pulse + direction" 3. See A 4.1 for details
not have	The X and Y axes were swapped	1. wiring error 2. Change parameters in the system definition	1. Check the external wiring 2. See section 8.7.2.4 for details, and set the XY axis interchange to "yes"
not have	The X/Y motor sometimes turns and sometimes doesnt	1. The motor plug at the back of the system is poorly connected 2. Motor chip soldering	1. Replug the motor interface 2. Check whether the 2 4V power supply voltage is stable 3. Return to factory for repair
not have	The cutting pattern is too small	1. Pulse Settings Incorrect 2. There is a problem with mechanical accuracy	1. The number of pulses in the F5 system parameters is small 2. Detect mechanical accuracy
not have	The cutting pattern is too large	1. Pulse Settings are incorrect 2. It may be caused by zero drift 3. There is a problem with the mechanical accuracy	1. The number of pulses in the F5 system parameters is small 2. Ground well and add a magnetic ring 3. Detect mechanical accuracy
not	The inner	1. The cut is set too	1. Set the correct cut again

have	and outer diameter of the cutting flange is not accurate	large or too small	
not have	The size of the cutting part is large and small	1. Mechanical problems 2. Electrical matching problem	1. Check gears, rack and pinion 2. The pulse signal matching problem of the system and driver is solved by connecting 4.7 K-10K resistors in parallel at both ends of Pul+ and Pul-
not have	All inputs are unresponsive	1. The wiring is wrong, the public end is wrong	1. Find the wiring, input the common terminal is CN 1 P13 or P25, that is, input power 24V-
not have	The input port is unresponsive	1. The wiring is wrong, the public end is wrong 2. The input port is damaged	1. Find the connection, and input the common terminal as 0V 2. See A 4.2 for details
not have	After turning on the computer, it enters the automatic interface and dies	1. The file is corrupted 2. parameter error	1. When the boot screen is displayed, press the [DEL] key to enter. 2. Parameter restoration (F5 system diagnosis, F8 system definition, F1 restore parameters)
not have	Enter the file management crash	1. File system error	1. Factory Settings (F5 system diagnosis, F8 system definition, F8 system upgrade, press F4 to factory Settings in the pop-up window, password 6931), try to restore parameter values or restore all Settings.
not have	Manual move car Prompt: hard limit alarm	1. The four input limit switches were changed from open to closed 2. The machine tool hits a hard limit	1. See A 4.3 for details 2. Remove alarm limit
not have	Manual move the car Prompt:	1. The emergency stop button was pressed	1. Reset the emergency stop button 2. See A 4.4 for details

	emergency stop alarm	2. The input stop, open and closed signals are reversed	
not have	The collision was suggested, but it did not happen	1. disturb 2. impact switch	1. Control interference sources 2. Check the collision switch
not have	Hint "Collision alarm"	1. The cutting gun hit the steel plate	1. Improve the positioning of the cutting gun
not have	The output ports are all closed	1. The public end of the output port is wrong 2. The circuit board chip is damaged	1. Check the wiring 2. Replace the chip
not have	Some of the outlets are not open	1. Output port damage	1. See A 4.5 for details
not have	The motor does not move in any of the four directions	1. The motor or driver is faulty 2. System to drive wiring error 3. Motor chip is bad 4. Set the speed to 0	1. Check the motor and driver 2. Check the wiring 3. Replace the motor chip 4. Set speed
not have	The direction of movement is opposite	1. The line is reversed 2. Servo parameter error 3. Set the system to no	1. Check the line 2. Adjust the servo parameters 3. See section 8.7.2.4 for modification of system parameters
not have	The motor travel distance is too short	1. pulse equivalency 2. Mechanical problems	1. Adjust accuracy 2. Adjust the mechanism
not have	The motor is overactive	1. pulse equivalency 2. drift 3. Mechanical problems	1. Adjust the accuracy 2. Servo encoder wire with magnetic ring 3. Adjust the mechanism
not have	Failure to open file	1. Check the file format 2. The version is older	1. Refer to the various formats on the specification sheet 2. Program upgrade

