

ARCBRO®

ARCBRO-F7600W series CNC SYSTEM User's Manual



Operator Manual

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Content

Technical Support	5
Chapter 1 Introduction of F7600 Control System	6
1.1 Introduction	6
1.2 System Features	6
1.3 Technical indicators	7
Chapter 2 System Boot.....	9
2.1 System startup and main interface description.....	9
2.2 Main interface function index.....	11
Chapter 3 Cutting Function	12
3.1 Cutting function index.....	15
3.2 Advance	16
3.3 Back	16
3.4 Offset cutting / cutting back / just back.....	17
3.5 Resetting function	18
3.6 Oxygen gas preheating time adjustment	19
3.7 Select the piercing point	20
3.8 Dynamic zoom	21
3.9 Exit cutting.....	22
3.10 Walking frame	22
3.11 Statistics function.....	23
Chapter 4 Component Options	26
4.1 Starting point selection	26
4.2 Angle correction.....	27
4.3 Repeated arrangement.....	29
4.4 Scale	33
4.5 Selection of lines and holes.....	33
Chapter 5 Manual Functions	38
5.1 Jog	39
5.2 Linkage.....	39
5.3 Fixed length movement	39
5.4 Break restoration.....	40
5.5 Laser offset	41
5.6 Double-trolley.....	42
5.7 Task saving and recovery	45
Chapter 6 Document Management.....	48

Service Support Spirit

6.1 Disk	49
6.2 File.....	49
6.3 Find file.....	49
6.4 Code editing.....	50
6.5 Delete files.....	51
6.6 Copy files	51
6.7 New folder	52
6.8 Preview.....	52
Chapter 7 Parameter Settings	54
7.1 Common parameters.....	55
7.2 Oxygen gas parameter	56
7.3 Plasma parameter.....	62
7.4 Powder injection parameters.....	65
7.5 System parameters.....	66
7.6 Axis parameter	67
7.7 System configuration	69
7.8 IP settings and THC control.....	75
7.9 Parameter import/ export.....	75
Chapter 8 Diagnostic Functions.....	77
8.1 Input diagnostics	77
8.2 Output diagnostics	77
8.3 Date and time.....	78
8.4 Manufacturer management.....	79
8.5 Rocker calibration	82
8.6 Program restart and shutdown.....	84
8.7 Power off	84
8.8 Restarting shaft card.....	84
Chapter 9 Graphic Management.....	85
9.1 Select graphics	85
9.2 Sheet/ hole size.....	86
9.3 Chain cutting.....	87
9.4 Use nesting software FLCAM.....	87
Chapter 10 Wiring Instructions	89
10.1 Input port description.....	89
10.2 Output Port Description	90
10.3 Motor interface description.....	91
10.4 Power In Description.....	94
10.5 Wiring Instructions for Telecontroller F1510 and F7000.....	94
10.6 Wiring instructions for remote control F1520 and F7000.....	97

Service Support Spirit

Chapter 11 Code Explanation	101
11.1 Code Symbol and interpretation.....	101
11.2 Coordinate System	102
11.3 G Code Explanation.....	102
11.4 M Code Explanation	109
Chapter 12 Height Adjustment Device.....	112
12.1 Basic description	112
12.2 Mode of wiring	112
12.3 Height adjustment device configuration.....	112
12.4 Height adjustment device initialization connection.....	113
12.5 Height adjustment device observation window	115
12.6 Height adjustment device parameter interface.....	116
Chapter 13 Drilling and Cutting Integrated System.....	118
13.1 Brief introduction.....	118
13.2 Interface description	118
13.3 Parameter declaration	120
13.4 Instructions for use	122
13.5 Manual operation	124
13.6 Drill axis initial distance setting.....	124
13.7 Graded drilling instructions.....	125
13.8 Cylinder drilling	126
13.9 Drilling timing	126

Technical Support

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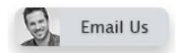
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Chapter 1 Introduction of F7600 Control System

1.1 Introduction

The F7600 series CNC system absorbs the advantages of many CNC systems at home and abroad, and with reference to the Company's F2000 series, F3000 series and F5000 series systems, a CNC system with more complete functions, stronger performance and more convenient use is developed. The product uses a multi-axis digital position control method that supports up to 6 axes of linkage, of which 4 axes have position monitoring. It is suitable for all CNC machine tools that use position control. Such as oxygen gas, plasma, laser cutting machine tools.

The F7000 controller runs on the Linux real-time operating system. It is equipped with Cortex-A8 chip and very large programmable device FPGA. The combination of software and hardware is adopted for interpolation. The Company has been engaged in numerical control system research for many years. Based on the original trajectory planning, speed preview and corner control, the S-type acceleration and deceleration and B-spline interpolation technology of the machine tool have been introduced, which makes the machine control more stable and the protection mechanism more perfect.

1.2 System Features

- ◆ More than 90 standard graphics libraries are integrated.
- ◆ Support EIA code and FLCAM, Fastcam, SigmaNest and other nesting software.
Support suffix TXT, CNC, NC, MPG, B3 and other G code formats.
- ◆ Support ESSI code common instructions.
- ◆ Support USB standard keyboard and mouse.
- ◆ Graphic scale, rotation, mirroring, arranging, etc.
- ◆ Kerf is added and the original size of the workpiece and the size of the slit are displayed simultaneously, which makes intuitive and convenient.
- ◆ Graphic steel plate correction, laser positioning

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- ◆ Customizable coordinate system supports all eight possibilities for two-dimensional coordinates.
- ◆ Edge cutting reduces the warm-up time of thick steel plates.
- ◆ Input and output port functions and port types (normally open and normally closed) can be customized.
- ◆ Oxygen gas, plasma, dusting, demonstration and other modes.
- ◆ Automatic corner speed limit prevents machine shake effectively.
- ◆ The starting line and the number of the punch are freely selectable.
- ◆ Dynamic/static processing graphic display, graphic enlargement/reduction, dynamic tracking of cutting points under magnification.
- ◆ Quick adjustment of commonly used parameters, real-time acceleration and deceleration in motion, etc.
- ◆ Power failure, breakpoint memory protection.
- ◆ Statistics on processing piece count, running time, number of piercing, etc.
- ◆ Support U disk offline upgrade.
- ◆ Hierarchical management authority facilitates factory management.
- ◆ System operational statistics and real-time status display.
- ◆ Support USB mouse and keyboard, touch operation, more humane human interaction.
- ◆ Support network data transmission, realize system networking, real-time monitoring operation (subsequent upgrade support).
- ◆ Reserve a variety of communication interfaces including CAN, RS485, RS232, etc.
- ◆ Support encoder feedback for finer cuts.
- ◆ Support gantry bilateral driving algorithm.

1.3 Technical indicators

- Number of linkage axes: 2-axis linkage (maximum expandable to 6 axes).
- Control accuracy: ± 0.001 mm.
- Motor drive: pulse + direction.

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- Impulse frequency: 250K.
- Operation speed: 30m/min.
- Power supply: DC24V DC power input, power greater than 80W.
- Electrostatic test: $\pm 4\text{KV}$.
- Input and output: 16-way input, 16-way output, full optocoupler isolation.
- System working environment: temperature -10°C - $+60^{\circ}\text{C}$; relative humidity 0-95% without condensation.

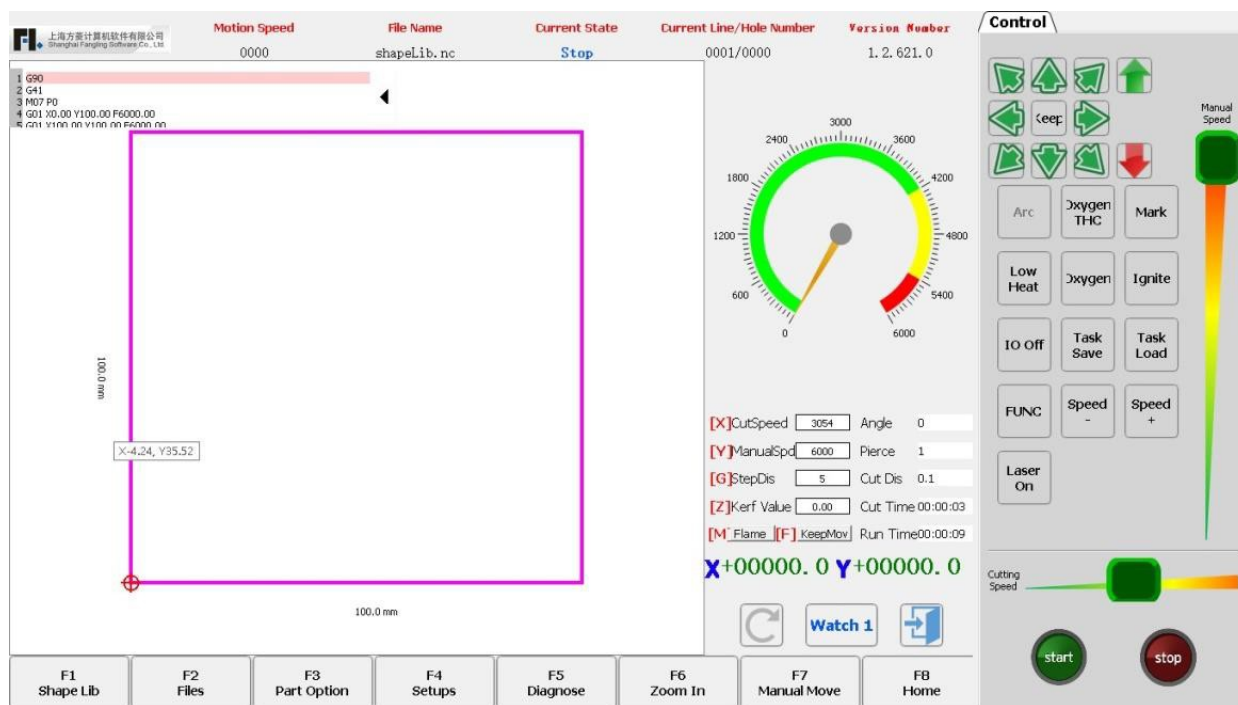
Chapter 2 System Boot

2.1 System startup and main interface description

After the system starts, it will enter the welcome interface, as shown in Pic 2.1. The pictures in the welcome screen can be upgraded to the user's picture. When the prompt "Press any key to continue the next step..." appears, press any key and the system will enter the main interface. The main interface of the F7600 series system is shown in Pic 2.2.



Pic 2.1 Welcome Interface



Pic 2.2 F7600 Series System Main Interface

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In the main interface, press **【F1】** - **【F8】** to correspond to the following functions:

【F1】 Graph management: there are dozens of graphic libraries of common parts, most of which have both chip size and hole size.

【F2】 Document management: enter optional hard disk files, USB flash drive files, find, edit, delete, file import and export, preview graphics and otherwise operate.

【F3】 Parts management: mirror image, rotation, plate correction, alignment, line selection, code editing, etc. for processing parts.

【F4】 Parameter settings: all parameters can be set here.

【F5】 System diagnosis: input and output diagnosis, date and time settings and factory management.

【F6】 Enlarge the graph: enlarge the cutting graph.

【F7】 Manual movement: manually move the machine, in this interface, power-off, breakpoint recovery operation, and laser torch bias operation can be done.

【F8】 Zeroing: after the machine starts cutting money or cutting is completed, the coordinates can be cleared.

【X】 : Set cutting speed.

【Y】 : Set manual shift speed.

【F】 : Set the manual shift mode, which can be set to jog, linkage and fixed length. **【G】** : Set the moving distance when moving at a fixed length. Description: press G to modify the fixed length distance number, and the manual transfer mode automatically switches to the fixed length mode.

【Z】 : The slit size can be set before the cutting operation starts or after the cutting is completed.

【M】 : Set the cutting mode. There are three modes: demo mode, oxygen gas cutting and plasma cutting.

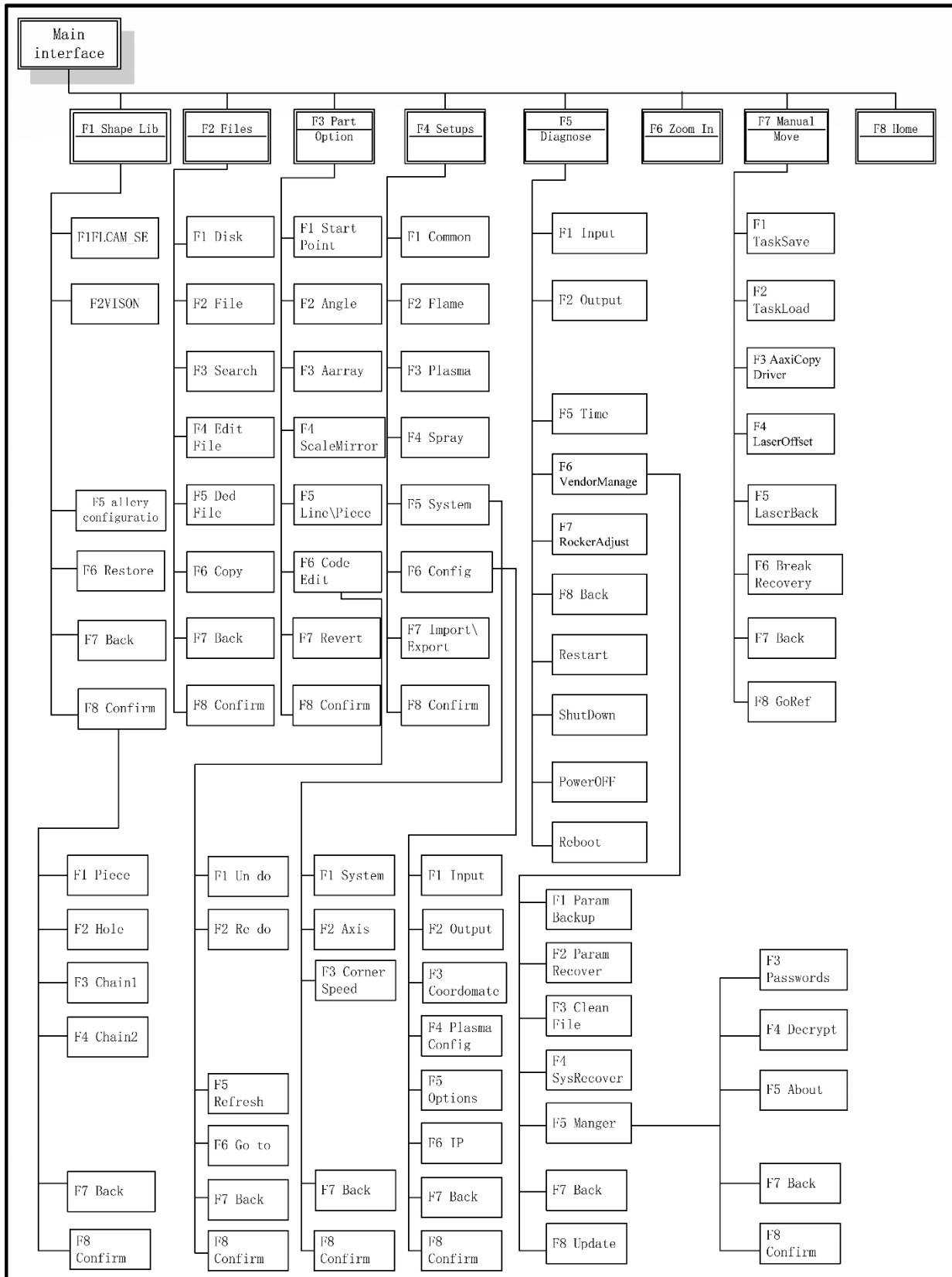
【START】 : Start cutting.

【STOP】 : Stop cutting.

【Space】 : Enter the cutting interface.

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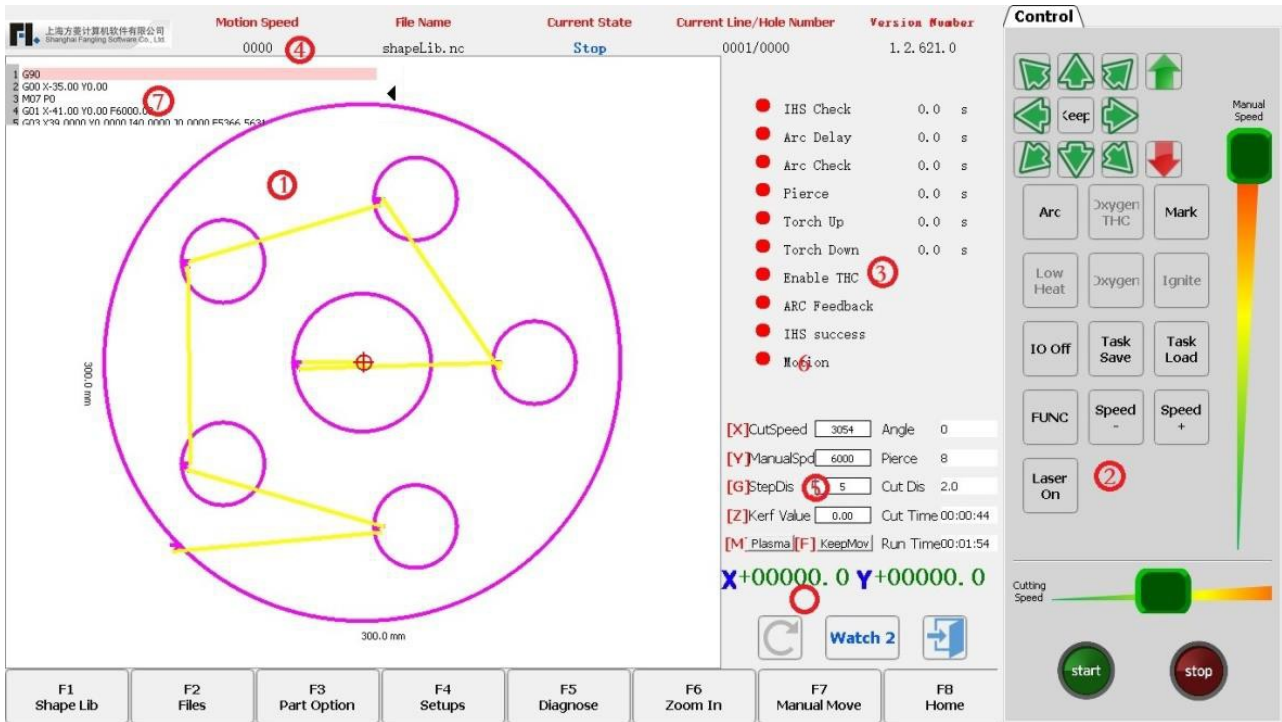
2.2 Main interface function index



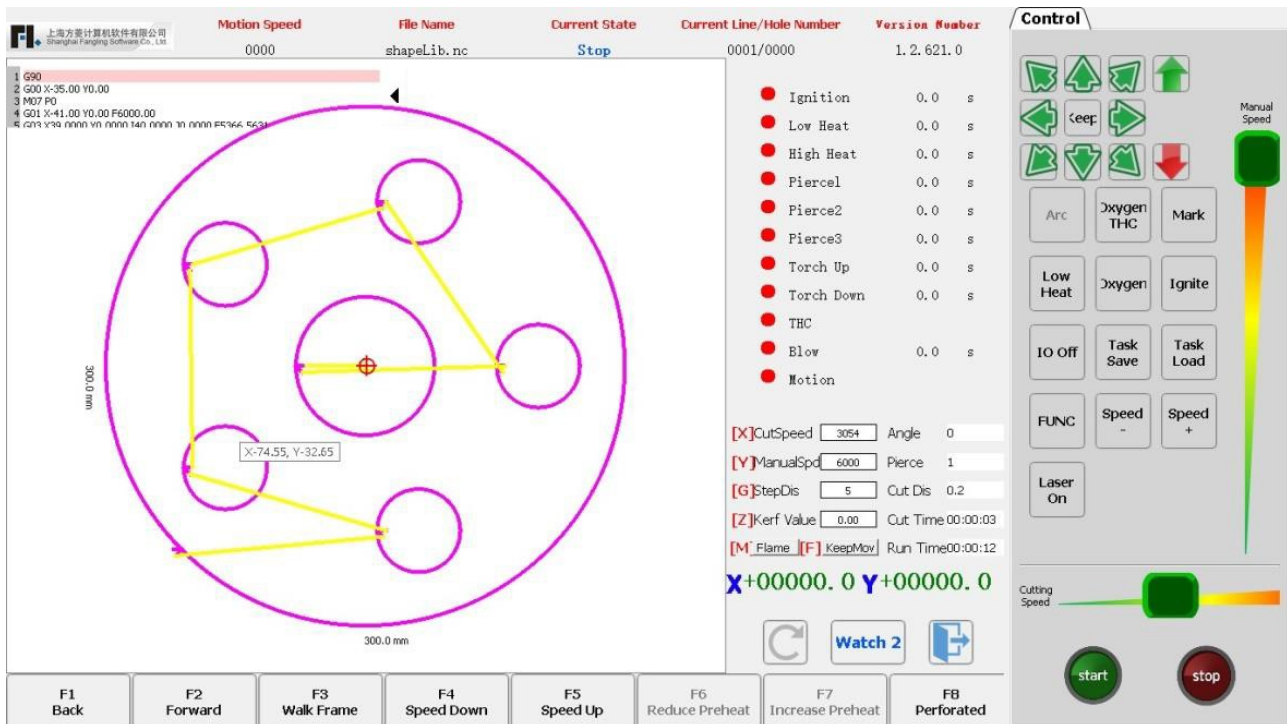
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Chapter 3 Cutting Function

As shown in Pic 3.1, press the Space button on the main interface to enter the cutting interface, as shown in Pic 3.2 below:



Pic 3.1 F7600 Series Main Interface



Pic 3.2 Cutting Main Interface

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- ❖ ❶ displays the actual cutting path of the currently machined workpiece, including the kerf value.
- ❖ ❷ displays the status of the strong key, and the corresponding output port can be opened and closed by the touch screen operation. Note: The strong current button of the F7600 is at the operator panel on the right.
- ❖ ❸ displays the status of the input and output ports used in the current cutting mode, and the real-time IO timing output.
- ❖ ❹ displays the current real-time machining speed, operating status, and machining files. During the machining process, fast speed control can be achieved by pressing [1]-[9]. For example, press the number [3], and the speed is automatically adjusted to 30%; press the number [8], and the speed is automatically adjusted to 80%. At the same time, [F4] or [END] can be used to decelerate, [F5] and [HOME] to accelerate.
- ❖ ❺ displays the current cutting speed, and some parameters used for cutting, as well as some cutting statistics information. The letters in [] above are shortcut keys, so pressing them can quickly change the corresponding parameters.
- ❖ ❻ displays the absolute coordinate position of the workpiece where the torch is currently located.
- ❖ ❼ displays currently executing G code. This status bar is a transparent form, which can be folded or expanded by the arrow on the right.
- ❖ [X] Modify the current cutting speed.
- ❖ [Y] Modify the current manual shift speed.
- ❖ [F] Change the current manual shift mode.
- ❖ [G] Modify the fixed length of the current fixed length movement.
- ❖ [Z] Press [Z] to set the kerf value before starting cutting or after cutting.
- ❖ [START] Start cutting.
- ❖ [STOP] Stop. Pressing it to pause all the actions that are going on in the system.
- ❖ [F1] Back: The torch returns along the original path of the track (the I/O port is closed at this time), and the piercing point will be suspended when it is back.

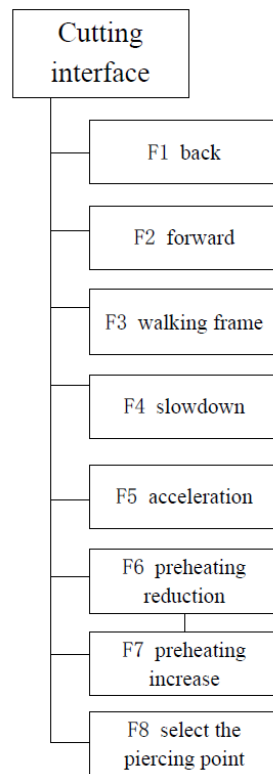
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- ❖ [F2] Advance: The torch advances along the cutting path (the I/O port is closed).
- ❖ [F3] walking frame or [F3] resetting: before just transferred into the processing file, and the machine movement, here is the walking frame function, the machine will walk the torch along the outer contour of the workpiece. After the machine is moved, here is the resetting function and the machine will return to the zero coordinate of the workpiece.
- ❖ [F4] Deceleration: reduce the cutting speed by 3% per press. Reduce manual shift speed when moving manually.
- ❖ [F5] Acceleration: increase the cutting speed by 3% per press. Increase manual shift speed when moving manually.
- ❖ [F6] Preheating decrease: reduce the preheating time, skip the remaining preheat time, and the system automatically remembers the preheat time.
- ❖ [F7] Preheating increase: increase the preheating time by 15 seconds each time.
- ❖ [F8] Select punching pointing: when the system is paused, the puncturing point is selected, and after the startup is started, it is dynamical enlargement function.
- ❖ Up, down, left and right 4 direction keys: move the cutting torch manually.

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3.1 Cutting function index

As shown in Pic 3.3, it is the operation index map for the cutting interface.



Pic 3.3 Cutting Operation Index

3.1.1 Normal speed regulation

The speed can be adjusted in the cutting interface system during automatic operation or when the system is paused.

Press [F5] or [HOME] on the operation panel, and each press will increase the speed by 3% based on the current speed. Keep pressing [F5] or [HOME] without releasing, and the speed will continue to increase until the maximum cutting speed.

Press [F4] or [END] on the operation panel, and each press will decrease the current base by 3%. Press [F4] or [END] without releasing, and the speed will be continuously reduced to 5% of the maximum cutting speed.

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3.1.2 Rapid speed regulation

Rapid speed regulation can be performed on the cutting interface during automatic operation or when the system is paused.

In the cutting interface, press the number keys [1]-[9] on the operation panel, and the speed will be quickly adjusted to 10 times the corresponding number. For example, press the number [3], the speed will be automatically adjusted to 30% ; press the number [8], the speed will be automatically adjusted to 80%.

3.2 Advance

The cutting is paused or ended. Press the [F2] key in the cutting interface, the system starts to go empty. There is no IO switching process such as ignition, perforation, etc., and the torch is moved along the contour of the cutting pattern. Press the [F2] or [STOP] key again to stop the system.

This function can also be used before cutting, if you want to check whether the cutting path is correct or the code is correct or not, or you need to pass the torch during processing. The forward speed and the cutting speed are set separately, and the "forward and reverse speed" in the commonly used parameters is used to set it.

3.3 Back

In the process of processing, if the original track needs to be returned due to reasons such as uncut, etc., the following process can be performed:

Press the [STOP] key first to put the cutter in the pause state.

Press the [F1] key in the cutting interface, the cutting machine will return along the original track. When the torch retreats to the position to be retracted, press the [F1] or [STOP] key again. If the retraction is too much, press [F2] at this time, and it can move forward in empty and then proceed to the desired position.

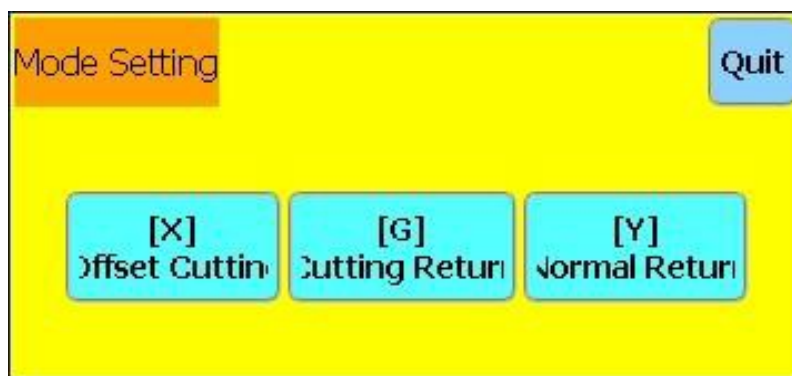
Caution: The forward and reverse functions can be repeated until the torch is in the desired position.

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When the torch is in the desired position, press the [START] key again. If the current cutting code line is G01 or G02 or G03, the system will automatically perforate before executing these programs, and then continue to run the current program; if the current line is not G01 or G02 or G03, the system directly executes the current line program.

3.4 Offset cutting / cutting back / just back

When the torch deviates from the actual path of the currently machined workpiece, press the [Start] key again, and the prompt in Pic 3.4 will appear:



Pic 3.4 Edge Perforation

There are two situations in which such a prompt occurs:

1-- When "Yes" is selected for "Edge Perforation" of common parameters, if the G code of the next processing line is M07, the system will automatically pause. At this point, you can manually move to any edge of the steel plate, press the [Start] button, and the system will appear as shown in Pic 3.3.

2-- When the machining is paused, if it is necessary to move the torch away from the actual machining workpiece due to mechanical failure or other reasons, press [Start] to display the prompt in Pic 3.4.

Offset cutting: If [X] is pressed, the system considers the current point to be the pause point and continues cutting. That is, the cutting point is offset. This button can be pressed when the cutter is paused or when the power is off, if the torch has an offset, or if the steel plate has a translation, or if the user wants an artificial offset cut.

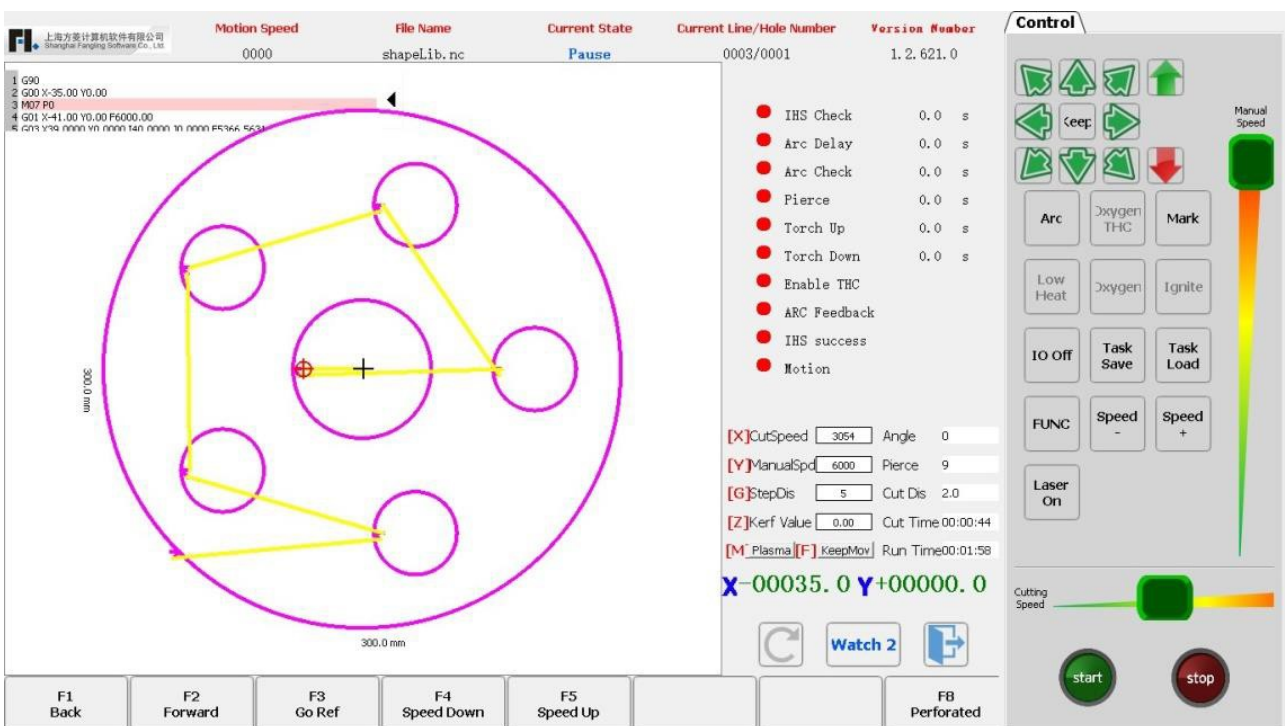
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Cutting back: If [G] is pressed, the system first cuts back to the pause point, and then continues cutting according to the original graphic. This function is especially useful for thicker steel plates, which can reduce the preheating time and improve the cutting efficiency; this function is commonly used edge perforation function.

Just back: If [Y] is pressed, the system will only return to the pause point quickly and then pause. When the cutting process is found to be faulty, or other problems, the torch needs to be removed from the cutting area for inspection. When the inspection needs to be returned to the pause point, the button can be pressed. After returning to the pause point, press the [Start] key again, and the system will automatically start cutting according to the original graphic.

3.5 Resetting function

When the machining is paused, if [F3] is pressed at this time, the system will automatically return to the starting point of the machining workpiece. After returning to the original point, the system will exit the cutting state.



Pic 3.5 Cutting Main Interface

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In the process of returning to the reference, the user can also press the [Stop] key to stop the operation. After stopping, continue to press [F3] to perform the return operation, or press the [Start] key to restart the cutting. The return and stop are not limited by the number of times.

3.6 Oxygen gas preheating time adjustment

During the preheating process, press [START] or [F9] to skip the preheating and piercing delay process and immediately open the punching signal to start cutting.

During the preheating process, press [Stop] (i.e. [F10] key) to maintain the preheating state until the [F9] key is pressed again, and the system continues the cutting process.

During the preheating process, press the [F6] key to end the preheating state, and remember this preheating time. This preheating time is used to preheat before encountering the M02 or M30 code.

Example: For example, the preheating time set by the original system is 60 seconds. When preheating is required, there will be a countdown on the interface. When the reading is normal, the system starts to continue cutting, but if there is still 10 seconds remaining in the system countdown, press F6, and the system immediately stops preheating, starts the cutting operation, and records the time that the preheating has been 50 seconds. The system automatically assumes that the user needs the preheating time of 50 seconds, and the preheating time during the next preheating will become 50 seconds.

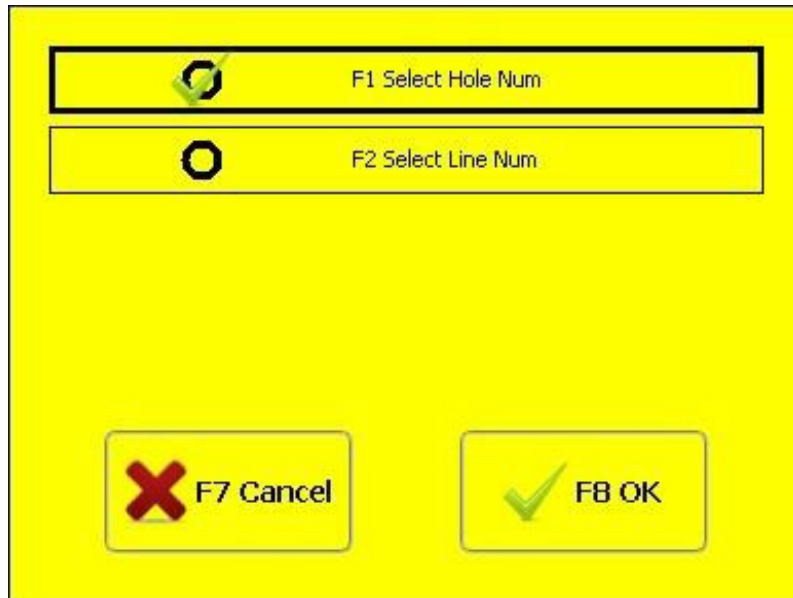
During the preheating process, each time the F7 key is pressed, and the preheating time is increased by 15 seconds, and later preheating time is maintained after the increase, until the cutting is completed.

Example: The preheating time set by the original system is 60 seconds. During the system countdown, press F7 once, the countdown on the interface is added for 15 seconds, and the next preheating time becomes 75 seconds when the next preheating is required.

