
Introduction

Thanks for using the portable flame/plasma CNC cutting machine produced by SHANGHAI HUGONG ELECTRIC (GROUP) CO., LTD—SHANGHAI GAS WELDING EQUIPMENT CO., LTD.

SHANGHAI GAS WELDING EQUIPMENT CO., LTD is the first company which dedicated to cutting product design, production in China. From 1958 to now, Company adhere to the research and development, develop a number of technologically advanced, practical, and good reliability of the cutting equipment, widely used in the pipeline, pressure vessel, shipbuilding and other industries. Portable CNC flame cutting machine is one of the successful product we developed.

This manual is to provide you with all the technical parameters of the machine, and tell you how to install, debug, use and maintenance the portable CNC cutting machine. Read the instructions carefully can help you know machine structure and working principle, and to use the machine safely and satisfactory.

Caution !!!

- 1. TO REPAIR THE WELDING MACHINE ONLY THE SKILLED PERSONNEL ARE ALLOWED!**
- 2. READ CAREFULLY OF THIS MANUAL BEFORE ASSEMBLY AND USING THE MACHINE!**
- 3. THE APPEARANCE DATA IN THIS SAMPLE COULD BE CHANGED WITHOUT NOTICE,OUR COMPANY HAS THE FINAL EXPLANATION OF THIS SAMPLE !**

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Chapter 1 Product Description

Portable CNC cutting machine is a programmable metal cutting equipment, mainly used for arbitrary planar cutting, can cut any plane of complex graphics. This product is simplify, small size, light weight, easy handling, apply to indoor cutting, and support the flame and plasma. (The machine can be equipped with automatic ignition device, gas system uses a solenoid valve control, simple operation, convenient.)

The manual only describes the operating instructions and basic maintenance procedures of this portable CNC plasma cutting machine. Maintenance of the equipment is limited to trained and qualified person. Untrained and unqualified person is absolutely prohibited to repair or debug the project not mentioned in this manual. Read this manual thoroughly to fully understand the performance characteristics of this machine to ensure correct operation of the equipment, give full play to its functions.

Portable CNC cutting machine is widely used in automobile, shipbuilding, engineering machinery and other industries. The biggest advantage of this product is the CAD format graphics can be converted to the G-code, put G code file into a U disk, enter the cutting machine which automatically G-code directly converted to the cutting procedure, in order to complete each cutting shapes.

INTECUT Series have three model----- INTECUT3、INTECUT4、INTECUT5。 This equipment includes machine, longitudinal rail, beam and cutting torch. The structure is light, appearance is delicate.

Chapter 2 Safety Operation

2.1 Safety notice

Please carefully read the manual before using this cutting machine.

2.2 Mechanical dangerousness

Operation and repair of automation equipments are a little dangerous and are careful. Please be far away from the working equipment. Please control the equipment by correctly using the panel's buttons. Don't wear so loose clothes when using and repairing the equipment.

2.3 High-voltage dangerousness

Be careful of electric shock during operation. Please install the equipment according to its manual. Don't touch cables or wires after power on. Only professional maintenance personal can open the controller. When the equipment has problems, power should be off and then repair.

2.4 Operation caution for Flame cutting

Carefully read this manual before operating, if not understand, please call the our company. In addition to the manual allows you to modify the parameters can be modified, the remaining parameters is prohibited to modify.

2.4.1 Operator's own defense

- Please always follow the rules that conform to safety and hygiene. Wear protective garments to avoid injuries to eyes and skins.
- When cutting, it is not allowed any part of your body to touch the machine and work piece.
- No touching on the output connection or any other electrification parts while cutting.
- No cutting for the container loaded inflammable or explosive materials.
- Do not operate under water or more humid place.
- No aiming the flame or fire to anybody.

2.4.2 Items which operator should pay attention

- Make sure all connection to the cutting machine are correctly before operation.
- The smoke is not good to health when cutting, Operate at workplace which has the ventilation.
- There will be sparks when cutting, please note that the isolation of the workplace and the surrounding.
- When cutting, it is not allowed to set the machine.

-
- No allowed to beat the cutting torch to clear the torch head.
 - No allowed any people else enter the working site.

2.4.3 Installation of Cutting machine and security of construction site

- Please do the protection of personal and cutting machine in some place which may have a foreign body falling from the air spaces,
- Ambient air, dust, acid, corrosive gases or substances in construction sites shall not exceed appropriate standard of content (To avoid accidents when cutting).
- The cutting machine should be installed: No direct sunlight, No rain, the temperature is at 0 °C ~ +45 °C, dry spaces.
- Foreign matter should not be allowed to enter the cutting machine, especially metallic foreign body.
- There is no severe vibration in working space.
- when cutting in the open spaces which has the larger wind, should be prepared to wind measures.

2.4.4 Safety inspection

- the operator operation should check the following items each time before power on:
- Check and clear the obstacles on this machine before use gas cutting, kept and used by the staff.
- Check gas line fittings and torch if there is air leakage.
- Regularly check the electrical component of the machine like switch, potentiometer etc.
- Prevent the motor from moisture and other foreign matter into the machine, and pay attention that there is no unusual phenomenon.
- Make sure that the cutting machines' output and input line is insulation and reliable connection.
- Component installed on the panel should be able to guarantee the normal operation of the cutting machine features.
- if the cutting cable can continue to be used.
- if the input cable is damaged, if there is damage, the safe handling must be carried out.
- Cutting machine supply network capacity is sufficient to allow the cutter to work properly, as well as access to the power of cutting machine shall be equipped with.



Caution: you must first cut off the power before the inspection and maintenance.

When users encounter meet fault which can't be ruled out or do not have the maintenance capability, shall promptly contact the manufacturer or supplier, ask for technology, repair and parts supply.

2.5 Plasma operation precautions

2.5.1 Electromagnetic radiation

Plasma arc cutting will produce high-intensity electromagnetic radiation, this radiation may interfere with the function of pacemakers, hearing aids or other similar electronic rehabilitation equipment. the staff around Plasma arc cutting equipment need ask the professional health-care workers whether there is harm. In order to prevent potential damage before using the machine, please read the information of all warnings, safety precautions and instructions ". And adherence to these strictly. If you have any questions, please consult the manufacturer.

2.5.2 Gases and smoke

Plasma cutting gas and smoke is dangerous, harmful to body, breathing zone need to avoid cutting gas and smoke, the head of the operating person need to avoid the group of welding produce smoke. If the ventilation is poor, can't the remove smoke and gas, please use the air respirators.

Smoke and gases generated by the metal and the drug layer outside metal, and different cutting process. When cutting with one or more of the following composition metal, we must be especially careful:

Sb	Cr	Hg
As	Co	Ni
Ba	Cu	Se
Be	Pb	Ag
Cd	Mn	V

Please read carefully before cutting the cutting materials, materials that came with instructions for safe use, these instructions will inform the harmful gases and smoke, the type and amount of information.

To prevent the cutting harmful gases injury, please following the following method of operation

- Using special equipment to collect the smoke and gases, such as dust emission devices.
- Do not cut in a location where has flammable and explosive gas or combustible explosive materials
- highly toxic gas phosgene vapors from chlorinated solvents and detergents, to remove all the substance of this gas can evaporate.

2.5.3 Electric shock

Electric shock can make people injured or killed. The plasma arc process uses high-voltage and generates the high voltage, they can cause operator or other staff to be serious or even fatal shock.

- Not touch any electric or hot parts.
- Wear dry gloves and dry clothes. Operators should be insulation to workpiece or the welding circuit.
- Cut off the power before the repairs and maintenance equipment.
- Read the manual thoroughly and do in accordance with its content.

2.5.4 Fire or explosion

Hot slag, sparks or plasma arc can cause fire of explosion.

- Be sure the area is safe before doing any cutting. Keep a fire extinguisher nearby.

Workshop shall not have flammable or combustible things. The material must remain in place must be properly protected.

- ventilated to remove explosive vapors.
- Do not cut or weld on container which may include the flammable materials
- When working in fire-prone locations should always be vigilant.
- When cutting aluminum underwater, or with the water touching the underside of the aluminum, free hydrogen may collect under the workpiece and detonate during plasma cutting operations.

2.5.5 Plasma arc radiation

The plasma arc radiation will stabbed the eye and burn skin. The plasma arc process can produce extremely bright ultraviolet and infrared light, poor protection will be stabbed the eye, burns the skin.

- For Eye protection, when cutting, users should always wear a helmet visor and cheek protection safety glasses or other protective apparatus of the eye.
- Wear welding gloves, Wear appropriate clothing to prevent skin of arc radiation, sparks burn skin.
- helmet and safety glasses should be kept well, if the glass is ruptured or vague, please replace ASAP.
- The work area also need anti-arc radiation, you can use shed, screen or cover.

Chapter 3 Technical Data

3.1 Working environment

- * The surrounding temperature range: when welding: water cooling: $0 \sim +45^{\circ}\text{C}$,
During transport or in storage: $-25 \sim +55^{\circ}\text{C}$.

When welding, If out of its working temperature, the controller probably works worse. If the temperature is below 0°C , the screen will not display normally.

- * Relative humidity: when at 40°C : $\leq 50\%$, when at 20°C : $\leq 90\%$.
- * The dust, acid and erodible materials in the air can not exceed the amount required by the mode (apart from the emissions from the welder). No violent vibration at the job site.
- * Altitude no more than 1,000m.
- * The wind speed should no more than 1m/s around the operation places.

3.2 Requirement of power supply

- * The voltage oscillogram should display actual sine wave,.
- * The oscillation of the supplied voltage should not exceed $\pm 15\%$ of the rated value.

In some places there is no normal power, such as zero wire and ground wire are together or no zero wire, an isolation transformer must be used from 2-phase/3-phase AC380V to 2-phase AC220V.



Warning rod is also a must.

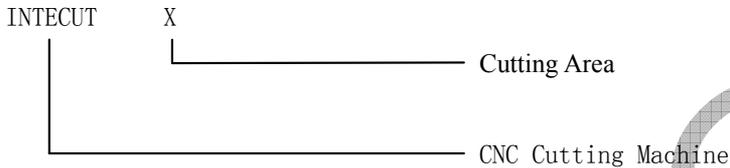
All parts of the cutting machine and the controller should connect ground.

Controller's ground wire diameter should be over 4 mm^2 , and try to keep a shorter distance to the ground, DC24V ground (-) must break with ground.

3.3 Product type coding

* Combination of the Chinese mandarin spelling and the Arabic numerals.

* Implication of Coding:



3.4 Technical data

Model	INTECUT 3	INTECUT 4	INTECUT 5
Power voltage	110V/230V(220~240V)		
Frequency	50/60Hz		
Rate input capacity	350W		
Screen	LCD 7"		
Effective cutting range	1220X2000mm	1220X3400mm	1500×3400mm
Speed without load	0~3000mm/min		
Flame cutting speed	100~750mm/min		
Beam length	1800mm	1800mm	2100mm
Vertical rail length	2500mm	4000mm	4000mm
Beam weight	17.5 kg	17.5 kg	19.5 kg
Machine weight	33 kg	33kg	33 kg
Vertical rail weight	34.5 kg	55 kg	55 kg
Whole machine weight	85kg	105kg	107.5 kg
Cutting model	Flame、 Plasma (Plasma cutting speed refer to Plasma cutter parameter)		
Oxygen	Max ≦ 1.5Mpa		
Gas	Acetylene、 Propane、 Methane、 LPG		
Gas pressure	Max ≦ 0.15Mpa		

Attention:

1. Z axis can lift by electric control, Torch can be used slantways;
2. Vertical rail can be reduced or increased appropriately by the requirement of customer.

Main parameter of plasma cutter

Model	Power Max 1650(Optional)
Power Voltage	3~380V
Frequency	50H/60Z
Rate input capacity	30KVA
Speed without load	0~3000mm/min
Recommend cutting thickness	3-16mm
Gas	Air or nitrogen
Cutting material	Carbon steel、Stainless steel、Al
Height control	Arc automatic height control, also can be used for flame torch

3.5 Remark and sign



Ground



Power Supply

II...A: Rated Maximum Input Current

UI...V: Rated Input Voltage

1~50/60Hz: AC 1~phase, Rated Frequency = 50Hz, Can use frequency 60Hz.

...V: Voltage Unit (Volt) ...A: Current Unit (Ampere) ...KVA: Power Unit (KVA)

IP22S: Case Protection Class. 'IP' is the code of International Protection. The first '2' mean preventing user's finger from the dangerous parts; preventing the solid material with the diameter no less than 12.5mm into the box. The second '2' means preventing water dropping vertically within 15° which is harmless. 'S' means water proof test is conducting while the movable parts are standstill.

3.6 Maintenance

Rotating parts of this machine should add lubricant every three months

Operator need a long time to rest or long out of the machine, must shut off the power to prevent motor and electrical components overheating burn.

Do an overhaul on the machine annually, check the wear of transmission parts, and adjust the gap between the transmission parts, or replacement of worn parts.

Chapter 4 Installation

4.1 Connection between longitudinal rails and rack-mounted

First, put the longitudinal rail parts out of the box, as Fig 4-1, put it on the smooth ground, the bottom of Vertical guide components is up. Install the two foot margin supporters to mounting hole of brace in the longitudinal rail, Tighten the screws up, then put foot margin supporters down, installation of longitudinal rail supporter is finished, as Fig 4-2.

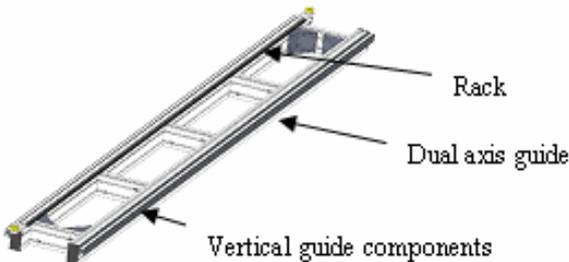


Fig 4-1

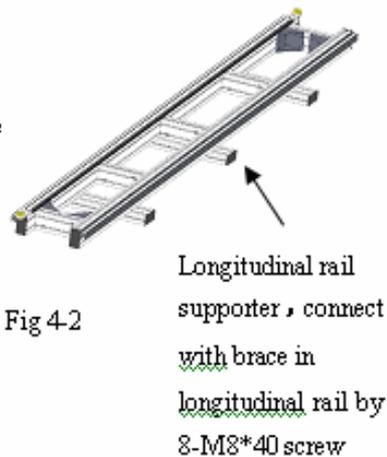


Fig 4-2

4.2 Installation between machine and longitudinal rail

First, put out the machine out of box, as Fig 4-3, Hold up the machine (No touch the slider, slider as Fig 4-3, Make the two sliders of machine and dual axis guider of longitudinal rail to be alignment (ensure straightness) , gently slide into the dual-axis guider, then gently push the machine, also slide two sliders into the dual-axis guider, gently push the machine, Make the

motor gear of machine and rack of longitudinal rail fully matched, when install the machine (The following actions shall be installed by person who is familiar with the mechanical knowledge, poor installation will lead to the damage of slider, it will cause the precision of mechanical transmission, If the precision problem caused by installation, our company is not responsible for it (Careful installation can prevent above things from happening)).

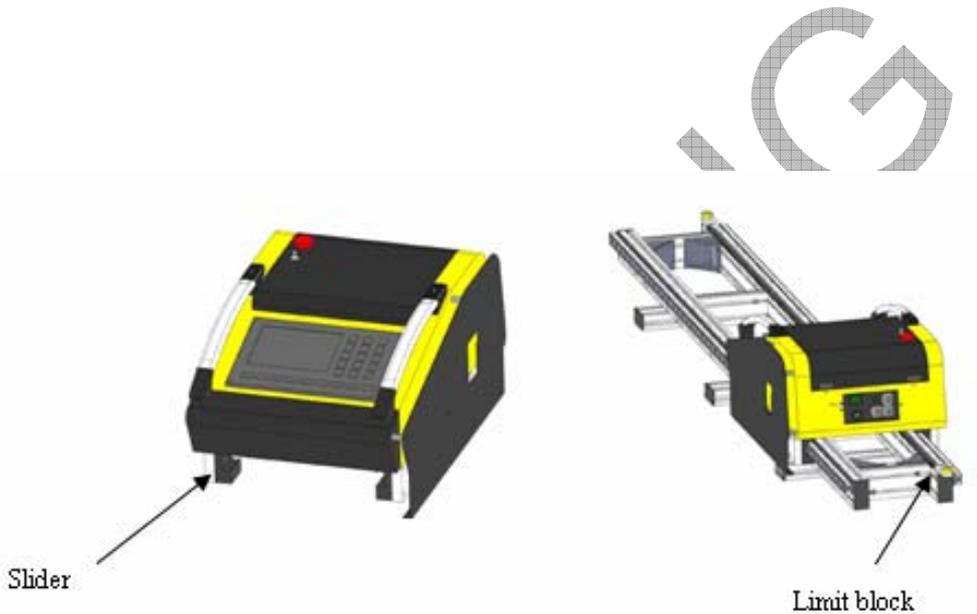


Fig 4-3 (machine part)

Fig 4-4 (mounting direction)

When install the machine, please follow the Fig 4-4, after finish installation, install the limit block as Fig 4-4, after installation of machine, gently push the machine, the machine can move smoothly then the installation between machine an longitudinal rail is finished, if not, please phone our company or seller.