not have	Editing files, prompt that the file cannot be edited	1. No files on the hard disk	1. There must be at least one file on the hard drive
not have	Some keys on the keyboard do not respond	1. The interface is not right 2. Button broken	1. Please go to the correct interface 2. Replace the button
not have	The keyboard is good and bad	1. The keyboard cable is loose	1. Plug in the keyboard cable
not have	The keyboard is unresponsive	1. The code card is dead 2. The keyboard cable is loose 3. There is a foreign body stuck	1. After turning on, press "DEL" on the welcome screen 2. Plug in the keyboard cable 3. Remove foreign bodies
not have	The USB drive does not respond to insertion	1. U disk is broken 2. USB port is broken 3. The USB cable is loose	1. Replace the USB drive 2. Replace the USB cable 3. Plug in the USB cable
not have	The prompt "Failure to open file" appears	1. The file format is incorrect 2. The folder was deleted	1. Check whether the file type is TXT CNC NC, etc 2. Create a new folder
not have	Hint "No file"	1. The file type is incorrect 2. The USB drive has no files 3. The USB drive format is incorrect	1. Check whether the file type is TXT CNC NC, etc 2. Check if there are files in the USB drive and whether the files are in the root directory of the USB drive 3. Format the USB drive as FAT or FAT32
not have	The prompt "Incorrect cutting speed" appears	1. The speed in the common parameters exceeds the maximum speed in the system	1. Modify the maximum cutting speed in the system parameters
not have	The prompt "Manual move speed	1. The speed of the commonly used parameters	1. Modify the maximum speed limit of manual moving in the system parameters

	error"	exceeds the maximum speed limit in the system	
not have	The message "Incorrect speed of empty journey transfer" is displayed	1. The speed in the common parameters exceeds the maximum speed limit in the system	1. Modify the maximum speed limit of the empty car in the system parameters
not have	The prompt "Incorrect cutting seam setting, cutting seam reset" appears	1. The set cut value exceeds the minimum radius value of the introduction and exit lines or arcs in the cutting pattern	1. Modify the introduction and lead-out lines 2. Reduce the cutting compensation value 3. Delete the small arcs in the graph
not have	The parameter import failed	1. There is no parameter file in the USB drive 2. There is a problem with the USB port 3. There is a problem with the USB drive	1. Check if there is a parameter file suffix named.DAT in the USB drive 2. Check if the USB port is working properly 3. Replace the USB drive
not have	The parameter export failed	1. The USB drive is not plugged in properly 2. There is a problem with the USB drive	1. Unplug and plug in the USB drive again 2. Replace the USB drive
not have	When upgrading the program, it prompts "Please insert a USB drive"	1. The U disk was not inserted during the program 2. There is a problem with the USB port 3. There is a problem with the USB drive	1. Please plug in the USB drive before upgrading 2. Replace the USB port 3. Replace the USB drive
not have	The upgrade program prompts "No upgrade file found"	1. The U disk has no upgrade file 2. The upgrade file is not in the root directory of the U	1. Check if there are any upgrade files in the USB drive 2. Put the upgrade file in the root directory of the U disk

		disk	
Incorrect code 0	The error code 0 is displayed	1. Encryption time expired	1. Need to decrypt
not have	The screen goes black when you turn on the computer	1. The system is not powered on 2. The power supply voltage is insufficient 3. 3A fuse is bad 4. The main board is not activated	1. Check whether the switch power supply is normal 2. Check whether DC24V voltage is normal 3. Replace the fuse 4. Send back to our company for replacement of motherboard
not have	After turning on the computer, there is a white screen and a flower screen splash screen	1. The driver board is broken 2. The display screen is broken 3. The line is loose	1. Replace the driver board 2. Replace the display 3. Unplug and reinsert the display cable