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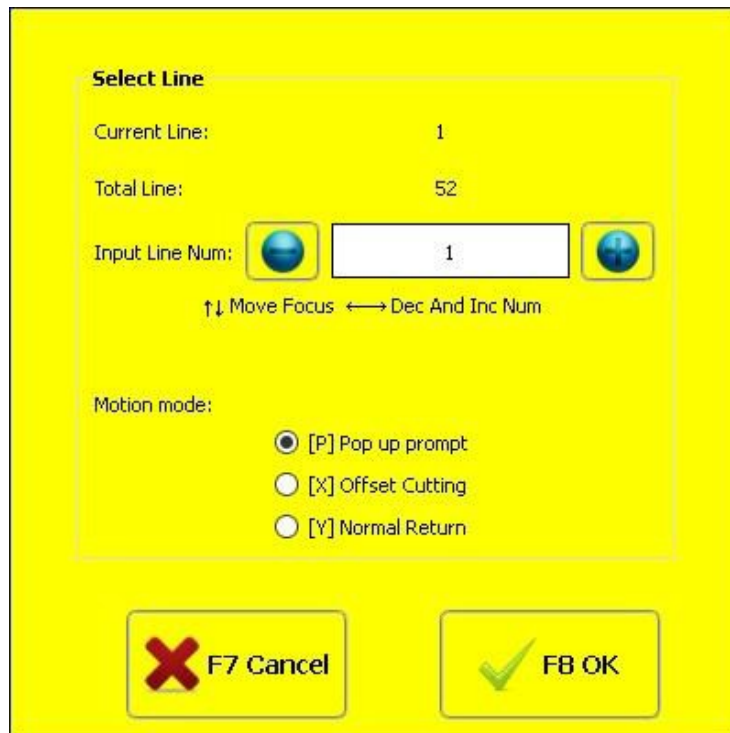
3.7 Select the piercing point

Before the cutting is started or when the cutting is paused, [F8] function key is to "Select Piercing Point". At this time, press F8, and the system will prompt:



Pic 3.6 Selecting the Piercing Point

Pic 3.1 If the ESC is pressed, the system will return to the cutting interface. If F2 is selected, the system prompt to select the corresponding line number:

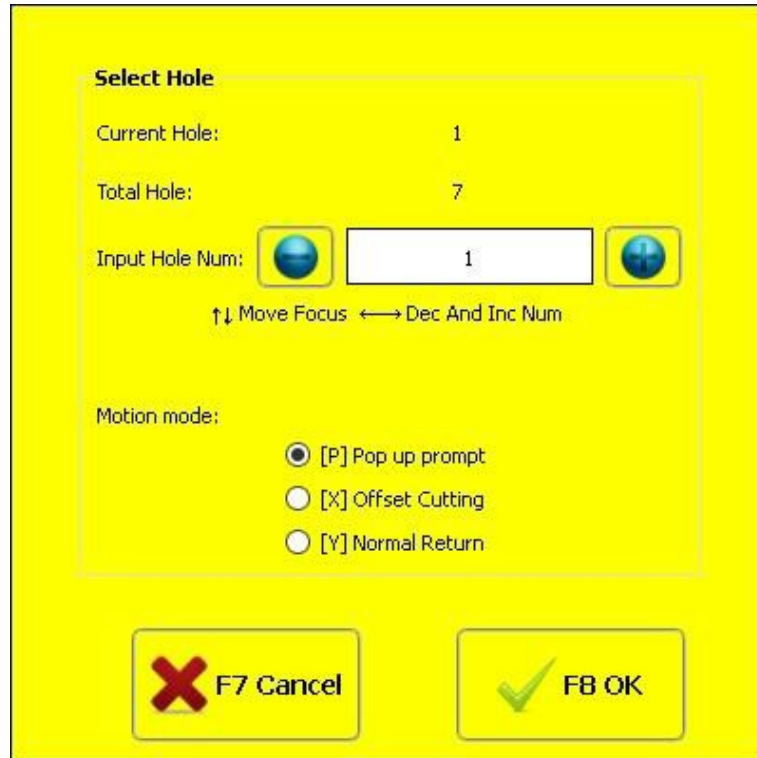


Pic 3.7 Line Number Selection

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At this point, you can manually enter the line number, click [F8] to confirm, and the system will start cutting from the selected code line.

If F1 is selected, the system prompt to select the corresponding hole number:



Pic 3.8 Hole Number Selection

At this point, you can manually enter the hole number, click [F8] to confirm, the system will start cutting from the selected perforation point.

3.8 Dynamic zoom

After the machining starts, the [F8] of the cutting interface will change to "Zoom". At this time, press the F8 button, the machining graphic will be enlarged in the drawing area and can be dynamically tracked.



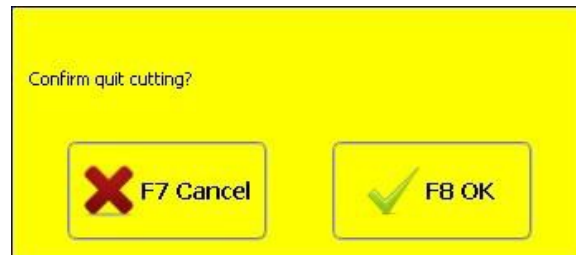
Pic 3.9 Cutting Interface Function Keys during Dynamic Zooming

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

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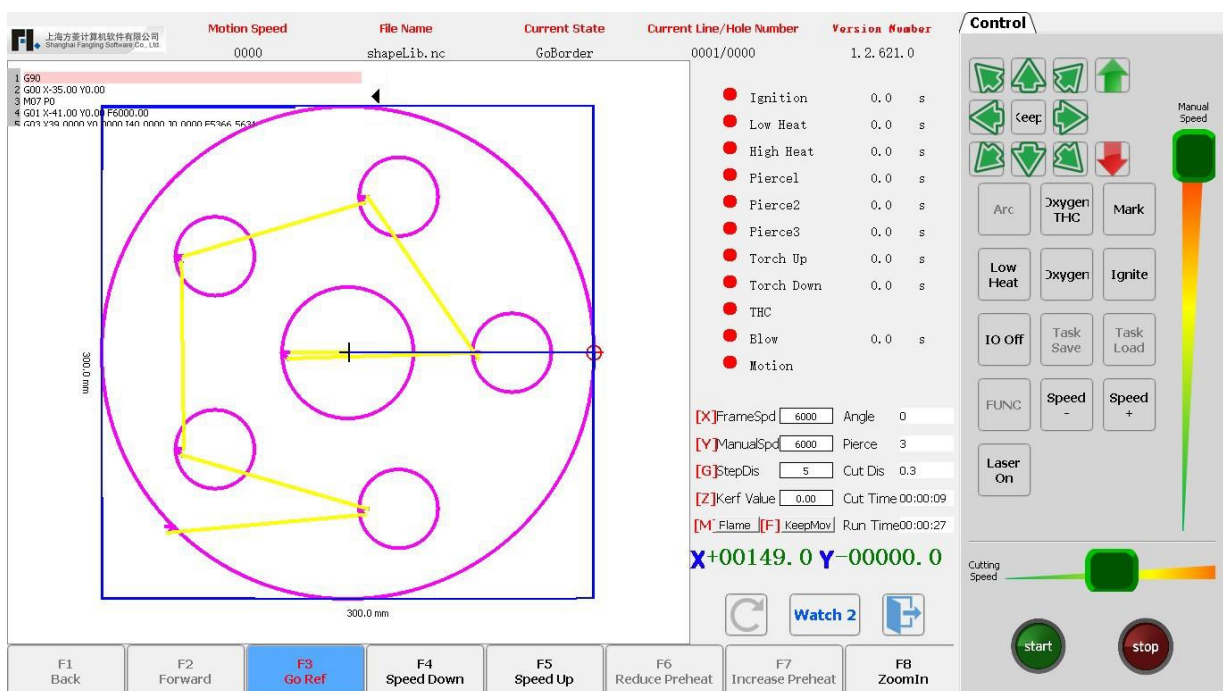
3.9 Exit cutting

When the cutting is not completed and the cutting machine is in the pause state, if the [Esc] key is pressed in the cutting interface, the system will prompt whether to exit the cutting. If [F8] is pressed, the cutting will be exited; if the [Esc] button is pressed, the cutting will not be exited, and the cutting will continue at the original position after entering the cutting interface again.



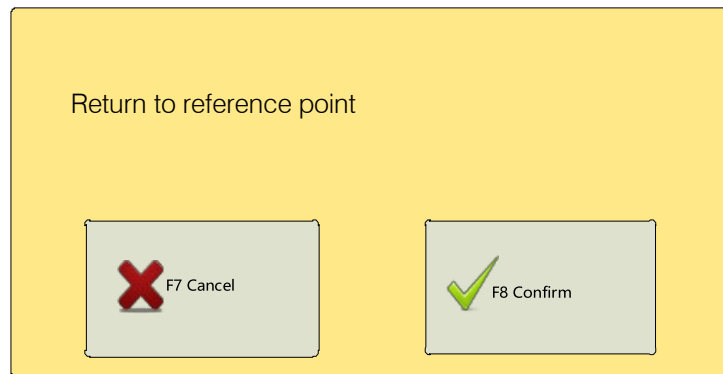
Pic 3.10 Exit Cutting Prompt

3.10 Walking frame



Pic 3.11 Walking Frame

Pic 3.1 Before starting the machining, press the space bar [Space] to enter the automatic machining interface. At this time, [F3] is the border function. After F3 is pressed, the system will walk counterclockwise along the blue frame shown in Pic 3.11. The starting point is in the lower left corner. After walking, the system prompts.



Pic 3.12 Resetting

Pic 3.12 At this time, if F8 is pressed, the system will automatically return to the machining starting point of the part. If ESC is pressed, the system will stop at the current point.

During waling frame process, you can also press STOP to pause the operation and press START to continue walking frame. Press [F3] again to return to the starting point.

3.11 Statistics function

The statistics function is used to record the number of perforations cut in the plasma and oxygen gas mode, the total cutting distance, the cutting time and the running time. Plasma cutting and oxygen gas cutting are calculated separately.

3.11.1 Related statistics:

Number of perforations: record the number of perforations during the cutting process.

Cutting distance: record the total cutting distance in metric - meter, British system - foot.

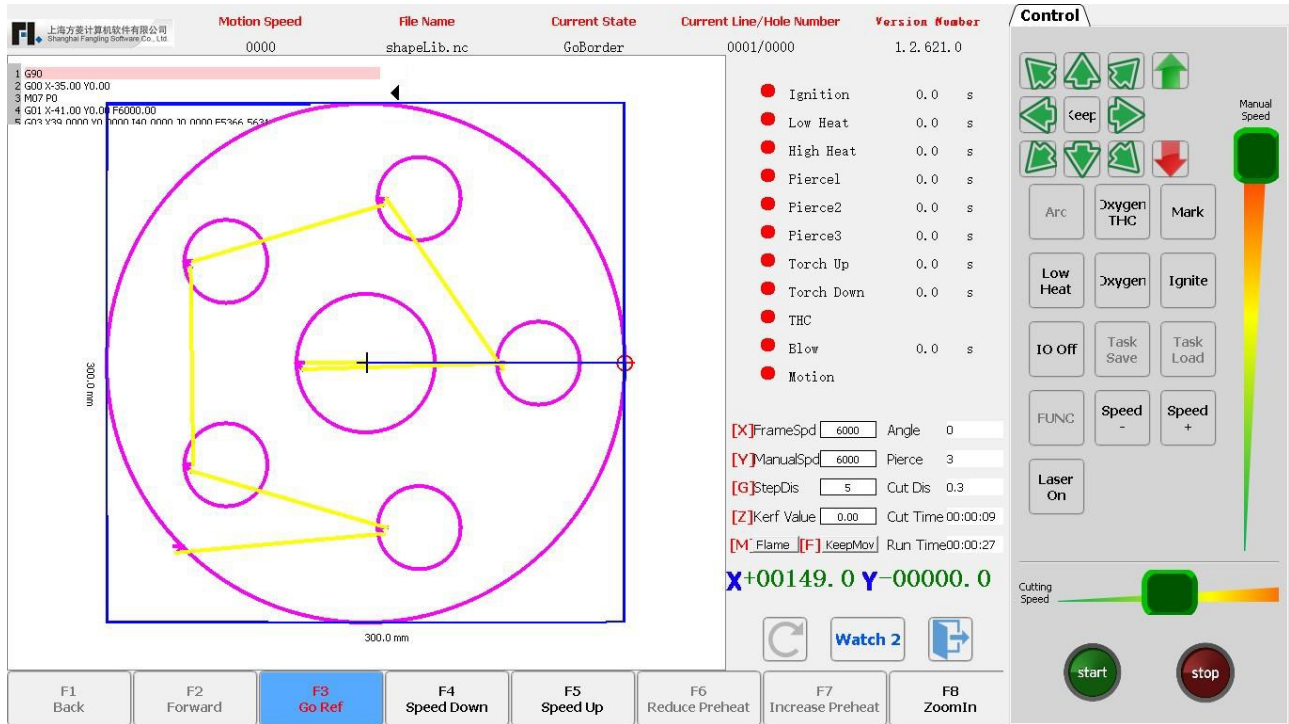
Cutting time: record the time during the cutting process.

Operation time: record cutting time + idle time + M07 status time.

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3.11.2 Statistics display

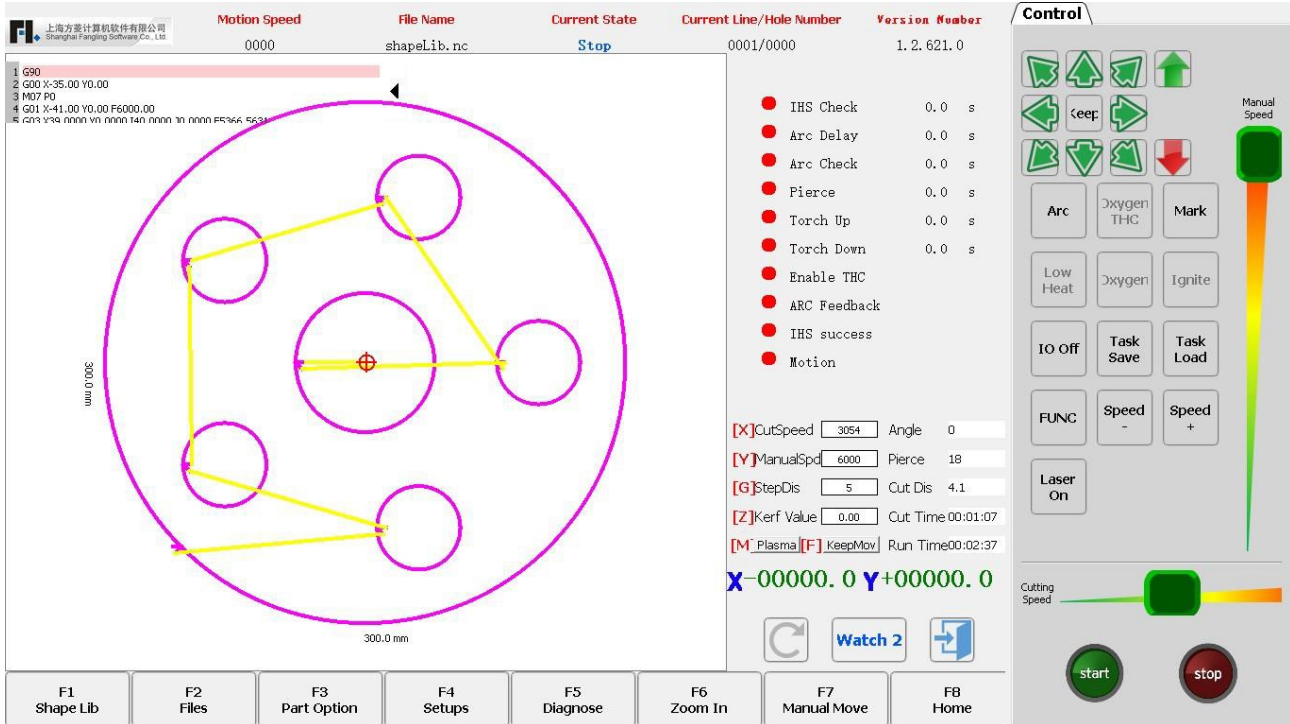
Under the oxygen gas cutting interface, the number of piercing times and cutting distance (unit: metric - meter, British system - foot), cutting time and running time of oxygen gas cutting are displayed in real time in the lower right corner. As shown in Pic 3.13:



Pic 3.13 Oxygen Gas Cutting Interface

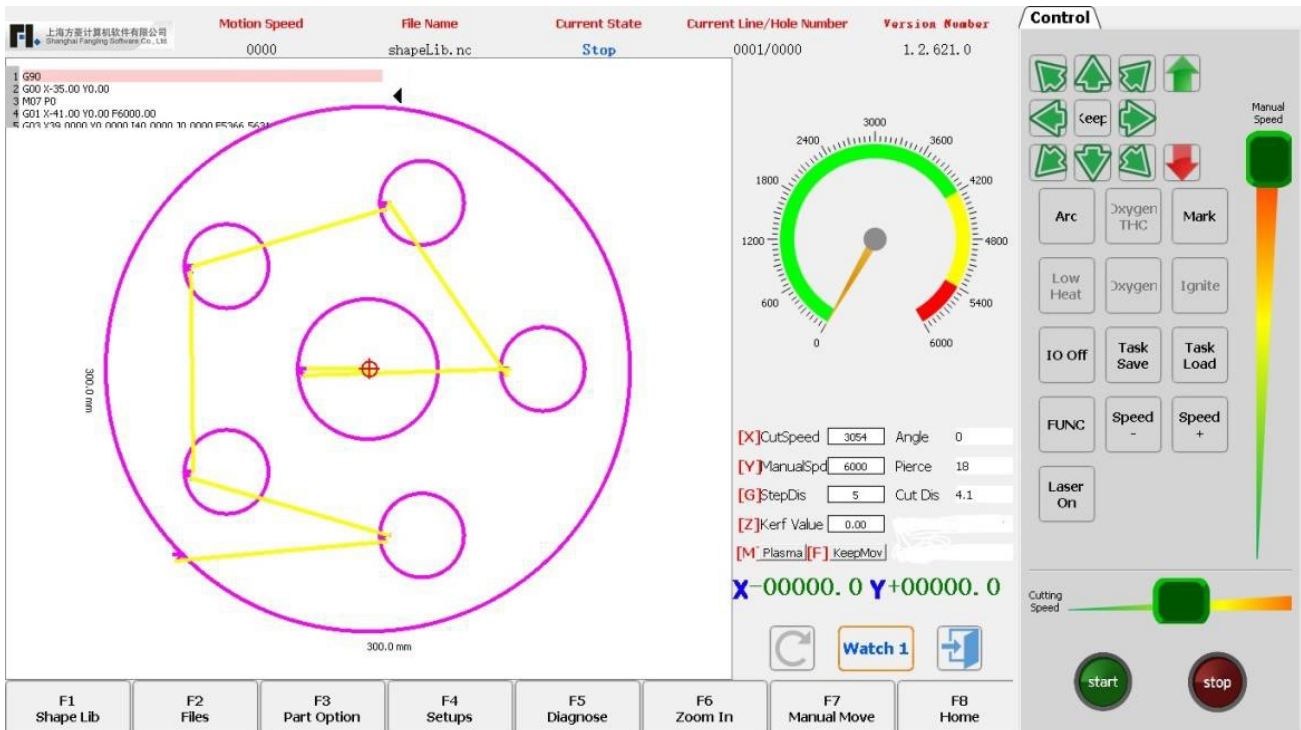
Under the plasma cutting interface, the number of piercing times and cutting distance (unit: metric - meter, British system - foot), cutting time and running time of plasma cutting are displayed in real time in the lower right corner. As shown in Pic 3.14:

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Pic 3.14 Plasma Cutting Interface

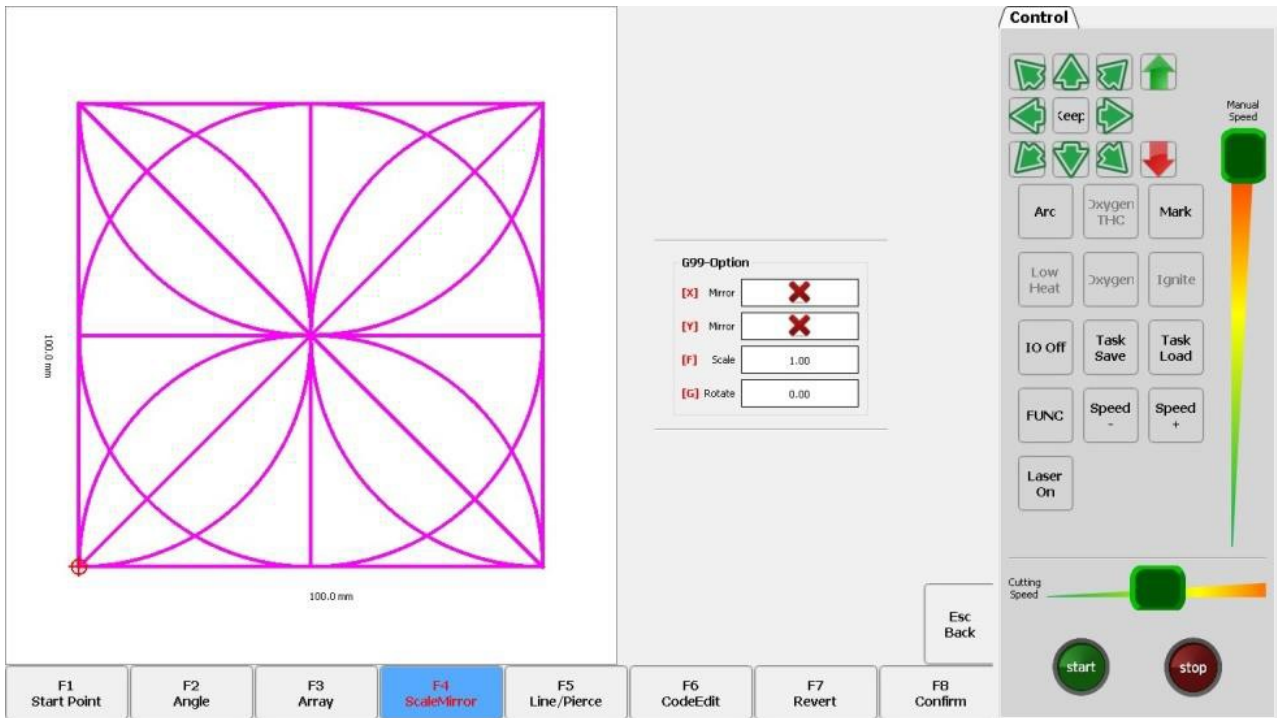
Under the non-plasma and oxygen gas cutting interface, no statistical parameters are displayed, as shown in Pic 3.15.



Pic 3.15 Non-plasma and Oxygen Gas Cutting Interface

Chapter 4 Component Options

Before starting to cut, press [F3 Part Options] on the main interface to select the starting point, angle correction, repeating, scaling, mirroring, rotation, etc. The interface is shown in Pic 4.1 Component Options.



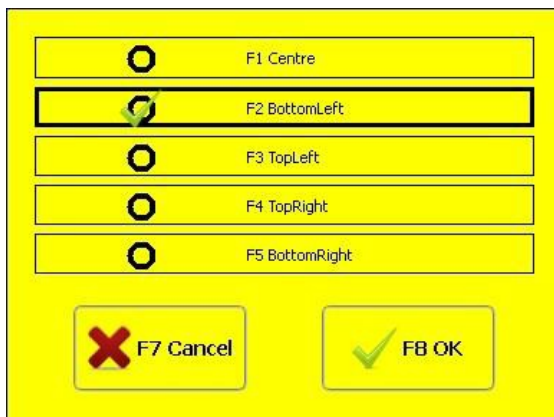
Pic 4.1 Part Options

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

Press Y to mirror the vertical axis (Y axis), that is, left and right mirror.

4.1 Starting point selection

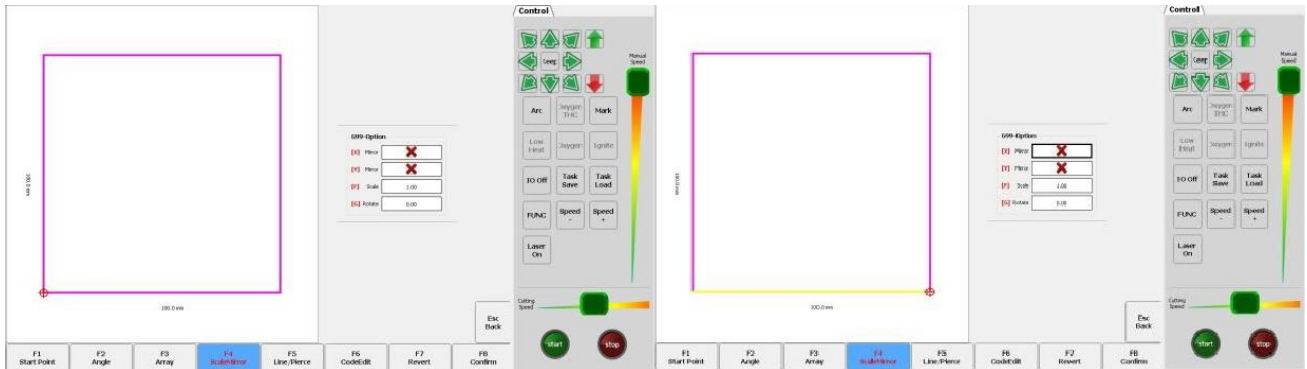
After pressing F1, the system prompts to select the starting point:



Pic 4.2 Starting Point Selection

Service Support Spirit

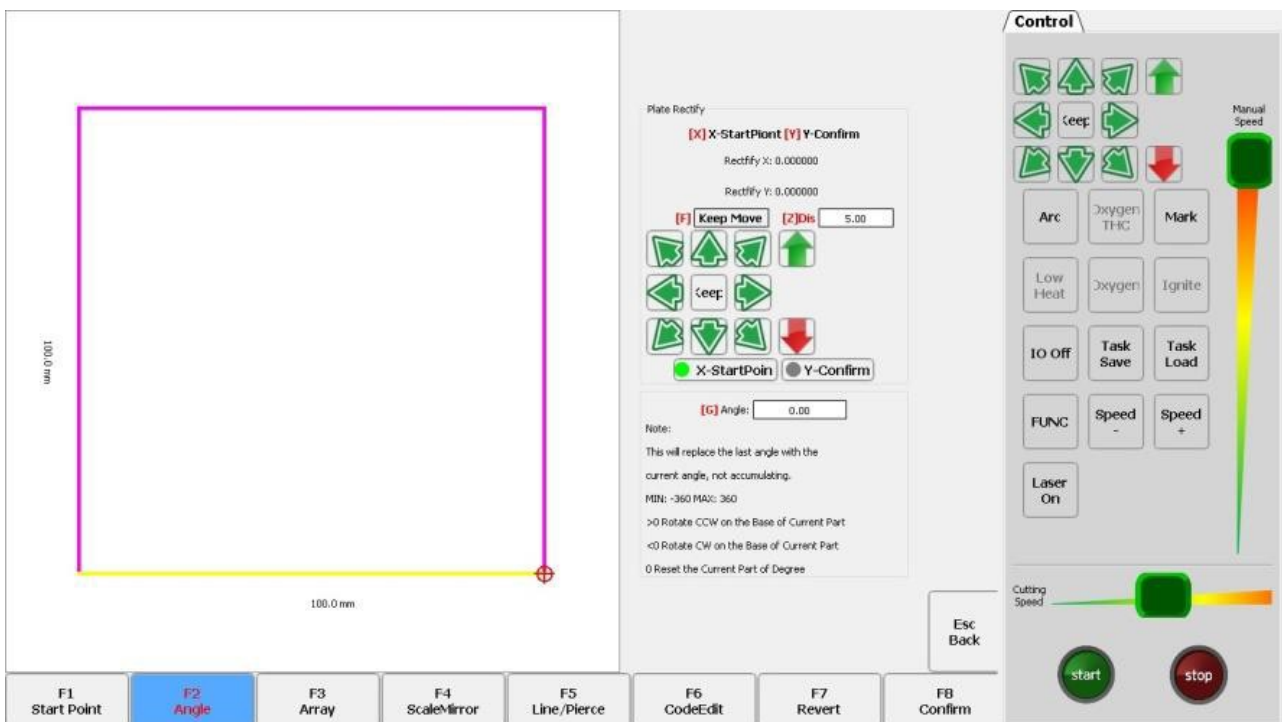
Pic 4.2 At this time, press the F1-F5 buttons, and the starting point of the cutting part will automatically jump to the corresponding position. For example, when F5 is pressed, the starting point of the part automatically jumps to the lower right corner. As shown in Pic 4.3.



Pic 4.3 Starting Point in the Lower Left and Lower Right Corners

4.2 Angle correction

After [F2] is pressed, as shown in Pic 4.4, the steel plate can be corrected or the angle can be directly input.



Pic 4.4 Angle Correction

Service Support Spirit

4.2.1 Steel plate correction

At this point, you can manually move the cutter's torch to any edge of the steel plate or to a corner of the steel plate. The movement path of the torch is shown in Pic 4.5. When the torch is in the good position, press the [X] button to set the current point as the calibration starting point.

Then manually move the torch to another point along the edge of the steel plate. Make sure that the two points are far enough and that the two points are on the same line as the same side of the steel plate.

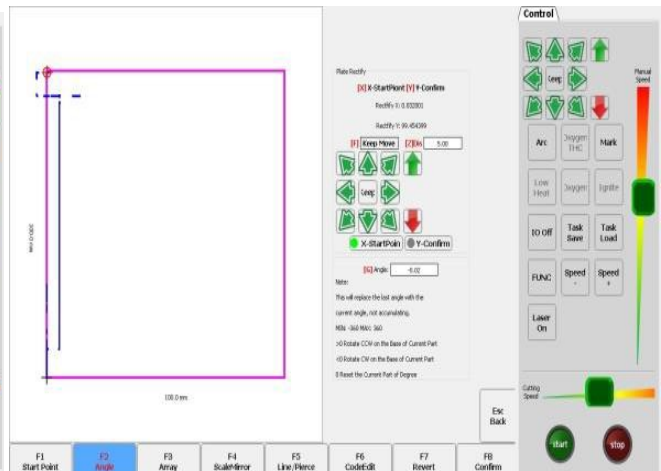
The path of the movement torch is shown in Pic 4.6. Then press [Y]. The system automatically calculates the offset angle of the current steel plate and then automatically corrects the graphic.

Description: If the laser torch is conPicd for calibration, the laser spot can be aligned to the edge of the steel plate for correction.

For details, please refer to Section 5.5 Laser Offset.



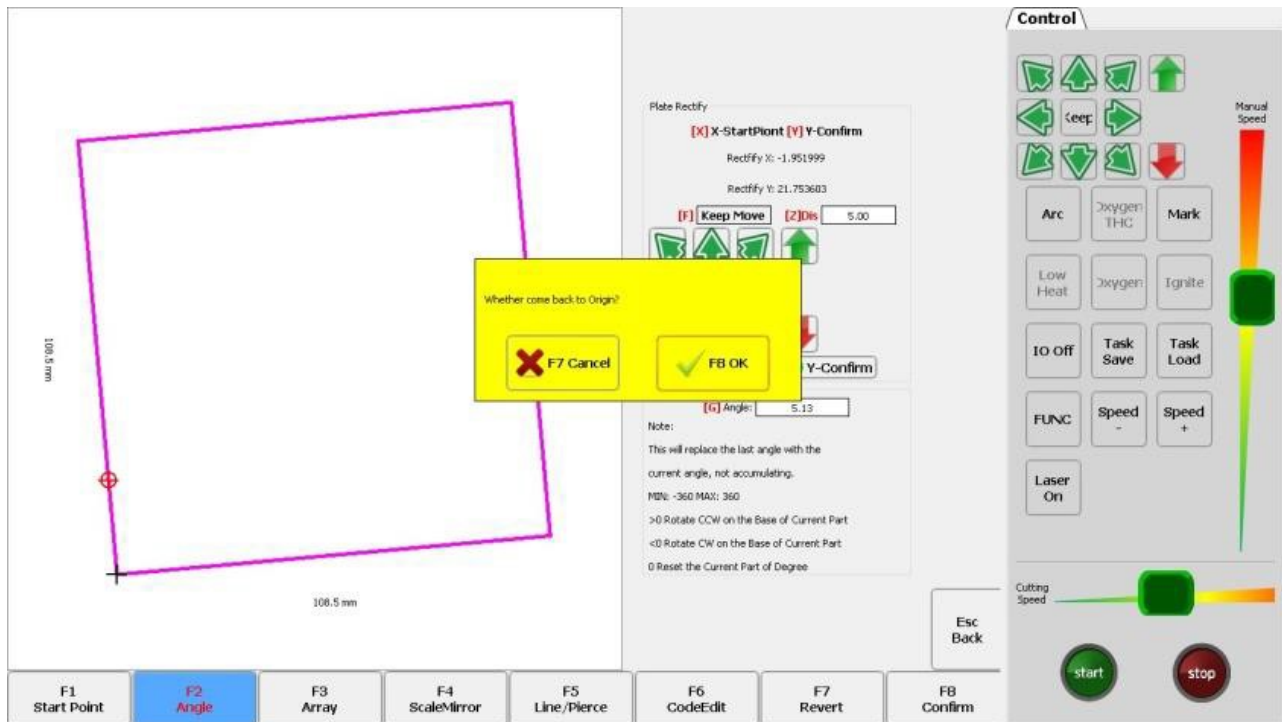
Pic 4.5 Move to the First Point Track



Pic 4.6 Move to the Second Point Track

After the calibration is completed, the system prompts whether to return to the starting point. If the [F8] key is pressed, the system will return to the starting point of the calibration. If [F7] is pressed, the system will return to the graphical interface without any operation.

Service Support Spirit



Pic 4.7 Return to the Starting Point after Correction

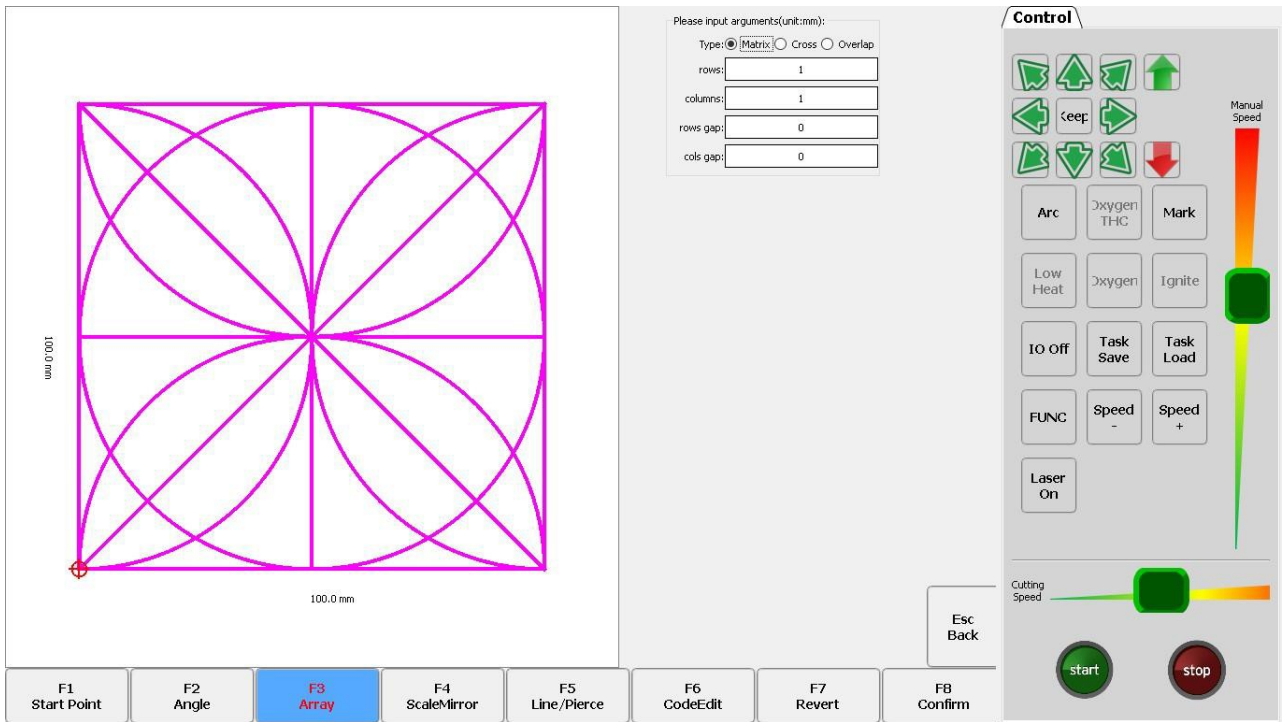
In the case that the angle at which the current workpiece needs to be rotated is known, the angle can be entered using the number button [G]. After the angle is manually entered, press ENTER to confirm and the machining graphic will rotate the corresponding angle. The positive angle is counterclockwise and the negative angle is clockwise. Press ESC to exit the angle correction.