4.3 Installation between beam and machine

in the beam, there are two gas pipe, torch, solenoid valve etc, so when installing, please be careful about those component. when installing beams, please ensure that the two axis slider parallel to the dual-axis of the beam guide and be vertical by side plate of machine; Note that the rack position, the rack position should be consistent with the gap of machine then put the beam into the machine, make the rack of beam and Motor elastic gear of machine completely

meshing, as Fig 4-5, Mechanical transmission structure of machine(X、 Y、 Z) is finished. Installation confirm, testing by the same way as the machine installation.

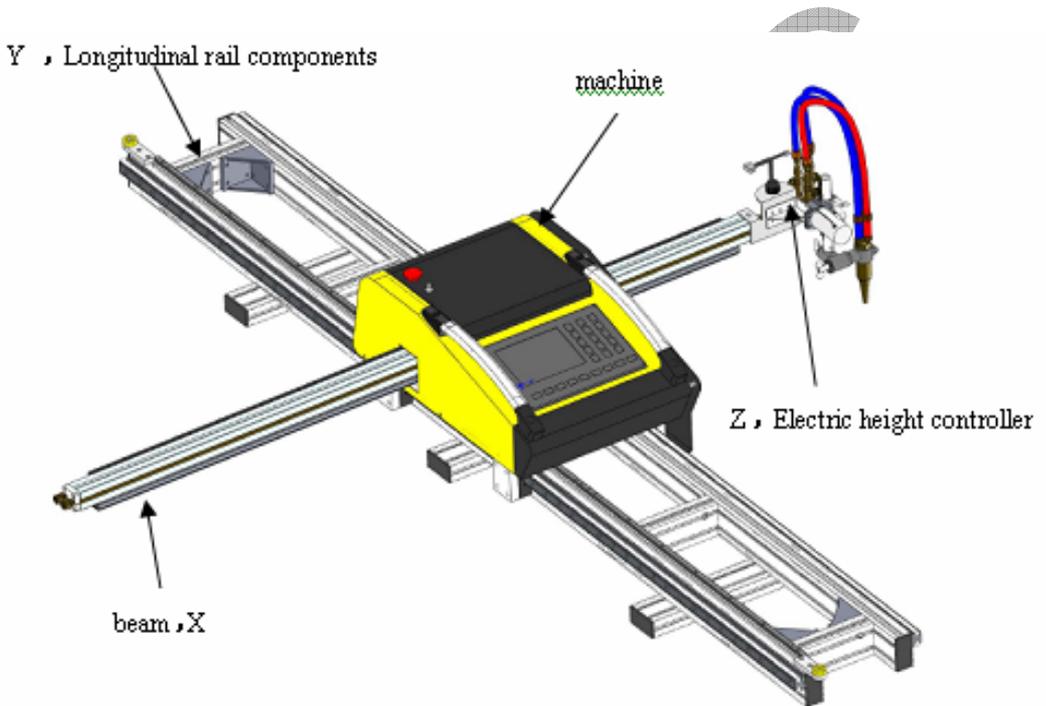


Fig 4-5

4.4 Electric height component

Electric height component can lift manually by PLC program, when cutting the long or lamellar workpiece, if find the workpiece deformation or not horizontal, then we can control the lifting of the torch directly by the button on the operating panel, more convenient than manual height control, electric height component is put in box, , Our company has finished the installation, customer only connect the cable and fasten it (Fig 4-6 is the electric height component).

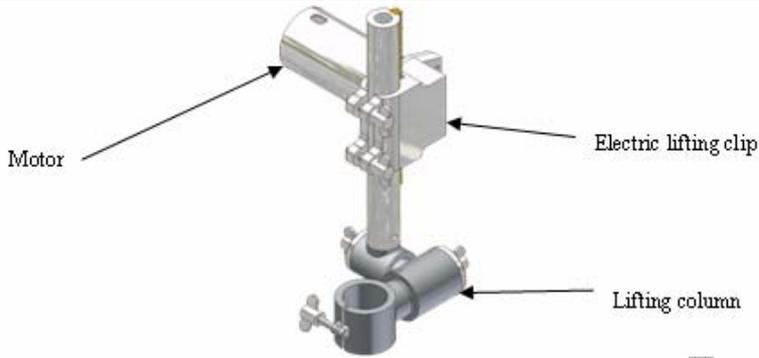


Fig 4-6

4.5 Connection between beam and electric high installation

Customer put out the torch from the box and install it as Fig 4-7

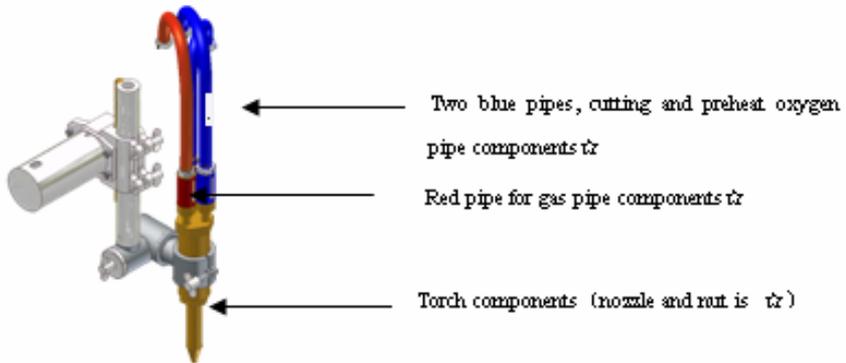
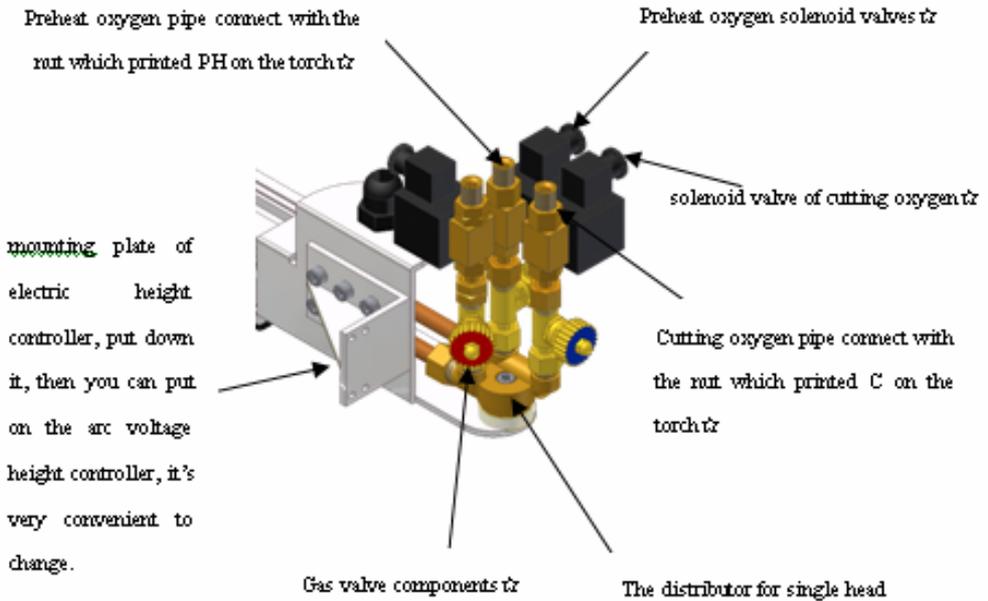


Fig 4-7 Text behind with ☆ symbol is consumable

Distinguishing method between Cutting oxygen pipe and preheat oxygen pipe: connect all the pipe well, gas test, if the gas flow is small, so it's the preheat pipe, on the contrary if the gas flow is big, it's the cutting pipe, test the crest line of torch, please adjust the fire as following steps: "turn on the gas valve and adjust the gas output to the min、 then turn on the preheat oxygen valve and adjust to the min, then ignite, generally, the fire will be on (when igniting, please be careful of the fire, don't put hands to the underface of torch, left or right offset 20-30mm is appropriate), if the fire isn't on, you can turn big the flow of the gas and oxygen. After the fire is on, please open the cutting oxygen valve(red valve in Fig 4-8)to adjust the crest line, can be adjusted accordingly by the thickness of workpiece (the adjustment of cutting crest line required considerable work experience, recommend to find professional person to

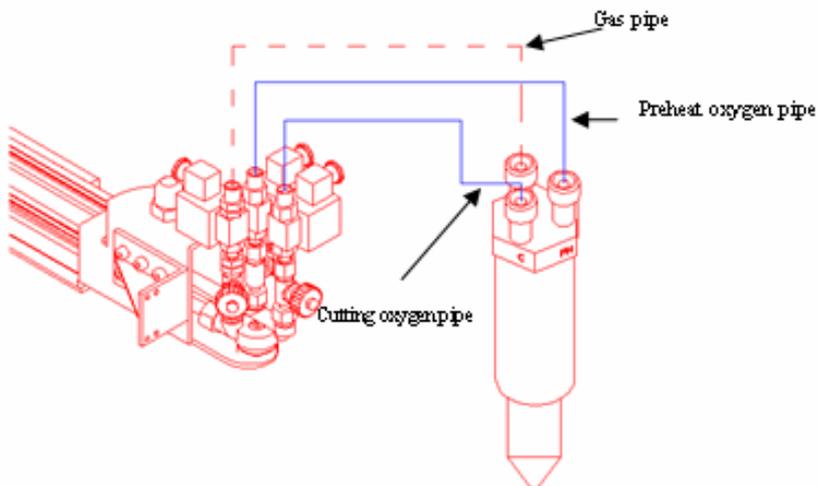
debug, above method is only for reference.) ” Fig 4-8 show the connection.



Connection between Gas valve and gas tube assembly is a left hand thread

Fig 4-8 Text behind with ☆ symbol is consumable.

Following picture is the Connection diagram of torch pipe, gas pipe, preheat pipe, cutting pipe and connection of beam. In strict accordance with the drawing of connections to connect, to avoid connection errors, resulting in not cutting, and other issues.



Connection method between beam and electric height component, user take out the beam from the box, Fig 4-9, Fig 4-10.

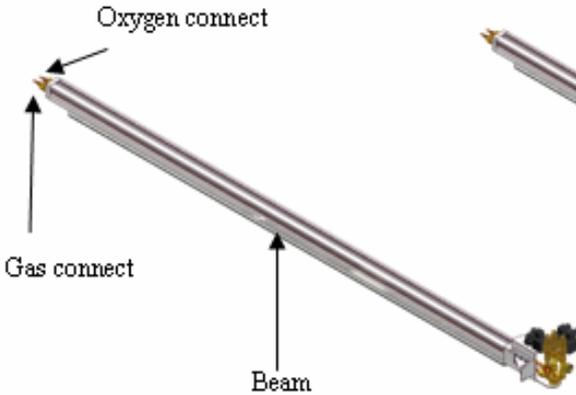


Fig 4-9



Fig 4-10

After all parts connect well, choose the nozzle by the thickness of workpiece, adjust the pressure of oxygen, gas and air to prepare to cut.

4.6 Installation between beam and height controller

The following Fig 4-11 show the connection of flame torch with capacitance height controller, 2-core connector (NO.②) is hang in the air, pipe connection as the Fig 4-10.

If customer want to use the plasma torch, please take off the flame torch (No ③), put the plasma torch into the holder (No ⑤), adjust the verticality of torch, No ⑥ is the thermal baffle, how to change the parameter of height controller after change the torch, please see chapter 7 THC Introduction.

If customer want to use the flame torch with electric height controller, please take off the 15-core connector (No ①), the height controller (No ④), and take on the electric height component, connect with 2-core

connector (NO.②), as the Fig 4-5.

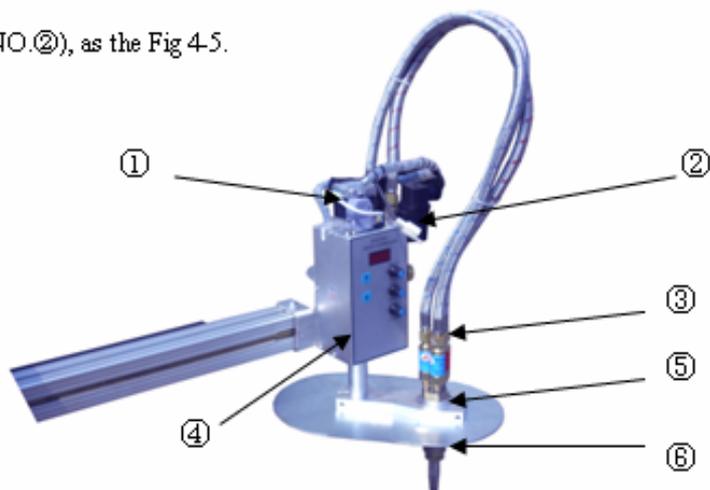


Fig 4-11

Notes: the height controller (No ④) has two modes: capacitance height control and arc voltage height control.

If customer want to use the plasma torch, please take on the **Voltage Dividing Plate** into the machine, as

Fig 4-12.

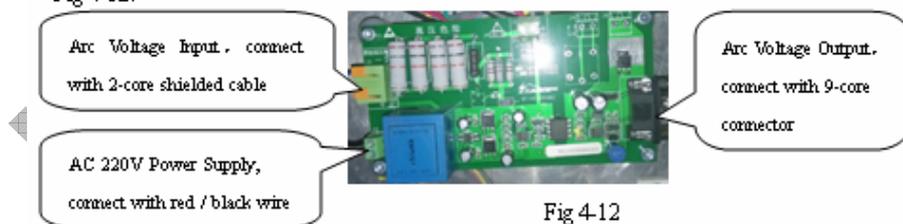


Fig 4-12

The Voltage Dividing Plate use only for plasma torch, flame torch do not use!

4.7 The port of machine shown as Fig 4-13



Fig 4-13

* 3-core connector: used for connect with plasma arc voltage output;

If the machine has flame cutting function only, the port do not connect, if the machine has plasma cutting function, please connect with the 3-core plug(as Fig 4-14) which is our company offered, and pay attention to the polarity;

* 4-core connector: used for connect with plasma start and xfer signal;

If the machine has flame cutting function only, the port do not connect, If the machine has plasma cutting function, please connect with the 4-core plug(as Fig 4-14) which is our company offered;

* 12-core connector: used for connect with height controller; please connect with the 12-core cable(as Fig 4-15) which is our company offered, the outlet beginning and end up to the beam(as Fig 4-16) and machine (as Fig 4-13) .



4-14



4-15



4-16

Chapter 5 Controller Introduction

5.1 Summarize

The digital controller HG 612 is a new production, which is integrated many merits of the same productions at home and abroad. The controller can control the motion of two axis, which is apt to the application of flame or plasma cutting. This controller is very light and handy and it is very easy to operate. The controller provides menu or illustration for all the operations for the convenience of users. All key switches are human oriented designed, and they are very convenient and comfortable.

5.2 System board and main interface

5.2.1 Introduction of operating board



Fig5-1 board and keys

- 【F1】 - 【F8】:** Function key in different interface
- 【S ↑ /PgUP】:** page-up key of code interface or Torch up in other interface
- 【S ↓ /PgDn】:** page-down key of code interface or Torch down in other interface
- 【F+ /HOME】:** Accelerate or skip to the head of code line
- 【F- /END】:** Decelerate or skip to the tail of code line
- 【1】 - 【9】:** during the cutting process, change the cutting speed to ratio of the speed limit you have set, for example press **【1】** , change the cutting speed to 10% of the speed limit you have set, press **【2】** , change the cutting speed to 20% of the speed limit you have set

5.2.2 Power on process and main interface

When power just on, the system will go for the process of self scan:

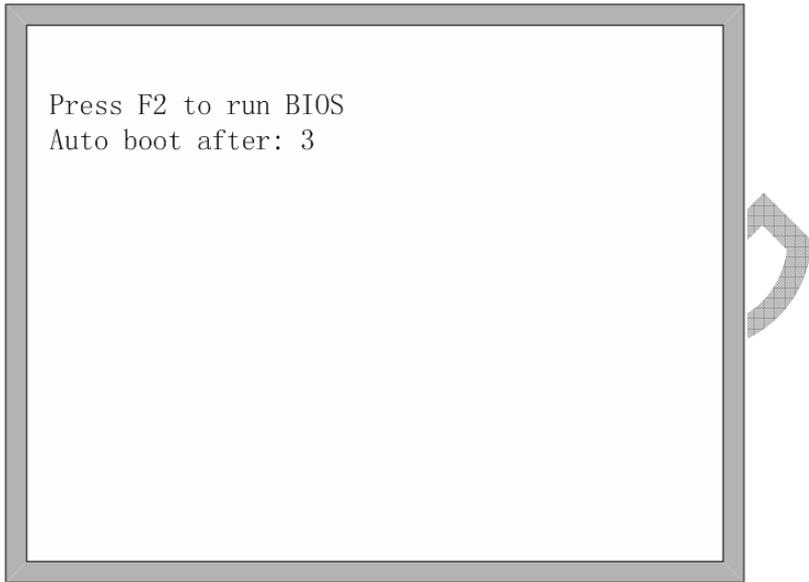


Fig 5-2 system self scan

In the starting process, there is 3 seconds to countdown, before the countdown is over, if pressing **【F2】**, it will enter the bios starting interface shown as Fig5-3 (please take the reference of the appendix 2 to run bios). If pressing any other key, it will jump over the countdown and directly enter the welcome interface. If pressing no key, it will countdown to 0 and then enter the welcome interface shown as Fig5-4.