A4.1 Motor chip testing

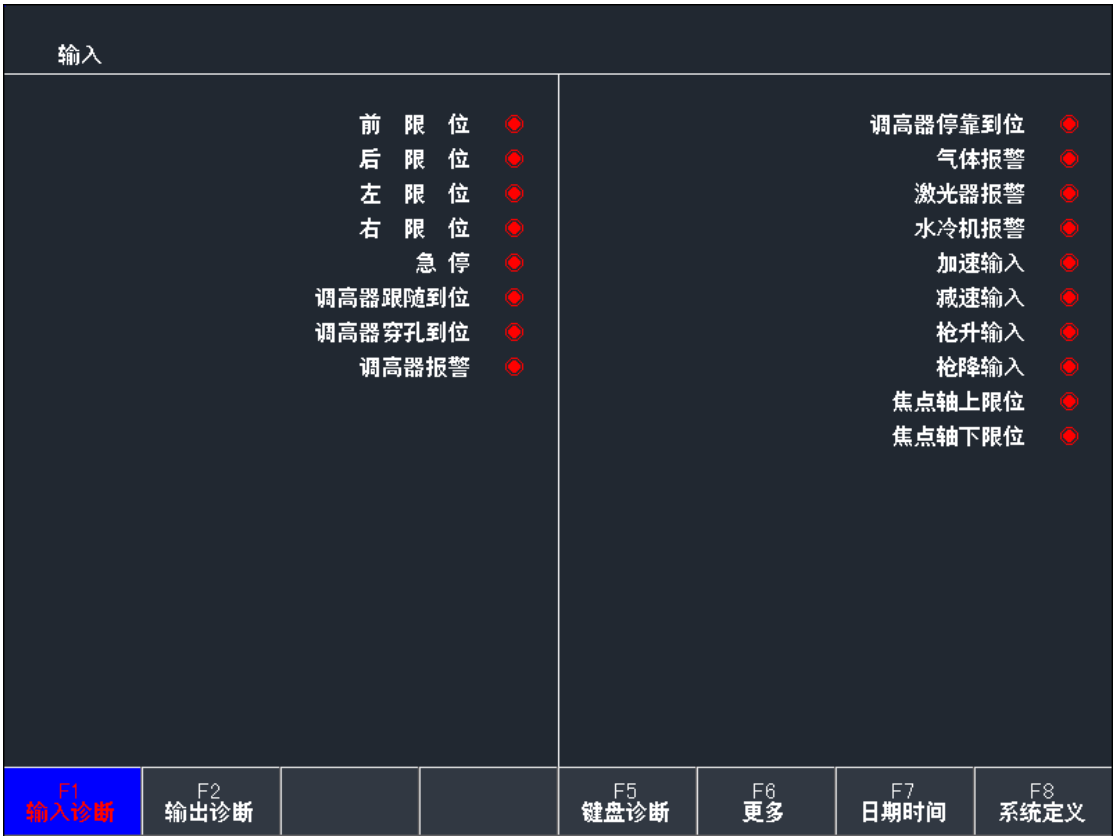
1. The X-axis motor fault can be measured in the following four situations below the CN3 socket of the system:
   - The measured voltage of tube foot 1 and 9 during walking is correct at DC ±3V-3.5V
   - When the measurement stops, the voltage of pin 1 and 9 is correct at DC ±3V-3.5V
   - The measured voltage of tube foot 2 and 10 during walking is less than 0.3 V
   - When measurement stops, the voltage of pin 2 and pin 10 is correct at DC 3V-3.5V

   If any of the above four situations is wrong, the motor chip will be damaged and need to be returned to the factory for repair
2. The Y axis motor fault can be measured in four cases below the CN3 socket of the system:
   - The measured voltage of tube feet 3 and 11 during walking is correct at DC ±3V-3.5V
   - When the measurement stops, the voltage of pin 3 and 11 is correct DC ±3V-3.5V
   - The measured voltage of tube foot 4 and 12 during walking is correct to 0V
   - The voltage of the tube foot should be correct at DC 3V-3.5V when the measurement stops

   If any of the above four situations is wrong, the motor chip will be damaged and need to be returned to the factory for repair

A 4.2 Input port detection

1. If there is no action signal at a single input port, you can enter the input diagnostic interface to check:
   Press F5 (System Diagnosis) to enter the input diagnosis interface



   The input port can be corresponded to the pin number of CN1 (for example, the first limit is pin 02) and 0V (CN1-13 pin)
   Short circuit test:

   - If the corresponding input port status indicator light in the input diagnosis changes after the short circuit, it indicates that it is normal
   - If the corresponding input port status indicator light in the input diagnosis is unchanged after the short circuit, it indicates an abnormality

It can be processed according to the redefined method of input port (please refer to section 8.7.2.1 of the manual for specific modification methods)

A 4.3 Hard limit alarm problem

Indicate hard limit alarm
If the machine tool does not collide with the limit, it is generally caused by the open or closed contact of the limit switch
You can enter the system input definition to modify:
Press F5 (System Diagnosis) -> F8 (System Definition) -> F3 (Definition) password: 1396, enter the system definition interface to modify the input port open or closed state

For example, if the "post-limit" has a limit alarm, the "post-limit" type can be inverted, that is, NC can be changed to NO or NO can be changed to NC.