Description: when the input angle is 0, the machining pattern is restored to the position at 0 degree, and the angle corrected by the steel plate and the angle manually input are cleared.

4.3 Repeated arrangement

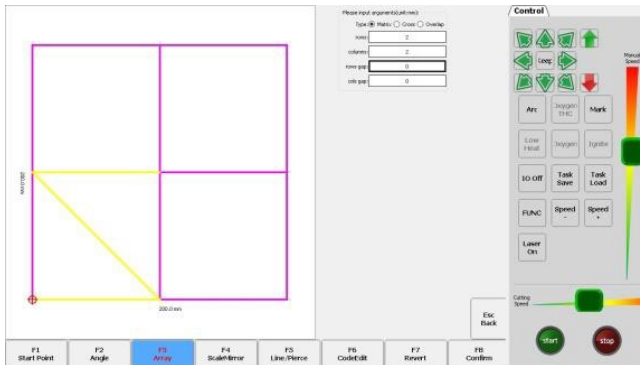
In the component options interface, press [F3]. The system interface is shown in Pic 4.8. There are three types of arrangement: matrix arrangement, staggered arrangement and stacked arrangement. Through the up, down, left and right buttons, you can select the matrix, interlace, stacking and other parameters and the parameters used in the arrangement.

Service Support Spirit



Pic 4.8 Arrangement Selection

Select the matrix to arrange the matrix:

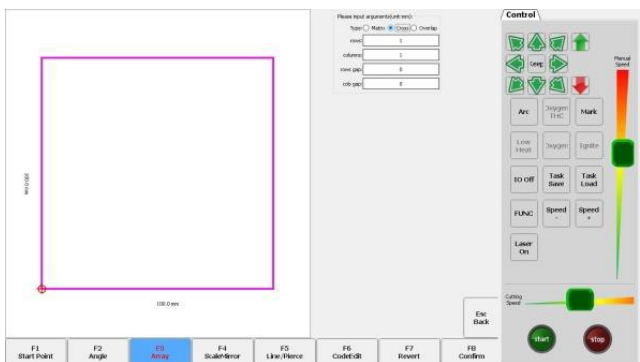


Pic 4.9 Matrix Arrangement Effect

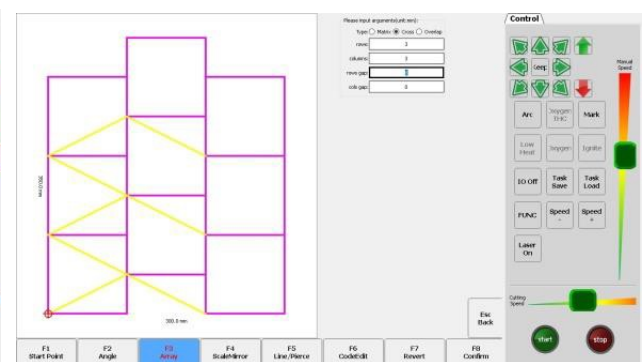


Pic 4.10 Matrix Arrangement Diagram

Select the interlacing for interlacing arrangement:



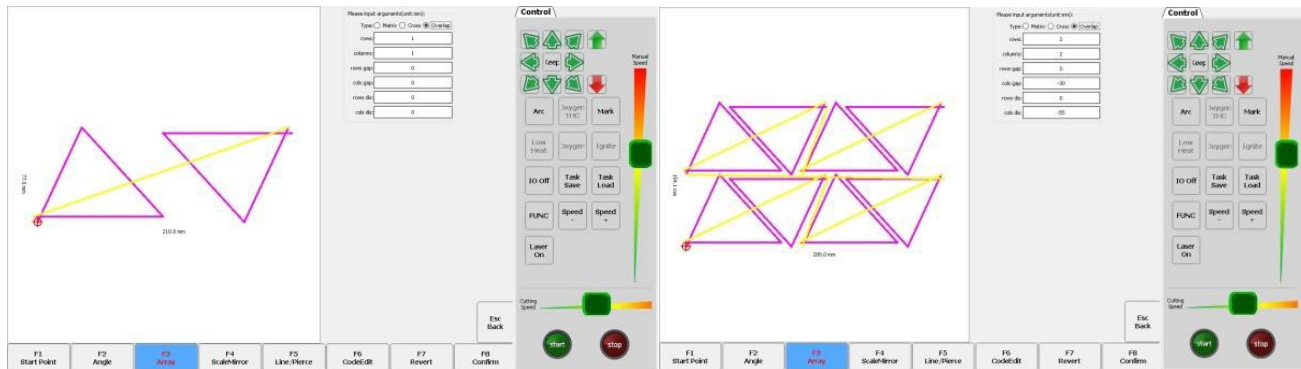
Pic 4.11 Interlace Arrangement



Pic 4.12 Interlacing Arrangement Effect

Service Support Spirit

Select the stacking for stacking arrangement:

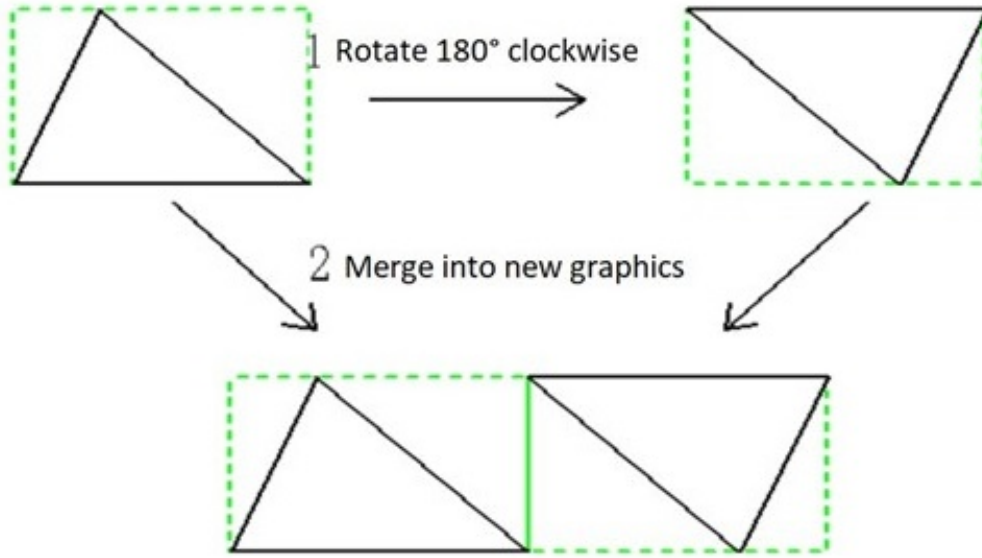


Pic 4.13 Stacking Arrangement

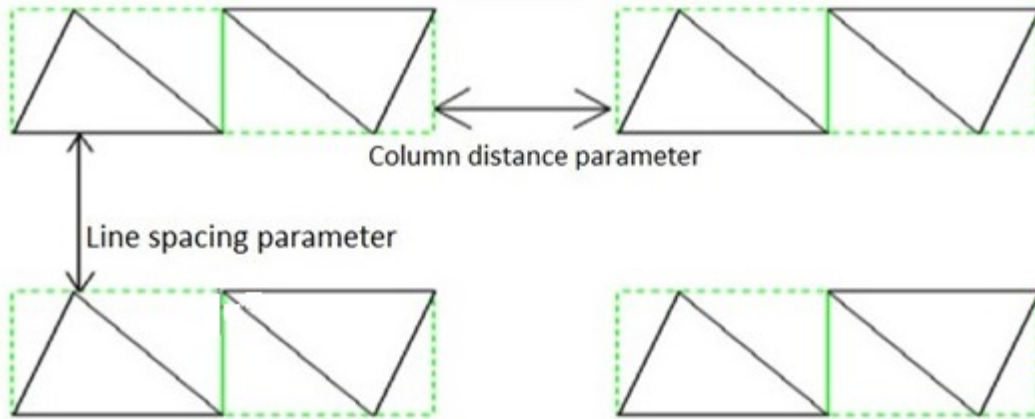
Pic 4.14 Stacking Arrangement Effect

- ❖ The stacking arrangement is mainly applied to graphics with symmetrical arrangement, such as triangles, trapezoids, and the like. The stacking arrangement first rotates the current graphic 180° clockwise from the center, and then the original graphic and the mirrored graphic are arranged in pairs to form a new graphic. The combination process is shown in Pic 4.16. Then, the combined new graphics are arranged in a matrix. Parameter Description:

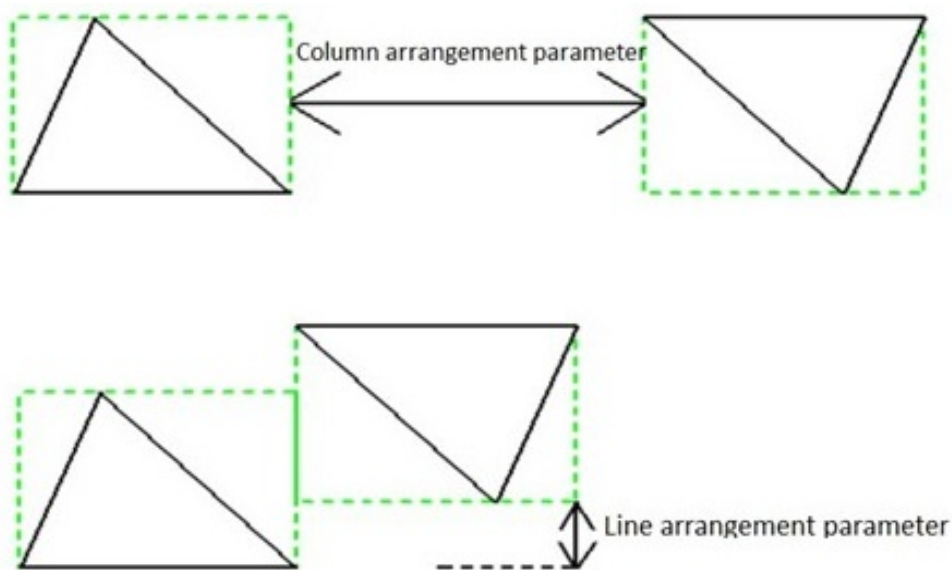
- ❖ **Number of rows:** The number of rows to be arranged for the combined graphics.
- ❖ **Number of columns:** The number of columns to be arranged for the combined graphics.
- ❖ **Line spacing:** The distance between the combined graphics and the combined graphics in the Y direction. This parameter can be negative.
- ❖ **Row pitch:** The spacing between the combined graphics and the combined graphics in the X direction. This parameter can be negative.
- ❖ **Line arrangement:** The distance between the two graphics in the Y direction when they are combined into a new graphic. This parameter can be negative.
- ❖ **Column arrangement:** When two graphics are combined into a new graphic, the distance between the two graphics in the X direction. This parameter can be negative.



Pic 4.15 Merge into New Graphics



Pic 4.16 Line Spacing, Column Spacing Parameters



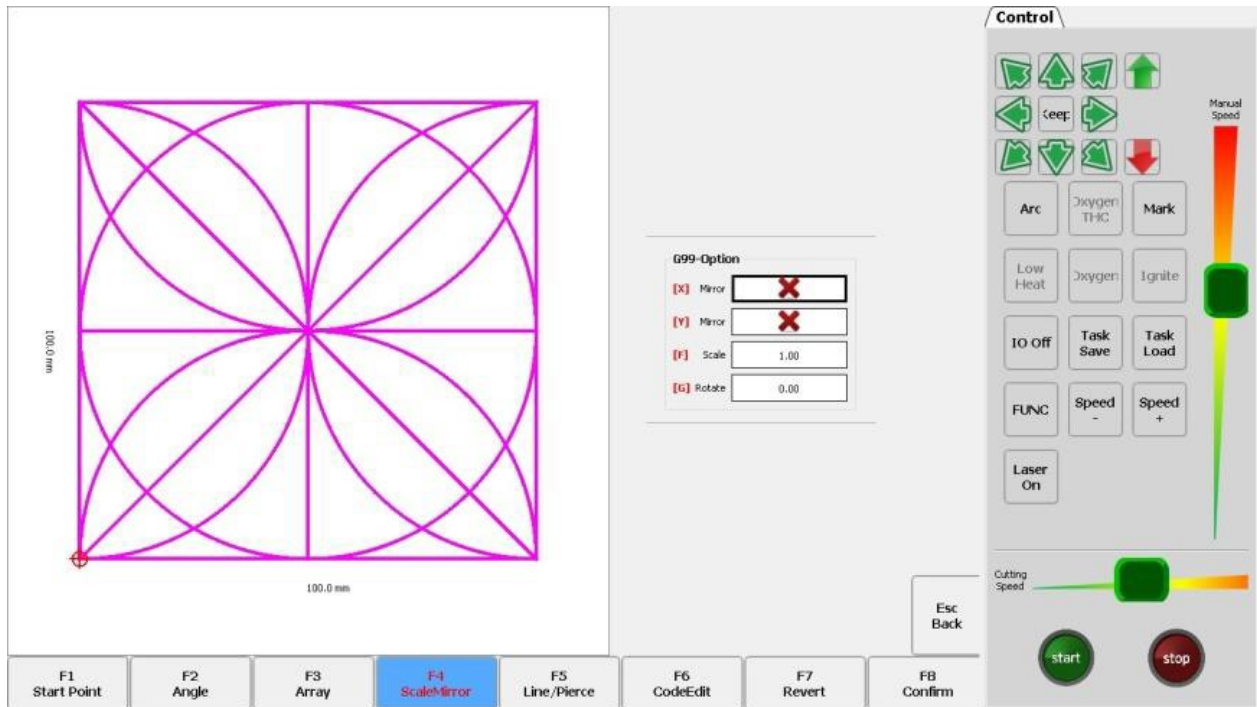
Pic 4.17 Column Arrangement and Line Arrangement Parameters

Service Support Spirit

4.4 Scale

In the component options interface, press [F4 Scaling], the system prompts as shown in

Pic 4.19:



Pic 4.18 Scaling

After the proportional parameter with the [F] button is input, the system automatically scales up or down when checking that the input parameters are not wrong.

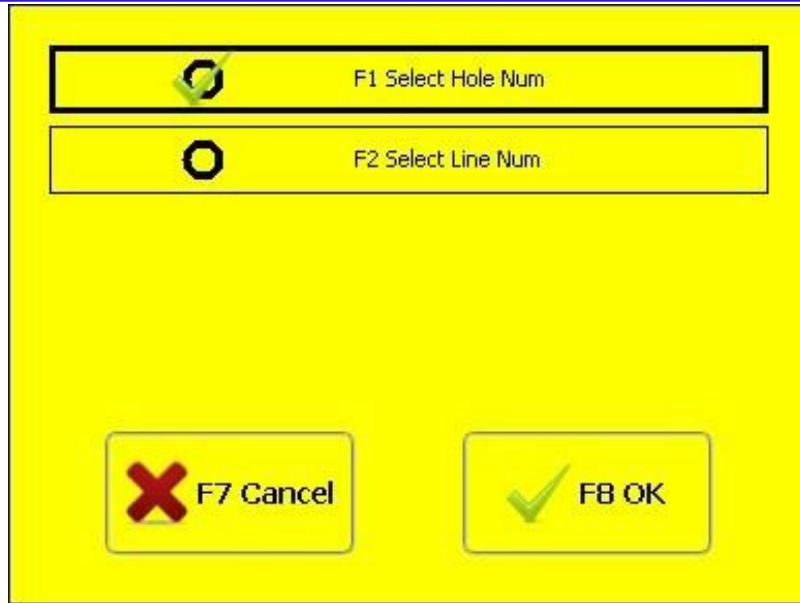
Attention: scaling also scales the incoming line and outgoing line.

4.5 Selection of lines and holes

In the component option interface, press [F5] to perform the row selection operation.

System prompt:

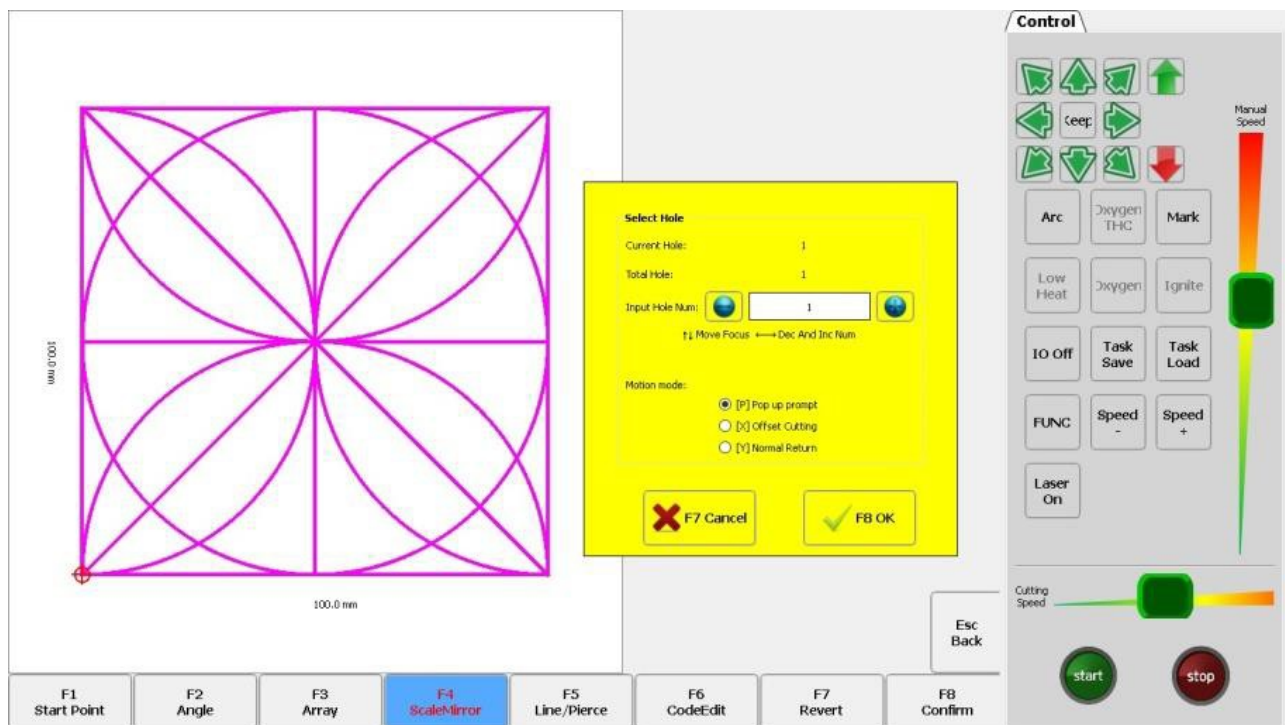
Service Support Spirit



Pic 4.19 Line and Number Selection

4.5.1 Hole selection

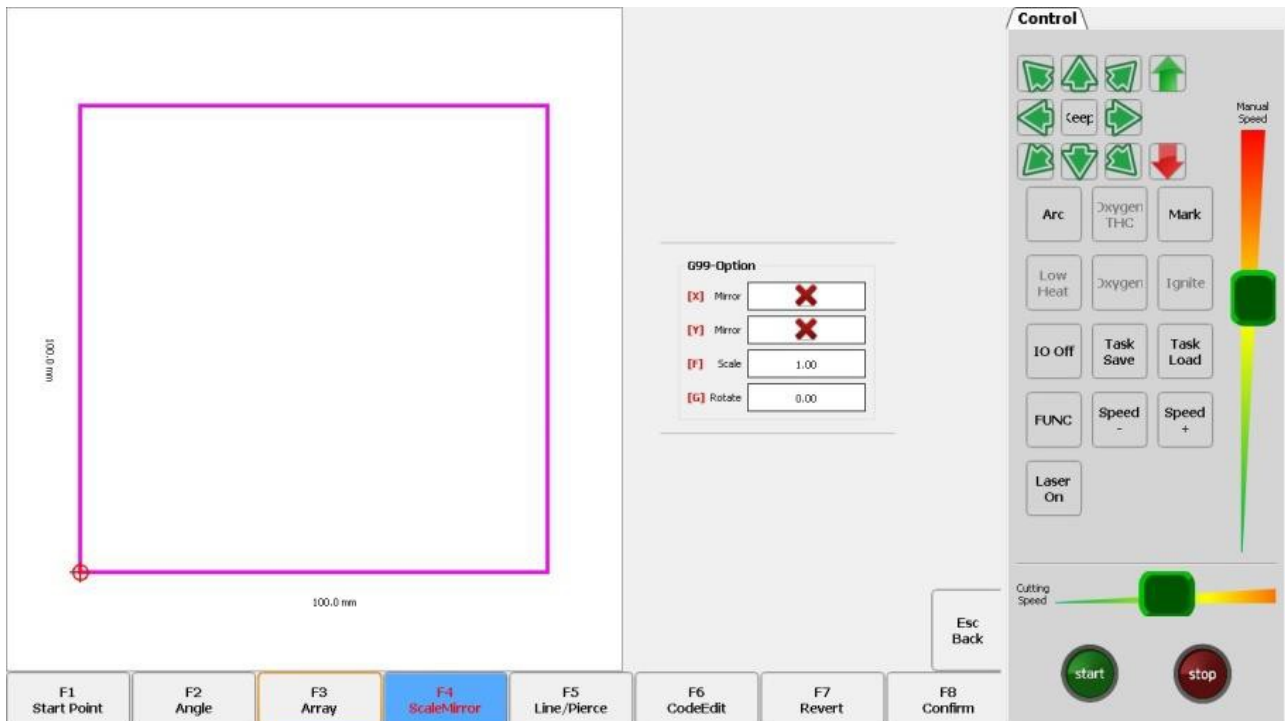
Press [F1] to select the hole number to start cutting. The system prompts:



Pic 4.20 Line Selection Prompt

Service Support Spirit

At this point, you can directly input the perforation point to start machining, or you can modify the perforation point through the arrow keys on the keyboard. It is necessary to have M07 statement in G code or ESSI code.



Pic 4.21 Selection of Sixth Hole

After the selection is completed, press [F8] to confirm.

4.5.2 Line selection

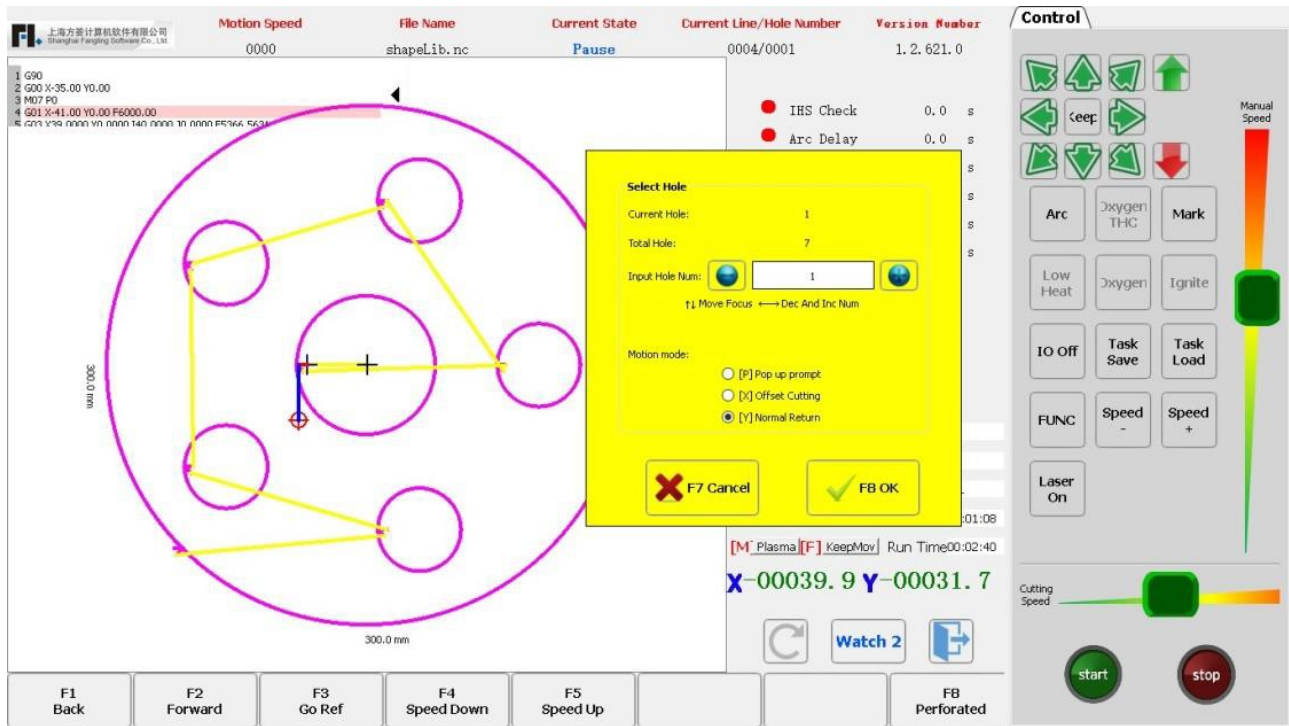
Similar to the operation of selecting lines. The line selection function corresponds to the line number in the processing file.

4.5.3 Operation after selecting a line

After the line selection or hole selection is completed, press the [F8] button continuously to exit to the main interface. After returning to the main interface, there are generally two operations. One is forward/backward and the other is to start cutting.

Service Support Spirit

After returning to the main interface, press the space button on the main interface to switch to the cutting interface. Press [F1]/[F2] on the cutting interface, and the dialog box shown in Pic 4.22 will pop up.



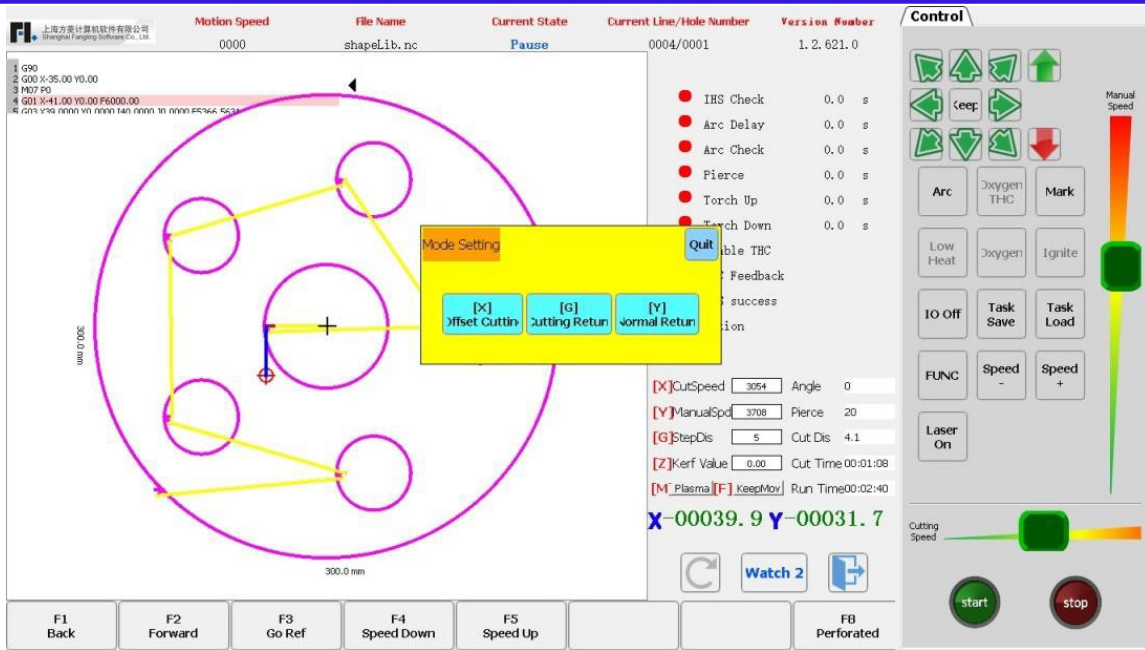
Pic 4.22 Way Selection

When the cutting torch is offset from the original cutting path, press the START button on the cutting interface and the system prompts as shown in Pic 4.23.

Press the Y button, and the system will also blank the line to the selected line number or perforation point.

Press the X button and the system will return to the original cutting path at the current position and start machining. If the G key is pressed, the system will start machining at the current position.

Service Support Spirit



Pic 4.23 Operation of Line and Number Selection

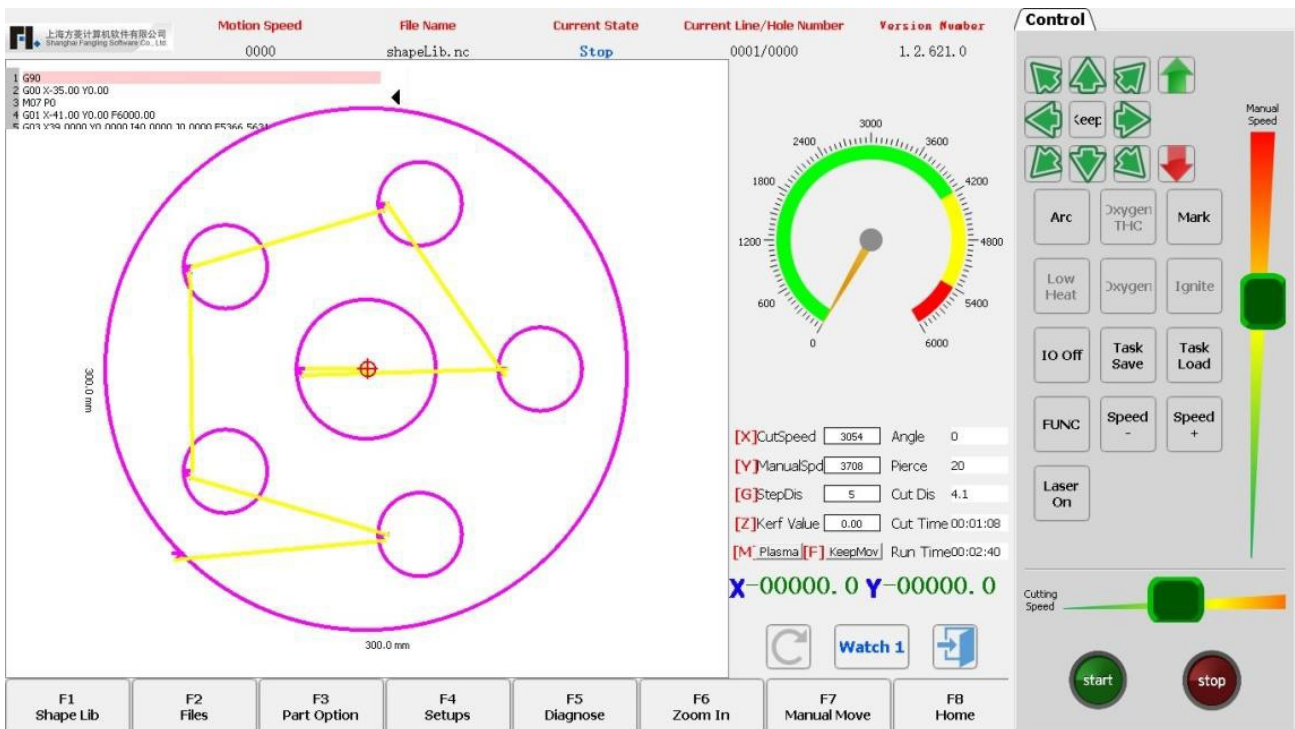
4.6 Graphics restoration

If you want to cancel all mirroring, rotation, correction, scale, and arrangement of the graph, press [F7] in the component option interface to automatically restore the original state of the graph, and cancel all mirroring, rotation, correction, scale, and arrangement and otherwise operations.

Chapter 5 Manual Functions

Click [F7 Manual Motion] on the main interface of the system to display the panel for manual shifting. As shown in Pic 5.1, the manual shift mode can be switched by the [F] button, which is divided into: jog, linkage and fixed length.

Manual shifting of the machine in four directions can be achieved by the up, down, left and right buttons.



Pic 5.1 Manual Main Interface

The speed in the manual state is controlled by the manual shift speed parameter in the usual parameters.

When moving manually, you can press HOME to accelerate, END to decelerate, or press the number key in the manual interface, the system speed will automatically adjust to the percentage of the corresponding number 10 times speed.

For example, press the number [3], the speed will be automatically adjusted to 30%; press the number [8], the speed will be automatically adjusted to 80%.

Service Support Spirit

5.1 Jog

In the main interface, use the [F] button to switch the manual shift mode. In the jog mode, press any direction button, and the system will move in that direction; release the direction button, and the system stops moving.

5.2 Linkage

In the main interface, use the [F] key to switch the manual shift mode. In the linkage mode, press any direction button and release, and the system will move in that direction; press any direction button or [Stop] button again and the system stops moving.

5.3 Fixed length movement

In the main interface, use the [F] key to switch the manual shift mode in fixed length mode. The system can set the fixed length by the [G] button.

7 8 9 Back

4 5 6

1 2 3

0 . -

Fixed Distance

New Value: 3

Origin Value: 5

F7 Cancel F8 OK

Pic 5.2 Input Fixed Length Distance

Service Support Spirit

After entering the fixed length, press [F8] to confirm. At this time, press any direction button and release, the system will automatically stop after moving the fixed distance in that direction; press any direction button or [stop] button during the movement, and the system will stop moving.

5.4 Break restoration

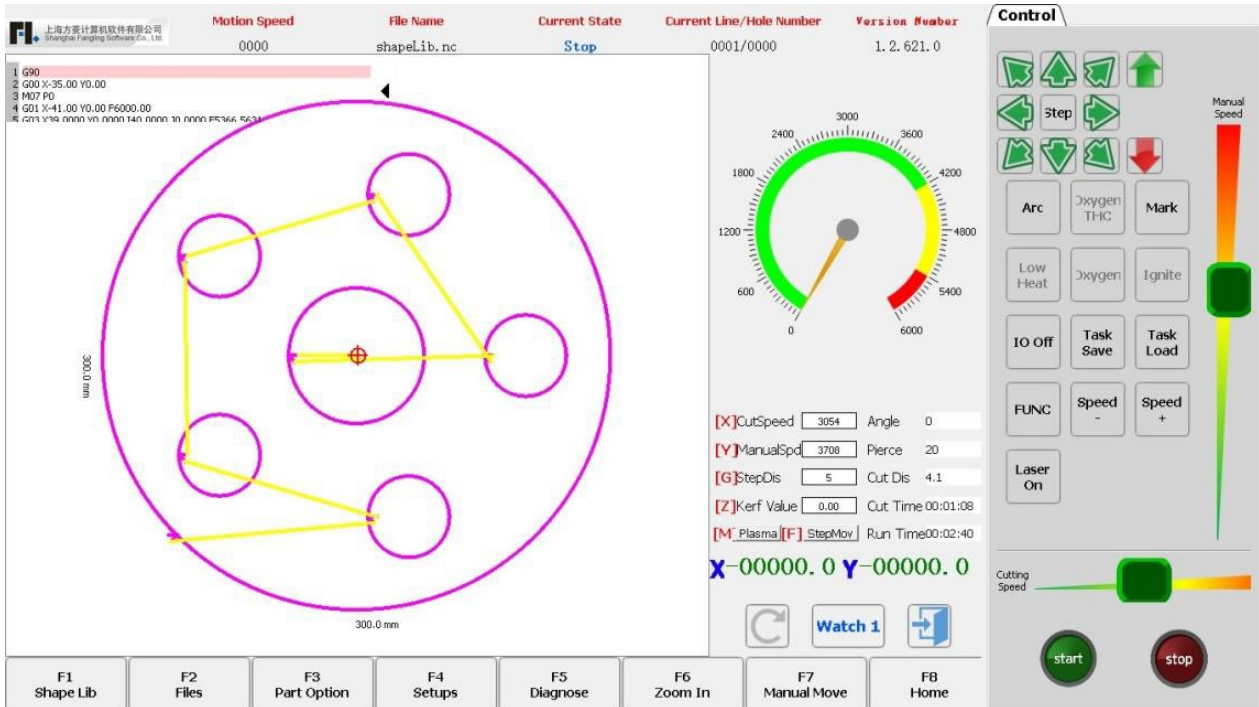
The break restoration function is mainly used to cause power failure during the cutting process and to temporarily stop cutting to handle other things. In order to ensure the normal use of the break restoration function, the following conditions must be met:

When the system is in the pause state, the system automatically remembers the current pause point as a breakpoint.