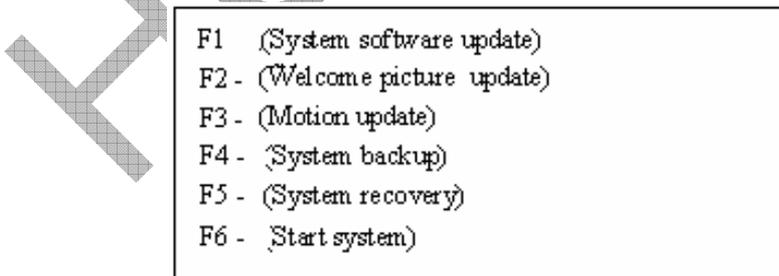


Fig 5-3 bios interface

SINCE 1958

THE FIRST CUTTING EQUIPMENT COMPANY IN CHINA



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HG612B

Fig 5-4 welcome interface

In the welcome interface, press any key to enter the main interface automatically shown as Fig5-5:

FLSK F2100B Version 3.3.73.1	Speed: 00000	File: SHAPE_43.TXT	Status:	Current Line/Hole: 00000/00000
			● Ignition	s
			● LowPreheat	s
+X:500.00 -X:0.00 +Y:500.00 -Y:0.00			● HighPreheat	s
			● Pierce 1	s
00001: (TEST PATTERN) 00002: G92			● Pierce 2	s
			● Pierce 3	s
F1 ShapeLib F2 Files F3 PartOption F4 Setups F5 Diagnose F6 ZoomIn F7 ManualMove F8 Zero			● TorchUp	s
			● TorchDn	s
X: +000000.00 Y: +000000.00			● THC En	s
			● Exhaust	s
CutSpeed [X] 1000.00 Kerf [Z] 1.20 ManualSpeed [Y] 3000.00 Angle 0.00			Manual [F] keepMov StepMov ContiMov	
			StepDis [G] 5.00 Flame Cu [G]	

Fig 5-5 the main interface

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

【F1】: ShapeLib: pressing F1 to enter the Shape Library including 45 common shape, and most of them have plate size and hole size.

【F2】: Files: You can load local files, U disk files or edit, import, export and delete codes.

【F3】: PartOption: make actions of mirroring, rotation, plate adjusting, plate arraying, selecting row and hole or code edition etc.

【F4】: Setups: setting all parameters.

【F5】: Diagnose: including input ports diagnosis, output ports diagnosis, keyboard diagnosis, system self check, date setting and system self defines.

【F6】: ZoomIn: Zoom in the shape in full screen.

【F7】: ManualMove: Manually move the machine.

【F8】: Zero: Clear the coordinate of X and Y before starting cut or after cutting over.

【X】: CutSpeed: Setting the cutting speed.

【Y】: ManualSpeed: Setting the manual moving speed.

【Z】: Kerf: Setting the kerfs' compensate value.

【F】: Manual: Setting the mode of manual movement including keepMov(keep movement), StepMov(step movement), ContiMov(continue movement). The selected mode is black background.

【G】: StepDis: Setting the distance of the fixed-length.

【M】: Selecting the cutting mode including Flame Cu(flame cutting), Plasma C(plasma cutting), Demo run.

5.2.3 Function index of main interface

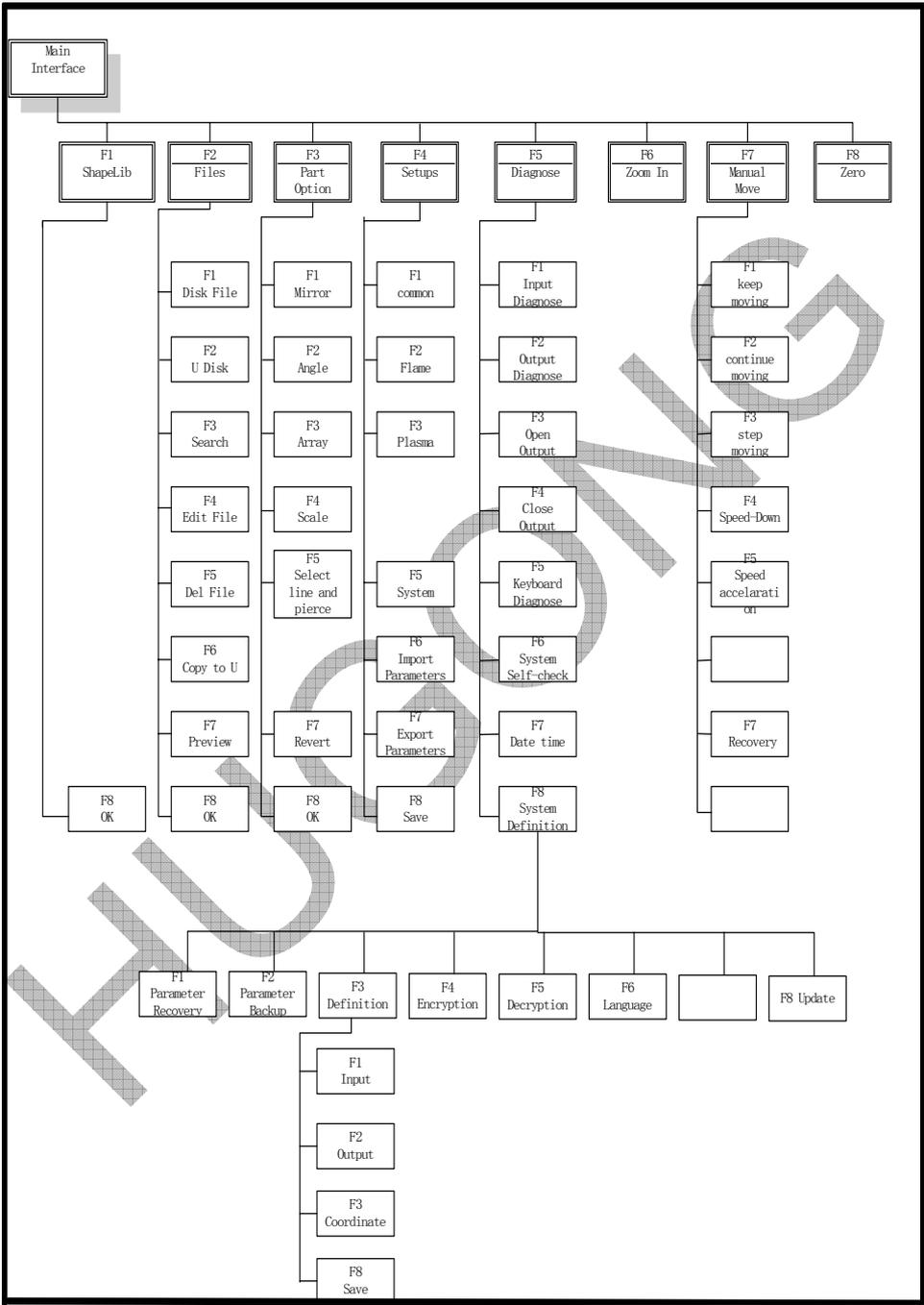


Fig 5-6
23

5.3 Cutting function

In the main interface, press the **【SPACE】** to enter the cutting interface, shown as follows:

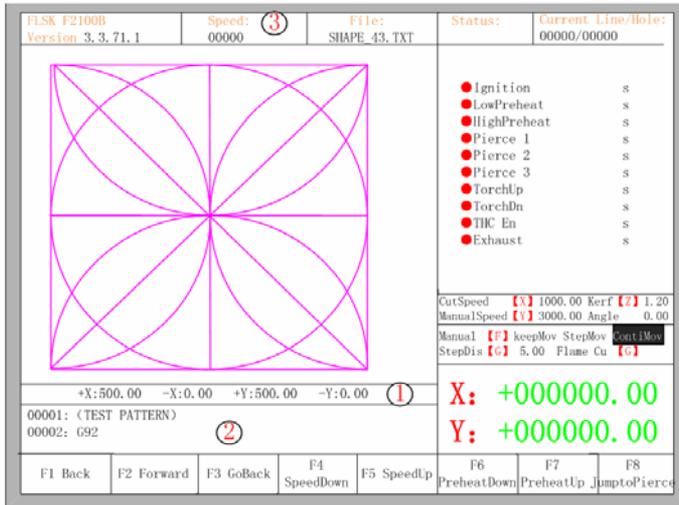


Fig 5-7 cutting function interface

Show the current workpiece's cutting path, including the slotted value.

Show the G-code being processed, shows the current and next line.

Show the current cutting speed, during processing, you can press the keyboard's number keys **【1】** - **【9】** to achieve quick speed regulation. For example, press the number **【3】**, the speed is automatically adjusted to 30%; press the number **【8】** the speed is automatically adjusted to 80%.

X shows the absolute coordinate of the torch in X direction.

Y shows the absolute coordinate of the torch in Y direction.

In the cutting interface:

- Press **【X】** : Modify the current maximum cutting speed.
- Press **【Y】** : Modify the current maximum speed manual shift car.
- Press **【F】** : Change the current manual method.
- Press **【G】** : Modify the current fixed-length fixed long-distance move.
- **【START】** (**【F9】**): Start cutting.
- **【STOP】** (**【F10】**): Parking, the system can suspend all ongoing actions.

- **【F1】** :The torch move back along the cutting path(I / O port closed)
- **【F2】** : The torch forward along the path (I / O port closed).
- **【F3】** : Return to the starting point of cutting torch, i.e. the starting point of the current work piece.
- **【F4】** : Decrease the cutting speed, each decrease of 1% click rate.
- **【F5】** : Increase the cutting speed, each 1% increase in click rate.
- **【F6】** : Reduce the preheat time, skip the remaining preheat time, and the system automatically records preheat time.
- **【F7】** : Increase the preheat time once 15 seconds.
- **【F8】** : When the system is suspended, for selecting perforation point; when the system begins to move, for the dynamic amplification.
- four direction keys (Up, down, left and right): When the gun through, manually move the torch.

5.3.1 Index of cutting operation

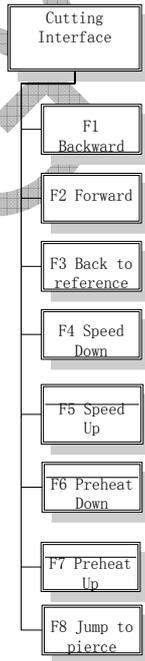


Fig 5-8 Automatic operation index

5.3.2 Speed regulation

5.3.2.1 Normal speed regulation

In automatic operation, or when the system is suspended, in the cutting interface the system can regulate speed.

The operation panel, press **【F5】** or **【PRE】**, increasing at a rate per click rate of 1%. Hold the **【F5】** or **【PRE】**, then the rate will continuously increase to 100%. Increased to 100%, the speed is "common parameters" in the "cutting speed."

The operation panel, press **【F4】** or **【NEXT】**, each click rate of speed reduced by 1%. Hold the **【F4】** or **【NEXT】**, then the rate will be continuously reduced to 1%. Reduced to a very slow speed when running in order to ensure the accuracy requirements, the system may auto-adjust the speed based on the size of "horizontal pulses" and "vertical pulses", actual speed may not be the "cutting speed" of 1% is greater than 1%.

5.3.2.2 Quick speed regulation

In automatic operation, or when the system is suspended, in the cutting interface the system can carry out quick speed regulation.

In the cutting interface, on the operation panel, press the number keys **【1】** - **【9】**, the speed will quickly adjust to the corresponding percentage figures 10 times, for example press **【3】**, adjust to 30% of the speed limit you have set, press **【8】**, adjust to 80% of the speed limit you have set.

5.3.3 Forward

In the automatic function interface, press key **【F1】**, the machine start to move without real cutting. The process does not include any ignition, perforation and any other I/O working. The machine just moves the torch according to the graphic figure.

The function can be used to check the trail and code before you start the real cutting process, or can also be used when the process needs through the gun. Press the red "STOP" key to stop the null cutting process if you want.

5.3.4 Backward

During the running process, if you want to go backward according to the origin trail to (maybe the iron board was not cut through), you can follow the following direction:

- First, press "STOP" key to set the machine at pause status.

- In the automatic function interface, press key **【F3】** (Back) to make the machine go backward along with the original trail. When the torch reaches the position you need, press “STOP” key to stop it. You may press key **【F2】** to go forward if the machine just went back too much.

Notice: Go backward or forward function can be used repeatedly to make the machine reach an ideal position.

- When the torch reaches the position you need, press “START” key again, if the current cutting code is G01, G02 or G03, system will automatically perforate before performing these procedures, and then continue the current program, if the current row is not G01, G02 or G03, the system will directly continue the current line program.

5.3.5 Edge cutting / offset cutting / return

When the torch is not on the actual path of the current work piece, it will prompt as follows:

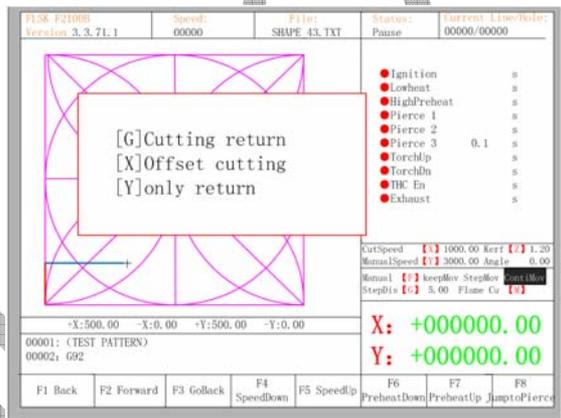


Fig. 5-9 edge perforation

There are two reasons led to this situation:

- (1) When the common parameter "edge perforation" selects "Yes" and the next processing line G-code is M07, the system will be automatically suspended. At this time, the torch can be manually moved to any edge of the plate, press the "start" button, the system will prompt as above

- (2) When the processing is paused, due to mechanical failure or other reasons, it needs to

move the torch out of the actual path of the workpiece, the above prompt will appear.

- If press **【G】**, the system cutting returns back to the paused point, continue to cut it. This feature is particularly useful for thick steel plate, it can reduce the preheat time and increase cutting efficiency. This function is the commonly-used edge perforation function.
- If press **【X】**, the system considers current point is the paused point, it will continue cutting it. That is, the system offsets the cutting point. When the cutting machine paused or a power outage, if the cutting tip or steel plate with the pan has been offset, or the user would like to think that is offset cutting, you can press this button.
- If press **【Y】**, The system only return to the paused point quickly, and then break off. During the cutting process, if discovery cutting torch malfunction, or other issues, need to move the cutting tip out of cutting region to overhaul. After the maintenance, this key can be pressed. Then return to the paused point, press the "start" button, the system automatically continues to cutting.

5.3.6 Back to Reference Function

Pause in the processing, if press the **【F3】**, then the system will prompt:

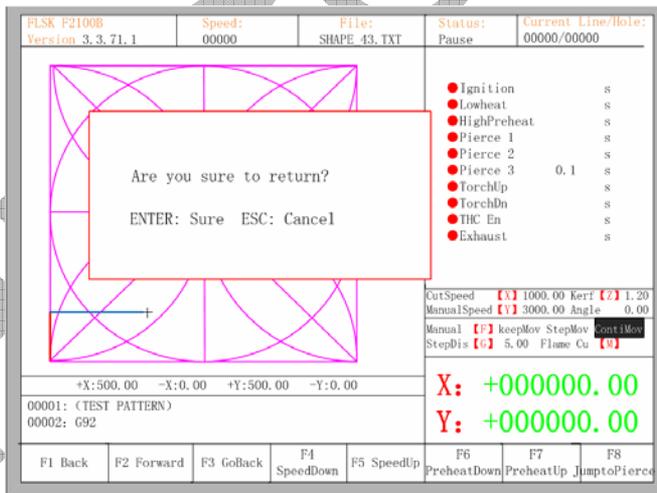


Fig. 5-10 return reference prompt

Press the Enter key, the system will automatically return to the starting point of the work piece, and then the system automatically switches to processing the main interface, and waits for further user action.