A 4.4 Emergency stop alarm problem

Prompt for emergency stop alarm

If the emergency stop switch is not pressed, it is usually caused by the open and closed contact of the emergency stop alarm signal

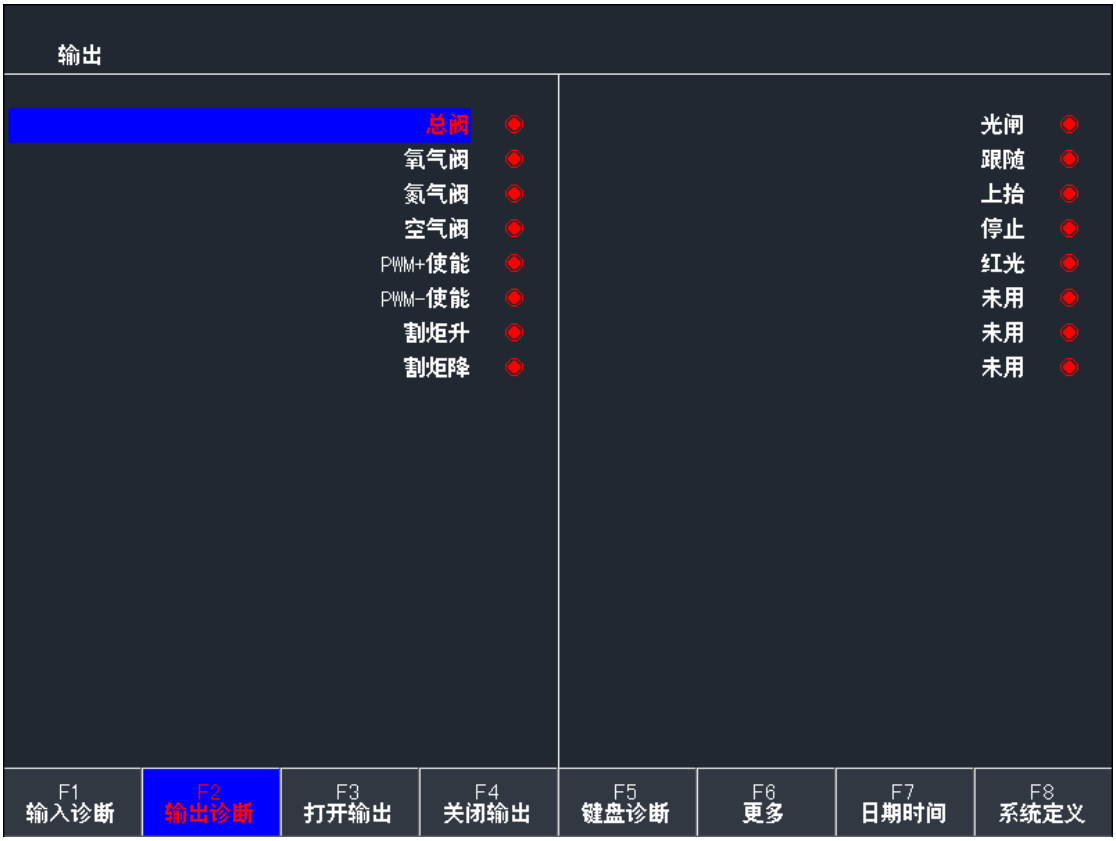
You can enter the system input definition to modify:

Press F5 (System Diagnosis) -> F8 (System Definition) -> F3 (Definition) password: 1396, enter the system definition interface to modify the emergency stop input port type, you can reverse the "emergency stop" type, that is, NC to NO or NO to NC

A 4.5 input/output port problem

The method to check whether the systems individual output ports are working properly is as follows:

1. Press F5 (System Diagnosis) -> F2 (Output)



2. Open the output port that needs to be tested

Measure and check whether the output pin number corresponding to the output port CN2 at the back of the system (for example, the ignition switch pin number 03) and the common terminal (pin 12 or 24) are the correct voltage DC 24V.

If there is no voltage, the output port will be burned out.

If you need to redefine the output port (see section 8.7.2.2 for specific definitions)

contact way

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