When the system is in the cutting operation, in the case of power failure, the system will remember the position when the power is off as a breakpoint.

When it is necessary to continue machining from the breakpoint, after the system is powered on, do not move the torch position. Press [F7] on the main interface to enter the manual shifting interface, as shown in Pic 5.3, and then press [F6] to restore the breakpoint. After restoration, if the torch has not been moved, it is just in the position before the power is cut off. At this time, press the [START] button, the system will start processing directly from the breakpoint.

Service Support Spirit



Pic 5.3 Manual Interface

After performing breakpoint recovery, if you find that the current position deviates from the power-off position, you can manually move the torch to the actual breakpoint and use the offset cutting function to offset the torch to the correct cutting path. For example, by using the back function, the torch is moved to the perforation point of a part. If the torch position is not in the actual perforation position, the torch can be manually moved to the correct perforation position, then press the start button and select [X] offset to cut.

Power failure recovery can also be achieved by selecting holes or selecting functions. (See section 4.6 for selecting holes).

5.5 Laser offset

The laser offset function means that the user installs a positioning device (laser cross positioning mark or laser spot) next to the cutting torch. The distance between the positioning device and the torch is fixed. The distance parameter is set in the system parameters (Section 7.5). With this function, the user can return the torch to the positioning point after the positioning is completed, mainly for steel plate correction, steel plate starting point search and so on.

Service Support Spirit

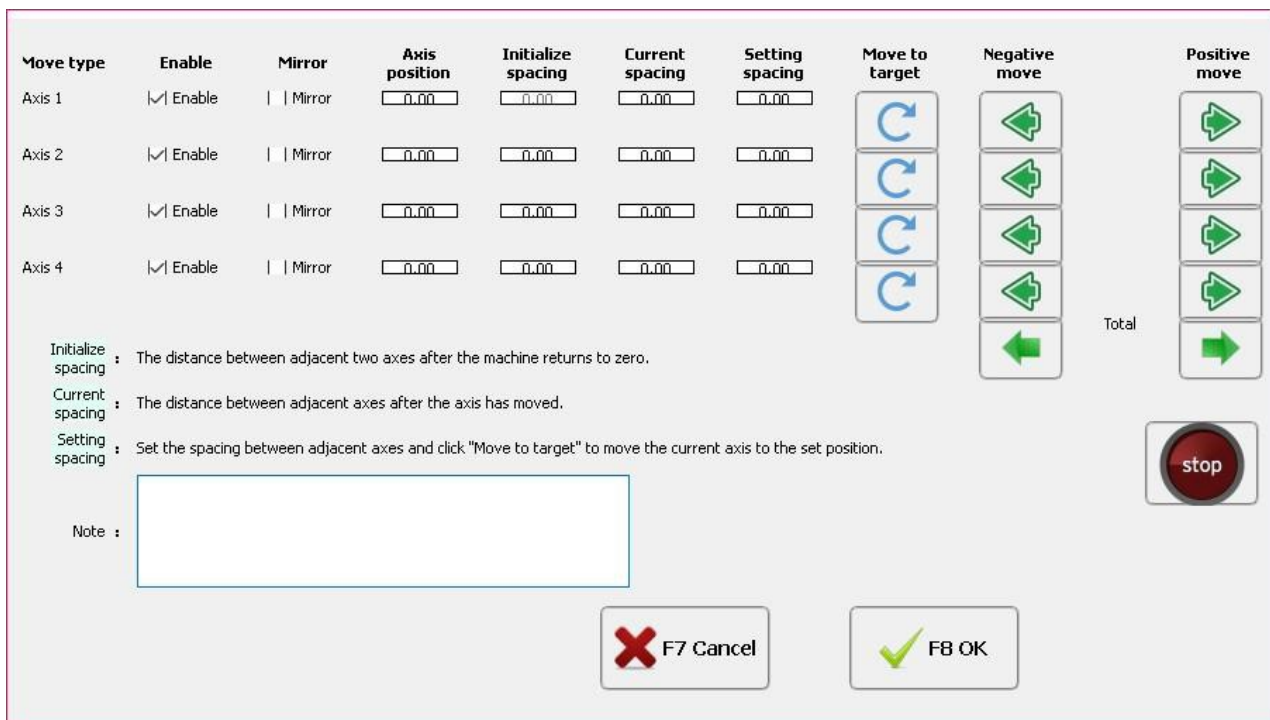
[F4] Laser offset: You can move the crosshairs to the position of the original torch..

[F5] Laser return: enable to move the torch to the crosshair position.

5.6 Double-trolley

5.6.1 Double-trolley configuration interface

After enabling the double trolley in the X-axis parameter configuration in [F4 Parameter Setting]-[F5 System]-[F2 Axis Parameter], the double-trolley function can be used after the program is restarted. (Note: The axis card must be restarted after the double car function is enabled to use normally, you can enter the double-trolley manual interface by [F7 Manual]-[F3 double-trolley], as shown below:



Pic 5.4 Double-trolley Configuration Interface

Configuration interface function description:

❖ **Movement mode**

1. Resultant movement: during movement, the enabled axes move together (the enabled axis coordinates change). The axis that is not enabled does not move (the coordinates do not change).

Service Support Spirit

2. Uniaxial movement: the current axis can be moved left and right.

❖ Enable

For a single axis, enable or disable. The enabled axis can be moved. There are a total of N axes. The 2-X axis must be enabled. ($X \geq 2$, $X \leq N$)

❖ Axis coordinate

The coordinate position of the current axis in the machine coordinate system.

❖ Initial spacing

When the current interval is 0, the time to complete the zero return is performed. The spacing of the axis from the previous axis.

❖ Current spacing

1. Display as (none) when not set.
2. This value is invalid when there is no return to zero although it is set. (display as: not returned to zero).
3. If the value is modified, the axis moves to that position immediately. (This function does not work when there is no zero return).
4. The zero offset is determined. $\text{Zero offset} = \text{Spacing} - \text{Spacing after zeroing}$.

Description:

5. If the axis 2 is moved separately, the distance from axis 2 to axis 1 will change in real time ($\text{coordinate offset of axis 2} - \text{coordinate offset of axis 1}$), and the distance of axis 3 from axis 2 will also change in real time ($\text{coordinate offset of axis 3} - \text{coordinate offset of axis 2}$).

❖ Set spacing

Set the spacing of the current axis to use for the Move In Place button.

Service Support Spirit

❖ Moving in the negative direction

1. Uniaxial movement: the current axis is moved and the other axes do not move. (At this point, the "Axis Enable" configuration is invalid)
2. Resultant movement: The enabled axes move together. The axis that is not enabled does not move.

❖ Moving in the positive direction

Others are the same as "forward movement".

❖ Return to zero

It is convenient for the user to measure the shaft spacing after zero return.

1. Zeroing direction: According to the parameter selection, zero return is supported.
2. Axis 1-axis N has 2 limit switches.
3. Return to zero order:

❖ Positive zero return:

1. Axis 1 first returns to zero, then axis 2, and finally axis N.
2. The axis N moves to the user set pitch and finally the axis 1 moves to the user pitch.

❖ Reverse zero return:

1. Axis N returns to zero first, and finally axis 1.
2. Axis 1 moves to the user set pitch and finally axis N moves to the user pitch.
3. During the zero return process, the other is checked in the hard limit. If the hard limit occurs, the zero return is stopped.
4. The zero return process can be conPicd to primary zero return or secondary zero return.
Use the encoder to return to zero.

Service Support Spirit

5.6.2 Shaft wiring

When "Double-trolley Enable" is enabled, use "axis 1" and "axis 4" on the control card to output terminals. The Z axis used in the "Drilling and Cutting Integrated Function" cannot be used at this time.

5.7 Task saving and recovery

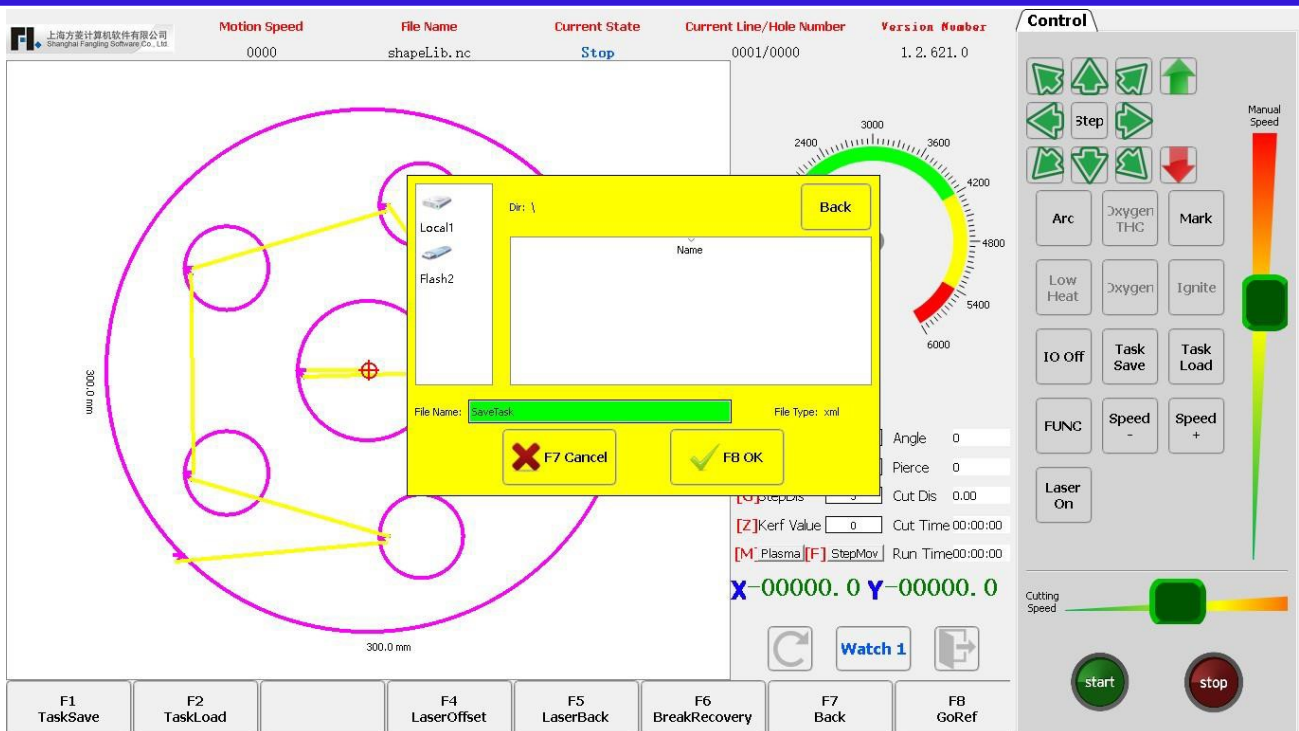
The following situations will be encountered in actual production: pause a graphic that is being cut and add a graphic that is urgently needed. In this case, the task saving and recovery function is used. The prerequisite for using the task saving function is: do not move the suspended cut plate.

5.7.1 Task saving

The task saving operation steps are as follows:

1. Pause the cut graphic and exit the cutting state.
2. In the main interface, click [F7 Manual Movement] to switch to the manual shifting interface.
3. Click the [F1 Task Saving] button on the manual transfer interface.
4. Enter the task name in the pop-up dialog box and click OK.

Service Support Spirit



Pic 5.4 Task Saving

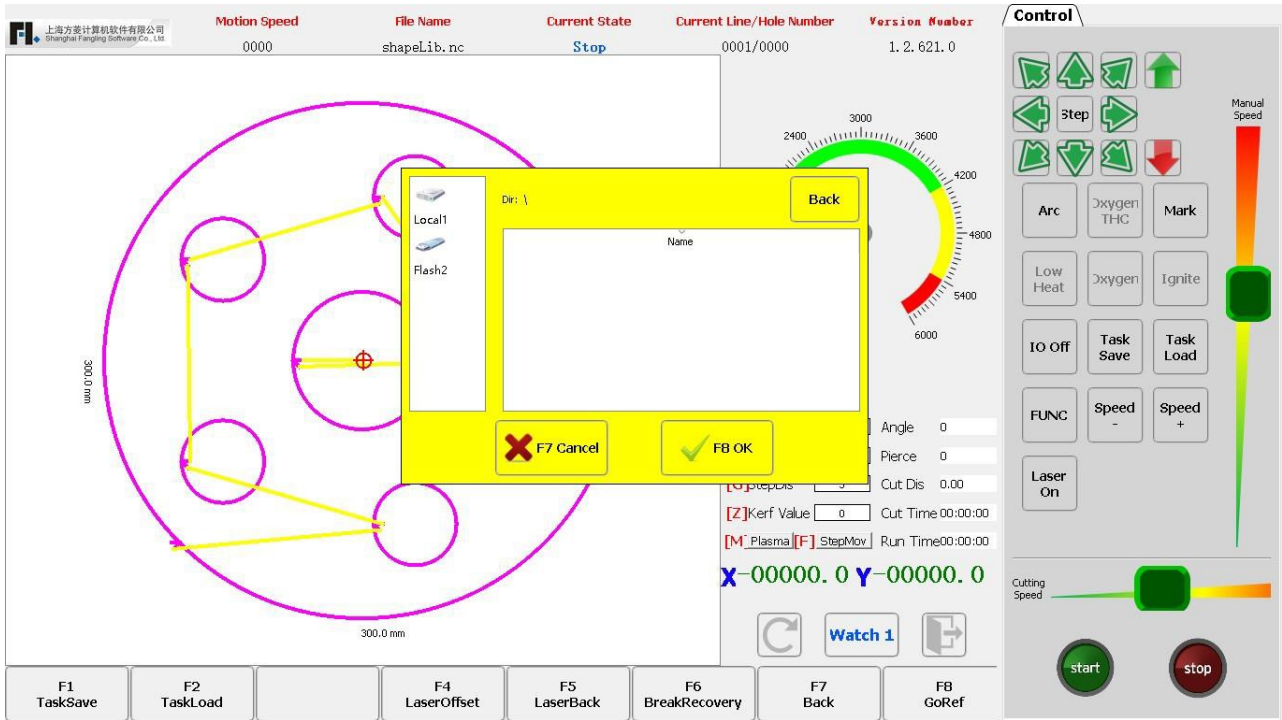
5. Manually move the torch to the machining position of the graphic to be cut.
6. Process urgently needed graphics.

5.7.2 Task recovery

Task recovery steps:

1. After the emergency graphic processing is completed, switch to the manual shifting interface.
2. Move the torch to the breakpoint of the previously unfinished pattern by manual shifting.
3. Click the [F2 Task Recovery] button, and select the task you want to restore in the pop-up dialog box. Select and click the OK button.

Service Support Spirit



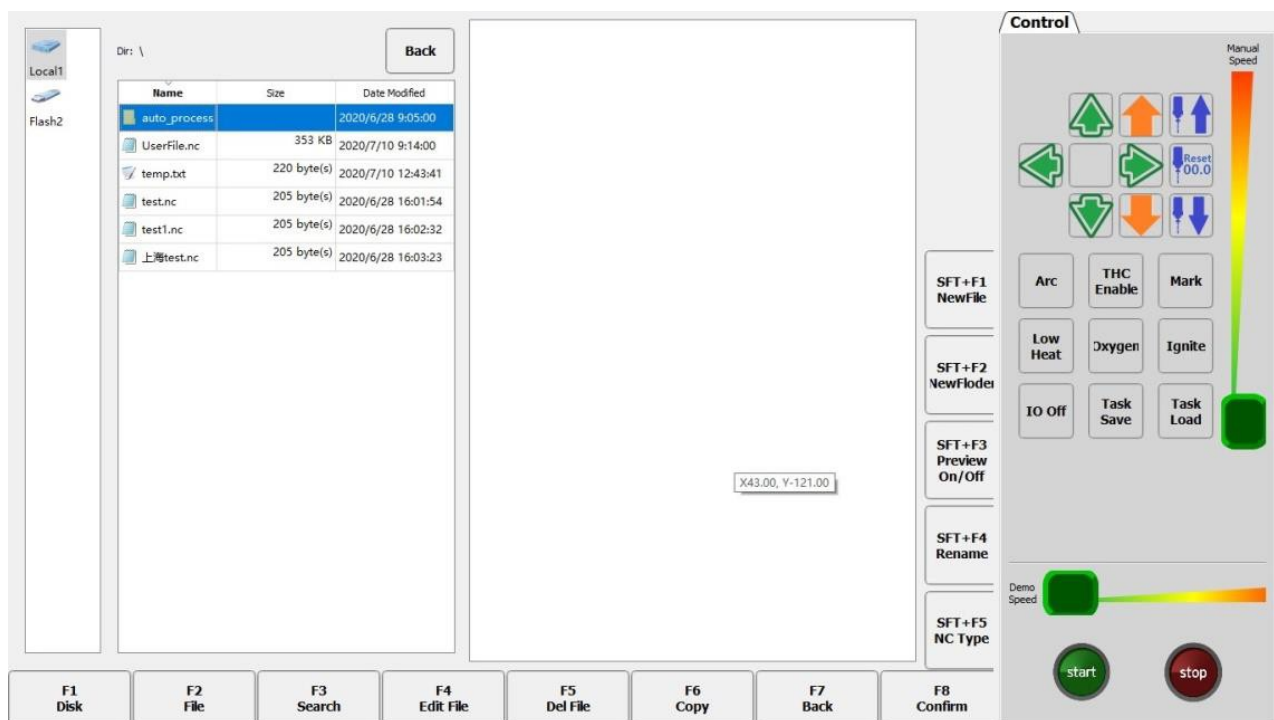
Pic 5.5 Task Recovery

4. After the recovery is successful, the program will switch to the cutting interface and there will be a "Recovery Successful" prompt. Then click the [F9] button to continue the unfinished cut.

Chapter 6 Document Management

The cutting file formats supported by this system are txt, cnc, nc, B3, MPG, etc. The system can not only edit existing files, but also export existing files to the outside or import external files into the system.

In the main interface, press [F2] to enter the file management interface, as shown in the Pic below.



Pic 6.1 Code Interface

In the file management interface, operations such as creating, searching, editing, deleting, and copying G code files can be implemented.

- ❖ [F1 disk]: Switch the cursor to the letter bar to switch the drive letter. Press F1 continuously to switch back and forth between the drive letters.
- ❖ [F2 document] Switch the cursor to the file bar.
- ❖ [F3 search] In the full search of the G code file, all files containing the input characters will be searched and listed.
- ❖ [F4 edition] Edit the currently selected G code file and refer to Section 6.4.

Service Support Spirit

- ❖ [F5 deletion] Delete the selected file or current folder.
- ❖ [F6 copy] Copy the file to another folder or to a USB flash drive.
- ❖ [F7 return]: return to the main interface.
- ❖ [F8 confirmation] If the current cursor place is a G code file, the current processing file is loaded into the system, and the system automatically returns to the main interface. If it is a folder, the folder will be opened.
- ❖ [SFT+F1]: Create a new G code file.
- ❖ [SFT+F2]: Create a new file folder.
- ❖ [SFT+F3] Turn the live preview function on or off, and the G code file where the cursor is located is displayed graphically in the preview area.
- ❖ [SFT+F4]: Rename the selected file.
- ❖ [SFT+F5]: Add the identifiable G code file format suffix.

6.1 Disk

Click [F1 disk] to position the cursor to the drive letter column for the drive letter switch.

6.2 File

Click [F2 File] to position the cursor to the file bar and use the up and down buttons or [F2] to select the file.

6.3 Find file

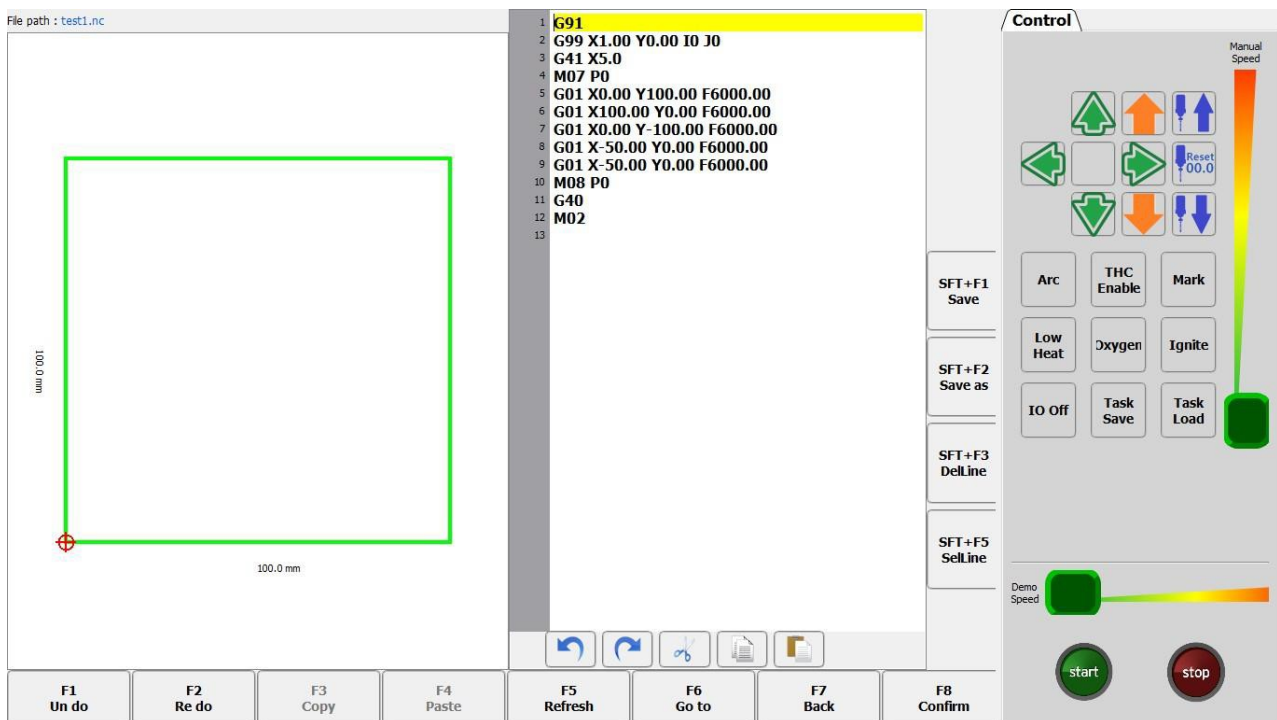
Press [F3] in the file management interface to search for files. Enter some or all of the characters of the file name you are looking for. Press F8 and the system will list the results of the search.



Pic 6.2 Find Files

6.4 Code editing

In the file management interface, move the cursor to the file name you want to edit and press [F4] to edit the code. The selected G code file can be edited as shown in Pic 6.3.



Pic 6.3 Code Edition

- ◆ [F1] Cancellation: cancel the operation in the previous step.
- ◆ [F2] Recreation: restore the cancelled operation.
- ◆ [F3] Copy: select the code to be copied and the copy button is available.

Service Support Spirit

- ◆ [F4] Paste: paste the copied code.
- ◆ [F5] Refresh: refresh the current code.
- ◆ [F6] Skip: skip to the code of the set line.
- ◆ [F7] Return: Go back to the previous screen and do not save changes made.
- ◆ [F8] Confirmation: save modifications and return to the previous screen.
- ◆ [SFT+F1] Saving: save modifications.
- ◆ [SFT+F2] Saving as: save the current G code file as another file.
- ◆ [SFT+F3] Delete line: delete the line where the current cursor is.
- ◆ [SFT+F5] select row: select the row where the current cursor is located.

6.5 Delete files

In the file management interface, press [F5] to delete the file, and a dialog box will pop up as shown in Pic 6.4 to delete the selected file or folder.

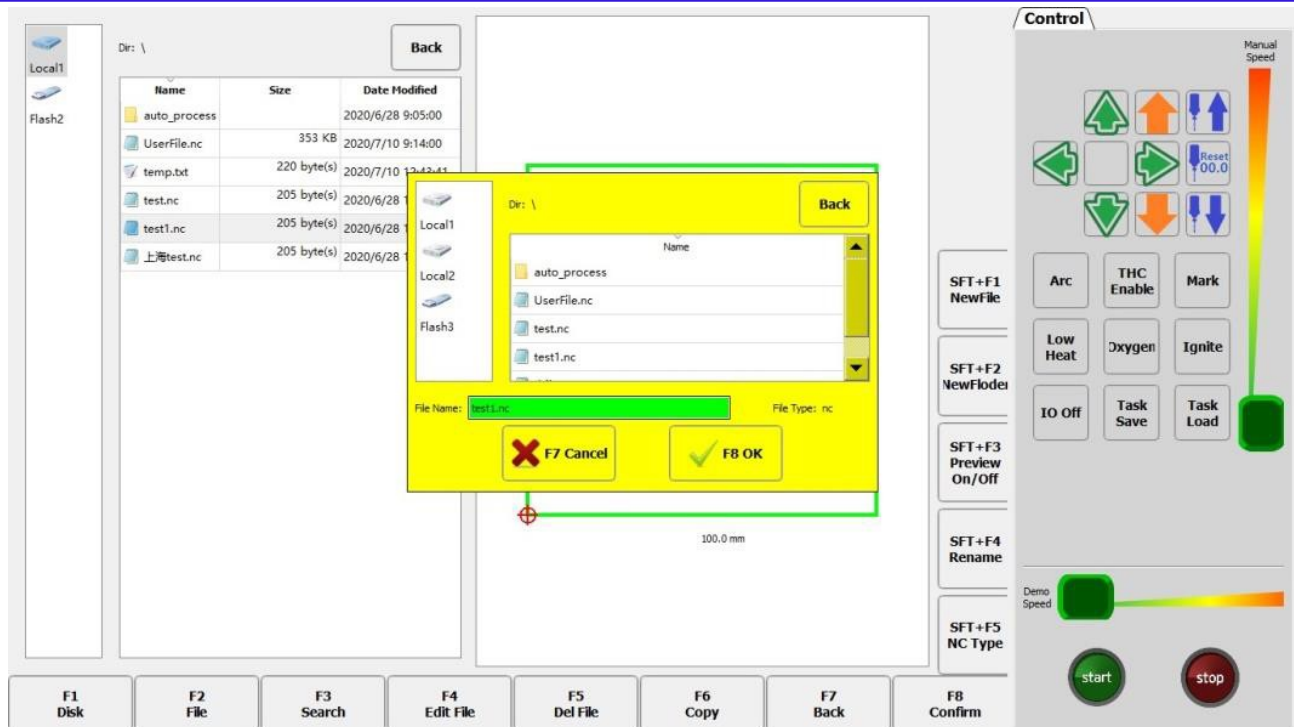


Pic 6.4 Delete Files

6.6 Copy files

In the file management interface, press [F6] to copy, a dialog box will pop up as shown in Pic 6.5, and then select the directory to be copied to.

Service Support Spirit



Pic 6.5 File Copy

In the file management interface, Press [SFT+F1] to create a new file, you can manually create a file and edit it.

6.7 New folder

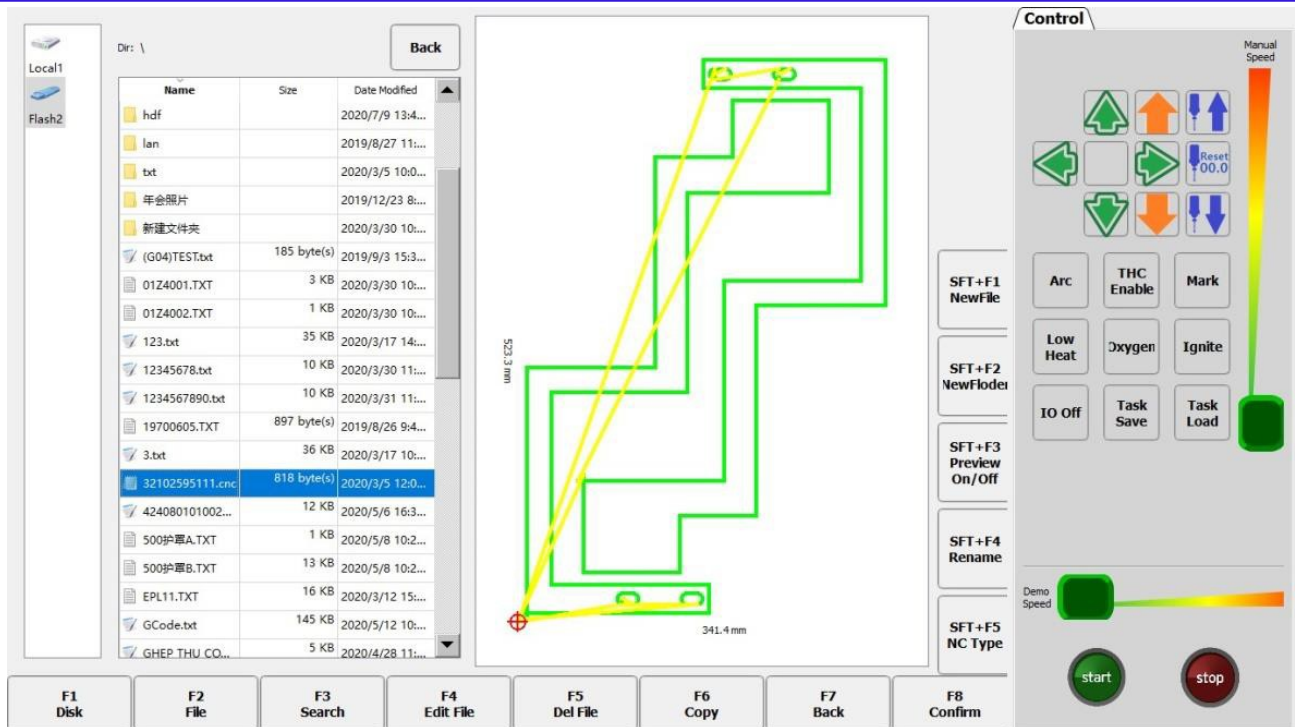
In the file management interface, press [SFT+F2] to create a new folder, you can create a folder and manage the G code files.

6.8 Preview

When the preview is on, when the cursor moves to the corresponding G code file, the graphic of the selected G code is displayed in real time. You can visually observe the part graphic corresponding to the current G code and select the corresponding machining part, as shown in Pic 6.6.

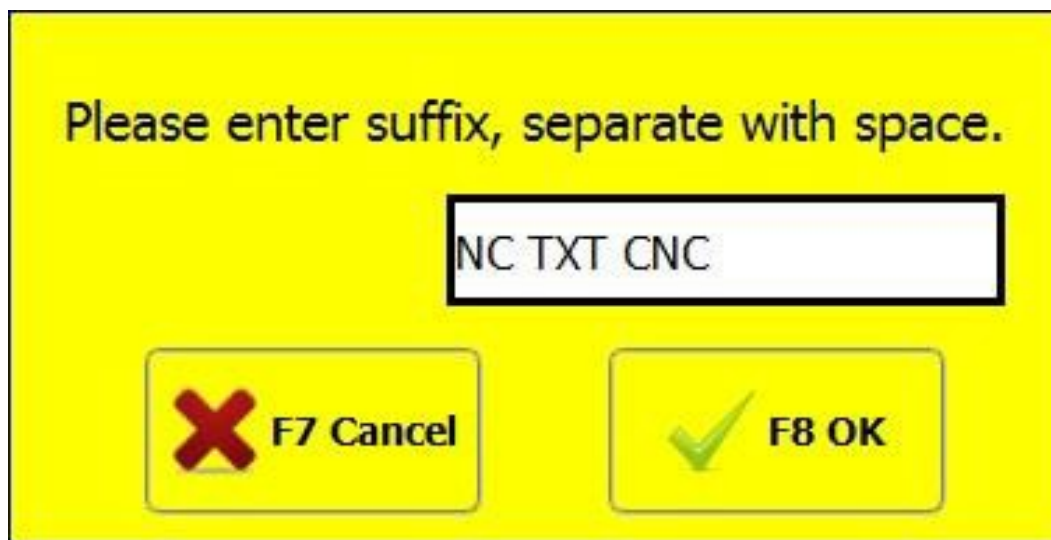
Caution: When you turn on the preview feature, it affects the speed of browsing files.

Service Support Spirit



Pic 6.6 Graphics Preview

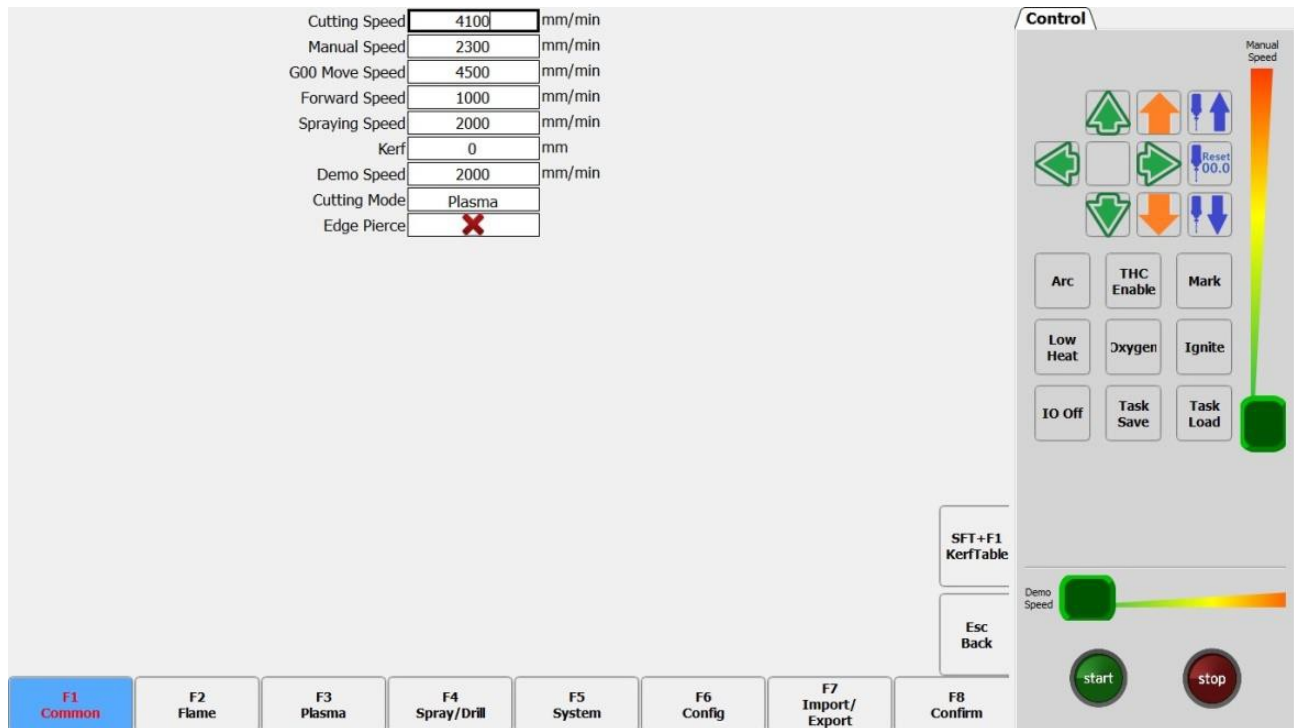
In the file management interface, press [SFT+F5] to add the file format, you can increase the file suffix of the identifiable G code, separated by spaces, as shown in Pic 6.7.



Pic 6.7 G Code Document Format

Chapter 7 Parameter Settings

In the main interface, press [F4] to enter the parameter interface, as shown in Pic 7.1 is the parameter function interface.