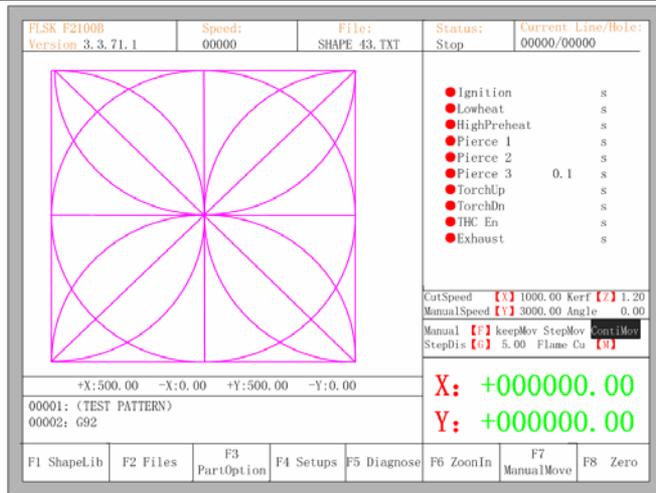


Fig. 5-11 main process interface

During the return process, the user can press the "Stop" button to stop the operation, and can continue to return operation after pressing of **【F3】**. Number of back to reference and stop has no limit.

5.3.7 Oxygen gas preheat time regulation

- In the preheat process, press the START (F9) key to skip the process of preheat and perforation delay, and immediately open the perforation signal then begin to cut.
- In the preheat process, press the stop (F10) key to stop preheat, waiting for the F9 key is pressed again.
- In the preheat process, press the F6 key then the preheat time will be reduced to the current preheat time spent, and skip the process of preheat and perforation delay, and open the perforation signal then begin to cut..

For example: the original system sets the preheat time of 60 seconds after null cutting, when preheat needed, the interface will count down, under normal circumstances, till 0, the system begins the next step of cutting, but if the system has the remaining 10 seconds of countdown time, press F6, then the system immediately stops preheat to begin the next step of cutting, and records the preheat time of 50 seconds, the system automatically thinks that users need preheat time of 50 seconds, the next preheat after the null cutting when the preheat time becomes 50 seconds.

● In the preheat process, each press the F7 key, preheat time increases by 15 seconds, and the preheat time maintains the increased value.

For example: The original system sets the preheat time of 60 seconds after the null cutting, during the system countdown, each press F7, on the interface the countdown increases by 15 seconds, and the next time you need to preheat, the initial preheat time be 75 seconds.

5.3.8 Perforation point selection

Before you start cutting or cutting is paused, the function key prompt F8 is "select new pierce", then press F8, the system will prompt:

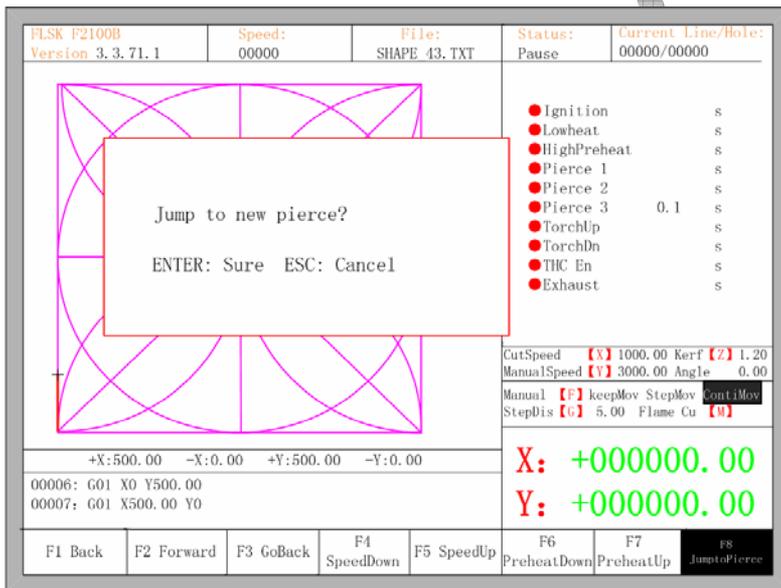


Fig. 5-12 select new pierce

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

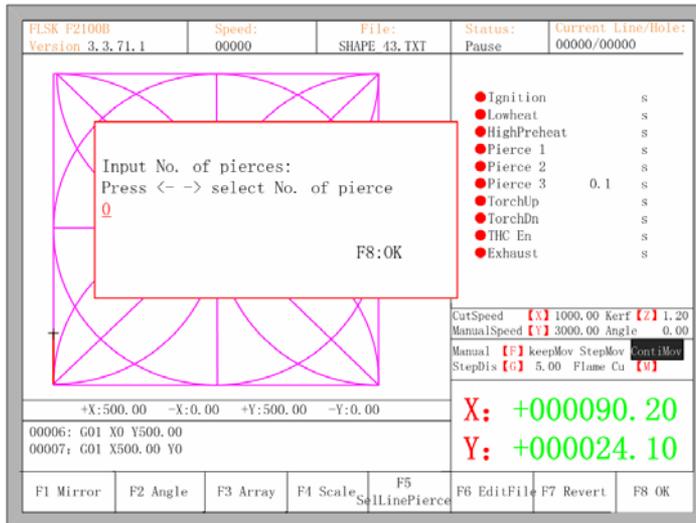
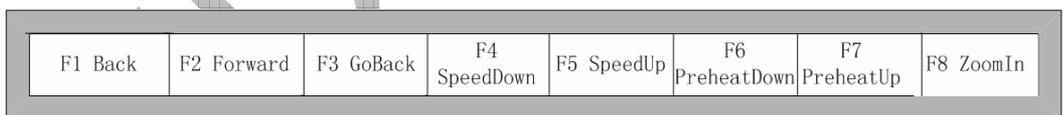


Fig. 5-13 pierce prompt

pierce point can be input manually at this time. You can also press ESC to exit without manual input perforation point, and then press the left and right arrow keys to select the perforation point.

5.3.9 Dynamic amplification

After the start of cutting, the F8 in the cutting interface will become "dynamic amplification", then press the F8 key, full-screen amplify the processing graphic, and dynamically tracking.



- Press the F8 key continuously, the system will progressively amplify graphic.
- Press ESC to exit the amplified display, back to the cutting interface.

5.3.10 Cutting exit

When the cutting operation does not get finished, and the cutting machine also being in the pause condition, if press **【Esc】**, the system will query whether quit the cutting operation. If pressing **【Enter】**, the system will exit, and if pressing **【Esc】** the system will not exit, get into the automatically interface and go on with the cutting operation at the current place.

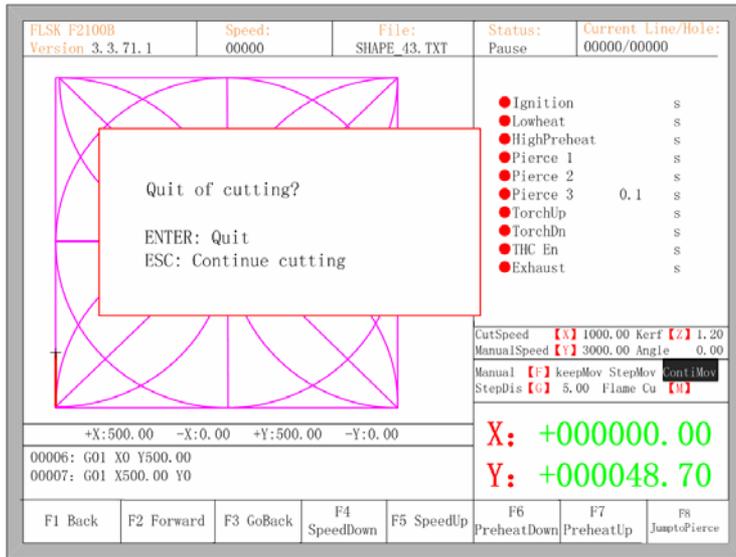


Fig. 5-14 Quit of cutting

5.3.11 Go Frame

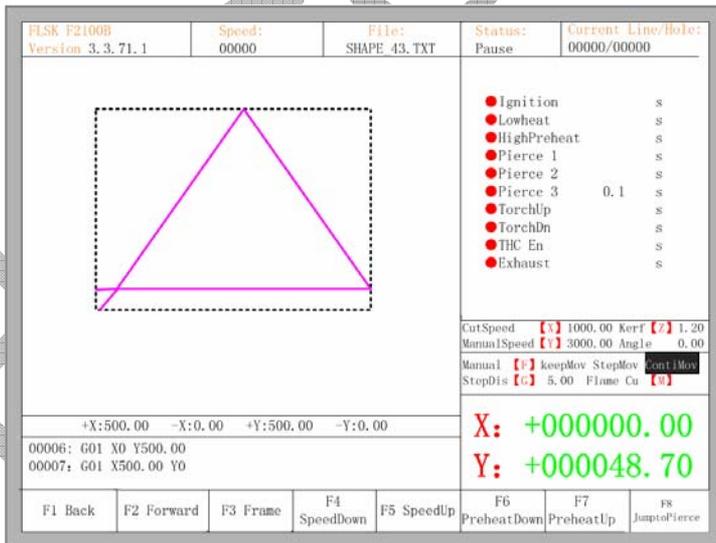


Fig 5-15 Frame test

Before working, Press Space key to enter the cutting interface, Now F3 is Frame test function. The controller will go along the frame. Start point is at left and bottom.

5.4 Part options

Before starting cutting, you can use “F3 PartOption” in the main interface. Press F3 to enter part options menu:

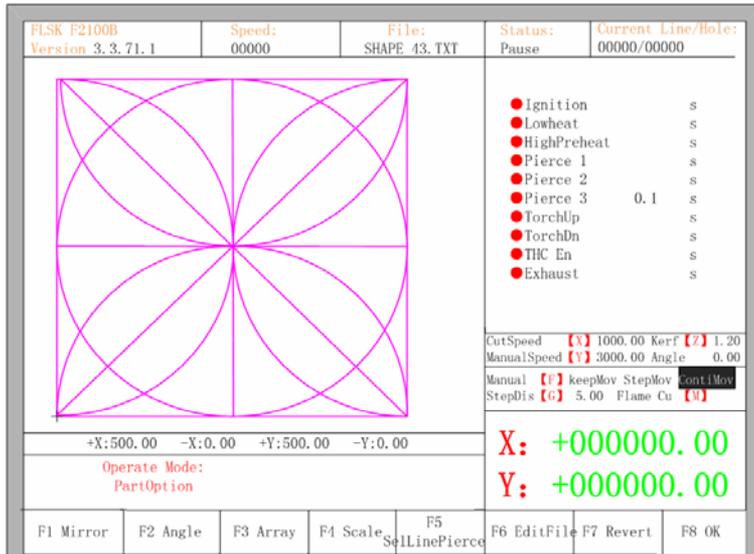


Fig 5-16 Part options

5.4.1 XY mirror

Press F1, the system will prompt:

F1 Xmirror
F2 Ymirror

- Press F1 to mirror along the horizontal axis(X axis)
- Press F2 to mirror along the vertical axis(Y axis)
- Press ESC to exit mirror operation

5.4.2 Angle adjustment

Press F2, the system will prompt:

F1- Steel plate adjust
F2- enter angle

- Press F1 to adjust steel plate
- Press F2 to enter angle directly
- Press ESC to exit angle adjusting

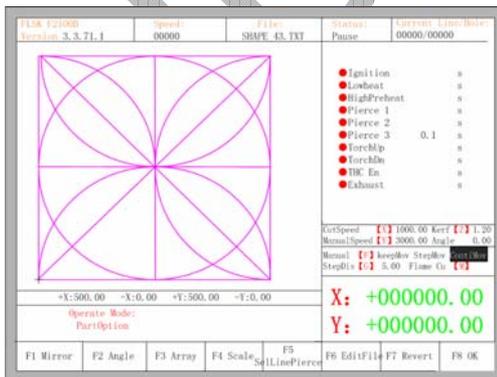
5.4.2.1 Steel plate adjustment

After entering steel plate adjustment menu, the system will prompt:

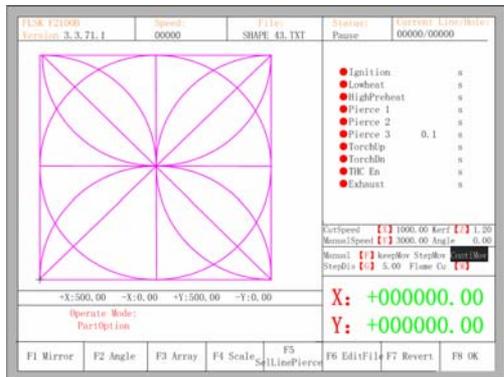
F1- Steel plate adjust
F2- enter angle

Here, you can manually move the cutting tip to the edge of one side or a corner of the plate. When the cutting tip moved to a good position, press **【X】** key to set the current point as the starting point of correction.

And then manually move along the cutting tip, as long as moving to the edges of the side. After ensuring the two points far enough and two points at the same side of the plate in the same line and press **【Y】**. The system will automatically calculate the current offset angle of plate, and then automatically rotate graphics.



Before adjusting



After adjusting

After adjusting, the system will ask whether to return to the start point, if press [ENTER], the system will back to the start point of the operation, if press [ESC], the system will do nothing but go back to the graphic interface.

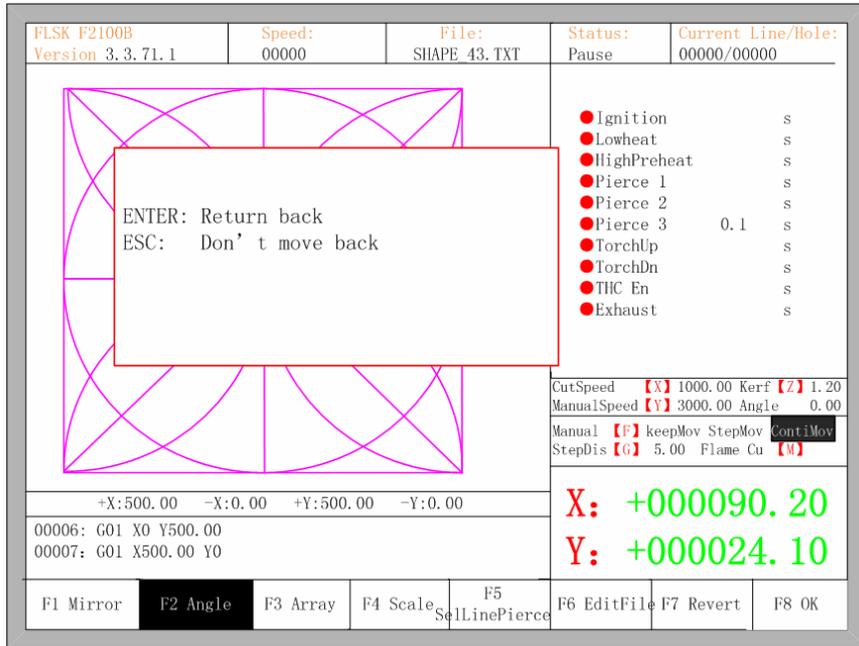
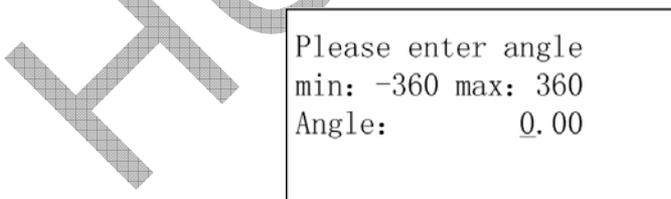


Fig5-17 Return to the start point after adjusting

5.4.2.2 Enter angle

When the angle of the current work piece is known, you can enter the angle:



Enter angle

After manually enter the angle, press [ENTER] to make sure, the graphic will be rotate with the corresponding angle. Positive angle means rotate in counterclockwise, while negative means clockwise. Press [ESC] to exit angle adjusting.

5.4.3 Array

In the part options menu, press [F3], the system will prompt as Fig 5-18, there are three ways to arrange, arrange in matrix, staggered arrange, arrange in stack.

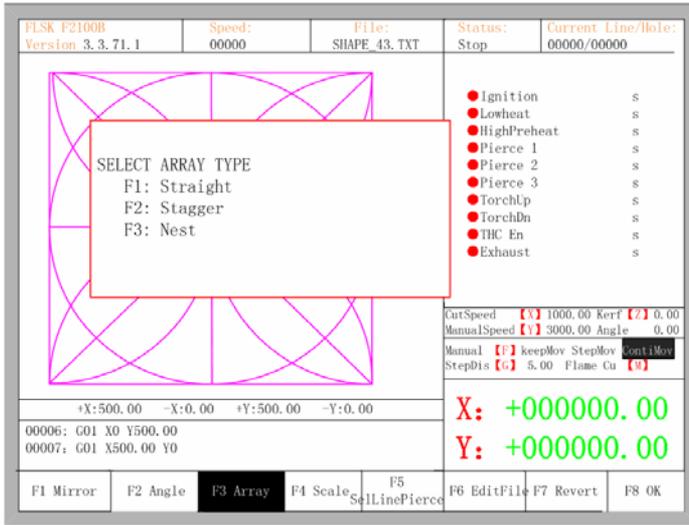


Fig 5-18 chooses arrange method

Press [F1] to carry on arranging in matrix:

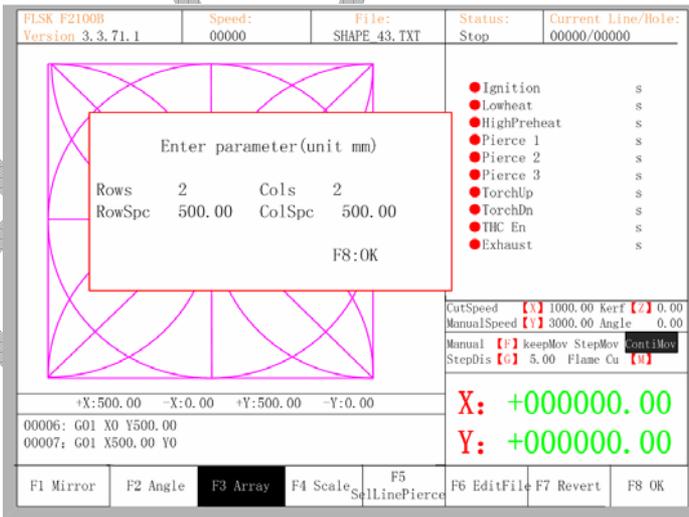


Fig 5-19 arrange in matrix

The result is shown in fig 5-20

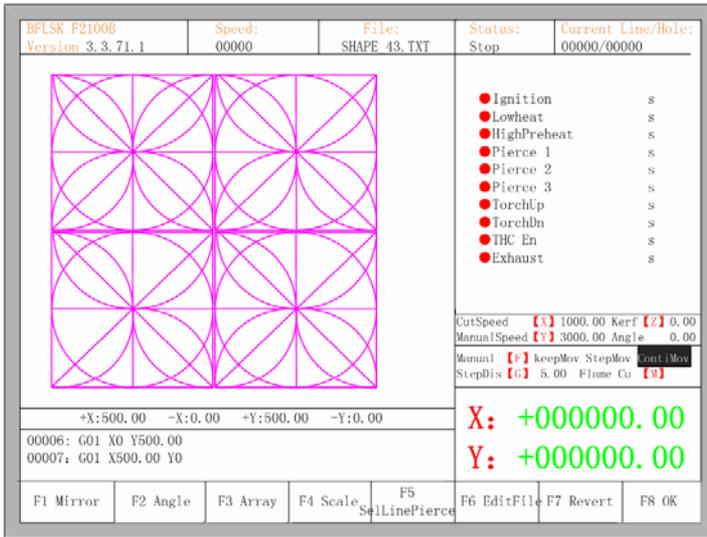


Fig 5-20 result of arranging in matrix

Press [F2] to enter staggered arrangement:

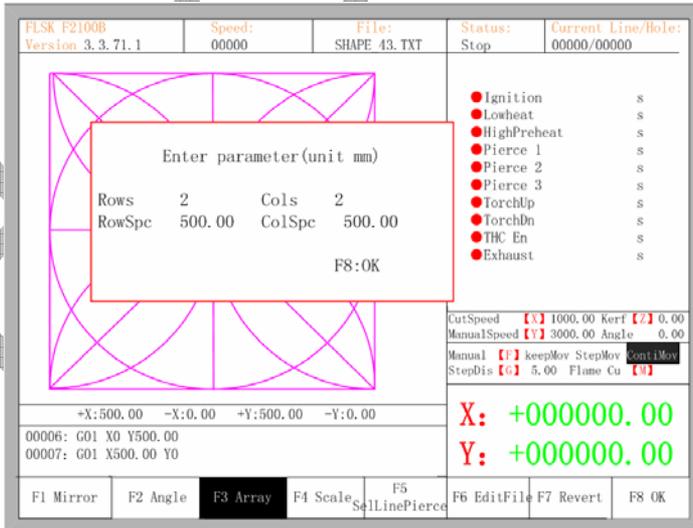


Fig 5-21 staggered arrange

The result is shown in fig 5-22:

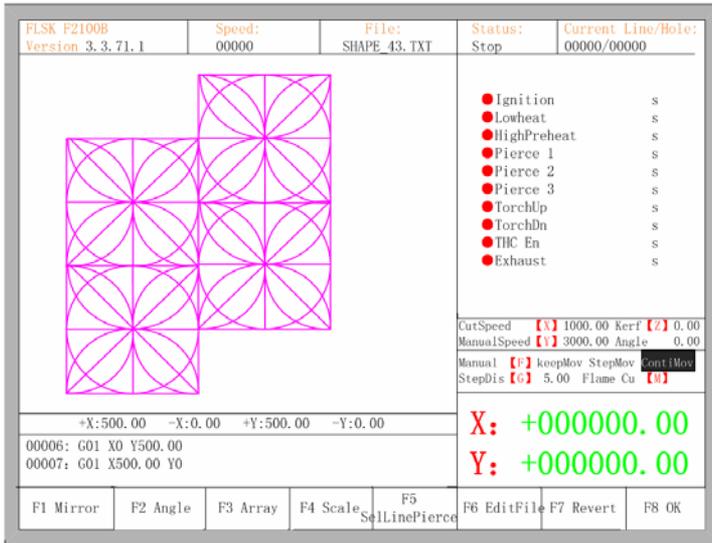


Fig 5-22 result of staggered arrangement

Press [F3] to enter arrangement in stack:

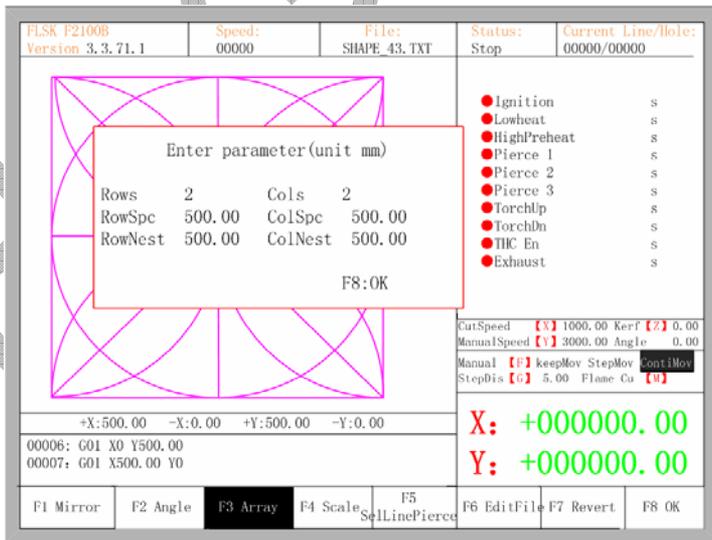


Fig 5-23 arrange in Nest

The result is shown in figure 5-24:

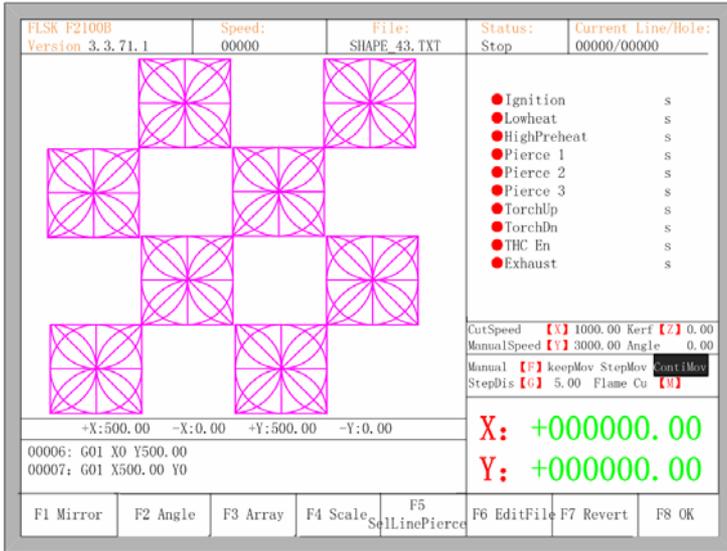


Fig 5-24 result of arrangement in nest

5.4.4 Zoom in/out

In the part options menu, press [F4] (zoom in/out), the system prompt as figure 5-25:

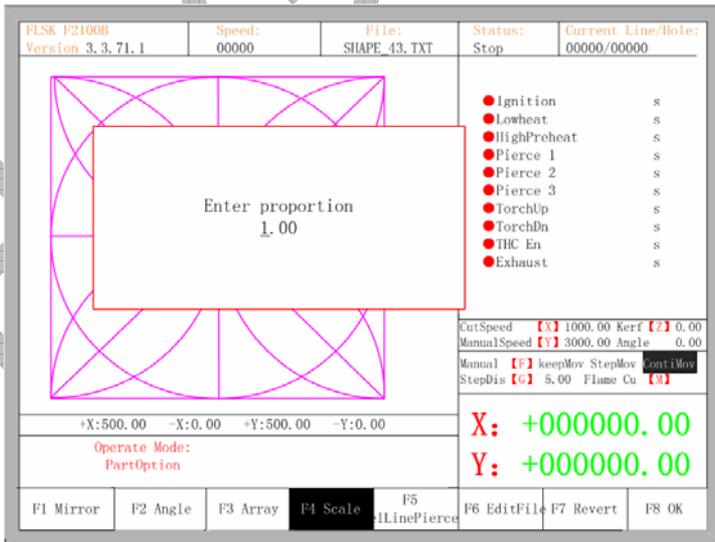


Fig 5-25 set scale

After entering the scale, press [Enter], then the system will automatically zoom in or zoom out the graphic when the parameter is checked to be correct.

5.4.5 Select row/number

In part options menu, press [F5] to enter selecting row/number, the system will prompt:

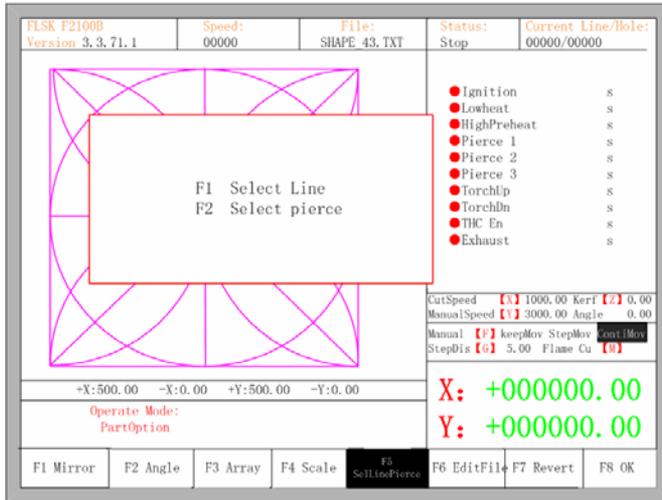


Fig 5-26 select Line/Pierce

5.4.5.1 Select row

Press [F1] to select the number of row to start cutting with, the system prompts:

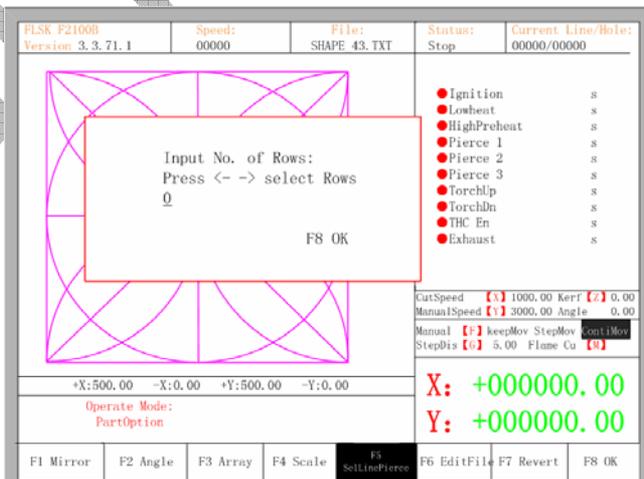


Fig 5-27 prompt to select row

Here , you can directly enter the row number or press ENTER to enter the interface and press ←or→to select row.

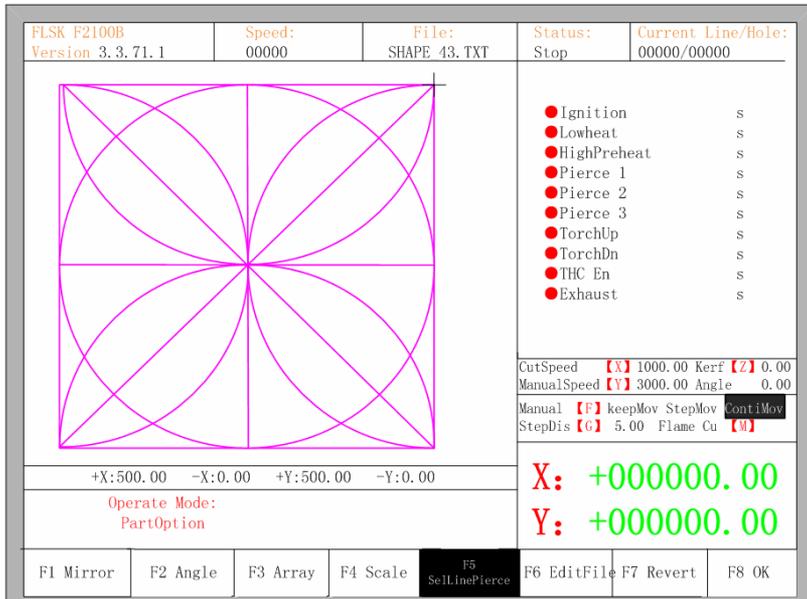


Fig 5-28 select row

After selecting row, press F8 to confirm.

5.4.5.2 select number

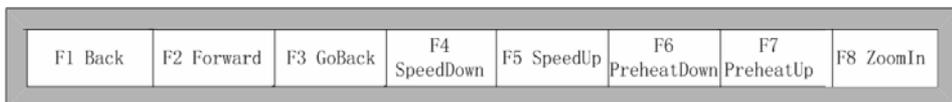
The operation is similar to the choosing row operation.

5.4.5.3 operation after select row/number

After selecting row or number, press F8 continuously to exit to the main interface. Press SPACE to enter the cutting interface, there are two kind of operation:

1 move from current position to the new position and then cutting

- Press F1 in the cutting interface, the system will directly run to the position of the selected row or number without cutting, then pause and wait for the next operation.



- Press START in the cutting interface, the system will prompt:

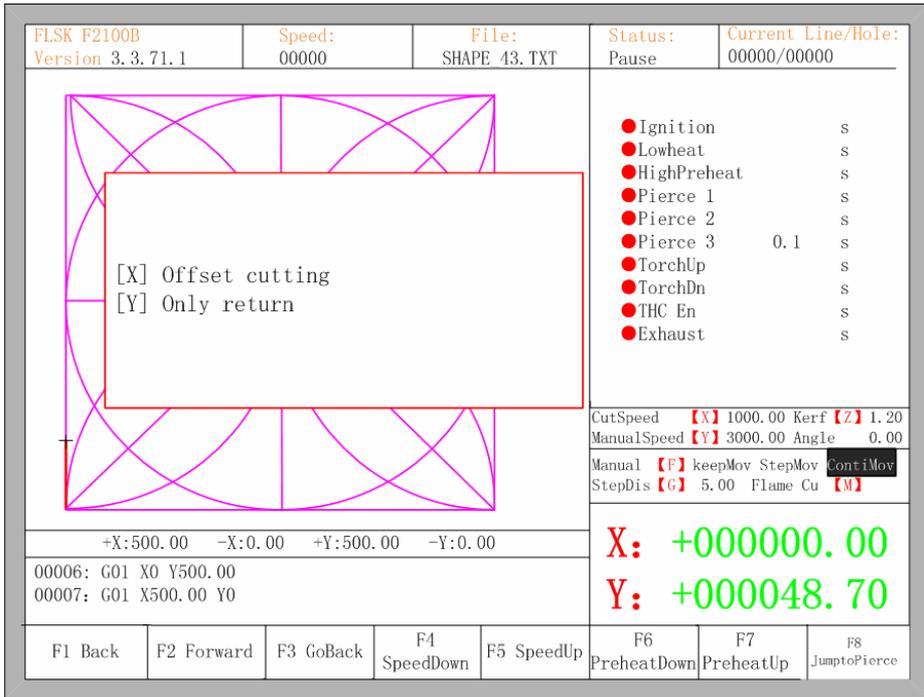


Fig 5-29 operation after selecting row/number

Press Y, the system will also directly move to the selected row and number, then pause and wait for the next operation.

2 Cutting from the current position

After the prompt of Fig 5-29, press X, then the system will start cutting from current position.