Pic 7.1 Parameter Interface

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

- ◆ **Common parameters:** Maximum cutting speed, manual shifting speed and idle speed setting, kerf compensation, cutting type selection, edge punching, etc.
- ◆ **Oxygen gas parameters:** All process parameters used in oxygen gas cutting.
- ◆ **Plasma parameters:** All process parameters used in plasma cutting.
- ◆ **Powder injection parameters:** ignition perforation fixed cycle of powder injection in the use of powder injection, powder injection shift and other parameters.
- ◆ **System parameters:** the setting of parameters such as system pulse number, maximum speed limit, motor parameters and software limit.
- ◆ **Configuration:** Input and output port function configuration, as well as machine coordinates and other related settings.
- ◆ **Import and export:** Import and export parameters.

Service Support Spirit

7.1 Common parameters

Pic 7.1 shows the common parameters of the system.

- ◆ **Cutting speed:** the highest speed when cutting.
- ◆ **Manual shifting speed:** the speed at which the torch moves when the torch is manually moved.
- ◆ **Idle stroke shifting speed:** the speed at which the torch moves when G00 or the torch is quickly returned.
- ◆ **Advance/astern speed:** the speed at which the path advances or retreats when paused during cutting.
- ◆ **Powder injection speed:** the speed at which the line is drawn through powder injection.
- ◆ **Kerf (half of kerf):** The dimensional accuracy of the cut parts is guaranteed. The user sets the kerf compensation value according to the kerf width (the kerf compensation value should be half of the actual kerf width), and the system will automatically generate a new cutting path to compensate for the kerf. The kerf value can be modified before a workpiece is cut. After the cutting is started, the kerf value is not allowed to be modified.
- ◆ **Demo speed:** cutting speed in demo mode.
- ◆ **Cutting type:** aerobic gas and plasma are available. Users can choose between two methods through the drop-down menu.
- ◆ **Edge perforation:** choose whether to use edge perforation. When edge perforation is used, the cutter automatically pauses whenever the M07 code is encountered. When the cutter is paused, the user can manually move the torch to the edge of the steel plate and then press the "Start" button, the system prompts:



Pic 7.2 Edge Perforation

When [G] is selected, the system will cut from the current point ignition to the pause point and then continue cutting. This is the function of edge perforation.

This function is especially useful when cutting thick steel plates. Thick steel plates are more difficult to perforate and have larger holes. If they are directly perforated in the cutting path, they may have an impact on the final product quality. The application of edge perforations can speed up the perforation, save cutting time and improve product quality.

Of course, without the use of edge perforations, the use of lead-through perforations is also a more effective method.

7.2 Oxygen gas parameter

Click [F2] on the parameter interface to switch to the oxygen gas parameter interface. As shown in Pic 7.3.

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The screenshot displays the 'Oxygen Gas Parameters' configuration screen. On the left, a list of parameters is shown with their current values and units. On the right, a 'Control' panel features various buttons and a speed slider. At the bottom, a row of function keys (F1-F8) is visible.

Ignite Time	0	s
Low Preheat Time	30	s
High Preheat Time	0	s
Pierce1 Time	0	s
Pierce2 Time	0	s
Pierce3 Time	0	s
Blow Time	0	s
Torch Up Time	0	s
Torch Down Time	0	s
Pierce Up Time	0	s
Pierce Down Time	0	s
THC Enable	<input checked="" type="checkbox"/>	
Preheat Oxygen Keeping	<input checked="" type="checkbox"/>	
Not Close Preheat After Exit	<input checked="" type="checkbox"/>	
Pierce Count	4	<input type="button" value="Clear"/>
Total Oxygen Workpieces	0	<input type="button" value="Clear"/>
Cutting Distance	2723.35	<input type="button" value="Clear"/>
Oxygen Cutting Time	00:00:11	<input type="button" value="Clear"/>
Oxygen Running Time	00:00:32	<input type="button" value="Clear"/>
Creep Time	0	s
Creep Speed	200	mm/min

Control Panel:

- Manual Speed slider (0.0 to 100.0)
- Directional arrows (Up, Down, Left, Right)
- Buttons: Arc, THC Enable, Mark, Low Heat, Oxygen, Ignite, IO Off, Task Save, Task Load
- SFT+F1 KerfTable
- Demo Speed slider
- Esc Back
- Start and Stop buttons

Function Keys:

- F1 Common
- F2 Flame (highlighted)
- F3 Plasma
- F4 Spray/Drill
- F5 System
- F6 Config
- F7 Import/Export
- F8 Confirm

Pic 7.3 Oxygen Gas Parameters

- ◆ **Ignition time:** during ignition, delay time when the high-pressure ignition switch is turned on.
- ◆ **Low-pressure preheating delay:** the time of low pressure preheating before perforation. Input any value in the range of ≥ 0 (unit: second). During the preheating process of the perforation, if the system is in the low pressure preheating phase, if you feel that the preheating time is not enough, you can press the "Stop" button or the [F7] button. When the stop button is pressed, the system starts to delay indefinitely. The thermal delay will increase automatically. When the preheating is completed, press the "Start" button to end the warm-up delay and start the high-pressure preheating delay. After pressing the [F7] button, the preheating time will automatically extend 15 seconds. And this time will be saved by the system.
- ◆ **High-pressure preheating delay:** same as low-pressure preheating delay. Just IO opened is different, the high-pressure preheating delay is before the low-pressure preheating delay.

Service Support Spirit

- ◆ **Primary perforation time:** low-pressure cutting oxygen perforation time. Input any value in the range of ≥ 0 (unit: second). When it is greater than 0, the IO port will be opened. If it is 0, the IO port will not be opened.
- ◆ **Secondary perforation time:** middle-pressure cutting oxygen perforation time.
- ◆ Input any value in the range of ≥ 0 (unit: second). When it is greater than 0, the IO port will be opened. If it is 0, the IO port will not be opened.
- ◆ **Level-three perforation time:** high-pressure cutting oxygen perforation time. Input any value in the range of ≥ 0 (unit: second). When it is greater than 0, the IO port will be opened. If it is 0, the IO port will not be opened.
- ◆ **Exhausting time:** the delay in opening the exhaust when the gas is off. Input any value in the range of ≥ 0 (unit: second).
- ◆ **Torch rise time:** the time the torch rises when the cutting oxygen is turned off. Input any value in the range of ≥ 0 (unit: second).
- ◆ **Torch lower time:** the time the torch is lowered before preheating. Input any value in the range of ≥ 0 (unit: second).
- ◆ **Perforation rise time:** The time when the torch rises before the perforation which is different from the torch rise time: the torch rise is the time when the torch rises when the torch needs to move to another place at the end of the current cutting line in the M08 code or M02 code; the perforation rise time is the time during which the torch rises after preheating during the perforation fixed cycle in the M07 code.
- ◆ **Perforation lower time:** The time when the torch is lowered during perforation, which is different from the torch lower time: torch lower time is the torch lower time when the cutting oxygen is not opened before preheating; perforation lower time is the

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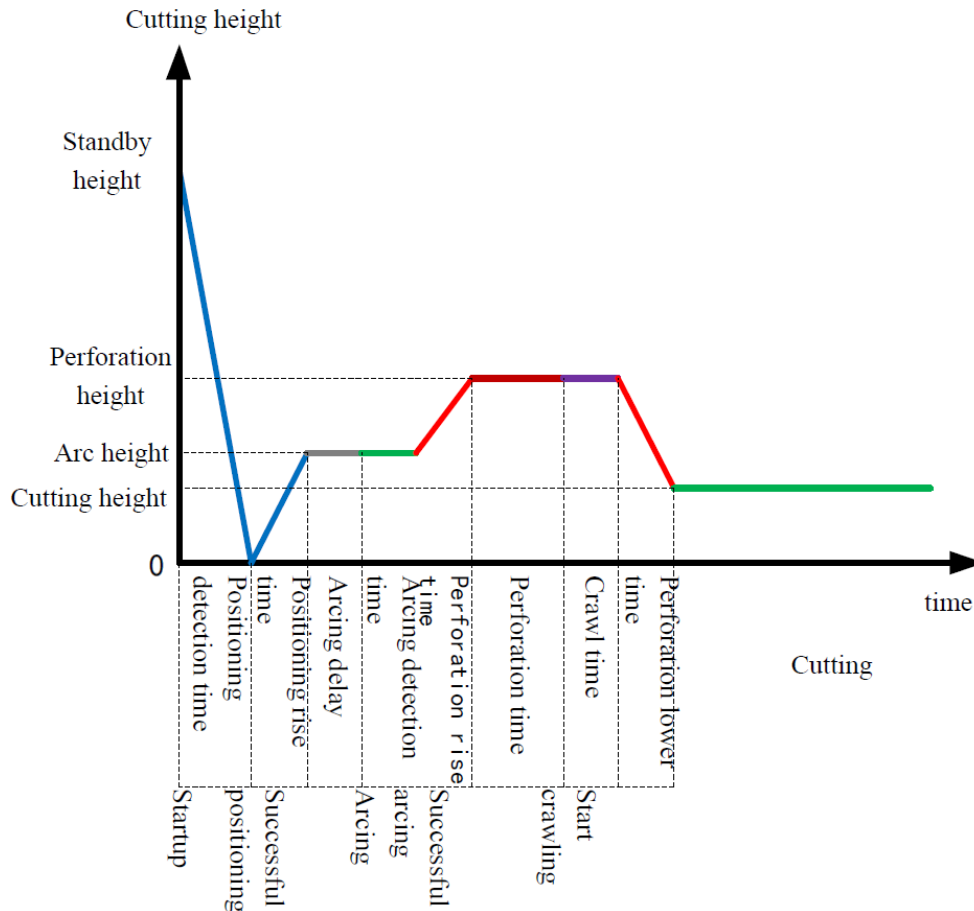
torch lower time after the perforation rise is completed and the cutting oxygen is opened during perforation fixing cycle.

- ◆ **Using heightening box:** select whether to use the heightening box according to the user equipment configuration.
- ◆ **M08 preheating oxygen holding output:** If this parameter is set to "Yes", the low pressure preheated oxygen IO port is always open during the cutting process before the cutting is completed (i.e. before the M02 code is encountered). If "No" is selected, the low pressure preheating will be turned off when M08 or M02 is encountered during processing.
- ◆ **Cutting ending preheating oxygen output retention:** if this parameter is set to "Yes", the preheated oxygen is always on.
- ◆ **Number of perforations:** record the number of perforations during the flame cutting process.
- ◆ **Piece number:** record the number of workpieces that have been flame cut.
- ◆ **Cutting distance:** record the total flame cutting distance in metric - meter, British system - foot.
- ◆ **Cutting time:** record the time during the flame cutting process.
- ◆ **Operation time:** record flame cutting time + idle time + M07 status time.
- ◆ **Crawl time:** crawl time. See Article 7.2.1 Dynamic perforation and crawling.
- ◆ **Crawling speed:** crawling speed. See Article 7.2.1 Dynamic perforation and crawling.

Service Support Spirit

7.2.1 Dynamic perforation and crawling

The dynamic perforation and crawl timing diagram is shown in Pic 7.4.



Pic 7.4 Dynamic Perforation Timing Sequence

- ◆ **Positioning detection time:** After the cutting is started, the torch is lowered. When the system detects the positioning success signal, the positioning detection time ends prematurely. If the system does not receive the positioning success signal after the positioning detection time is over, the system alarms. When this parameter is 0, the system will skip the detection of the positioning success signal and the torch will not lower, and directly enter the positioning rising phase.
- ◆ **Positioning rise time:** after the positioning success signal is detected, the torch is lifted, and the lifting time is the positioning rise time. When this parameter is 0, the torch does not rise, and the system directly enters the arcing delay phase.

Service Support Spirit

- ◆ **Arcing delay:** After the positioning rise time is over, the system will delay the arcing for a while, which is defined as the arcing delay. When this parameter is 0, the system does not delay and directly starts arcing.
- ◆ **Arcing detection time:** After the arcing delay time is over, the system will open the arcing port and start detecting the arcing success feedback signal. When the arcing success return signal is detected, the arcing detection time ends early. If the system has not received the arcing success feedback signal after the arcing detection time is over, the system prompts an error and terminates the cutting of the current workpiece, and exits the program according to the break-point memory. When the parameter is 0, the system directly detects the arcing success feedback signal. If the signal is not detected, an error will be reported. After the signal is detected, the system enters the next stage.
- ◆ **Perforation rise time:** After the arc is successfully started, the torch starts to rise, and the lifting time is the perforation rise time. When this parameter is 0, the torch does not rise and the system goes directly to the next stage.
- ◆ **Perforation time:** After the end of the perforation rise time, the system begins to statically perforate, and the time of perforation is the perforation time. When this parameter is 0, the system will skip this time and enter the crawling phase.
- ◆ **Crawl time:** after the end of the static perforation, if there is more and higher slag accumulation at the perforation point, the arc pressure will be unstable when cutting in this area, and at the same time, in order to prevent the slag from blocking the torch. Therefore, it is necessary to move forward for a period of time without prohibiting the increase, which is the crawl time. When this parameter is 0, the system will skip this time and enter the perforation lower phase.
- ◆ **Perforation lower time:** At the end of the crawling time, the torch is lowered to the normal cutting height to start cutting. This lower time is the perforation lower time. When this parameter is 0, the torch does not drop and the normal cutting starts directly.

Service Support Spirit

7.3 Plasma parameter

As shown in Pic 7.5, it is the plasma parameter. These parameters need to be set when the machine uses plasma cutting.

The screenshot displays the ARCBRO control interface. On the left, a list of plasma parameters is shown with their current values and units. The 'Arcing Check Time' parameter is highlighted with a red box and has a value of 15. Below the parameters is a row of function keys: F1 THC, F2 CutChart, F3 Plasma (highlighted in blue), F7 Return, and F8 Confirm. On the right, the 'Control' panel features a 'Manual Speed' slider, directional arrows, and buttons for Arc, THC Enable, Mark, Low Heat, Oxygen, Ignite, IO Off, Task Save, and Task Load. At the bottom of the control panel are 'start' and 'stop' buttons.

Arcing Check Time	15	s
Arcing Delay	0	Min:0 Max:60
Pierce Time	0	s
Torch Up Time	0	s
Locate Check Time	0	s
Locate Up Time	0	s
THC control type	EnableTHC	
Low Speed THC Off Ratio	95	% mm/min
THC Off Min Distance	5	mm
Forbid THC Arc Radius	5	mm
Thc Delay After Plasma Pierce	0	s
Arc Breaking Check Time	0	s
Cylinder THC Enable	X	
Arc Voltage Check	X	
Time Ahead of Voltage Off	0	s
Pierce Count	39	Clear
Total Plasma Workpieces	5	Clear
Cutting Distance	10918.12	Clear
Plasma Cutting Time	00:02:52	Clear
Plasma Running Time	00:09:23	Clear
Creep Time	0	s
Creep Speed	200	mm/min
Plasma Pierce Up Time	0	s
Plasma Pierce Down Time	0	s

Pic 7.5 Plasma Parameters

- ❖ **Arcing detection time:** The longest time to send an arcing command to accept feedback to receive a command.
- ❖ **Arcing delay:** The time the system waits before arcing. At this point, all outputs are closed. Input any value in the range of ≥ 0 (unit: second).
- ❖ **Perforation delay:** the perforation time, input any value in the range of ≥ 0 (the unit: second).
- ❖ **Torch rise time:** the time the torch rises before arc breaking. Input any value in the range of ≥ 0 (unit: second).
- ❖ **Arcing detection time:** Input any value in the range of ≥ 0 (unit: second). If the arcing success feedback signal is not detected within the detection time, the system prompts

Service Support Spirit

an error message and terminates the cutting of the current workpiece, and exits the program according to the break-point memory. If the successful arcing input signal is detected within the arcing detection time, the system stops detecting and starts cutting.

- ❖ **Positioning detection time:** Input any value in the range of ≥ 0 (unit: second). The time used for the positioning detection. If the positioning success signal input is not detected beyond this time, it is considered that the positioning is unsuccessful and the system alarms. If the positioning success signal input is detected within the detection time, the positioning detection is ended and the positioning starts to rise.
- ❖ **Positioning rise time:** Input any value in the range of ≥ 0 (unit: second). If the positioning success signal input is detected during the positioning detection, the torch lifting time.
- ❖ **Low speed off arc voltage adjustment (corner signal):** This parameter is a percentage. Open the "close arc voltage auto-adjustment" port at X% of the cutting speed to keep the torch at a fixed height to prevent the arc height from changing at low speed and the torch to be burnt in severe cases. Unit: %.
- ❖ **Close heightening minimum distance:** The effect is the same as the low speed closing arc voltage adjustment (corner signal). This signal is not turned off according to the speed of the arc voltage, but according to the length of the line segment at the beginning and end of the current machining curve. From the distance of "close the height-adjusted minimum distance" at the beginning of the curve, and within the distance of "close the height-adjusted minimum distance" before the end of the curve, open the "close arc voltage auto-adjustment" port to keep the torch at a fixed height.
- ❖ **Heightening enabling delay after perforation:** After the perforation is completed, the arc voltage is unstable. At this time, the height is not adjusted. After the delay is set, the arc voltage is stable and the height is increased.

Service Support Spirit

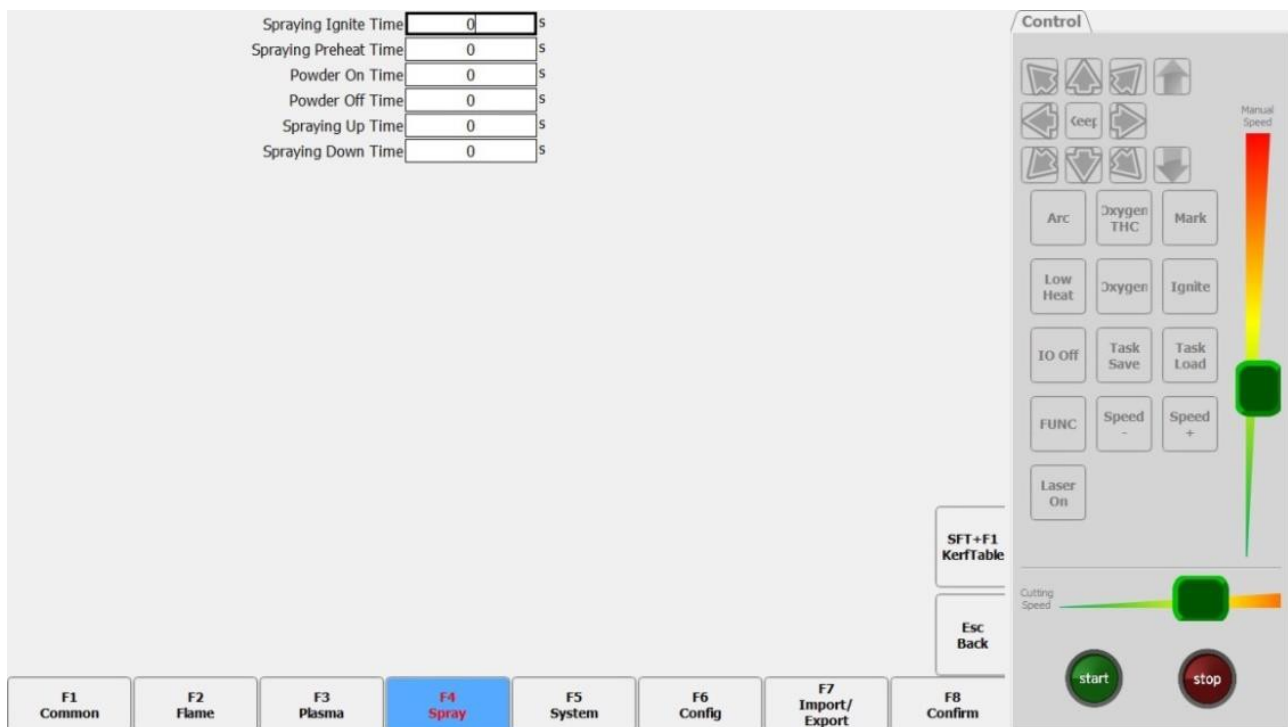
- ❖ **Arc breaking detection time:** When the arc break occurs, the system delays the time of "arc breaking detection delay". If the arc break still occurs, it is considered that the arc break has occurred, stopping the machine operation and alarming. This function is used to process the workpiece with the lead wire. After the delay time, the lead wire has passed, and the plasma has not broken the arc, the next workpiece can be directly processed. This function effectively prevents false arcing when cutting the lead wire.
- ❖ **Using air cylinder to heighten:** When this parameter is selected, the cutting torch in the cut keeps the output.
- ❖ **Cutting middle arcing voltage detection:** If this option is selected, the continuity of the arc voltage is detected during cutting, and an arc-breaking alarm is issued when the arc voltage is lost.
- ❖ **M08 advance close arcing voltage time:** Under normal circumstances, the plasma arc voltage is turned off when M08 is encountered. When this value is greater than 0, the plasma arc voltage is turned off before the M08 is encountered. Unit: s. Use this function when cutting small circles or having lead wires.
- ❖ **Number of perforations:** record the number of perforations during the plasma cutting process.
- ❖ **Piece number:** record the number of workpieces that have been plasma cut.
- ❖ **Cutting distance:** record the total plasma cutting distance in metric - meter, British system - foot.
- ❖ **Cutting time:** record the time during the plasma cutting process.
- ❖ **Operation time:** record plasma cutting time + idle time + M07 status time.
- ❖ **Crawl time:** crawl time. See Article 7.2.1 Dynamic perforation and crawling.

Service Support Spirit

- ❖ **Crawling speed:** crawling speed. See Article 7.2.1 Dynamic perforation and crawling.
- ❖ **Perforation rise time:** For dynamic perforation parameters, see Article 7.2.1 Dynamic perforation and crawling.
- ❖ **Perforation lower time:** For dynamic perforation parameters, see Article 7.2.1 Dynamic perforation and crawling.

7.4 Powder injection parameters

As shown in Pic 7.6, it is the dusting parameter of the system, which is the parameter related to the dusting line.



Pic 7.6 Powder Injection Parameters

- ❖ **Powder injection ignition time:** Input any value in the range of ≥ 0 (unit: second).
- ❖ **Powder injection preheating time:** Input any value in the range of ≥ 0 (unit: second).
- ❖ **Dusting on/off time:** The delay of the dusting opening relative to the opening/closing of the powder injection opening, input any value in the range of ≥ 0 , the unit: second.
- ❖ **Powder injection rise time:** The time when the powder injection torch rises.
- ❖ **Powder injection lower time:** The time when powder injection torch lowers.

Service Support Spirit

7.5 System parameters

As shown in Pic 7.7, it is the system parameter.

Max Speed	6000	mm/min
Cutting Accel	200	mm/s ²
Manual Move Accel	200	mm/s ²
EStop Accel	1000	mm/s ²
Spraying Horizontal Offset	0	mm
Spraying Vertical Offset	0	mm
Laser Horizontal Offset By Flame	0	mm
Laser Vertical Offset By Flame	0	mm
Plasma Horizontal Offset By Flame	0	mm
Plasma Vertical Offset By Flame	0	mm
Jet Printer Horizontal Offset By Flame	0	mm
Jet Printer Vertical Offset By Flame	0	mm

Pic 7.7 System Parameters

Maximum speed: Limit the maximum speed of cutting operation, unit: mm/min.

Cutting accelerated speed: The acceleration and deceleration of the machine tool during the cutting process. Unit: mm/s².

Manual shift accelerated speed: accelerated speed of machine operation when manually moving, unit: mm/s².

Quick stop accelerated speed: Deceleration of machine operation in the case of quick stop. Unit: mm/s².

Lateral deviation of powder injection torch relative to flame torch: the lateral displacement of the powder torch relative to the torch.

Longitudinal deviation of powder injection torch relative to flame torch: the longitudinal displacement of the powder torch relative to the torch.

Lateral deviation of laser positioning torch relative to flame torch: refers to the lateral distance of the laser cursor relative to the flame torch. A positive number indicates that the laser cursor

Service Support Spirit

is in the positive direction of the flame torch, and a negative number indicates that the laser cursor is in the lateral negative direction of the flame torch. Unit: mm.

Longitudinal deviation of laser positioning torch relative to flame torch: refers to the longitudinal distance of the laser cursor relative to the flame torch. A positive number indicates that the laser cursor is in the positive direction of the flame torch, and a negative number indicates that the laser cursor is in the negative direction of the flame torch. Unit: mm.

Lateral deviation of plasma torch relative to flame torch: the lateral distance of the plasma torch relative to the flame torch. Unit: mm.

Longitudinal deviation of plasma torch relative to flame torch: the longitudinal distance of the plasma torch relative to the flame torch. Unit: mm.

7.6 Axis parameter

As shown in Pic 7.8, there are some basic parameters about the axis.

The screenshot displays a control interface for a 'Horizontal axis'. On the left, a list of parameters is shown with their current values and status:

Axis Name	Horizontal axis	
PulseDir		✗
Pulse	200.000000	p/mm
Soft limit Enable		✓
Max Position	1000	mm
Min Position	-1000	mm
Home Reverse		✗
Home Offset	10	mm
Encoder Enable		✗
Encoder Pulse Unit	500.000000	p/mm
Encoder Dir		✗
Amp Alarm Enable		✗
Amp Alarm Enable NCNO	NC	
Copy Driver Enable		✓

At the bottom of the parameter list are function keys: F1 System, F2 Axis (highlighted), and F7 Back, F8 Confirm.

On the right, the 'Control' panel includes a 'Manual Speed' slider, directional arrow buttons, and a grid of buttons: Arc, THC Enable, Mark, Low Heat, Oxygen, Ignite, IO Off, Task Save, Task Load. Below this is a 'Demo Speed' slider and 'start'/'stop' buttons.

Pic 7.8 Horizontal Axis System Parameters

Service Support Spirit

Parameter	Value	Unit	Status
Axis Name	Vertical axis		
PulseDir			✗
Pulse	200.000000	p/mm	
Soft limit Enable			✓
Max Position	1000	mm	
Min Position	-1000	mm	
Home Enable			✓
Home Reverse			✗
Home Offset	10	mm	
Encoder Enable			✗
Encoder Pulse Unit	500.000000	p/mm	
Encoder Dir			✗
Amp Alarm Enable			✗
Amp Alarm Enable NCNO	NC		
Dual Driver			✓

Control Panel
Manual Speed: 00.0
<input type="button" value="Arc"/> <input type="button" value="THC Enable"/> <input type="button" value="Mark"/>
<input type="button" value="Low Heat"/> <input type="button" value="Oxygen"/> <input type="button" value="Ignite"/>
<input type="button" value="IO Off"/> <input type="button" value="Task Save"/> <input type="button" value="Task Load"/>
Demo Speed: [Slider]
<input type="button" value="start"/> <input type="button" value="stop"/>

F1 System	F2 Axis				F7 Back	F8 Confirm
-----------	---------	--	--	--	---------	------------

Pic 7.9 Vertical Axis System Parameters

Vertical and horizontal axis system parameter description:

- ◆ **Axis name:** Select the axis to be set via the drop down box.
- ◆ **Pulse reverse:** Set the current selection axis to reverse.
- ◆ **Impulse number:** The number of pulses required to move 1mm on the axis currently selected to retain four decimal places.
- ◆ **Soft limit enabling:** when this option is selected, the coordinate value of the current selection axis can not be greater than the maximum coordinate set by it, can not be smaller than the minimum coordinate set by it, otherwise the machine will be prompted soft limit alarm, stop running.
- ◆ **Maximum coordinates:** The maximum coordinate limit value that the software sets the system to move, in the unit of mm. When any current coordinate of the system is greater than the corresponding maximum coordinate limit value, the system will stop running.
- ◆ **Minimum coordinates:** The minimum coordinate limit value that the software sets for the system to move, in the unit of mm. When any current coordinate of the system is

Service Support Spirit

less than the corresponding minimum coordinate limit value, the system will stop running.

- ◆ **Bilateral drive:** Open the dual drive function of the gantry shaft.
- ◆ **Zeroing reserve:** The current axis returns zero in reverse direction.
- ◆ **Zeroing offset:** The distance from the origin of the machine coordinate system to the zeroing switch after zeroing. (>0) The setting is too small. After the zero return is completed, the zero return switch status may still be triggered, and the limit alarm is reported.
- ◆ **Encoder enabling:** Use the encoder feedback coordinates as the feedback of the shaft card.
- ◆ **Encoder pulse equivalent:** pulse type corresponding when the encoder feedback shaft moves 1mm.
- ◆ **Encoder reverse:** The encoder feedback axis coordinate value is inversed.
- ◆ **Servo alarm enabling:** turn on the servo alarm function.
- ◆ **Servo alarm enabling constant opening and closing:** servo alarm type selection of input port.
- ◆ **Double-trolley enabling:** open double-trolley function.

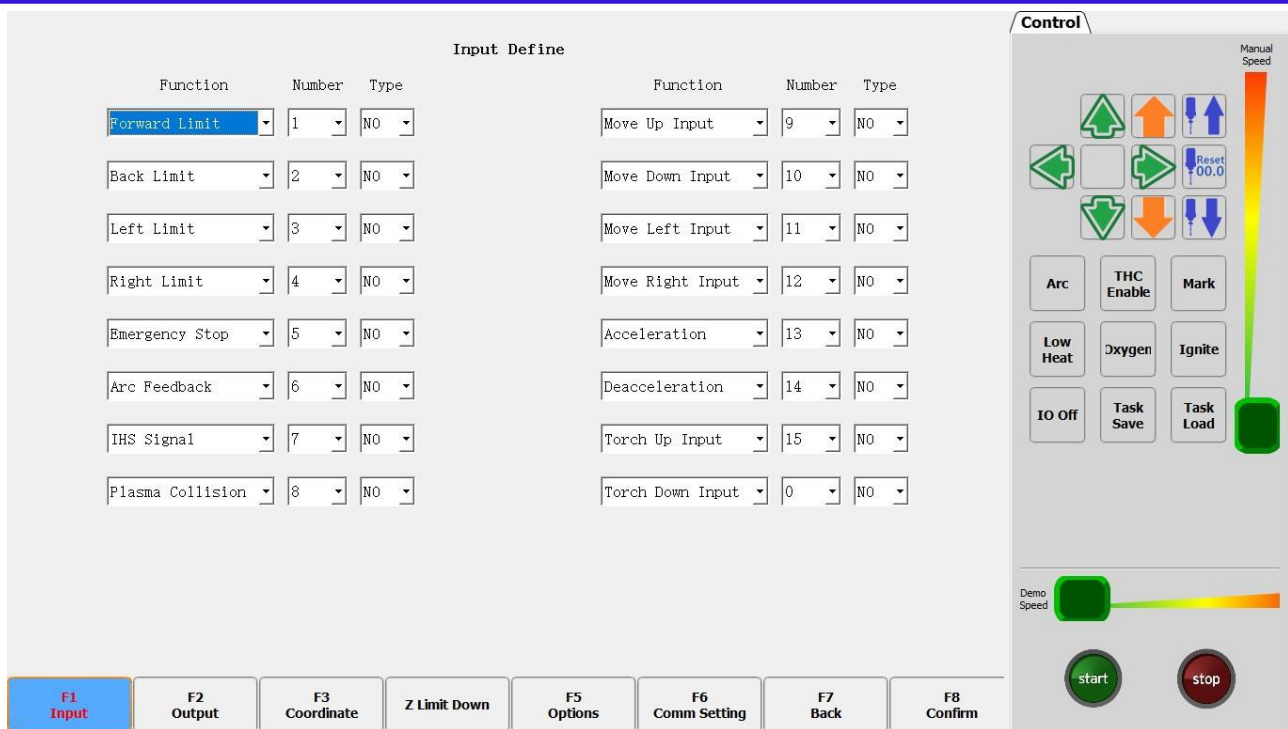
7.7 System configuration

In the parameter setting interface, press [F6] to enter the system configuration interface. Under this interface, you can set the system's input IO port, output IO port, System coordinates, controller options, and IP.

7.7.1 Input port definition

The controller can change the definition of the input IO port according to the user's needs, including changing the serial number of the IO port on the input terminal, and the normally open or normally closed type of the input port. As shown in Pic 7.9.

Service Support Spirit



Pic 7.10 Input Port Definition

In this interface, use the arrow buttons [↑], [↓], [←], [→] to position the cursor to the option to be modified, press [Enter] to open the tab of the drop-down box where the cursor is located, and through [↑], [↓], move the cursor, press [Enter] again to set the selected parameter.

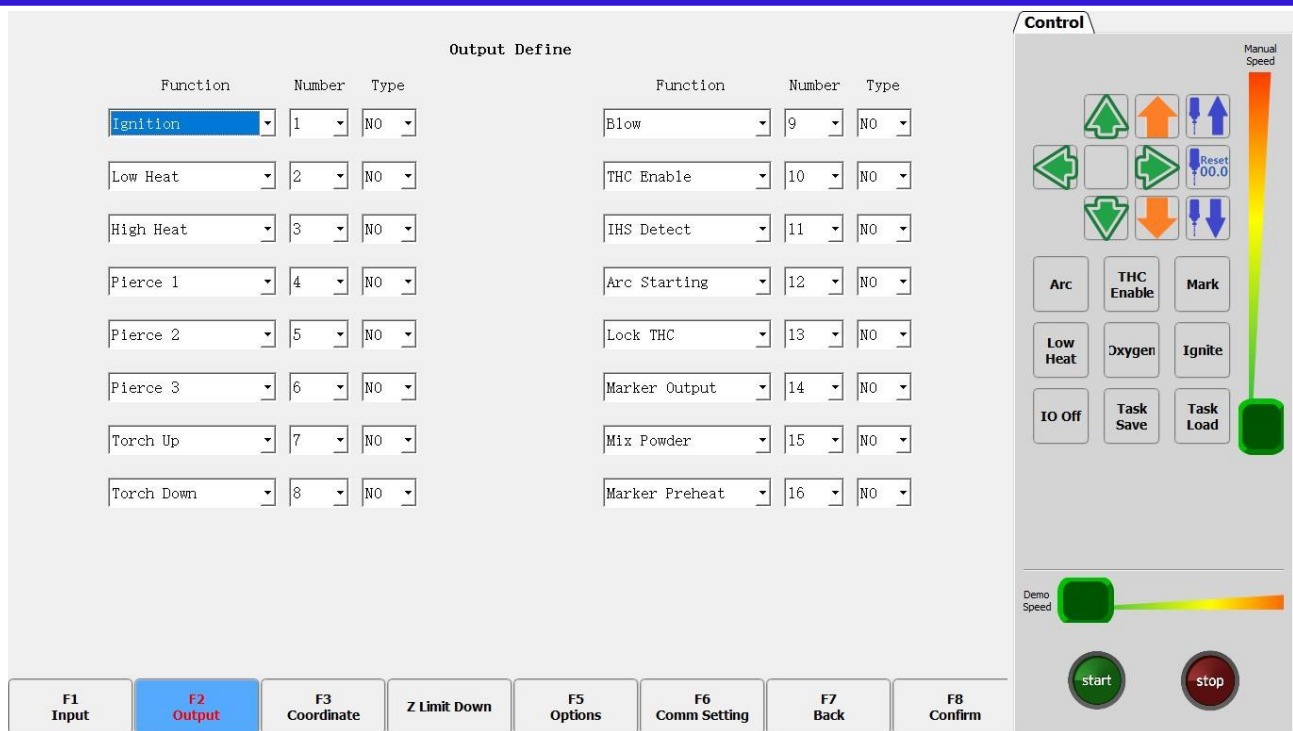
Number: 01 - 16.

Type: NO is normally open, NC is normally closed.

7.7.2 Output port definition

This controller can change the definition of the output port according to the user's requirement: the sequence number of the output port on the output terminal and the normally closed type. As shown in Pic 7.10.

Service Support Spirit



Pic 7.11 Output Port Definition

In this interface, use the arrow buttons [↑], [↓], [←], [→] to position the cursor to the option to be modified, press [Enter] to open the tab of the drop-down box where the cursor is located, and through [↑], [↓], move the cursor, press [Enter] again to set the selected parameter.

The output port types are all triode open-circuit output types.