5.4.6 Restore

If you want to cancel all of operations with graphics including mirror, rotation, adjust, scale and array, press [F7] in the part options menu, the system automatically revert to original state of the graphics.

5.5 Manual function

In the automatic interface, press **【F7】** (Manual) to enter manual function interface, shown as Fig 5-30:

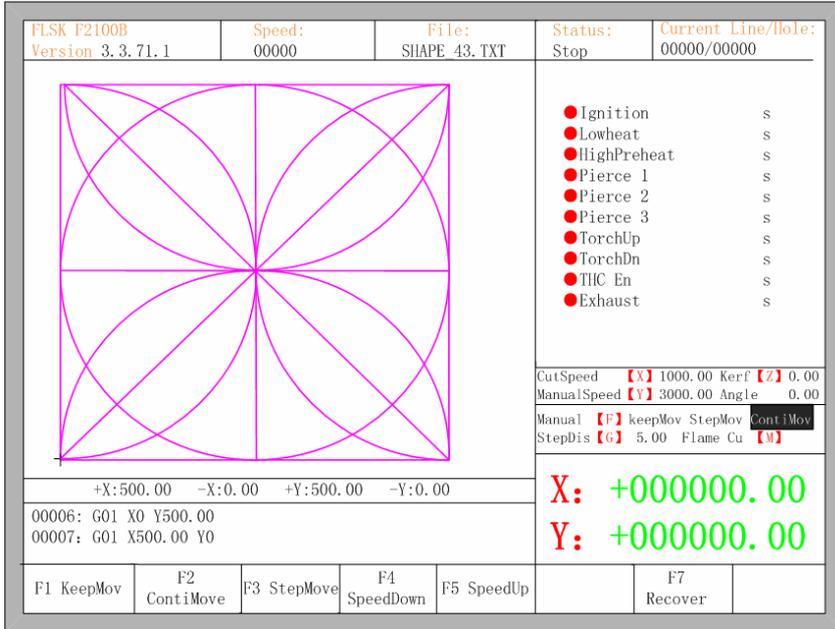


Fig 5-30 manual function interface

The speed in the manual status is controlled by the manual moving parameters. During the process of fixed moving function, you can adjust speed by acceleration or deceleration key. In the manual interface, press numeric key, the cutting speed changes to ratio which is 10 times of the corresponding figure of the speed limit you have set, for example press **【3】**, change the cutting speed to 30% of the speed limit you have set, press **【8】**, change the cutting speed to 80% of the speed limit you have set.

5.5.1 Fixed moving function

When you enter into the manual interface, the default option is continuous moving function. Press key **【F1】** to go for the fixed moving function. At this moment, the system will move toward the specified direction if any directory key is pressed, and when the directory key is released, the system will stop.

5.5.2 Continuous Moving Function

When in the manual interface, press F2 to enter the continuous-moving function interface. At this moment, the system will move toward the specified direction if any directory key is pressed and then released, and when the directory key or stop key is pressed the system will stop.

5.5.3 Fixed-length moving

In the manual interface, press F3 to enter the interface of fixed-length moving,. The system prompts to input the fixed length:

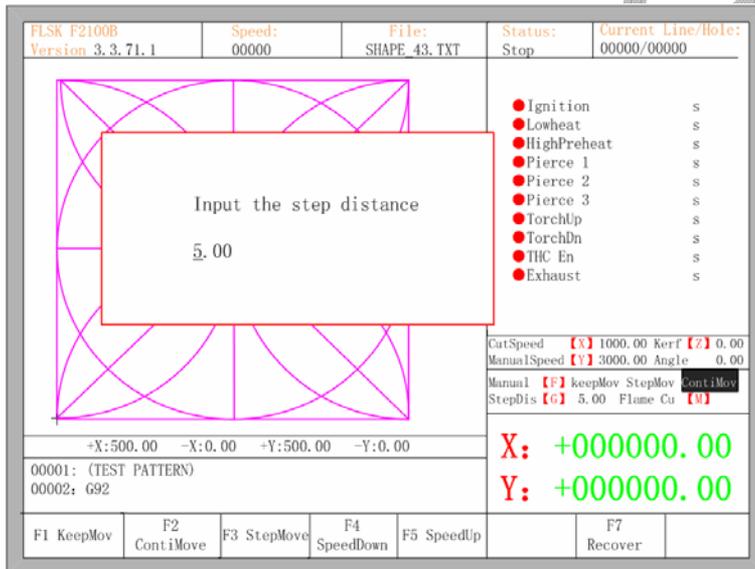


Fig 5-31 Input the fixed length

After inputting the fixed length, press ENTER. Press any direction key and then release, the system will move the fixed length toward the direction, in the process of moving, when any direction key or stop key is pressed, the system will stop moving.

5.5.4 Breakpoint recovery

To guarantee that the breakpoint could work correctly, you need to satisfy the following conditions:

1. When the system is paused, the system will automatically regard the paused point as the current breakpoint and remember it.
2. When the system is in the process of incising, the breakpoint signal is connected with the

urgent alarm input, when power is off, the system will regard the power-off point as the breakpoint and remember it.

When you need to process after the breakpoint, after the system powers on, don't move the torch, press F7 in the main interface to enter the manual function interface, then press F7 to recover the breakpoint. After recovering it, if the torch hadn't been moved and is on the position when the power is off, press START keyboard, the system will process directly.

After the breakpoint is recovered, if the position is off from the original one, you could move the torch to the original point manually, or realizing it through choosing rows or numbers. (Please refer to chapter 5.4.5 Row and number Selection). The method is : choose stopping incising, move the torch to the original point manually, choose the nearest row through choosing the row selection(or number selection), press "START", then the system will show in Fig 5-32:

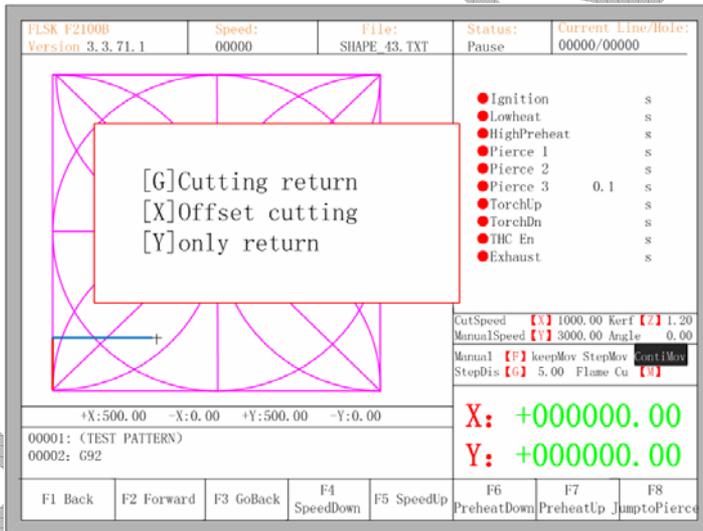


Fig 5-32 restore breakpoint

- Press G, the system will start incising from point which is after moving, and after returning to the position before the torch moves, it will process according to the normal curve.
- Press X, regarding the position after moving as the position before moving, and then process.
- Press Y, move from the position after moving to the position before moving, then wait for the next operation.

5.6 File Operation

The system supports cutting code which has txt and CNC postfix. And the maximum capacity is 1M, the largest number of rows is 10000 lines. You can edit, compile, delete, export internal document, also you can import the file in the U disk into system.

In the main interface, press key【F2】(code) to enter local machine code interface, shown as follows:

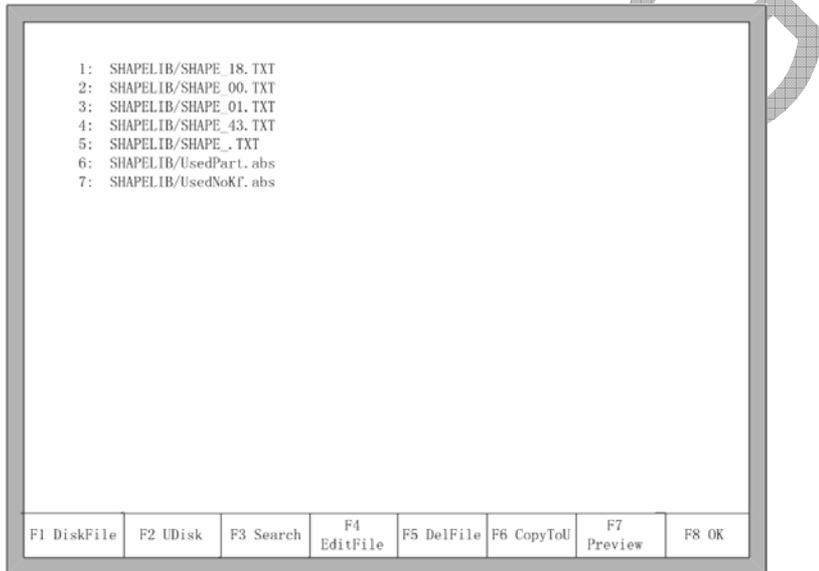


Fig 5-33 code interface

5.6.1 Files in the Hard Disk

In the file manage interface, press F1 to enter the hardware file list, as shown in Fig 6.1 the system only lists the folder, TXT file and CNC file.

- Press F4, if the current position of the cursor is txt file or cnc file, you could edit them. Please refer to chapter 6.5 on how to edit files.
- Press F5, if the current position of the cursor is txt file or cnc file, you could delete them.
- Press F6, if the current position of the cursor is txt file or cnc file, you could copy the current file to the flash disk when it is connected to the USB interface.
- Press F7, if the current position of the cursor is txt file or cnc file, you could preview the current graphic.

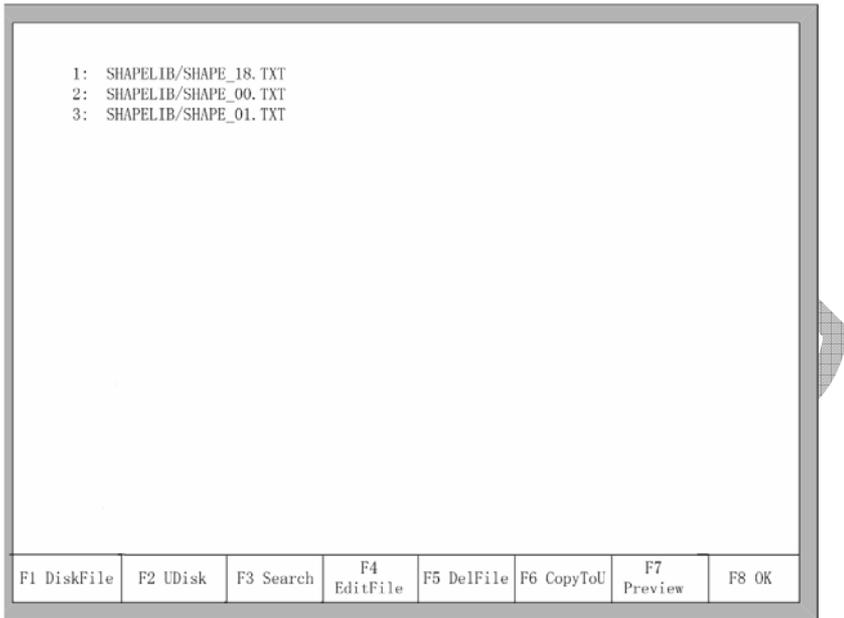


Fig 5-34 Graphic preview

Press F8, if the current position of the cursor is txt file or cnc file, you could import the current file to the system, after importing, the system will return to the main interface.

5.6.2 Files in the U Disk

In the code interface, press key **【F2】** to go for U Disk interface.

In the U Disk interface, choose the corresponding cutting code, press **【F6】**, the system will save this code into the internal documents.

Notices: When you open a file on U disk, you must save it as the local machine code before you start cutting. When saved the U disk documents, file name automatically memory, shown as Fig 5-35:

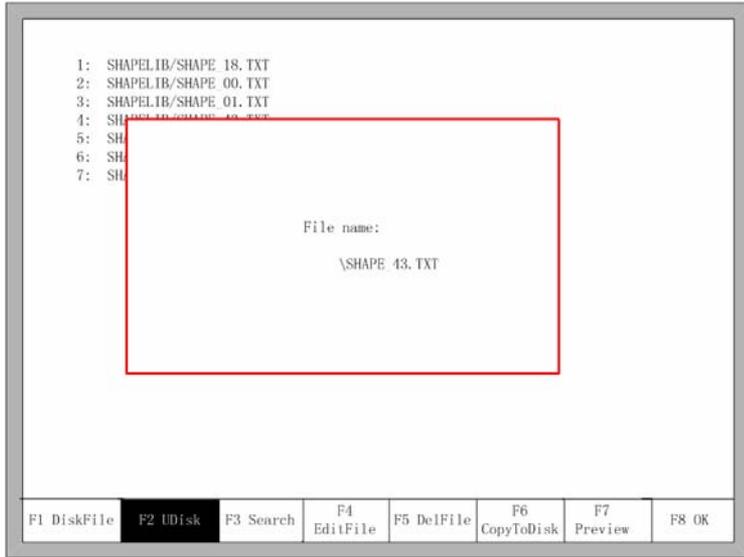


Fig 5-35 save U disk files

When input file name, if you do not want to change the file name, you can be directly press **【Enter】** to preserved; or modify the file name and then press **【Enter】** to save. If the same named file has already existed, the system prompts:

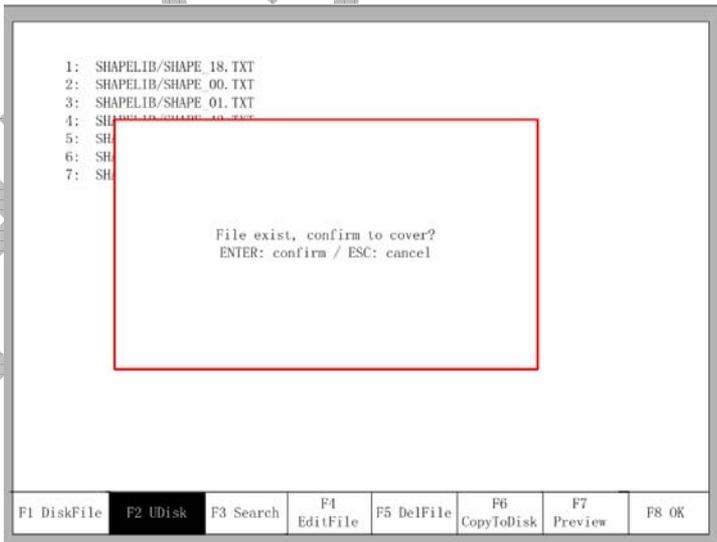


Fig 5-36 Replacement documents

If you want to replace the internal documents, press **【Enter】** key, if you want to change the file name, press **【Esc】**, change the file name and then save.

5.6.3 Search File

In the file manage interface, press key **【F3】** to search a file. You can input all or part of the file name, then press **【Enter】**, and the system will list all the files that include the input word or file name.



Fig 5-37 search file

5.6.4 Edit code

In the local machine code interface, move the cursor to the file that you want to edit, then press **【F4】** to enter the edit interface.

When enter the characters, some keys are reuse keys. Press these keys directly, enter the characters under the button. If first press **【Shift】** key, release the **【Shift】** key and then press Shift Multiplexing button, then enter characters on the button. Or press both **【Shift】** and reuse keys, then enter characters on the button.

When editing the code, press **【F2】** can insert a new line after the current line, and press **【F3】** to delete the current line. Press **【F + Home】** key, the cursor automatically moved to the first

character of the current editing line, press the **【F-End】** , the cursor automatically moved to last character of the current line.

Each edit line supports 128 characters maximum.

When you open a file on U disk or new a code file, you must save it as the local machine code before you start cutting. Otherwise, you cannot make use of the breakpoint recovery function or power off protection function.

After edit the code , press **【F8】** to save the code.

5.6.5 New Code

In the editing code interface (reference 5.6.4 edit code), you can press key**【F4】**to create an new file to input your own code, shown as Fig 5-38.



Fig 5-38 new code

5.6.6 Compile Code

After create a new code or edit the code, if you want to know the code is valid or not , in the edit interface, press **【F1】** ,you can compile code to check whether the code is correct.

5.7 Parameter Setting

In the main interface, you can get the parameter interface by pressing key【F3】(Para). The parameter function interface is showed in Fig 5-39

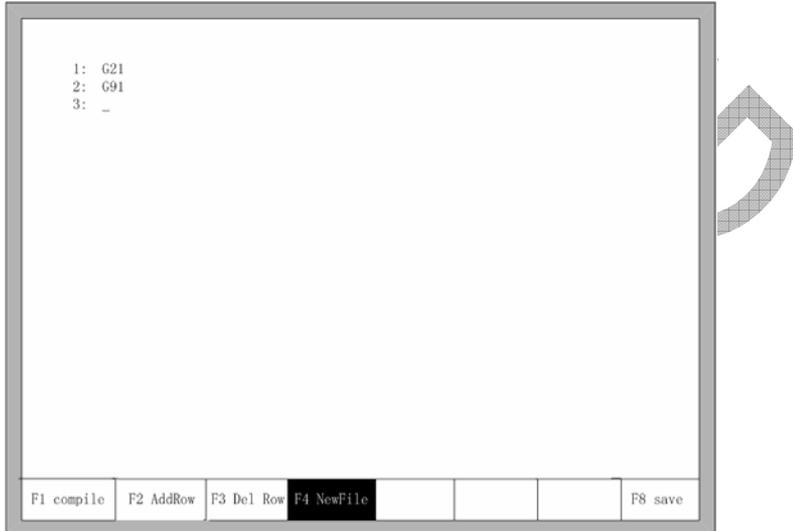


Fig5-39 Parameter Interface

You can set five kinds of parameter in the parameter interface:

- 1) Common parameters: cutting speed, manual move speed, G00 move speed, the size of kerf gap, corner speed, cutting type, edge cut enable, hold preheat.
- 2) Flame parameters: all the parameters used in oxygen gas cutting
- 3) Plasma parameters: all the parameters used in plasma cutting
- 4) Maring parameters: ignition, perforation cycle parameters, dry dusting offset

System parameters: you can set system pulses, maximum speed limit, motor parameters and soft limit parameters.

5.7.1 Common parameters

It is the favorite's parameters in Fig5-39.

Cutting Speed: the maximum cutting speed, unit is mm/m.

Manual Move Speed: the moving speed of cutting torch in manual, unit is mm/m.

G00 Move Speed: the cutting torch speed when G00 is executed or the cutting torch go back to

the reference or some other occasion, unit is mm/m.

Kerf: According to the cutting gap width, users set Kerf Gap compensation(the value should be half of the cutting gap) to ensure the dimensional precision, the system will generate a new path automatically to make compensation to work piece. Before cutting a work piece, you can modify kerf gap value, once begin to cut, you are not permitted to modify the value.

Corner speed: Plate thickness affect the cutting tip's ac/dc rate when it moving. The angle between the end of a cut-point line's tangential direction and the direction of the tangent line of the beginning of next cutting point, and the thickness of plate determines cutting tip speed at the transition.

If the normal cutting speed is V , angle is α , plate thickness is h , then cutting tip speed in at the time of intersection is V_x

$$V_x = \frac{\alpha h}{50\pi} V$$

Notice: The unit is mm. The max thickness of plate is 100 mm, if more than 100mm also are considered to be 100mm

Cutting Type: There are two cutting types : Oxygen fuel gas and Plasma parameters. You can press **【←】** or **【→】** to switch with them.

5.7.2 Flame Parameters

The oxygen fuel parameters, in Fig 5-40, control time delay in IO operation, and whether use high adjustment.

Ignition time	0.00	s
Low preheat time	0.00	s
High preheat time	0.00	s
Pierce 1 time	0.00	s
Pierce 2 time	0.00	s
Pierce 3 time	0.10	s
Exhaust time	0.00	s
Torch up time	0.00	s
Torch down time	0.00	s
Pierce up time	0.00	s
Pierce down time	0.00	s
THC enable	No	<->
Hold preheat	Yes	<->
Edge cutting enable	No	<->

F1 Common	F2 Flame	F3 Plasma		F5 System	F6 Import	F7 Export	F8 Save
-----------	-----------------	-----------	--	-----------	-----------	-----------	---------

Fig5-40 Flame Parameters

- **Ignition Time:** the time delay of opening ignition I/O.
- **Low Preheat Time:** The preheating time before perforating the steel plate. Enter any positive number ,unit is s. During the low pressure preheating process, you can prolong the preheating time by pressing “stop” key, then the preheating time will delay until you press the “start” key to start to high pressure preheat delay.
- **High Preheat Time:** Like **Low Preheat Time** except open different IO.
- **Pierce 1 time:** Perforation time with low pressure fuel gas. Enter any positive number ,unit is s.
- **Pierce 2 time:** Perforation time with middle pressure fuel gas. Enter any positive number ,unit is s.
- **Pierce 3 time:** Perforation time with high pressure fuel gas. Enter any positive number ,unit is s.
- **Exhaust Time:** The delay of turned off oxygen gas to open the exhaust. Enter any positive number ,unit is s.
- **Torch Up Time:** When oxygen gas is turned off, the time for the torch to lift up. Enter any

positive number ,unit is s.

- **Torch Down Time:** When oxygen gas is turned off , the time for the torch to put down. Enter any positive number ,unit is s.

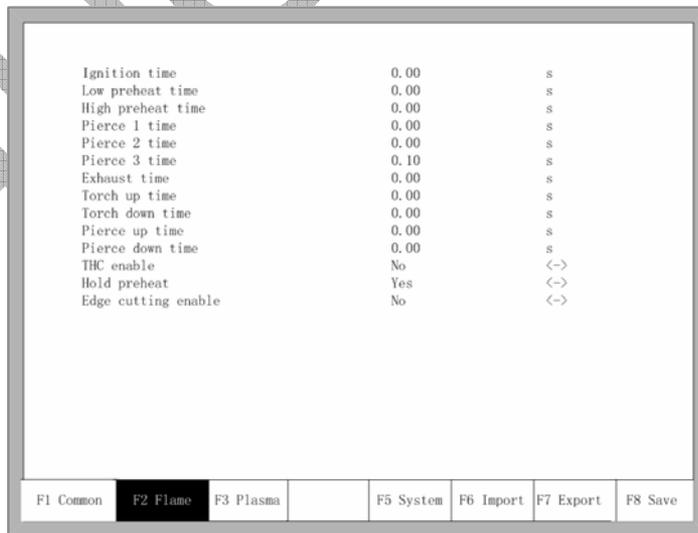
- **Pierce Up Time:** Time for the torch to lift up during perforating. The difference between **Torch Up Time** and **Pierce Up Time** is that: **Torch Up Time** means the time that the torch needs to lift up when it needs to move to another place after the current cutting is over; while the **Pierce Up Time** means the time that the torch needs to lift up after preheating in the fixed cycle of perforation.

Pierce Down Time: Time for the torch to put down in the perforation. The difference between **Torch Down Time** and **Pierce Down Time** is that: **Torch Down Time** means the time that the torch needs to put down before preheating; while the **Pierce Down Time** means the time that the torch needs to put down after finishing **Torch Up Time** and opening cutting oxygen in the fixed cycle of perforation.

THC Adjustment: According to the user device configuration, choose whether or not to use high adjustment box.

5.7.3 Plasma Parameters

As shown in the fig 5-41, these are Plasma Parameters, which are related with the precision of transmission shaft of the machine.



Ignition time	0.00	s
Low preheat time	0.00	s
High preheat time	0.00	s
Pierce 1 time	0.00	s
Pierce 2 time	0.00	s
Pierce 3 time	0.10	s
Exhaust time	0.00	s
Torch up time	0.00	s
Torch down time	0.00	s
Pierce up time	0.00	s
Pierce down time	0.00	s
THC enable	No	<->
Hold preheat	Yes	<->
Edge cutting enable	No	<->

F1 Common F2 Flame F3 Plasma F5 System F6 Import F7 Export F8 Save

Fig 5-41 plasma parameters

-
- **Arc time:** Before the arc starting, the system time to wait. At this point, all output I/O are turned off. Enter any positive number ,unit is s.
 - **Pierce time:** Perforation time. Enter any positive number ,unit is s.
 - **Torch Up Time:** When arc press is turned off, the time for the torch to lift up. Enter any positive number, unit is s.
 - **Arcing Check Time:** Enter any positive number, unit is s. If not detected any feedback signal of success arc starting within the detection time, the system prompts an error message and terminates the current work of cutting, according memory breakpoints to withdraw from the program.
 - **Position check Time:** Enter any positive number, unit is s. Delay time of the success of position check.
 - **Position up Time:** Enter any positive number, unit is s. Before positioning check, the time for the torch to lift up.
 - **Close arc:** In setting the rate of X%, open the output port, close the arc press signal, to prevent the steel melting under low-speed cutting tip due to temperature is too high.
 - **Distance to close arc:** in the minimum distance of the cutting line of the initial segment or end segment, close the arc voltage increases.
 - **Lose arc delay:** detect the delay time of the feedback of the broken arc, if there's still no arc voltage input, the situation is considered to be broken arc. This parameter can effectively avoid the arc broken alert because of the sensitivity of the broken arc detection in the cutting methods with lead, this guarantees the continuousness of the cutting and avoid the interrupt of frequent alert .

Watch arc enable: Real-time detection of arc voltage signal in cutting process.

If setting "yes", in the cutting process, the system detects he real-time arc voltage feedback signal. If do not detect the signal, the system terminates the current work of cutting, according memory breakpoints to withdraw from the program.

If installing a "No", then in the cutting process does not detect arc voltage feedback signal.

5.7.4 System parameters

The system parameters, as showed in Fig 5-42, are related with the precision of transmission shaft of the machine.

Horizontal Axis Pulse	125.000	n/mm
Vertical Axis Pulse	125.000	n/mm
Max cutting speed	2000.000	mmpm
Max G00 speed	6000.000	mmpm
Max Manual speed	3000.000	mmpm
Small arc limit	500.000	mmpm
Flame adjust time	0.40	s
Plasma adjust time	0.30	s
Emergency stop time	0.08	s
Start speed	250.000	mm
Max +X	100000.000	mm
Max +Y	100000.000	mm
Min -X	-100000.000	mm
Min -Y	-100000.000	mm

F1 Common F2 Flame F3 Plasma **F5 System** F6 Import F7 Export F8 Save

Fig 5-42 System Parameters

- **Horizontal Axis Pulse:** The number of pulse that system needs to generate when the machine move 1mm towards X axis, maintaining 3 digits at most after decimal point.
- **Vertical Axis Pulse:** The number of pulse that system needs to generate when the machine move 1mm towards Y axis , maintaining 3 digits at most after decimal point.
- **Max Cutting Speed:** the maximum cutting speed, unit is mm./m.
- **Max G00 speed:** the allowable maximum speed when cutting tips idling.
- **Small Arc Limit:** Maximum speed at cutting a small arc.

Small arc definition:

0 mmpm < cutting speed < 2000mmpm	small arc = 5mm
2000 mmpm < cutting speed < 4000mmpm	small arc = 10mm
4000 mmpm < cutting speed < 6000mmpm	small arc = 15mm
6000 mmpm < cutting speed < 8000mmpm	small arc = 20mm
8000 mmpm < cutting speed < 10000mmpm	small arc = 25mm
10000mmpm < cutting speed < 12000mmpm	small arc = 30mm
12000mmpm < cutting speed < 15000mmpm	small arc = 35mm

- **Flame adjust time:** the whole time for the system accelerates from its start speed to the

expected cutting speed.

- **Plasma adjust time:** when plasma cutting , from the time the motor starts to the time when the motor is up to the cutting speed.
- **Emergency STOP Time:** When encounter Emergency Stop input, the time for dropped from the current speed to zero.
- **Start Speed:** the system's speed when it began to start. Generally do not have to start from 0 , motor will allow a start speed.

Max Coordinate: The maximum positive coordinate which the machine can reach horizontally. Its unit is mm(millimeter). If current coordinate exceeds the value, the system will stop running.

Min Coordinate: The minimum negative coordinate which the machine can reach horizontally. Its unit is mm(millimeter). If current coordinate is less than the value, the system will stop running

5.7.5 Parameter import

In the parameter configuration interface, press F6 to import the parameters. The parameters should satisfy two conditions:

1. The parameters exported from the incising machine control system(refer to 5.7.6 Parameter Export) should satisfy the specified format. The file format is F2300.DAT
2. The file should be stored under the root folder of flash disk which is connected to the USB interface.

When the above condition is satisfied, in the Fig 5-43, press Enter to confirm, and then you could import the backup parameters to the system.

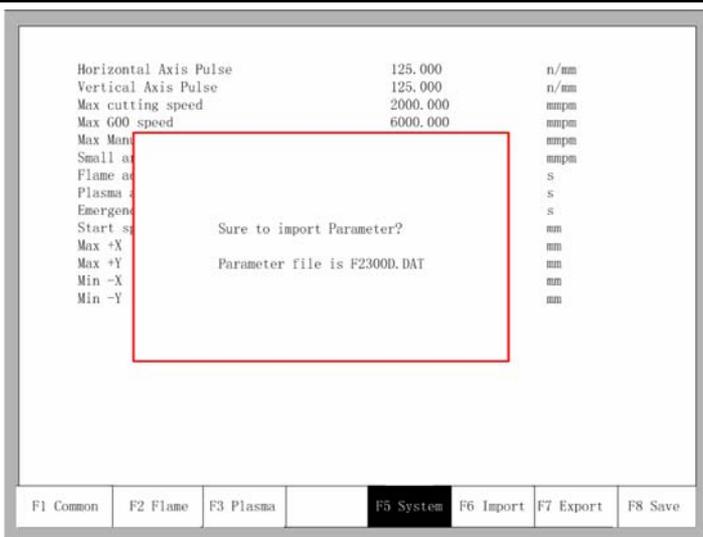


Fig 5-43 Parameter import

5.7.6 Parameter export

After the parameter configuration is over, press F7 in the parameter configuration interface to export the parameters, you should connect the flash disk to the USB interface before exporting.

In the interface shown in Fig 5-44, after pressing Enter, the parameters will automatically be saved in the root folder of flash disk, the file name is F2300.DAT

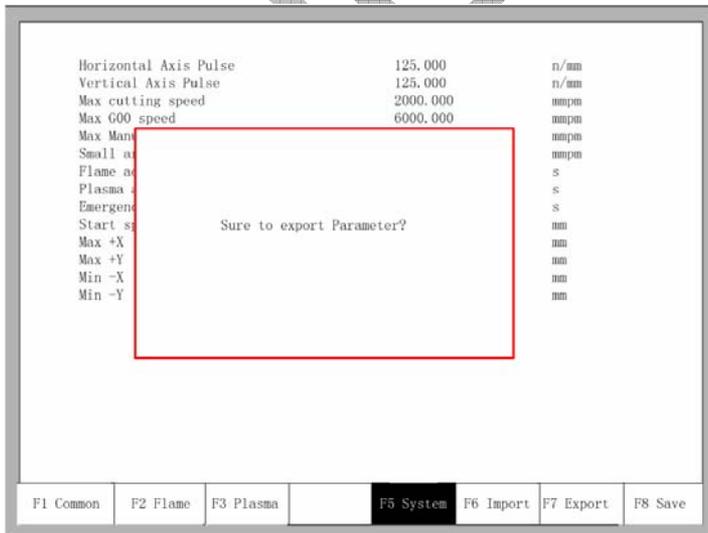


Fig 5-44 Parameter export

5.7.7 Save parameters

After parameter modification, press **【F8】** to save, shown in Figure 5-45

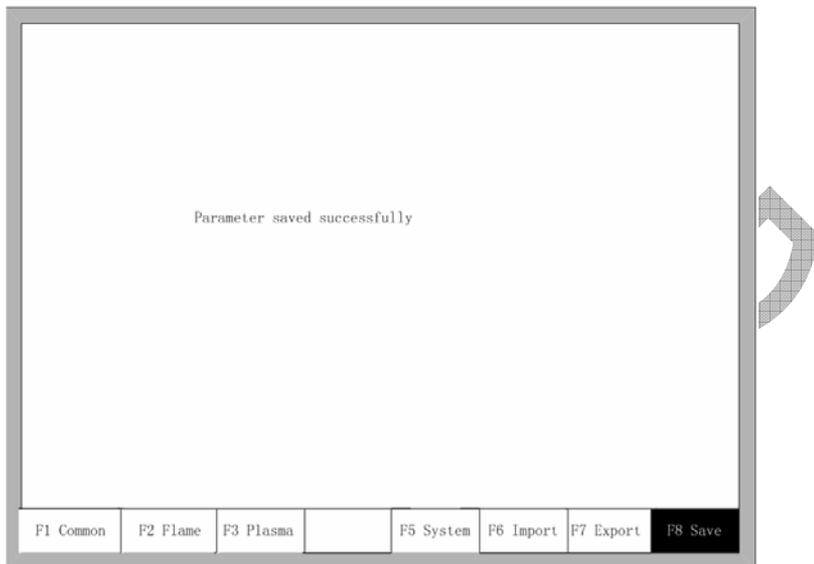


Fig 5-45 System Parameters

Note: when any parameter has been modified, you must take preservation operation to keep modification valid, or the system will take the original parameters.