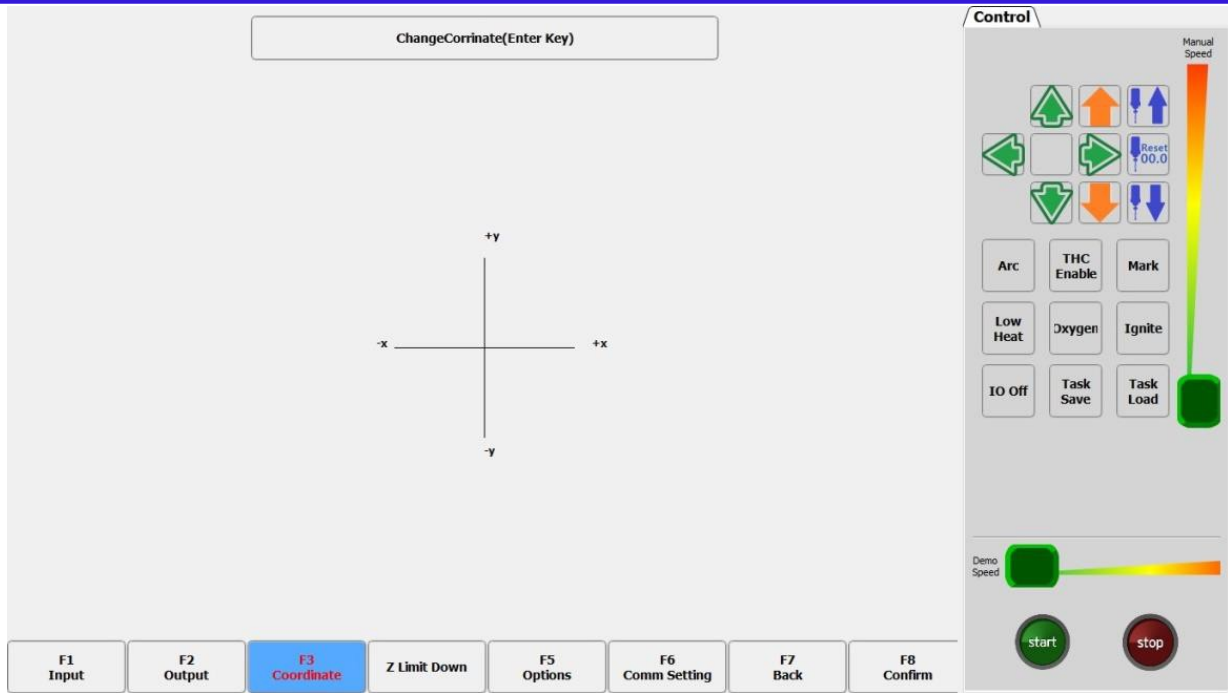
NO: Indicates that the output signal is normally open.

NC: Indicates that the output signal is normally closed.

7.7.3 Coordinate definition

This system can provide users with a definition of the coordinate system, as shown in Pic 7.11.

Service Support Spirit



Pic 7.12 Coordinate System Definition

In this interface, press [Enter] continuously to change the system in eight coordinate systems. After the user needs the coordinate system, press [F8 Save] to save the set coordinate system.

7.7.4 Options



Pic 7.13 Option Default Coordinates

Service Support Spirit

Some option options for the system can be conPicd in the option interface.

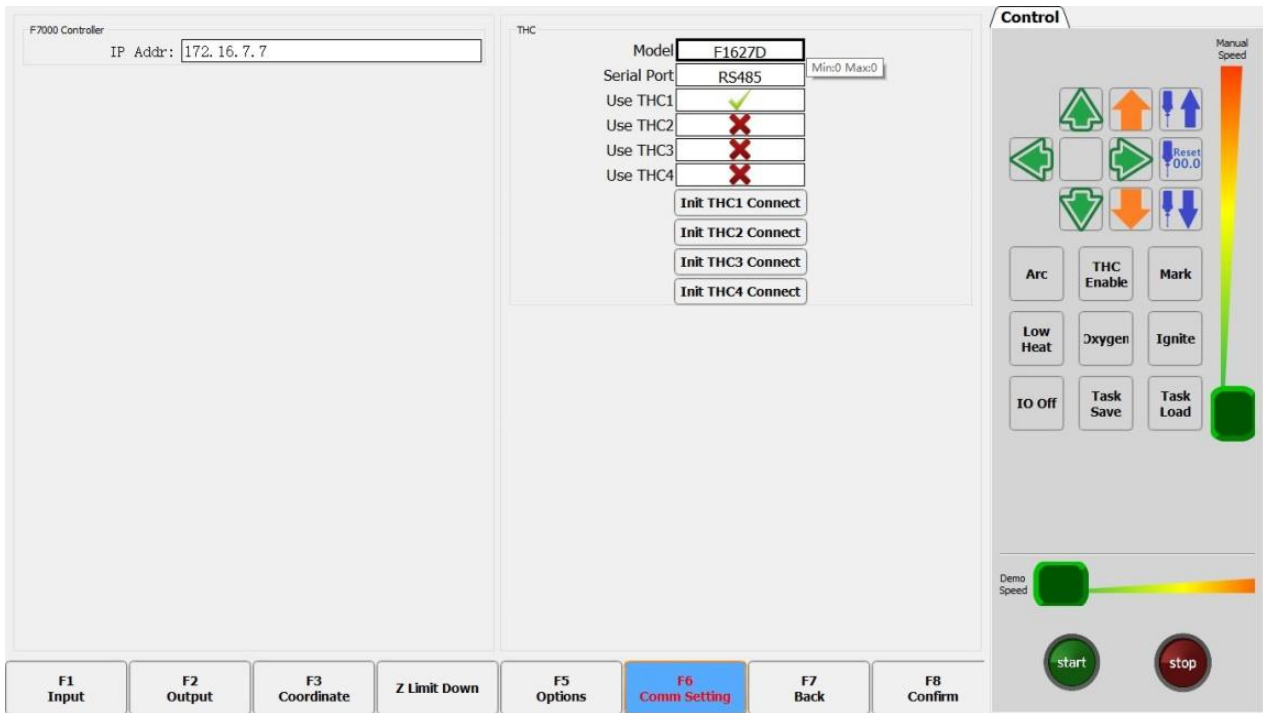
- **Type of telecontroller:** Select the type of telecontroller selected by the system.
- **Telecontroller com port:** select COM port for telecontroller access.
- **Default coordinates:** The default coordinates can be changed to relative coordinates or absolute coordinates.
- **Arc IJ coordinates:** Set G code G02 or G03, the following I or J parameters are relative coordinates or absolute coordinates by default. In general, the IJ coordinates of an arc are relative coordinates, and only a few G codes of the arc IJ coordinates are absolute coordinates.
- **Unit type:** Units can switch between British and metric units.
- **Small line fitting:** When there are too many small line segments in G code and continuous jitter or vibration occurs during machine running, set this parameter to "Yes", in general, set it to "No".
- **Plate angle memory:** By default, the corrected angle of the plate is not memorized. When this parameter is set to "Yes", the steel plate angle memory will be automatically memorized until the plate correction or angle is cleared again.
- **F instruction disabling:** When the parameter is "Yes", the F instruction (that is, the speed limit instruction) behind the G code is ignored.
- **Manual angle for plate correction:** when the parameter is "Yes", the angle input manually in Article 4.3.3 Input Angle is also the angle of plate correction, this angle will be displayed on the main interface, if the plate angle memory function is opened, the angle will be added to the plate correction angle and saved.
- **Strictly check the G code specification:** whether to check the G code strictly. When G code specifications are strictly used, some code errors can be avoided, but the code requirements are relatively high.
- **Boot prompt break-point:** in the case of incomplete cutting, whether to prompt after rebooting.

Service Support Spirit

- Follow the error measurement: the hardware is connected to the encoder, and the shaft parameter uses the encoder. The interface draws the trajectory graph using the coordinates fed back by the encoder.
- **Slot coverage enabling:** whether the parameters for slot modification behind G41, G42, and G43 work.
- **Corner way:** choose the way of corner of machine tool.
- **Corner tolerance:** Use the arc to fit the corner accuracy, the lower the value, the closer to the sharp angle, but the more obvious deceleration.
- **Forward and backward jog and linkage:** used to control the forward and backward mode of cutting.
- **Zeroing mode:** Select the zeroing mode of the machine tool.
- **Primary zeroing speed:** zeroing parameters: the speed at which zeroing switch is quickly found.
- **Secondary zeroing speed:** zeroing parameter: Slow approach zeroing speed.
- **Use Z signal:** When returning to zero, return to zero using the Z trust number.
- **Gantry synchronization error alarm:** Open gantry synchronization error check function.
- **Gantry synchronization when zeroing:** return to zero after the completion, it will automatically perform gantry synchronization function. Need to turn on parameters: return to zero using Z-phase number, shaft open encoder feedback.
- **Gantry synchronization allowance error:** The value of the gantry's error, and it lasts for a certain time (gantry's synchronization error duration). The machine will generate an alarm.
- **Duration of the gantry synchronization error:** the value of the gantry error (the gantry synchronization error) and the duration of a certain amount of time. The machine will generate an alarm.
- **Maximum error of gantry synchronization:** The maximum deviation allowed in the execution of gantry synchronization after the function of gantry synchronization is enabled. Once the error reaches this value, the machine immediately stops running.

Service Support Spirit

7.8 IP settings and THC control



Pic 7.14 F7600 Series IP and THC Control Interface

- **IP address:** The IP address of the F7600 series connected motion control card.
- **Model:** Including common models, F1627D, F1627S, F1650.
- **Serial port:** using RS²32, RS485 communication.
- **THC control:** Select and use THC, only one THC at a time.

7.9 Parameter import/ export

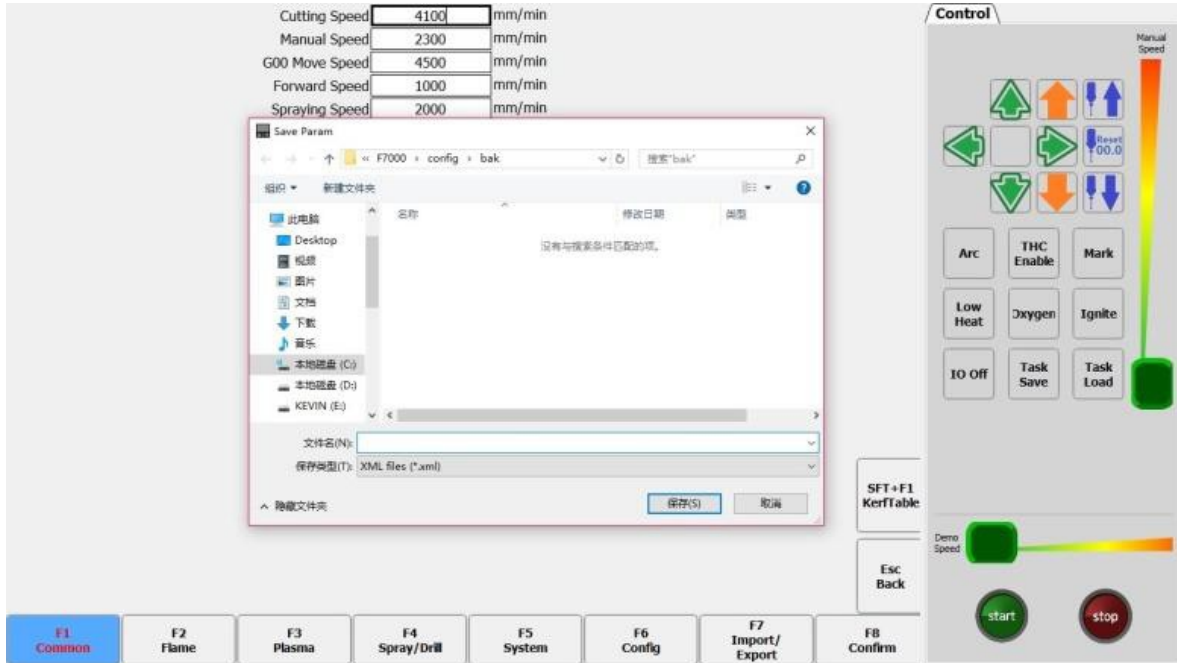
Press [F7] in the parameter setting interface to import and export parameters from the U disk or the local hard disk. As shown in Pic 7.14.



Pic 7.15 Parameter Import/Export

Service Support Spirit

Select [X] to export the parameters and the dialog box in Pic 7.14 will pop up. After selecting the exported location, click [F8 Confirmation] to save all parameters of the current system to the target location. When exporting, you can modify the exported file name.



Pic 7.16 Parameter Export

Select [G] to import parameters, you can load the saved parameter file. Combined with the parameter export function, it is convenient for the user to save the parameters of different materials and thicknesses into parameter files, and when needed, directly load the corresponding parameter files.



Pic 7.17 Parameter Import

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

Caution: After any parameter has been modified, it must be saved if the modified parameter is to take effect. Otherwise, the system will continue to use the parameter that was not modified.

Chapter 8 Diagnostic Functions

Press [F5] on the main interface to enter the system diagnosis interface, as shown in Pic 8.1. In the diagnostic interface, you can diagnose the input and output of the system.

8.1 Input diagnostics

In this interface, the system will read the information of the current input IO and display the status information of the current input IO. Green "●" indicates that the input is valid, and red "●" indicates that the input is invalid. It can be used to test the status of the input port.



Pic 8.1 Input Port Diagnosis

8.2 Output diagnostics

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

Press [↑], [↓], [←], [→] to move the cursor to the corresponding output port, press [F3] to open the corresponding output port, and press [F4] to close the corresponding output port. The green "●" indicates that the output is valid, and the red "●" indicates that the output is invalid. It can be used to test whether the output port can work normally.

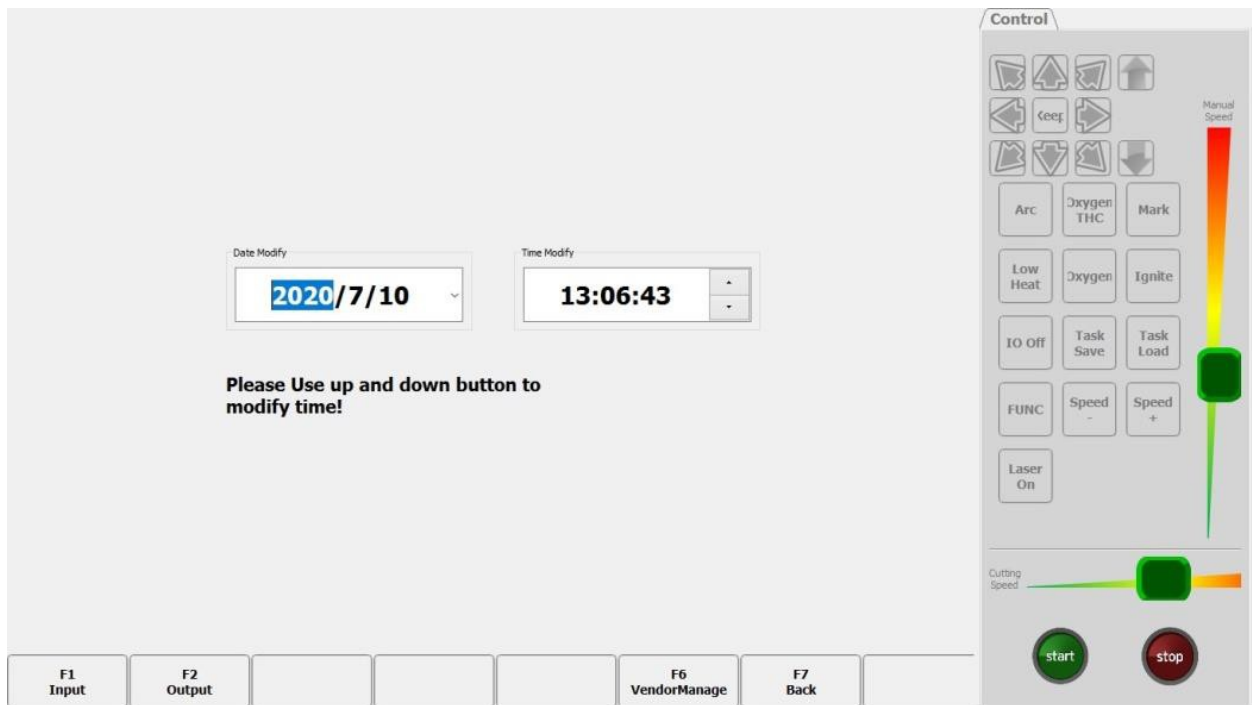
Service Support Spirit



Pic 8.2 Output Port Diagnosis

8.3 Date and time

Press [F5] in the system diagnostic interface, as shown in Pic 8.3, you can set the date and time of the system.



Pic 8.3 System Time

Service Support Spirit

Move the cursor to the corresponding date or time or week, press [↑] or [↓] to adjust the system time.

8.4 Manufacturer management

In the diagnosis interface, press [F6] manufacturer management, you can restore the system, screen calibration and other operations.



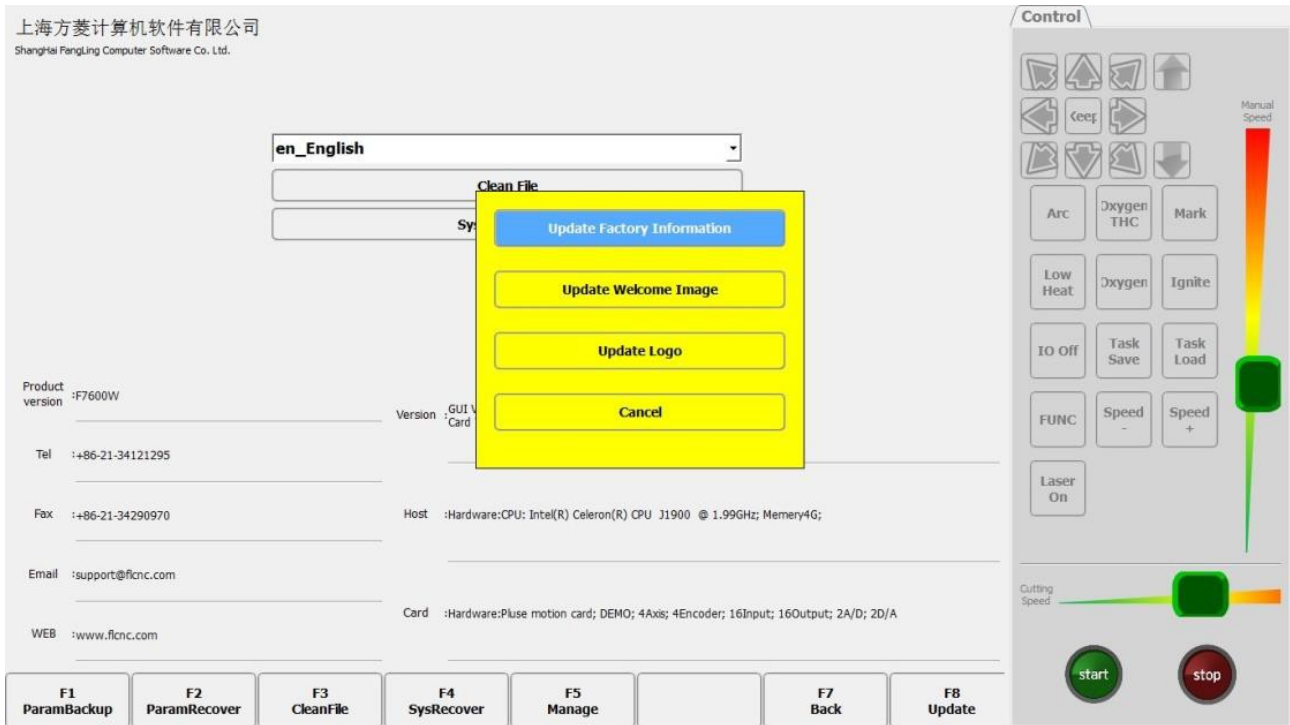
Pic 8.4 Manufacturer Management

First put the upgrade file in the USB flash drive, and then plug it into the system's USB interface. In the manufacturer management interface, as shown in Pic 8.4, select [F8] to upgrade, the system will pop up the upgrade interface, as shown in Pic 8.5, you can upgrade the system, or replace the boot image, and the logo image in the upper left corner of the host surface.

Description:

F7600 Series Upgrade: When the system is F7600 series, the upgrade frame shows the "OneCut Controller Upgrade", the upgrade only upgrades the motion controller function. For the upgrade of the upper computer operating software, please use the installation package exe file to install.

Service Support Spirit



Pic 8.5 Upgrade Interface

- ◆ **Update the manufacturer information:** the manufacturer information can be updated according to the actual demand.
- ◆ **Update welcome picture:** choose the inside of the best to make a good picture of boot, click confirm, the next boot is using the new picture of boot. Format requirements of welcome picture: picture size 800 * 600 pixels, picture format BMP, JPG, PNG.
- ◆ **Update Logo:** Select the logo image to be updated, click Confirm, restart the system, and use the new logo. Logo image format requirements: picture size 200* 30 pixels, picture format BMP, JPG, PNG.

8.4.1 System Restore, Parameter Backup/Restore

In the Pic 8.4 Manufacturer Management Interface, select [F4] System Restore, you can restore the system parameters to the factory parameters. After the restore is successful, the system will automatically restart. Select [F1] to back up the parameters that have been debugged by the manufacturer. Press [F2] to restore the parameters of the factory backup. For the F7600 series, the factory backup restore address is:

D:\backup\f7600w\parameter\f7000param.xml.

Service Support Spirit

8.4.2 Management

In the Pic 8.4 Factory Management Interface, click [F5] to enter the management interface, as shown in Pic 8.6. This interface encrypts and decrypts the system. Click the [About] button to see the version number of the system. When the system is started, if there is an authorization error, the system will directly enter this interface.

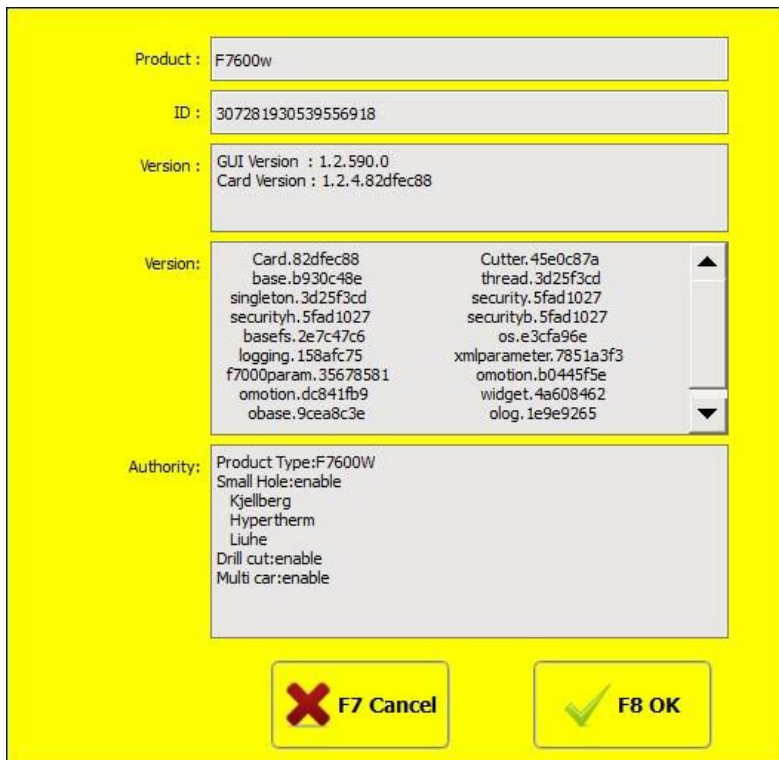


Pic 8.6 Management Interface

Click the [F3 Password] button and the password reset dialog will pop up. The default old password is empty. The manufacturer can modify the new password. After the manufacturer modifies the new password, the original authorization will be invalid and you need to contact the company for reauthorization.

When the authorization is required, the manufacturer needs to provide the modified password, as well as the ID number. The ID number is displayed on the interface, as shown in Pic 8.7. Different passwords will generate different authorizations.

If the password provided by the manufacturer is wrong, the authorization generated by the company is invalid. Therefore, manufacturers must **keep in mind the modified password**.



Pic 8.7 About Interface

After the authorization expires, click [F4] to pop up the decryption dialog box. Enter a new authorization code to re-authorize. After the authorization is successful, the number of authorized days of the decryption dialog is updated.

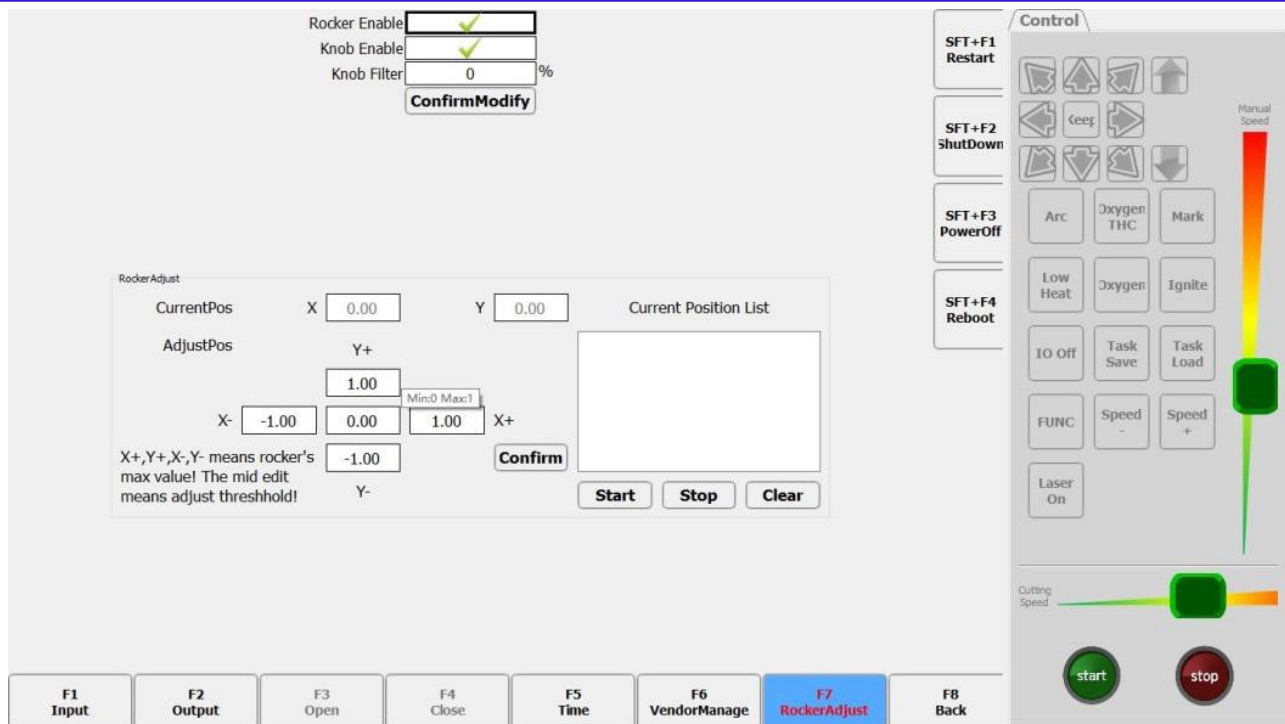
8.4.3 File clean up

In Pic 8.4 Manufacturer Management Interface, select [F3] to delete the file, you can clean all the G code files in the current system.

8.5 Rocker calibration

As shown in the Diagnostic Interface shown in Pic 8.1, press F7 to enter the rocker calibration interface, as shown in Pic 8.8:

Service Support Spirit



Pic 8.8 Rocker Calibration

There are two parts of the interface in this interface, and the upper part of the interface is the parameter modification interface:

- **Rocker enabling:** Whether or not rocker used in the control system works.
- **Knob enabling:** Whether or not the knob used in the control system works.
- **Knob filter:** When the knob turns less than the filter value, the knob turns less than the filter value.

The following part of the interface for the rocker calibration interface, you can remove the impact caused by the rocker inaccurate: when used to make the rocker to the largest in all directions, according to the current coordinates of the maximum minimum of X, Y corresponding to the X +, X-, Y +, Y-, click confirm the rocker calibration function is completed.

- **When the rocker value is not zero in the natural state, the rocker threshold can be used:** when the rocker value is less than the threshold value, the rocker does not work.

Service Support Spirit

8.6 Program restart and shutdown

On the right side of the system diagnostic interface shown in Pic 8.1, there are two buttons [Restart Program] [Close Program]. The function of restarting and closing the program can be realized by these two buttons.

8.7 Power off

As shown in the right side of the System Diagnostic Interface in Pic 8.1, the system can be turned off by this button [SFT+F3 Shutdown].

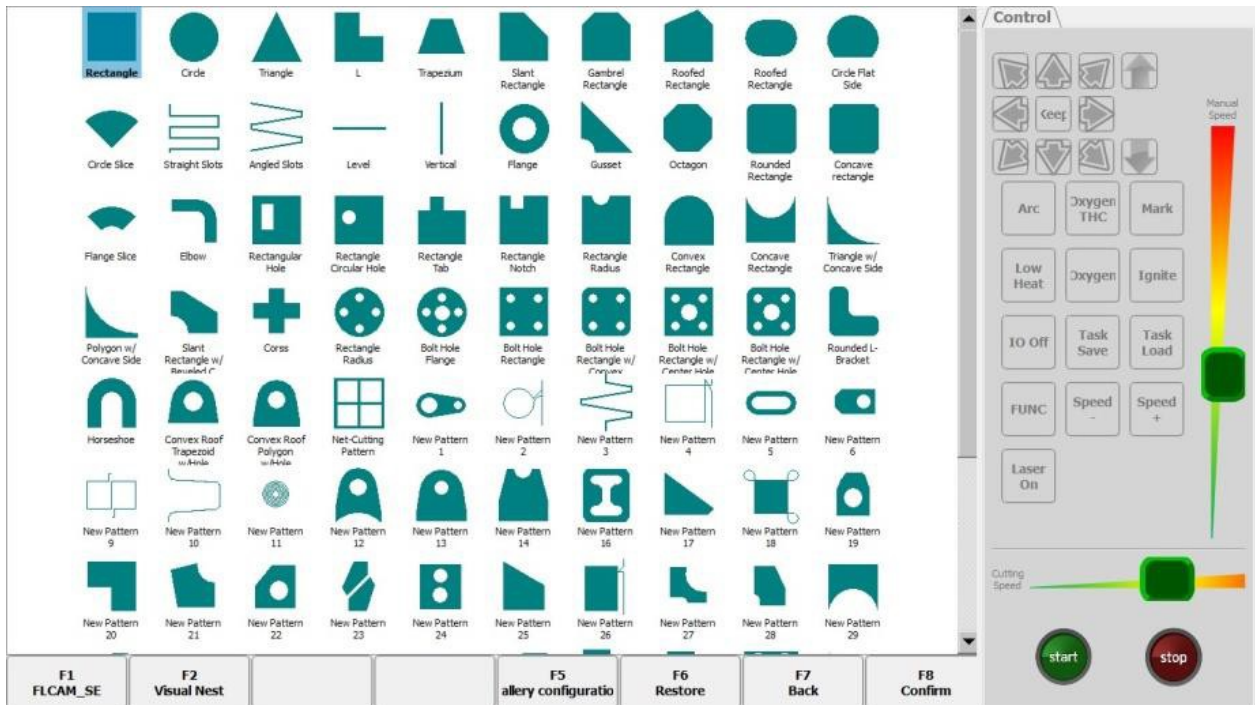
8.8 Restarting shaft card

On the right side of the system diagnostic interface shown in Pic 8.1, there is a button [SFT+F4 Restart Axis Card]. The function of restarting the axis card can be realized by this button.

When this function is used, the program must be connected to the axis card, otherwise there will be an error reminder. After the axis card restarts successfully, the program will restart automatically.

Chapter 9 Graphic Management

In the main interface, press [F1] to enter the library interface, as shown in Pic 9.1.

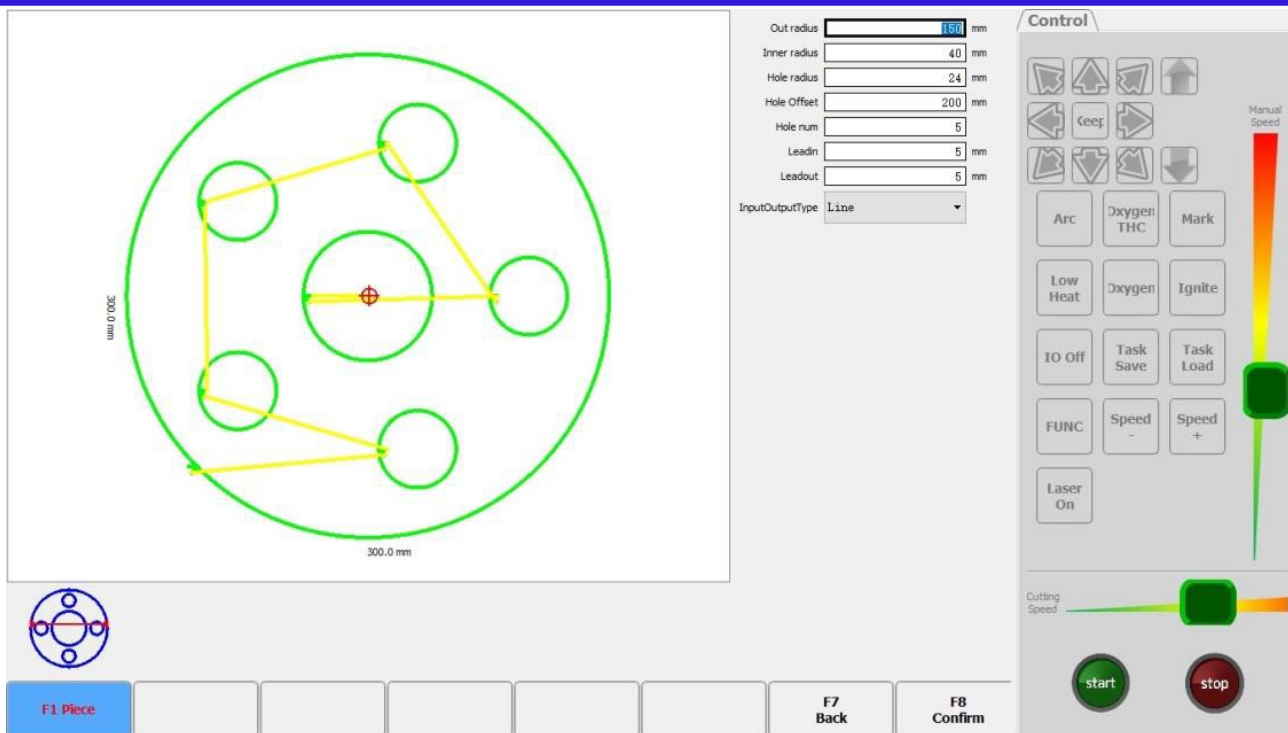


Pic 9.1 Library Page

Press [↑], [↓], [←], [→] in this interface to select different graphics, or directly select the graphics through the touch screen. The program saves changes to the graphics parameters. To restore the default graphic parameters, click the [F6 Parameter Recovery] button.

9.1 Select graphics

In the library home page, after moving the cursor to the desired graphic, press [F8] to confirm, and select different graphics to have two different interfaces, as shown in Pic 9.2.



Pic 9.2 Chip Size Interface

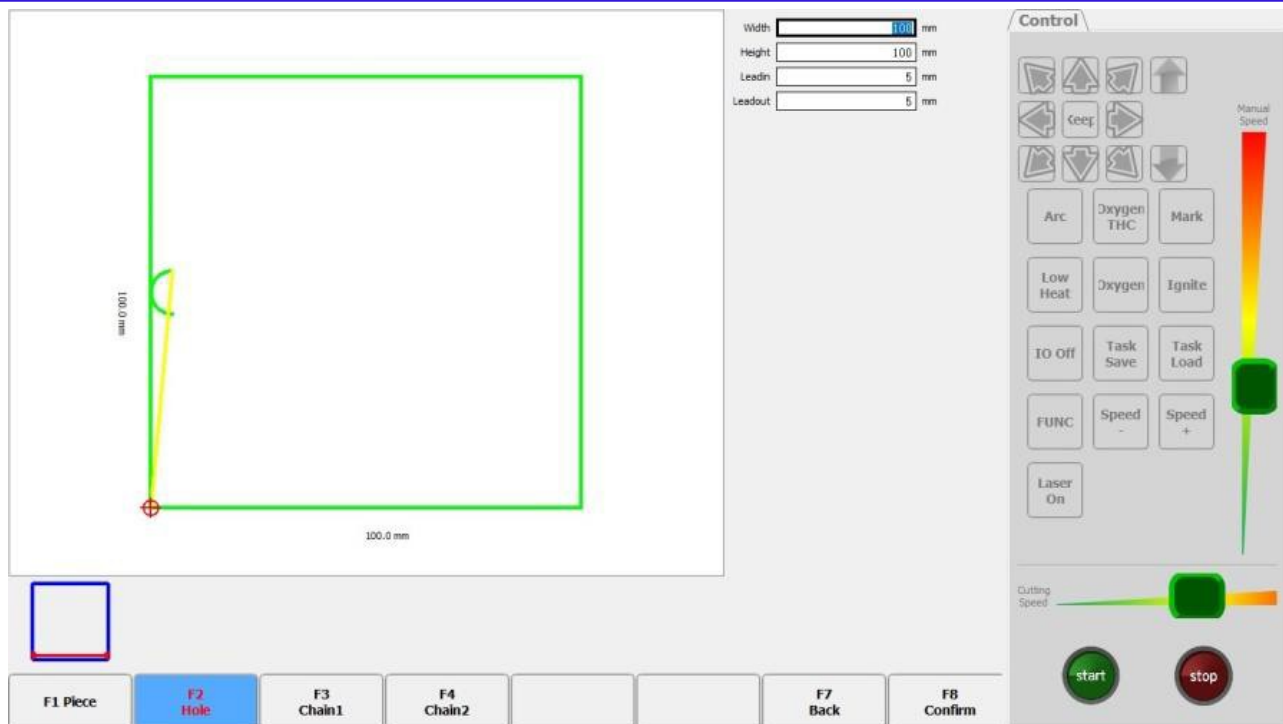
The left side of the screen shows the actual effect picture of the current graphic, as well as the length and width. The right side shows some parameters related to the current graphic, which can be modified arbitrarily. Below the actual renderings, a reduced version of the rendering is displayed, along with the parameters of the current cursor.

You can select the size to be modified by [↑], [↓], [←], [→]. After the completion of [F8] confirmation, you can automatically enter the cutting function interface of Pic 3.1.

9.2 Sheet/ hole size

In the Pic 9.2 slice size interface, press [F2] to enter the hole size interface, as shown in Pic 9.3.

Service Support Spirit



Pic 9.3 Hole Size

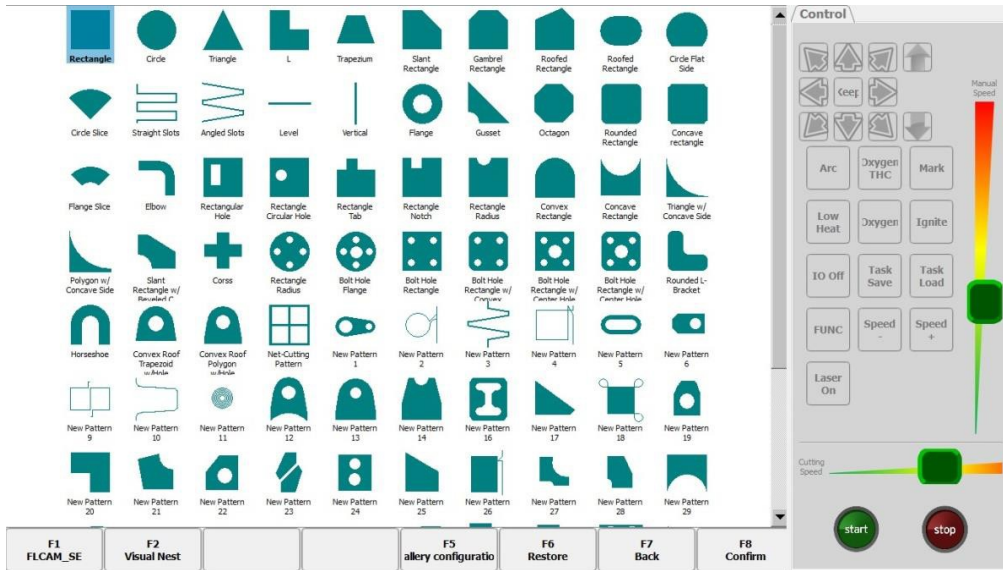
Modify the parameters to the same size. After the modification is completed, [F8] confirms, and you can also enter the cutting function interface in Pic 3.1.

9.3 Chain cutting

The controller can realize the chain cutting function of the graphic library, and the chain cutting can reduce the piercing point, improve the cutting quality, reduce the number of piercing times and improve the efficiency when the flame is cut.

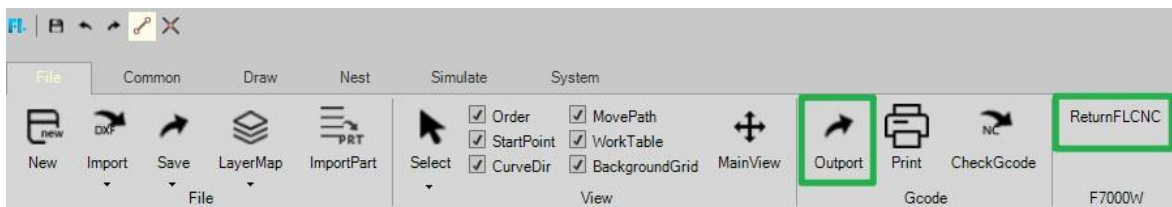
9.4 Use nesting software FLCAM

F7600 series system if FLCAM nesting software is installed. When you open the library interface, the FLCAM_SE button will appear in the lower left corner of the interface, as shown in Pic 9.4. Clicking this button will open FLCAM.



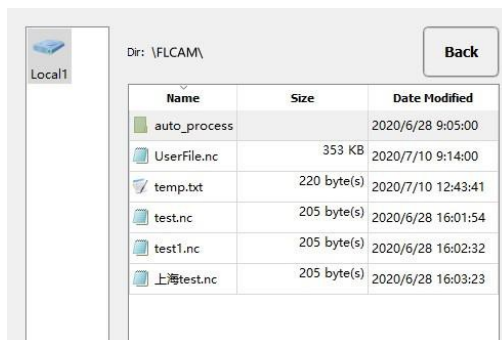
Pic 9.4 F7600 Series Library Interface

After the customer edits the cutting pattern in the nesting software, click the [Export] button under the [File] menu to export the graphic to the FLCAM folder (local FLCAM directory) in the working directory of the F7600 series program. Then click the [Back to CNC] button under the [File] menu, the desktop will return to the F7600 series operation interface.



Pic 9.5 FLCAM _ SE Menu Button

When the system return to the F7600 series operation interface, the program will automatically switch to the file management interface. That opened in file management interface is the FLCAM folder of local 1. You can process the exported file by selecting it.

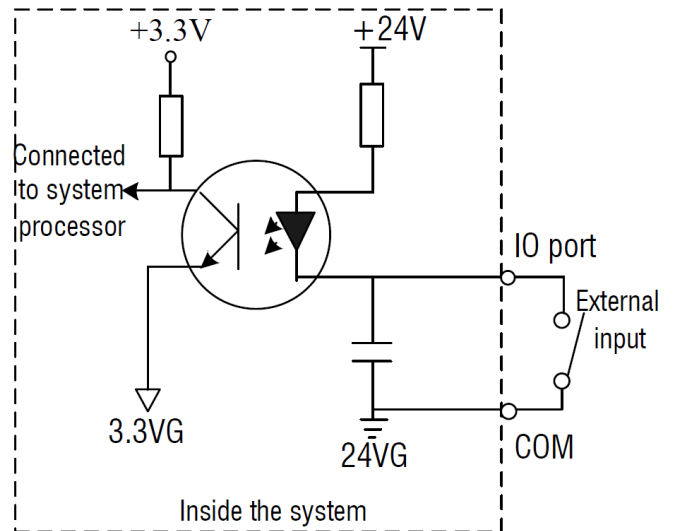


Pic 9.6 Select the File that FLCAM Exports

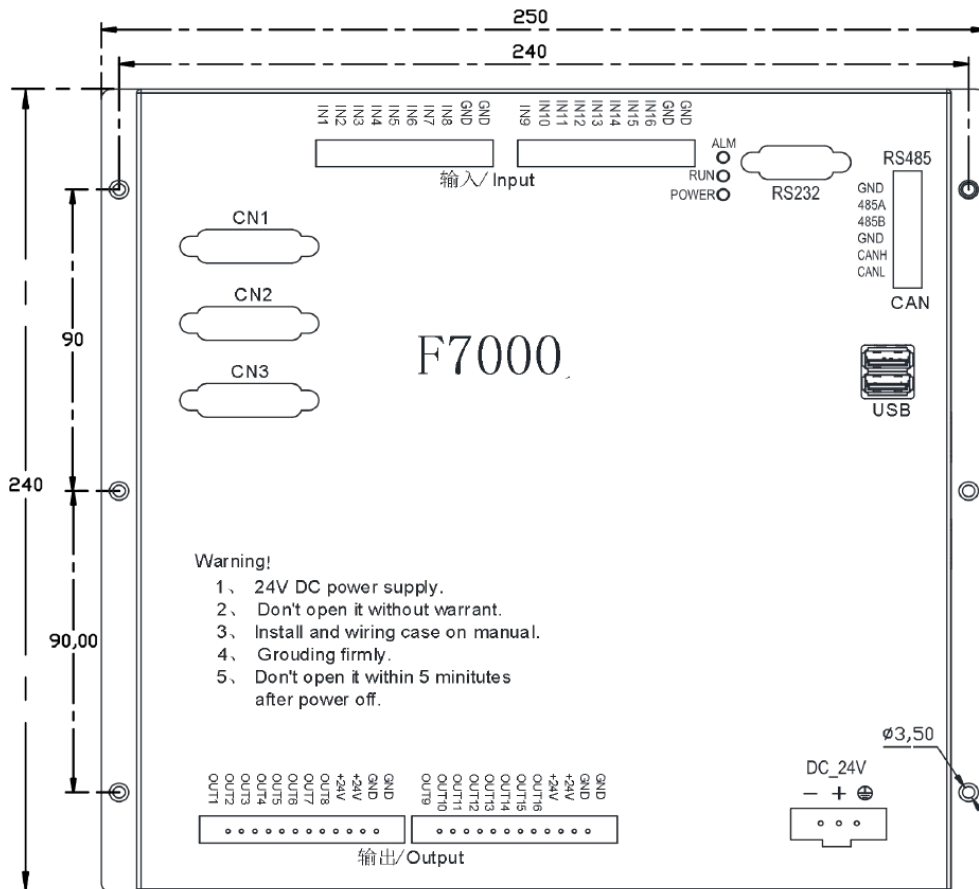
Chapter 10 Wiring Instructions

10.1 Input port description

The input signal is a mechanical contact switch, which is supported by the normally open or normally closed type. It is valid when connected to 24VG, and is invalid when it is suspended or connected to 24V. The common terminal of the external switch is connected to 24VG, and the other end of the external switch is connected to the corresponding IO port. The system has a total of 16 input ports. The internal circuit diagram is shown in Pic 10.1.



Pic 10.1 Input Circuit



Pic Motion Controller

Service Support Spirit

Table 10.1 Input Port Definition:

Input Port	Signal name	Remark	Input Port	Signal name	Remark
IN1	Front limit		IN9	Right shift	
IN2	Rear limit		IN10	Shift left	
IN3	Left limit		IN11	Forward	
IN4	Right limit		IN12	Back shift	
IN5	Quick stop		IN13	Ignition	
IN6	Arcing success		IN14	Cutting oxygen	
IN7	Position		IN15	Torch rise	
IN8	Plasma collision		IN16		
GND	24VG	+24V_GND Power ground	GND	24VG	+24V_GND Power ground

Description: The input port and function description are factory default configurations that can be changed by Article 7.7.1 Input Port Definition.

10.2 Output Port Description

Output voltage is 24V, low level is effective; the common end of the external relay coil is connected with 24V + (24V + of the power supply that can also be connected to the system), and the other end of the relay coil is connected with the corresponding IO port.

- ◆ The output is subjected to a maximum load current of 300 mA.
- ◆ A total of 16 output ports.
- ◆ Its internal circuit is shown in Figure 10.2.

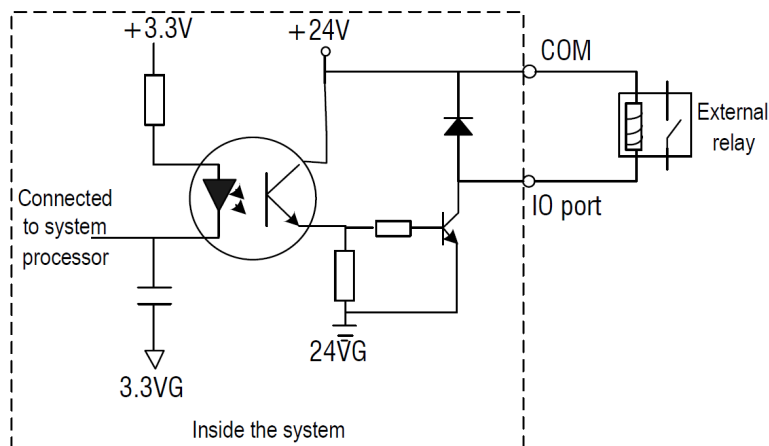


Figure 10.2 Output Interface Circuit Schematic Diagram

Service Support Spirit

Table 10.2 Output Port Definition:

Output Port	Signal name	Remark	Output Port	Signal name	Remark
OUT 1	Ignition		OUT 9	Exhaust vent	
OUT 2	Low pressure preheating		OUT 10	Height adjustment box enabling	
OUT 3	High pressure preheating		OUT 11	Plasma positioning	
OUT 4	Low pressure cutting Oxygen		OUT 12	Plasma arcing	
OUT 5	Medium pressure cutting oxygen		OUT 13	Turn off heightening (corner signal)	
OUT 6	High pressure cutting oxygen		OUT 14	Powder injection	
OUT 7	Torch rise		OUT 15	Dusting	
OUT 8	Torch down		OUT 16	Powder injection preheating	
+24V	+24V	+24V/3A Power output	+24V	+24V	+24V/3A Power output
GND	24VG	+24V_GND Power ground	GND	24VG	+24V_GND Power ground

Description: Output port and function description is factory default configuration, can be changed through Article 7.7.2 output port definition.

10.3 Motor interface description

The system has a total of six motor interfaces. The first four motor interfaces are identical and support the encoder function. A DB port is a motor interface. The latter two motor interfaces do not support encoders, and they are defined in the same DB port.

Service Support Spirit

Table 10.3 CN1 - CN4 Motor Interface Definition Table

15-core interface pin number	Signal name	Remark
1	CP+	Pulse positive
9	CP-	Pulse negative
2	DIR+	Direction positive
10	DIR-	Direction negative
3	ENC_A+	Encoder A positive
11	ENC_A-	Encoder A negative
4	ENC_B+	Encoder B positive
12	ENC_B-	Encoder B negative
5	ENC_Z+	Encoder Z positive
13	ENC_Z-	Encoder Z negative
6	ENOUT	Servo enabling
14	Alarm IN	Servo alarm
7		
15	PGND	24V negative
8	24VOUT	24V positive (output)

Table 10.4 CN5 Motor Interface Definition Table:

15-core interface pin number	Signal name	Remark
1	A5_CP+	No. 6 axis pulse positive
9	A5_CP-	No. 6 axis pulse negative
2	A5_DIR+	No. 6 axis direction positive
10	A5_DIR-	No. 6 axis direction negative
3	ENOUT_6	No. 6 axis servo enabling
11	AlarmIN_6	No. 6 axis servo alarm
4	A4_CP+	No. 5 axis pulse positive

Service Support Spirit

10.3.1 Y-axis single drive wiring

When the Y-axis is single-drive, CN1 is the X-axis motor interface and CN2 is the Y-axis motor interface. The wiring is shown in Figure 10.3.

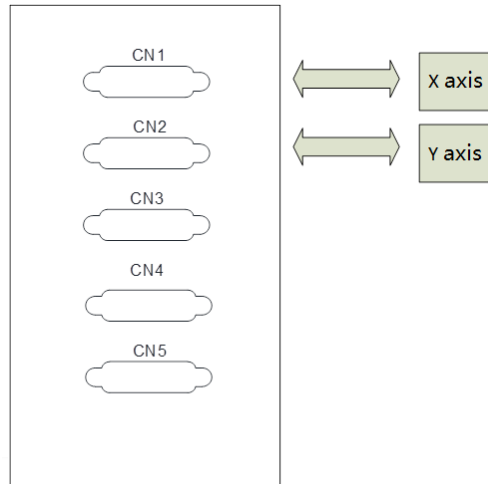


Figure 10.3 Y Axis Single-drive Wiring

10.3.2 Y-axis double drive wiring

In the axis parameter configuration interface, when the [bilateral drive] parameter of the Y axis is checked, the CN1 port is the X-axis motor interface. CN2, CN3 port is Y-axis motor interface. The wiring is shown in Figure 10.4.

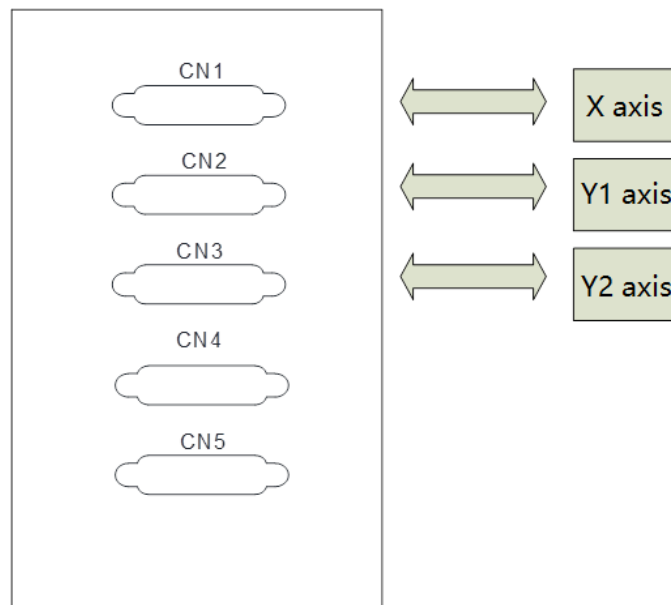


Figure 10.4 Y-axis Dual-drive Wiring

Service Support Spirit

Caution:

Do not install the motor on the double-drive machine firstly, and run it at no load first. Be sure to confirm the direction of rotation of the motor, the mechanical installation method, and then install the motor.

10.4 Power In Description

Power In input pin 24V-, 24V+, PE.

Table 10.5 Power Port Signal Definition Table

3-core interface pin	Signal name	Remark
1	24V-	24V power
2	24V+	24V power
3	PE	Grounding pile

Caution:

Please connect the PE to the ground pile, not to the PE of the switching power supply, and not to the machine frame.

10.5 Wiring Instructions for Telecontroller F1510 and F7000

10.5.1 Introduction of Telecontroller F1510-T

Wireless remote control module performance and features:

1. 433MHz free ISM frequency band license-free trial;
2. Remote control distance > 30m, at least not less than 0.5m;
3. Hardware detection error code, software optimization algorithm, two-way communication, to ensure stable and reliable communication;
4. The sending and receiving modules are matched by address, the address can be set manually, and the maximum support is 128 addresses;
5. The wireless remote control transmitting module is powered by a dry battery and can be used for at least 6 months;

6. The receiving module is 8421 port mode or single IO mode, and up to 16 output ports.

Remote control layout



Figure 10.13 Remote Control Layout

Transmitter description:

Buttons: Start, Stop, Start (start), four directions (↑ ↓ → ←), one hand (Manual), Ignition, Preheat, CutOxy, Plasma, Forward, Back, Close, Manual Rate, 19 buttons in total.

Pilot lamps: 3 manual speed lights (5%, 50%, 100%), 3 manual mode lights (electric, linkage, fixed length), 1 signal indicator, 1 battery indicator (or same as signal indicator).

Instructions: When the power is turned on, the manual rate defaults to 50% light, the manual speed is secondary state, and the manual rate is continuously pressed. The manual rate change state machine is manual rate twice (50% light) -> manual rate three times (100%) The light is on -> manual rate once (5% light on) -> manual rate twice (50% light on). When starting up, the default is to activate the manual as one state, the jog light is on, the manual change state machine is Manual once (the jog light is on) -> Manual second (continuous light is on) -> Manual three times (fixed light is on) -> Manual once (the jog light is on).

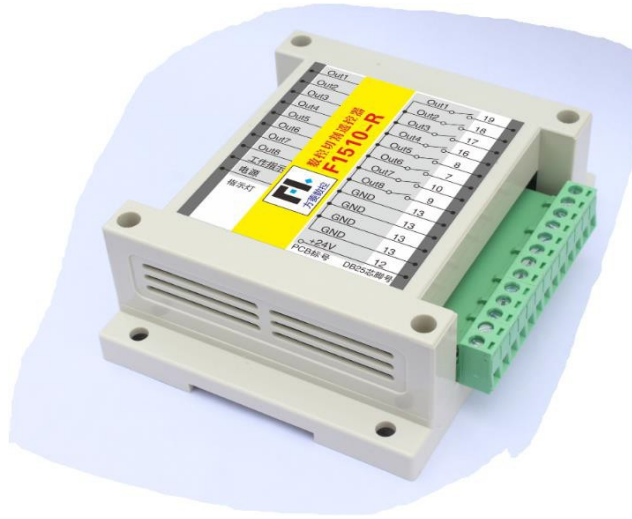
10.5.2 Receiver output

Model No.: Numerical control F1510-R Output port: 8

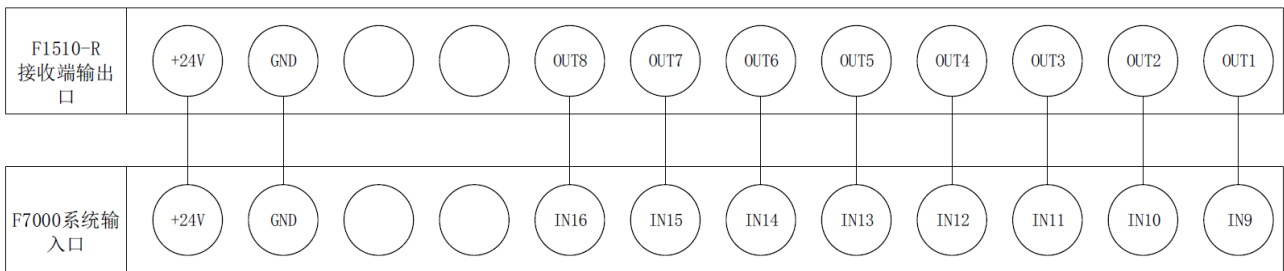
Power supply: 24 VDC.

Service Support Spirit

Each output port has an LED light corresponding to the state of the IO port. When it is ON, it is on, and when it is OFF, it is off.



Remote control and F7000 series wiring instructions:



10.14 Wiring Diagram of F7000 Pin and F1510-R

10.5.3 Remote control configuration of F7000 system

After the F7000 system is started, you need to enter F4 parameter setting → F6 configuration → F5 option → "Remote type" to "8421" in the interface, as shown in Figure 10.10.

Service Support Spirit

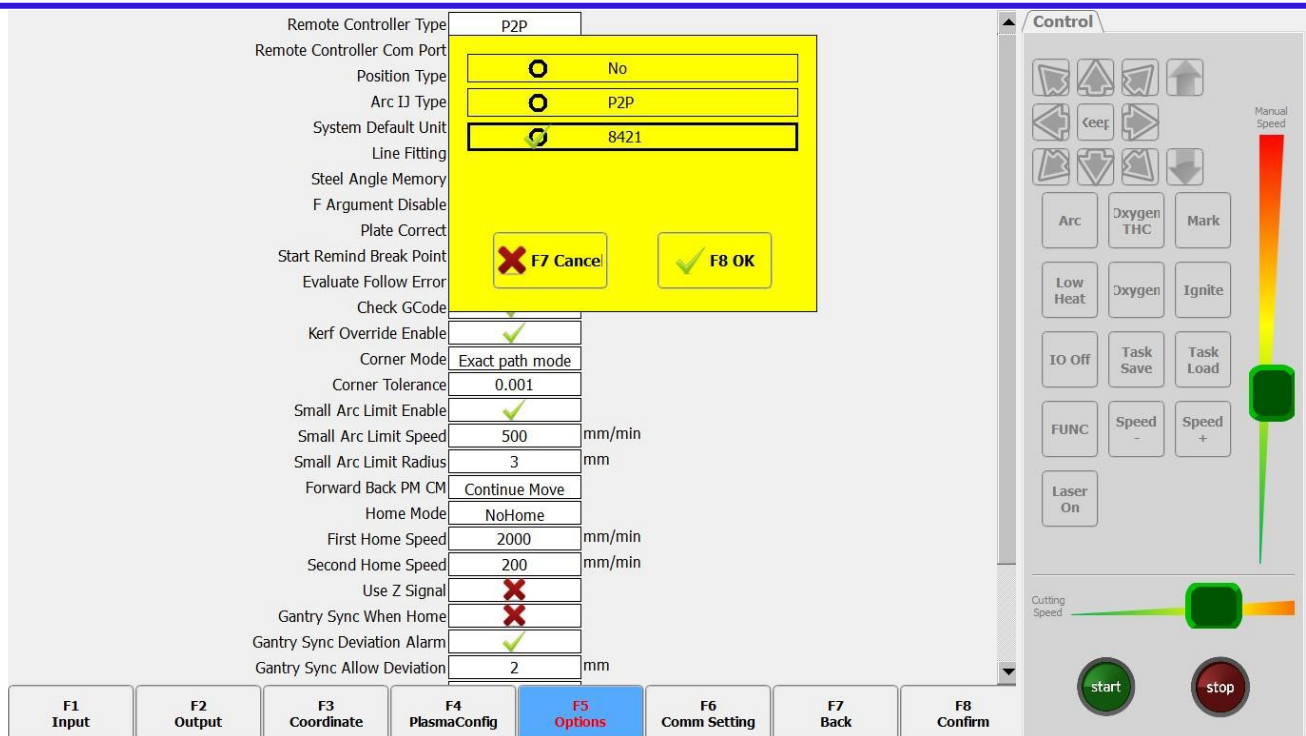


Figure 10.15 Remote Control Type Selection

And in the F7000 interface F4 parameter settings → F6 configuration → F5 option "input port definition" to configure, as shown in Figure 10.11.

10.6 Wiring instructions for remote control F1520 and F7000

10.6.1 Introduction of Remote Control F1520-T

Wireless remote control module performance and features:

1. 433MHz free ISM frequency band license-free trial;
2. Remote control distance > 30m, at least not less than 0.5m;
3. Hardware detection error code, software optimization algorithm, two-way communication, to ensure stable and reliable communication;
4. The sending and receiving modules are matched by address, the address can be set manually, and the maximum support is 128 addresses;
5. The wireless remote control transmitting module is powered by a dry battery and can be used for at least 6 months;

Service Support Spirit

- F1520 remote control is divided into handheld transmitter F1520-R and receiving terminal F1520-T;
- The receiving module F1520-R is a serial port RS232 wiring mode, which is convenient for user wiring.

Transmitter F1520-T Description:



Figure 10.16 Remote Control Layout

- **Buttons:** Start, Stop, Start (start), four directions (↑ ↓ → ←), one hand (Manual), Ignition, Preheat, CutOxy, Plasma, Forward, Back, Close, Manual Rate, 19 buttons in total.
- **Pilot lamps:** 3 manual speed lights (5%, 50%, 100%), 3 manual mode lights (electric, linkage, fixed length), 1 signal indicator, 1 battery indicator (or same as signal indicator).
- **Instructions:** When the power is turned on, the manual rate defaults to 50% light, the manual speed is secondary state, and the manual rate is continuously pressed. The manual rate change state machine is manual rate twice (50% light) -> manual rate three

times (100% The light is on) -> manual rate once (5% light on) -> manual rate twice (50% light on). When starting up, the default is to activate the manual as one state, the jog light is on, the manual change state machine is Manual once (the jog light is on) -> Manual second (continuous light is on) -> Manual three times (fixed light is on) -> Manual once (the jog light is on).

10.6.2 Receiver F1520-R wiring instructions:

The telecontroller receiver F1520-R adopts the standard serial port wiring mode and is directly connected to the 9-pin DB connection terminal of the RS232 serial port of the system, as shown in Figure 10.13, the serial port telecontroller receiver.



Figure 10.17 Serial Telecontroller Receiver

As shown in Figure 10.14, you can connect the RS232 back interface diagram of the serial port, and you can plug the receiver directly.

Service Support Spirit

F7000 series motion controller:

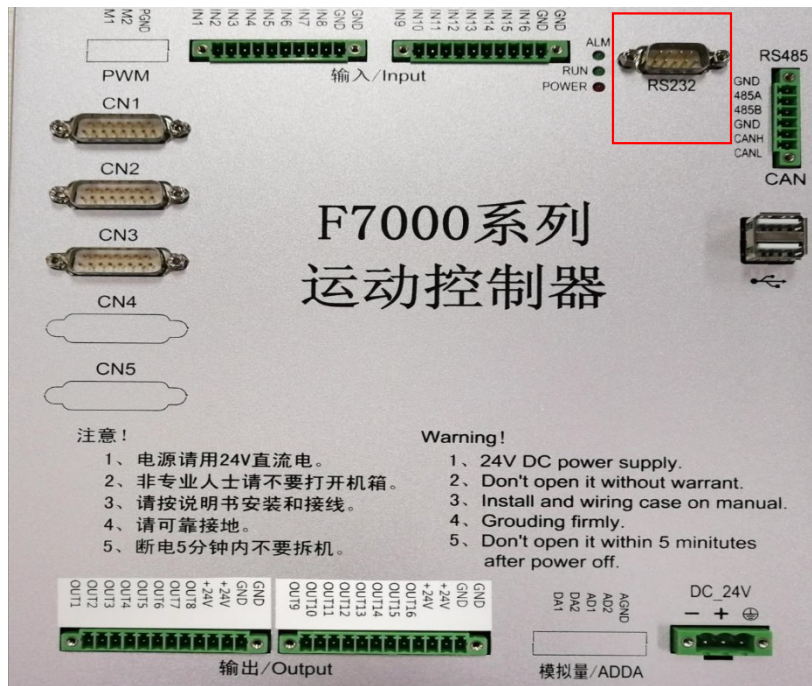


Figure 10.18 Rear Interface Diagram

10.6.3 Remote control F1520 and F7000 wiring instructions:

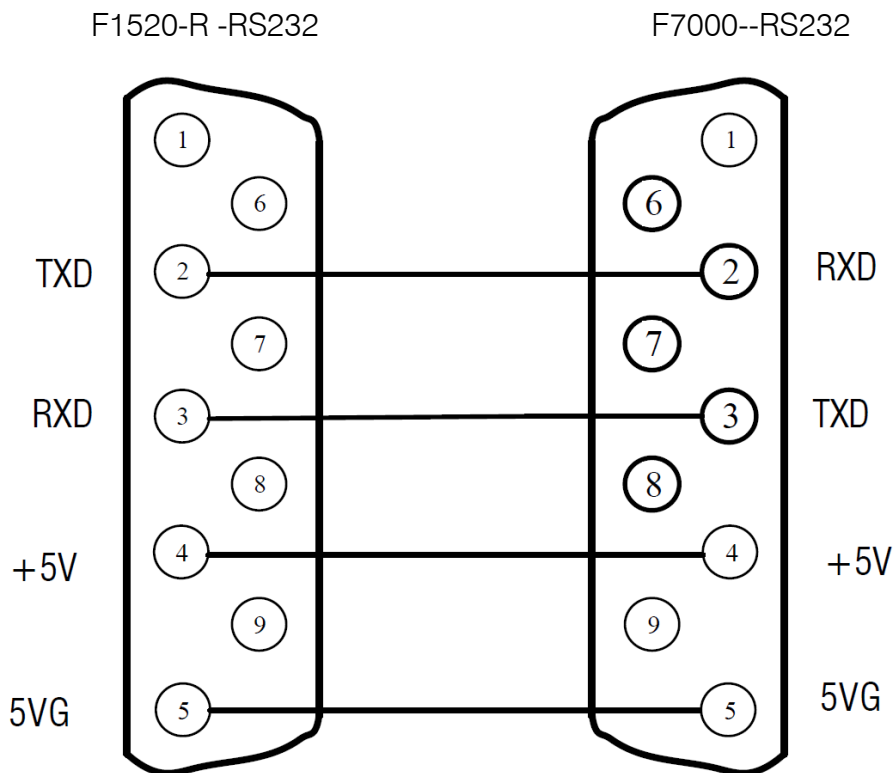


Figure 10.19 F1520-R Wiring Definition Diagram

Chapter 11 Code Explanation

11.1 Code Symbol and interpretation

In the cutting machine programming, the following programming symbols are generally available, with corresponding parameter following it.

Table 11.1 Programming symbols interpretation

Programming symbols	Function interpretation
N	Programming segment number
G	Code for ready
M	Auxiliary function
X	Relative coordinate or absolute coordinate of X axle
\Y	Relative coordinate or absolute coordinate of Y axle
U	Relative coordinate of X axle
V	Relative coordinate of Y axle
I	Coordinate d-value of X axle between circle center and arc's start
J	Coordinate d-value of Y axle between circle center and arc's start
R	Arc's radius, when it's positive value, the arc $<180^\circ$; when it's negative value, the arc $>180^\circ$
F	Cutting rate, used for G01, G02, G03

In the following context, all the symbol “/” is the relationship of OR. For example, X/U

Service Support Spirit

represents that the result is either X or U, both of which cannot simultaneously be. N represents parameter value, for example, Xn expresses that n is the following parameter. 【means】optional context, which can be selected or not.

11.2 Coordinate System

This system uses right-hand Descartes coordinate system acquiescently, as the Pic 11.1 shows.

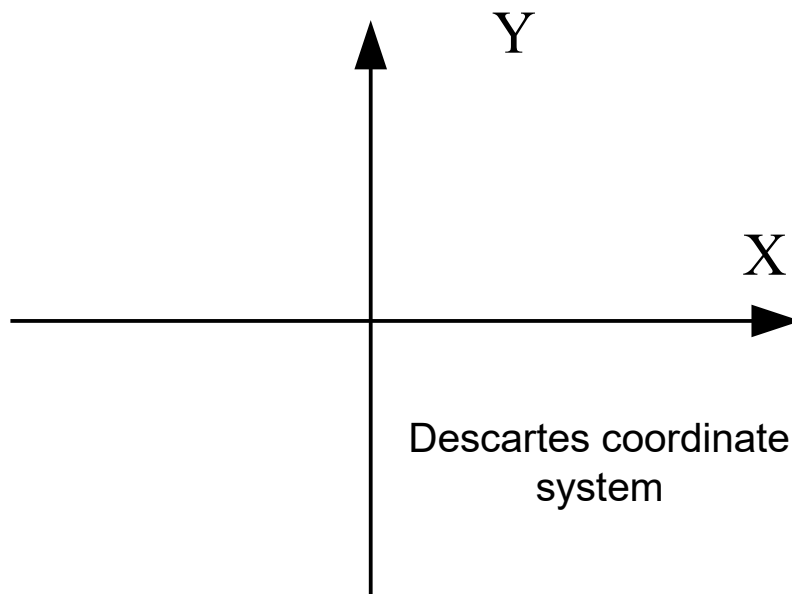


Fig 11.1 Descartes coordinate system

Of course, the system also can be defined coordinate system by user, referencing "Coordinate definition".

11.3 G Code Explanation

The G code which this system supports for is shown as the table 11.2.

Table 11.2 Common G code table

G99	Parameter: X/U Y/V I J	Part option parameter
G92	Parameter: X Y	Reference point setting
G91 / G90	No parameter	Relative/Absolute coordinate

Service Support Spirit

G20 / G21	No parameter	inches/metric
G41 / G42	No parameter	Left/right Kerf compensation
G40	No parameter	Cancel Kerf compensation
G00	Parameter: X/U Y/V	straight line rapid moving tool
G01	Parameter: X/U Y/V	Straight line cutting
G02	Parameter: X/U Y/V I J	Clockwise arc cutting
G03	Parameter: X/U Y/V I J	Anticlockwise arc cutting

1. G92 Reference point setting

Format:

G92 **【Xn】【Yn】**

Parameters meaning:

【Xn】【Yn】 expresses absolute coordinate of setted reference point and is also absolute coordinate of which machine tool goes back to. If no parameter after G92, the default reference point coordinate is (0, 0). Generally, while machine tool is taking (0,0) as reference point, this code can be ignored.

Note:

After input this code, coordinate of reference point setted by G92 can be saved automatically. Before new cutting code hasn't been inputted, the coordinate of this reference point is always available, whether system is power off or not. After input a new cutting code, if new code has G92 instruction, the coordinate of this reference point is the context after G92, if no G92, the reference point is default (0, 0). in one code file, G92 only appears once.

Example:

a. G92 X0 Y0

Take (0,0) as reference coordinate, when press "go back" function key, the machine tool goes back to coordinate point (0, 0).

b. G92 X20 Y0

Take (20,0) as reference coordinate, when press "go back" function key, the machine tool goes back to coordinate point (20,0).

2. G90/G91

Format:

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G90/G91

G90: absolute coordinate. X/Y in the code means absolute coordinate value; U and V mean relative coordinate value.

G91: relative coordinate. X/Y in the code means relative coordinate value; U and V also mean relative coordinate value.

Example:

a. G90 usage

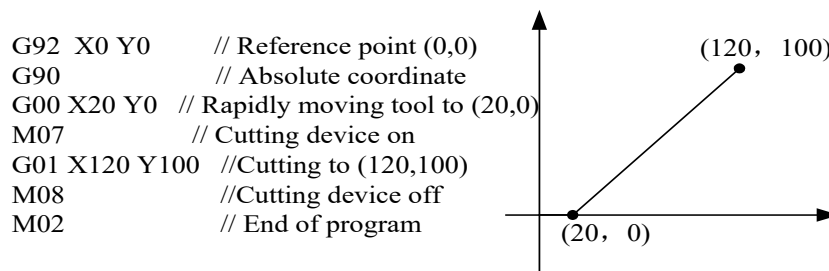


Fig 10.2 G90 usage

b. G91 usage

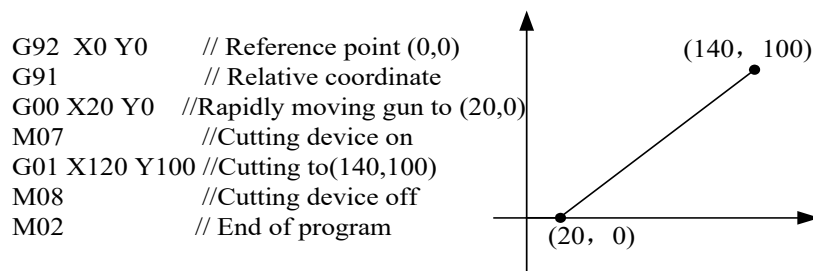


Fig 10.3 G91 usage

3. G20/G21

Format:

G20/G21

G20: inches unit. All of X, Y, I, J, R, U, V after G20 are inches unit.

G21: metric unit. All of X, Y, I, J, R, U, V after G21 are metric unit.

Note:

If no G20/G21 in the code, take the metric as data's unit.

The conversion formula of inches and metric: 1 inches \approx 25.4mm.

4. G00 Traverse rapidly

This instruction expresses that rapidly traverse to specific location, which the system will rapidly move to at the rate of "G00 move speed* time ratio" from start point.

Unique Solution

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Format:

G00 X/Un Y/Vn **【Fn】**

Parameters meaning:

- ↪ Fn – rapidly moving to specific location at the limited rate;
- ↪ Un – displacement of endpoint's X coordinate relative to start point of current segment, unit(mm);
- ↪ Vn – displacement of endpoint's Y coordinate relative to start point of current segment, unit(mm);
 - (in the relative coordinate system):
- ↪ Xn – displacement of endpoint's X coordinate relative to start point of current segment, unit(mm);
- ↪ Yn – displacement of endpoint's Y coordinate relative to start point of current segment, unit(mm);
 - (in the absolute coordinate system):
- ↪ Xn – displacement of endpoint's X coordinate relative to working start point, unit(mm);
- ↪ Yn – displacement of endpoint's Y coordinate relative to working start point, unit(mm);

Example:

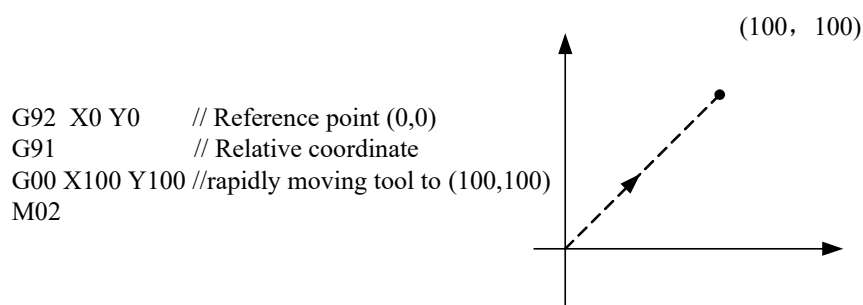


Fig 10.4 G00 usage

5. G01 Linear interpolation(at cut speed)

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This instruction expresses that linearly incise to specific location, which the system will cut to at the rate of “incise speed* time ratio” from start point of current segment.

Format:

G01 X/Un Y/Vn **【Fn】**

Parameters meaning:

The same to the meaning of G00 code, the difference of them is only that G00 expresses linearly walking(meaning: input ports are all closed), but G01 expresses linearly incising.

6. G02 Clockwise Circular interpolation

This instruction expresses that incise clockwise arc (clockwise interpolation) to specific location, which the system will cut to at the rate of “incise speed* time ratio” from start point of current segment.

Format:

G02 X/Un Y/Vn in Jn **【Fn】** or G02 X/Un Y/Vn R **【-】** n **【Fn】**

Parameters meaning:

- ↪ Fn – incise at limited rate;
- ↪ Un – displacement of endpoint's X coordinate relative to start point of current segment, unit(mm);
- ↪ Vn – displacement of endpoint's Y coordinate relative to start point of current segment, unit(mm);
- ↪ in – displacement of circle centre's X coordinate relative to start point of current segment, unit(mm);
- ↪ Jn – displacement of circle centre's Y coordinate relative to start point of current segment, unit(mm);
- ↪ R **【】** -]n – the radius of arc, when the angle of arc $\leq 180^\circ$, R is positive. Otherwise, it's negative, unit(mm);
(in the relative coordinate system):
- ↪ Xn – displacement of endpoint's X coordinate relative to start point of current segment, unit(mm);
- ↪ Yn – displacement of endpoint's Y coordinate relative to start point of current segment,

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unit(mm);

(in the absolute coordinate system):

↪ X_n – displacement of endpoint's X coordinate relative to working start point, unit(mm);

↪ Y_n – displacement of endpoint's Y coordinate relative to working start point, unit(mm);

Example:

Example 1: B->A

G92 X0 Y0 // Reference point (0,0)

G91 // Relative coordinate

G00 X60 Y100 //Rapidly move tool to B

G02 X-40 Y-40 I0 J-40 //The arc 1

/(G02 X-40 Y-40 R-40)

M02

Example 2: A->B

G92 X0 Y0 // Reference point (0,0)

G91 // Relative coordinate

G00 X20 Y60 //Rapidly move tool to A

G02 X40 Y40 I40 J0 //The arc 2

/(G02 X40 Y40 R40)

M02

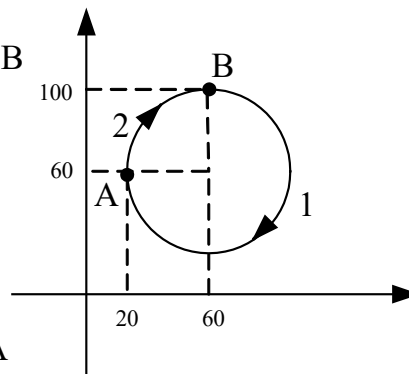


Fig 10.5 G02 usage

7. G03 Counterclockwise Circular interpolation

The same to G02. The difference is that G02 is clockwise circular(clockwise arc), but G03 is counterclockwise circular(counterclockwise arc).

8. G40/G41/G42 Kerf Compensation

These functions are used for kerf compensation. Because flame incision and plasma incision both finally have the existence of kerf when incise rine expressed by code is only actual size of workpiece, the actual incision workpiece within regard to the effect of kerf isn't needed size. After set the kerf compensation, the system will automatically work in the effect of kerf and incise workpiece with actual size.

G41/G42 must match with G40 to be used. If G41/G42 is ignored, the default kerf compensation is zero; if G40 is ignored, kerf compensation is available.

Format:

G41 //Enable Left Kerf Compensation

..... // incision code

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G40 //Disable Left Kerf Compensation
 G42 // Enable Right Kerf Compensation
 // incision code
 G40 // Disable Right Kerf Compensation

Example:

(Convex Roof Trapezoid w/Hole)

```
G21                      /* metric unit */
G91                      /* relative coordinate */
G99 X1 Y0 I0 J0        /*proportion factor is 1, rotate angle is 0, no mirror image*/
G00 X44.45 Y41.275     /* Rapidly moving to (44.45, 41.275)*/
G41                      /* Left Kerf Compensation */
M07                      /* incision beginning*/
G03 X0 Y0 I19.05 J0    /*Counterclockwise Circular interpolation */
M08                      /* incision ending */
G40                      /* Disable Left Kerf Compensation */
G00 X-44.45 Y-41.275   /* Rapidly moving to (-44.45, -41.275) */
G41                      /* Right Kerf Compensation */
M07                      /* incision beginning */
G01 X25.779438 Y58.031634 /*Linear interpolation */
G02 X75.441125 Y0 I37.720562 J-16.756634 /* Clockwise Circular incision*/
G01 X25.779438 Y-58.031634 /* Linear interpolation */
G01 X-127 Y0           /* Linear interpolation */
M08                      /* incision ending */
G40                      /* Disable Right Kerf Compensation */
M02                      /* End of program */
```

Note:

The value of Kerf Compensation should be half of actual kerf width.

9. G99 proportion、rotate、image

Format:

G99 Xn Yn in Jn

Parameters meaning:

↪ X – proportion factor, can be set from 0.001 to 1000.

↪ Y – rotate angle, can be set from -360° to 360°.

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- ↪ I – image of X axis, make image along X axis, 1 expresses that there is image, 0 expresses that there is no image.
- ↪ J –image of Y axis, make image along Y axis, 1 expresses that there is image, 0 expresses that there is no image.

Note:

A code can have G99, also cannot. If there is G99, the parameter X, Y, I, J after code should not be ignored. Mirror image and rotation will take the origin (0, 0) of Descartes coordinate as reference point.

10. Programming notice items

- ↪ The program must contain the instruction of G92 (reference point setting) and M02(end of program).
- ↪ G41/G42 must match with G40 to be used. If G41/G42 is ignored, the default kerf compensation is zero; if G40 is ignored, kerf compensation is available.
- ↪ If G20 / G21 is ignored, the system will execute G21 (metric unit).
- ↪ If G90 / G91 is ignored, the system will execute G91 (relative coordinate).
- ↪ M07 and M08 can't be neglected.
- ↪ When there is one parameter in the code of G00、G01、G02、G03 is ignored, if this parameter is absolute coordinate, the system will set it G code coordinate value of last row; If it's relative coordinate, the system will set it 0.
- ↪ G00、G01、G02、G03 can be simplified: G0、G1、G2、G3.
- ↪ If there is contiguous G00 (or G01、G02、G03) around, the following G00 (or G01、G02、G03) can be ignored.

11.4 M Code Explanation

Table 10.3 Common M code

M07	No parameters	Perforation fixed cycle
-----	---------------	-------------------------

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M08	No parameters	End cutting canned cycle
M11	No parameters	Build powder injection offset
M12	No parameters	Cancel powder injection offset
M09	No parameters	Opening powder injection
M10	No parameters	Shut off powder injection
M00	No parameters	Pause instruction
M02/M30	No parameters	End of program

- M07 Cutting device on

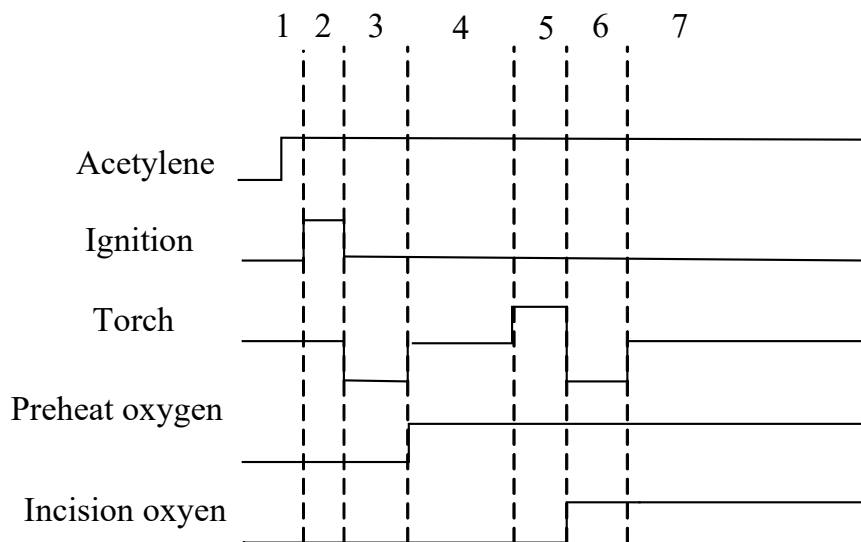


Fig 10.6 sketch map of cutting device on

1. If acetylene hasn't been open, open it.
2. Open ignition and delay "ignition delay time".
3. Open torch down and delay "torch down time".
4. Close torch down, open preheat oxygen and delay "preheat delay time". If in the processing of preheat, press "STOP" key, the preheat time will be automatically delayed. Finish preheat delaying until press "START" key again and save the time of preheat delaying automatically in the parameter.
5. Open torch up and delay "Perforation up time".
6. Close torch up, open incision oxygen, open perforation down and delay "Perforation down time".
7. Close torch down, begin to incise.

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- **M08 Cutting device off**
 1. Close incision oxygen;
 2. Open torch up and delay “Torch up time”;
 3. Close torch up.
- **M00 End of instruction**

in the processing of incision, the system will stop the machine tool with the M00 instruction, waiting for the next operation.
- **M02/M03 End of program**

Chapter 12 Height Adjustment Device

12.1 Basic description

F2000 CNC system V1.2 version has added the function of multi-height adjustment device. Currently supported height adjustment devices are F1650, F1627D, F1627S. This document mainly describes the configuration of the height adjuster and the operation interface.

12.2 Mode of wiring

For details on the F1650 wiring, please refer to the "Fine Hole Cutting Installation and Commissioning Manual".

For details on the F1627S/D wiring, see 10.5 F7000 and FCB1200PC and F1627D/S Wiring Instructions below.

12.3 Height adjustment device configuration

To use the multi-level adjuster function, you need to configure the height adjustment device in the program first. After the program starts, click [F4 Parameter Setting] - [F6 Configuration] - enter the password 1396 - [F6 Communication Settings]. In the pop-up communication interface, there are configuration options for the height adjuster.

As shown in Figure 12.1.

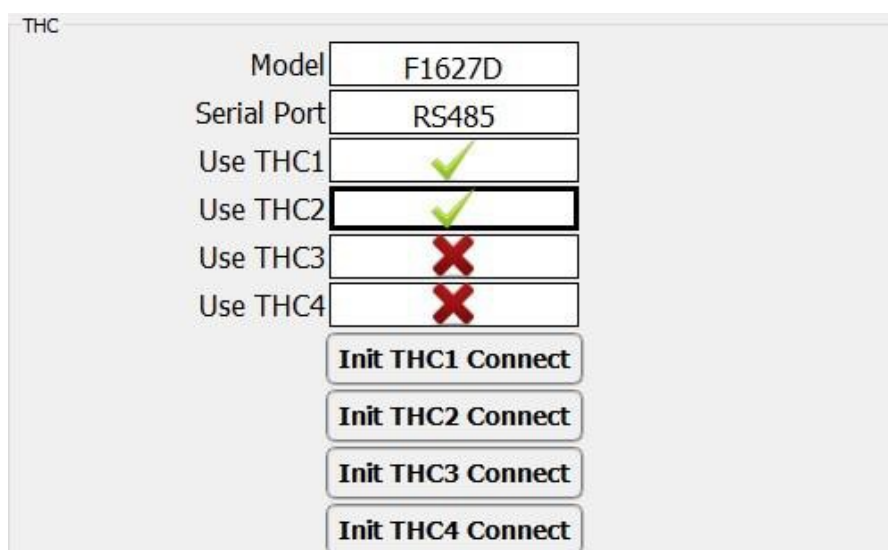


Figure 12.1 Height Adjustment Device Configuration

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- ◆ **Type of height adjustment device:** Select the height adjustment device you want to use. The default height adjuster model is "common", which means that the normal IO height adjuster is used, that is, the external height adjuster is not used. This type of height adjuster does not support the multi-tune function. Caution: F7000 software needs to be restarted after the model of the altifier is changed.
- ◆ **Use THC1,2,3,4:** System mount up to 4 height adjustment devices. Please check if you want to use the height adjuster. If only one height adjuster is used, tick "Use THC1" to turn off the other three options. If using two height adjustment devices, check "Use THC1" and "Use THC2". And so on.
- ◆ **Initialize THC1,2,3,4 connections:** The communication of the multi-height adjustment device is implemented via ModBus. Each height adjustment device has a ModBus slave address. If the slave address of height adjustment devices is the same, the communication will not be normal. Therefore, after the height adjustment device is connected to the system, you need to set the ModBus slave address of the height adjustment device. The initialization button is used to implement the function of changing the slave address.

12.4 Height adjustment device initialization connection

The height adjustment device initializes the connection process only after the height adjuster is replaced, and it is not necessary to repeat the configuration if the height adjuster device is unchanged.

The height adjustment device initializes the connection steps:

- **Enter the aligner configuration interface:** Connect the actual aligner 1 to the system and disconnect the other THC. Click the [Initialize THC1 Connection] button. A confirmation dialog will pop up, as shown in Figure 12.2.

Please disconnect other THCs and connect only the THC to be initialized!

 F8
Confirm

Figure 12.2 THC Initialization Link

- **Click to confirm:** The following figure will pop up. The ID is being reset at this time. The logical process of resetting: Searching for the ID of the current connection's aligner. Our height adjustment device height adjustment device ID range is 1 - 15. Then reset the raised slave address to 1. If you click the [initialize THC2 connection] button, you set the height adjustment device ModBus from station address to 2. And so it goes.

Connection success. Resetting ID... F7 Cancel

Connection success. Resetting ID...

 F7 Cancel

Figure 12.3 THC Reset ID

After the reset is successful, the following interface will pop up.



Figure 12.4 THC Link Initialization Success

Disconnect the physical connection of the height adjustment device 1, or power off. Then go to the height adjustment device 2 and click the [Initialize THC2] button... Repeat this process until all the height adjustment devices to be used are initialized successfully.

12.5 Height adjustment device observation window

After the height adjustment device is configured successfully, go to the main interface, switch the cutting mode to [Plasma], and then click the observation window switch button to switch to the height adjustment device observation window. The height adjustment device observation window is shown in Figure 12.5 below:

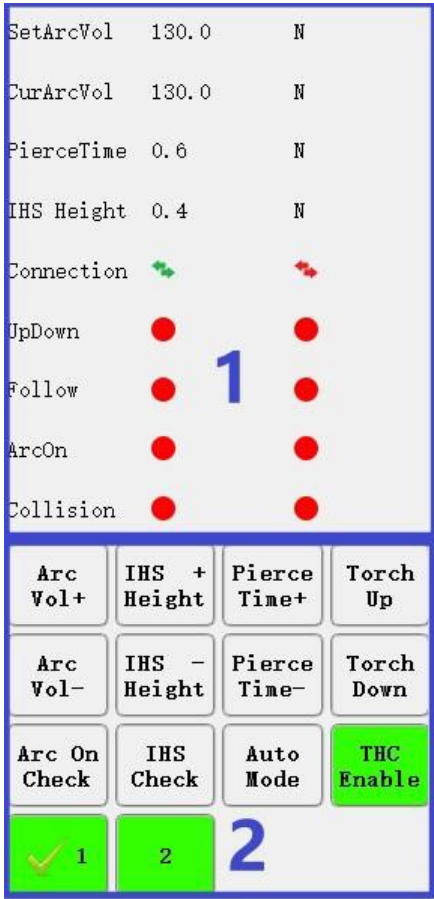


Figure 12.5 Height Adjustment Device Observation Window

The observation window can be divided into two parts: 1 status display area and 2 operation areas. The current status display area has two sets of data (there are several sets of data using several height adjusters). On the left is the data for THC1 and on the right is the data for THC2.

At the bottom of the operating area is a row of digital buttons, there are currently buttons 1 and 2. When we click which button, indicating which THC to choose. There will be one more before the button clicked . Which height adjuster is selected, which operation adjuster is operated by the operation button of the operation area.

12.6 Height adjustment device parameter interface

Click [F4 Parameter Settings] - [F3 Plasma] - [F3 Plasma] - [F1THC] on the main interface. You can enter the THC interface. As shown in Figure 12.6 below:

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Figure 12.6 Height Modifier Parameter Configuration

The height adjustment device parameter interface has a common parameter interface, a system parameter interface, an input and output parameter interface, a diagnostic interface, and an import and export button of the height adjuster parameter. Through the parameter interface, the parameters of the height adjuster can be modified.

After confirming, the modified data is sent to the height adjuster. The version number of the height adjuster displayed at the top of the interface, as well as the selector box for the height adjuster. If you select the height adjuster 1, the parameters of the height adjuster 1 are displayed on the interface. If the selection is 2, then the parameters of the height adjuster 2 are displayed.

Enabling THC: To control whether the height adjustment device handles off-line status, the offline height adjustment device cannot operate in the view window, and does not update the status of the height adjustment device. Every time you enter the THC interface, it will check whether the connection is normal. If the selected height adjuster is not connected, the parameters will not be modified.

Chapter 13 Drilling and Cutting Integrated System

13.1 Brief introduction

The F7000 series of drilling and cutting integrated systems for cutting machines with drilling functions. Drilling shafts are controlled in two ways: one using a motor and the other using a cylinder. Different control methods have different parameter configurations of the system.

The configuration of the drilling and cutting integrated system is relatively simple, and only the drilling-related parameters need to be additionally configured on the basis of the ordinary F7000 system. Therefore, before reading this manual, users need to know about the company's F7000 system. Refer to the company's "CNC cutting machine control system F7000" manual.

Ordinary F7000 system, if you want to upgrade to a drill-and-cut system, you need to update the license.

13.2 Interface description

The drilling and cutting integrated system requires an additional interface. Different drill axis control modes and different interface configurations. The basic IO configuration of the F7000 system, as well as the hardware wiring, refer to the "CNC Cutting Machine Control System F7000" manual.

13.2.1 Motor control

The input port needs to be configured with the "Z-axis upper limit" and "Z-axis lower limit" functions.



Figure 14.1 Motor Control Input Configuration

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The output port needs to be configured with the "Open rig" function.

Open Drill	14	NO
------------	----	----

Figure 14.2 Motor Control Output Configuration

The motor interface needs to be configured with the CN4 motor port (on the F7000 control card) to control the rise and fall of the drill shaft.

13.2.2 Cylinder control

The input port needs to be configured with the "Z-axis upper limit" and "Z-axis lower limit" functions.

Z Limit Up	15	NC
Z Limit Down	16	NC

Figure 14.3 Cylinder Control Input Configuration

The output port needs to be configured with the functions of "open the drill rig", "close the drill shaft cylinder" and "open the drill shaft cylinder".

Open Drill	14	NO
Open Z Cylinder	15	NO
Close Z Culinder	16	NO

Figure 14.4 Cylinder Control Output Configuration

Caution: The function uses the actual I/ O port, and the IO is always open and closed, which needs to be connected according to the actual hardware wiring.

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13.3 Parameter declaration

In the main interface, press [F4 Parameter Setting] to enter the parameter setting interface, and then press [F4 Powder/Drill] to enter the drilling parameter interface, as shown in Figure 14.5.

Spraying Ignite Time	0	s
Spraying Preheat Time	0	s
Powder On Time	0	s
Powder Off Time	0	s
Spraying Up Time	0	s
Spraying Down Time	0	s
Drill X Offset	0	mm
Drill Y Offset	0	mm
Drill Stop Lift Height	100	mm
Drill Quickly Lift Height	20	mm
Drill Hole Depth	10	mm
Drill Auto Quickly Lift Speed	1000	mm/min
Drill Manual Speed	500	mm/min
Drill Hole Speed	100	mm/min
Drill Hole Steps	1	
Drill Use Cylinder	X	
Cylinder Open Time	3	s
Cylinder Close Time	3	s
Close Drill Machine When Drill Stop	X	

Figure 14.5 Drilling Parameters

Lateral displacement of the drill gun: the lateral displacement of the drill gun relative to the cutting nozzle.

Longitudinal displacement of the drill gun: the longitudinal displacement of the drill gun relative to the muzzle.

Drilling end lift distance (height): In motor control mode, the distance from which the drill gun rises after the whole hole is finished.

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Drilling quick raising distance (Height): In motor control mode, as shown in Figure 3.2, after each drill, the drill gun is rapidly lifted from B to a point A above the surface of the steel plate (where there is a certain distance Δd between B point and C point on the surface of the steel plate).

Drilling distance (depth): In motor-controlled mode, as shown in Figure 3.2, the depth (d) of the drill gun drilled into the steel plate plus Δd .

Automatic air speed (rapid lift): In motor control mode, the speed required by the drilling gun to complete the "drilling fast descent distance".

Drilling manual speed up and down: motor controlled mode, manual speed up and down the drill gun

Drilling attack speed: In the motor control mode, the drilling gun completes the "hole distance" required speed.

Step times per drill: In motor-controlled mode, this parameter is how many times the drill needs to go back and forth to tap a hole. After each stepping down, lift up to the zero coordinate position of the board, then quickly descend to the top 2mm of the drilling position, and continue drilling

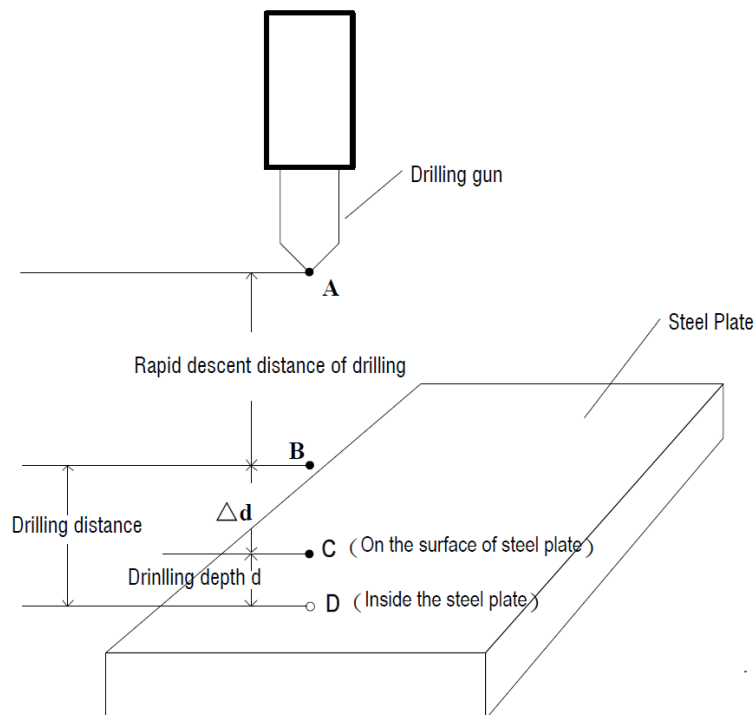


Figure 14.6 Schematic Diagram of Drilling Down

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Use the cylinder to adjust the height: When this function is selected, the drill shaft is controlled by the cylinder.

Cylinder opening time: In cylinder control mode, the time to open the cylinder.

Cylindrical closing time: In cylinder control mode, the time to close the cylinder.

Close the motor after each drill: under the motor control mode, the drill is completed, whether to turn off the motor.

In the motor control mode, the z-axis related parameter settings are located in the axis parameter interface. Enter method: Click[F4 parameter setting] on the main interface, then click[F5 system], enter the password 1396, then click[F2 axis parameter], select "z axis" in the drop-down list of the "axle name".

13.4 Instructions for use

13.4.1 Code specification

The G code and M code for the rig are described as follows:

1. Drilling instruction G63

This directive indicates that the drill begins to drill.

2. Offset instruction M11

This directive indicates that the drill creates an offset.

3. Back offset instruction M12

This instruction indicates that the drill is offset back. Example:

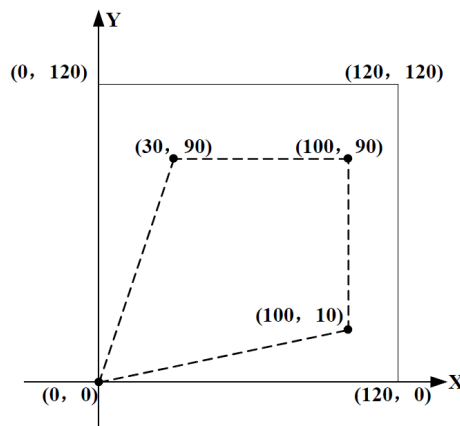


Figure 14.7 Drill G, M Code Usage

Service Support Spirit

```
G92 X0 Y0 // Set the reference point coordinates to (0,0)
G91 // Set relative coordinates. The parameters after X, Y appearing in the
code represent relative coordinate values.
G21 // Set the metric unit. All X, Y, I, J, R, U, V are metric units
M11 // Build Offsets
G00 X100 //The drill gun moves quickly to the (100,10) point
Y10
G63 // Drilling holes
G00 Y80 //The drill gun moves quickly to the (100,90) point.
G63 // Drilling holes
G00 X-70 //The drill gun moves quickly to the (30,90) point
G63 // Drilling holes
G00 X-30 //The drill gun moves quickly to the (0,0) point
Y-90
M12 // Offset back
G42 // right-hand slot compensation
M07 // perforation fixed cycle
G01 X120 Y0 //Line cut to point (120,0)
G01 X0 Y120 //Line cut to point (120,120)
G01 X-120 //Line cut to point (0,120)
Y0
G01 X0 //Line cut to point (0,0)
Y-120
M08 // End Cutting Fixed Cycle
G40 // Cancel right-hand seam compensation
M02 // End of program
```


13.5 Manual operation

A system for drilling and cutting, the manual panel has buttons for manual movement and clearing of the drill shaft. As shown in Figure 14.8 below.

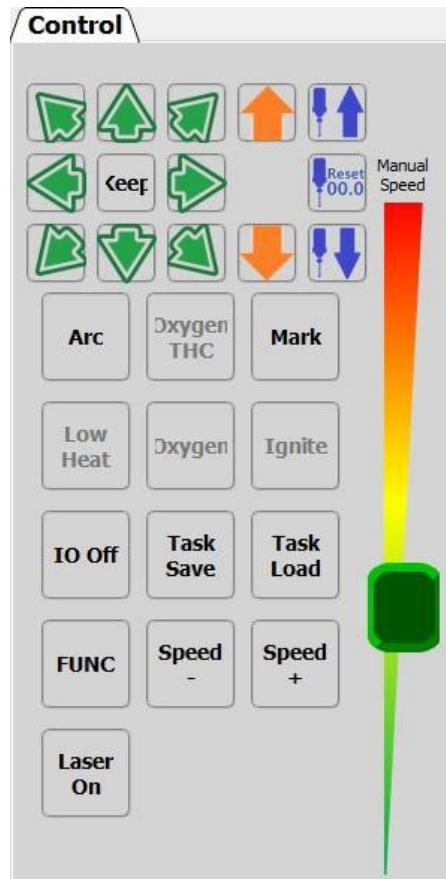


Figure 14.8 Drill Shaft Manual Panel

13.6 Drill axis initial distance setting

1. Manually lower the rig close to the steel plate surface in the drilling mode until the drill shaft is near the starting position of the drill hole. The B position in Figure 14.6.
2. Click the button on the manual panel to clear the drill axis and clear the drill axis coordinate to zero.
3. Manually raise the drill shaft to the appropriate position to stop.
4. Complete the 0 position setting of the drill axis.

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13.7 Graded drilling instructions

For example, the drilling distance (depth) is set to 10mm. If the number of drilling steps for each time is 4, the stepping distance per drilling is $10/4=2.5\text{mm}$, then the drilling process is:

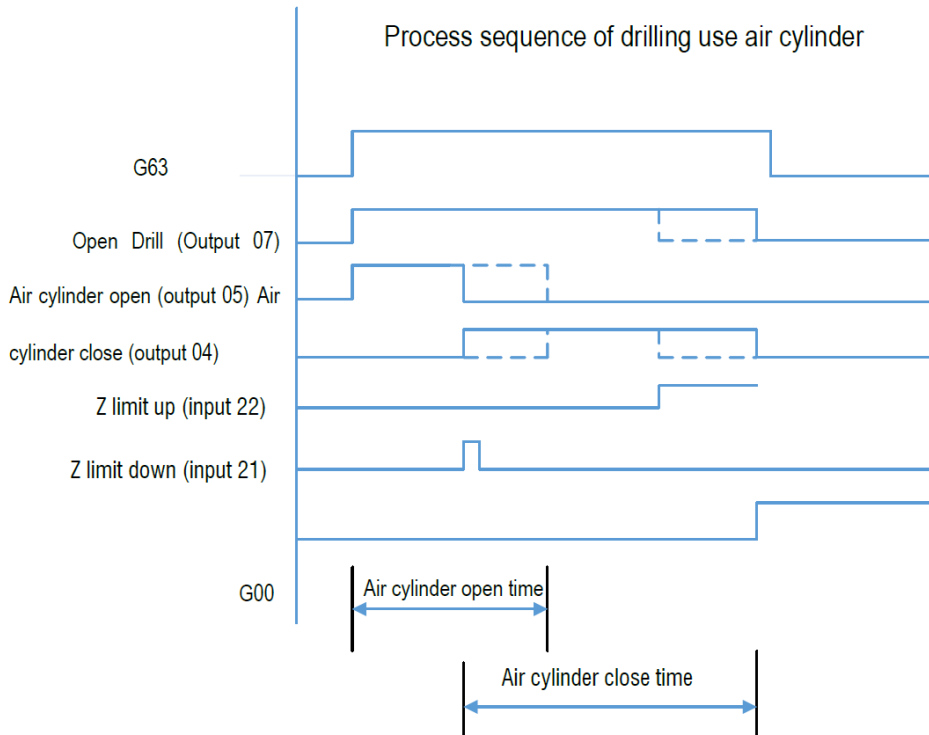
1. Move to the 0 position quickly, the B position in Figure 3.2 (the same below), that is, the upper surface of the steel plate.
2. Start drilling again at a distance of $10\text{ mm}/4 = 2.5\text{ mm}$, then rise quickly to 0; then drop quickly by 0.5 mm ($2.5-2$) (2 mm higher than the position of the last attack).
3. Run $2 + 2.5 = 4.5\text{mm}$ at the drilling speed, the total depth of the hole is $0.5\text{mm} + 4.5 = 5\text{mm}$, then quickly rise to 0 position, and quickly descend to 3mm ($5-2$) position;
4. Run $2+2.5=4.5\text{mm}$ at the drilling speed, the total drilling depth is currently $3+4.5=7.5\text{mm}$, then quickly rise to 0 position and quickly drop to 5.5mm ($7.5-2$) position;
5. Run $2+2.5+4.5\text{mm}$ at the drilling speed, the total drilling depth is currently $5.5+4.5=10\text{mm}$;
6. Move quickly to the rapid lifting distance (height) of the hole or the lifting distance (height) at the end of the hole. The last stop height, the system will automatically determine whether it is the last drill hole. If it is the last drill hole, it will move quickly to the end of the drill hole lift height (height). If it is not the last drill hole, it will move to the lifting distance (height) at the end of the hole quickly.

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13.8 Cylinder drilling

The drilling parameters in Figure 14.5 are selected using cylinder drilling.

The working principle is as follows:



13.9 Drilling timing