5.8 Diagnosis Function

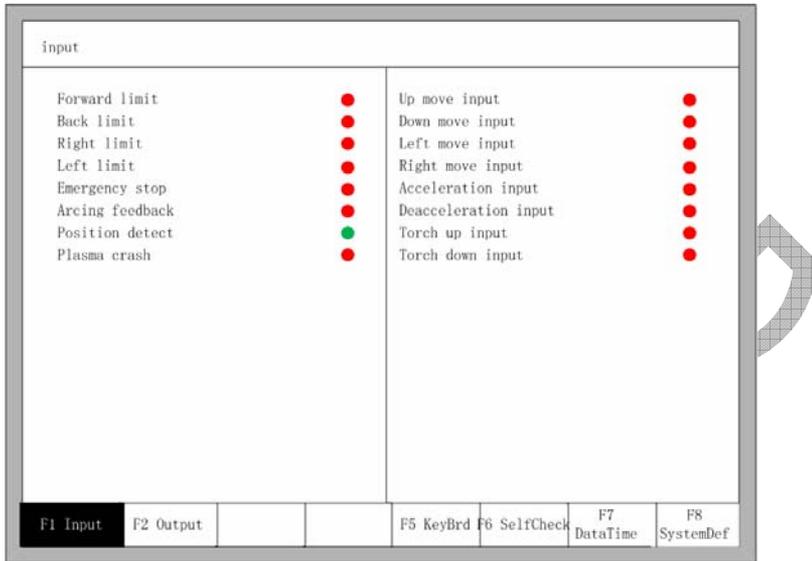
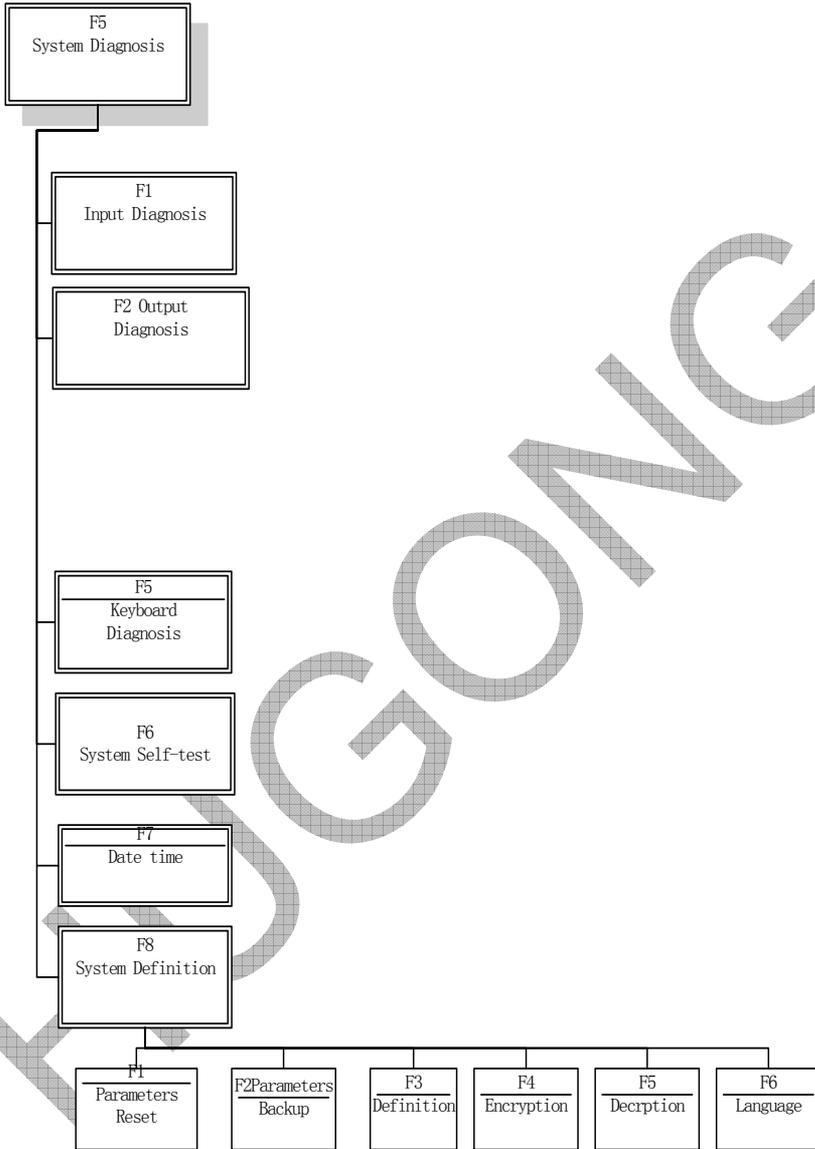


Fig 5-46 Diagnostic interface

You can be diagnosing the I/O and keyboard in the interface.

5.8.1 Diagnosis interface index



5.8.2 Input Diagnosis

The system will read current IO information when press **【F1】**(Refresh) to refresh the interface, and display all IO's status. "On" means the input is effective, and "Off" means the input is ineffective.

5.8.3 output Diagnosis

In diagnosis interface ,press **【F2】** to enter output diagnosis interface, shown as Fig 5-47



Fig 5-47 Output diagnosis

Press **【↑】**, **【↓】**, **【←】**, **【→】**, you can move the cursor to the corresponding output port, press **【 F3 】** to open the corresponding output port, press **【 F4 】** to close the corresponding output. ● represents the valid output, ○ represents the invalid output.

5.8.4 Key-press Diagnosis

In the diagnostic interface, a key value will be displayed behind “KEY:”, whenever the key is pressed.

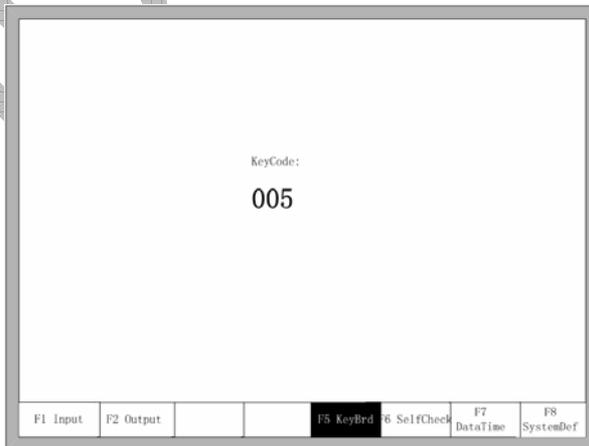


Fig 5-48 Keyboard Diagnosis

5.8.5 System self-check

In the system diagnosis interface, press F6 to enter the system self-check interface.

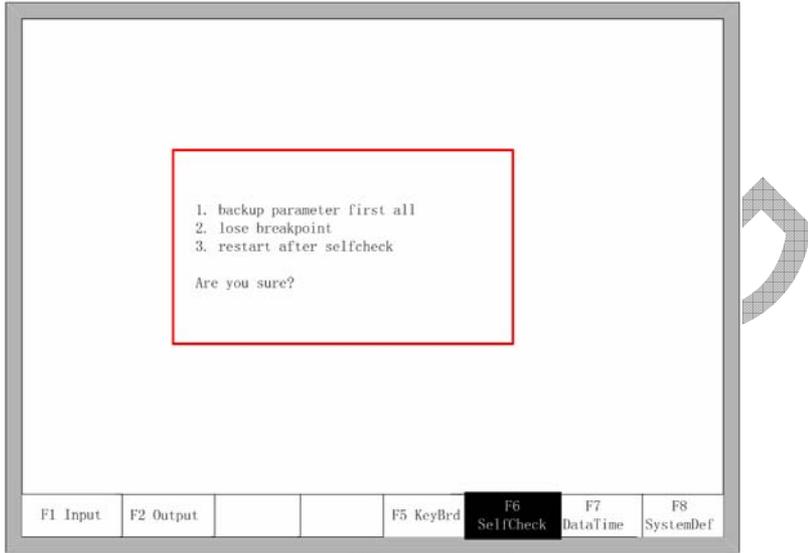


Fig 5-49 System self-check

If the self-check is OK, the system will show “Self-check pass” ,

If the self-test is down, there will be the following alarm type:

- DSP Dual ram is error
- ARM Dual RAM is error

When coming across these situations, please power off, reboot after about half minutes. If the situation happened on the machine which has been working for long time, please open the chassis and clean up the dust.

5.8.6 Date and time

Press F7 in the system diagnosis interface to set the date and time

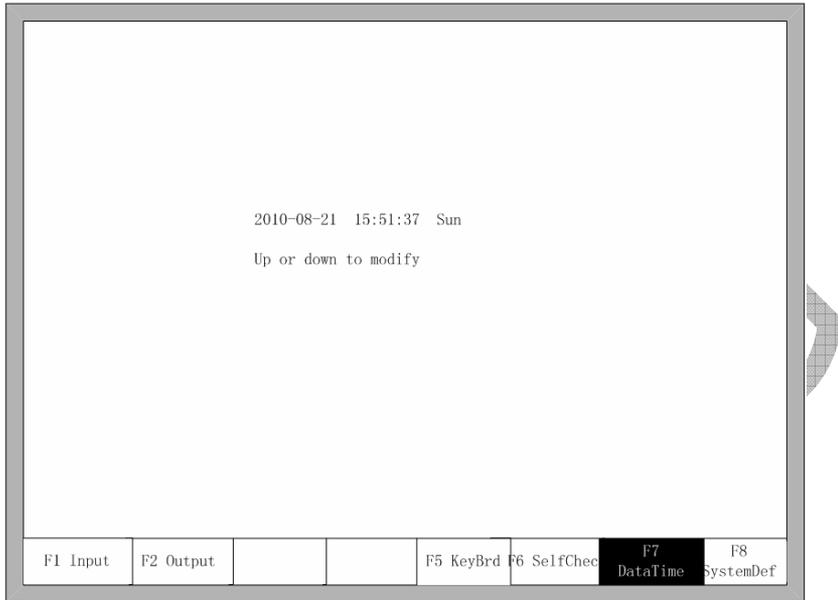


Fig 5-50 System time

Move the cursor to the corresponding date, time or week, press 【↑】或【↓】 to adjust the time

5.8.7 System Definition

In the system diagnosis interface, press F8 to enter the system custom definition interface, in the interface, you could set the input IO, output IO or system coordinate, also reset or backup the parameters and one key switch between English or Chinese.

5.8.7.1 Parameter backup and restore

Parameter Backup: The process of parameter backup is, in the main interface press F5(System Diagnosis), F8(System Definition), F2(Parameter Backup). The system will need code, after inputting the code “1396”, press Enter, the system will import the default parameters. In the following process, if the parameters is modified or some of them is broken, reset the parameters.

Warning: after adjusting the equipment, please backup the parameters.

Parameter Reset: The process of reset the parameters is, press F5(System Diagnosis) in the main interface, F8(System Definition), F1(Parameter Reset).

Warning: After resetting successfully, please restart the system.

5.8.7.2 Input definition

The controller could change the IO definition, including changing the order of IO number, the type of IO(normally open or closed) according to the user's need. In the system custom definition interface, press F3 to enter the definition interface, press F1 to enter the input definition interface. As shown in fig 5-51.

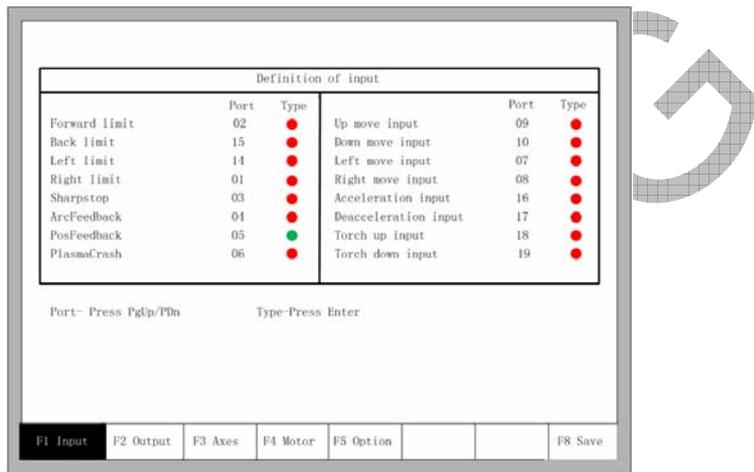


Fig 5-51 input definition

In the interface press **【↑】**, **【↓】**, **【←】**, **【→】**, move the cursor to the position that needs changing, press **【PageUp】** 或 **【PageDown】** to change the number of the Input, press **【Enter】** to change the type of the input.

If the external type of input is normally closed, please set the IO type to ●, if the type is normally open, please set the IO type to ●.

5.8.7.3 Output definition

The controller could change the IO definition, including changing the order of IO number, the type of IO(normally open or closed) according to the user's need. In the system custom definition interface, press F3 to enter the definition interface, press F1 to enter the input definition interface. As shown in fig 5-52.

Definition of output					
	Port	Type		Port	Type
Ignition	03	●	Exhaust	06	●
LowPreheat	01	●	THC	08	●
HighPreheat	17	●	PosDetect	19	●
LowOxygen	04	●	ArcStart	16	●
MidOxygen	05	●	LowSpdInCorner	18	●
HighOxygen	14	●	Dust spray	07	●
TorchUp	02	●	Raise dust	20	●
TorchDown	15	●	Dust preheat	21	●

Port- Press PgUp/PDn Type-Press Enter

F1 Input	F2 Output	F3 Axes	F4 Motor	F5 Option			F8 Save
----------	------------------	---------	----------	-----------	--	--	---------

Fig 5-52 output definition

In the interface press **【↑】**, **【↓】**, **【←】**, **【→】**, move the cursor to the position that needs changing, press **【PageUp】**或**【PageDown】**to change the number of the Output, press **【Enter】** to change the type of the Output.

The output type is open drain transistor output type.

type ● means that if the output signal is effective, the transistor is on. type ● means that is the output signal is effective, the transistor is off.

5.8.7.4 Coordinate definition

The system could provide IO definition for the user. As shown in Fig 5-53

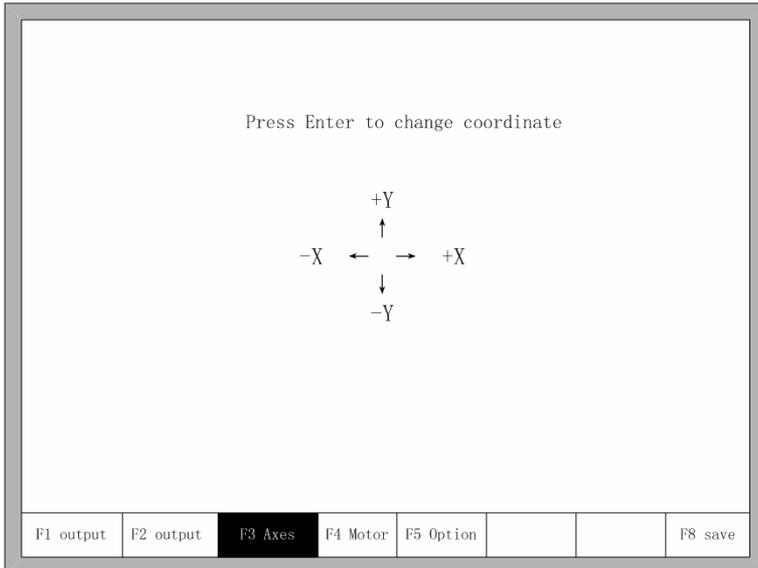


Fig 5-53 Coordinate Definition

In the interface, press Enter repeatedly to change among 8 type of coordinates. Press F8 to save.

5.8.7.5 Motor

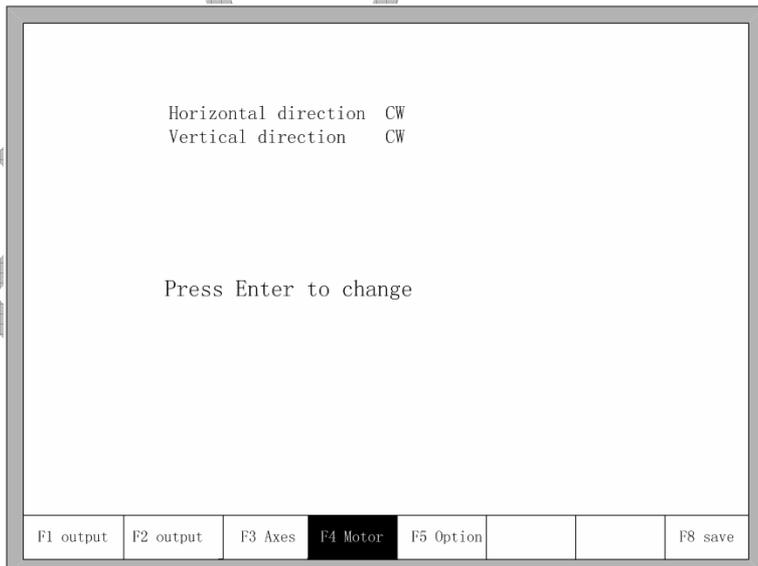


Fig 5-54 Motor Direction

Press Up or Down key to move cursor to the according motor, Motor move direction can be changed between CW and CCW by pressing ENTER.

5.8.7.6 Option

5.8.7.6.1 Remote control

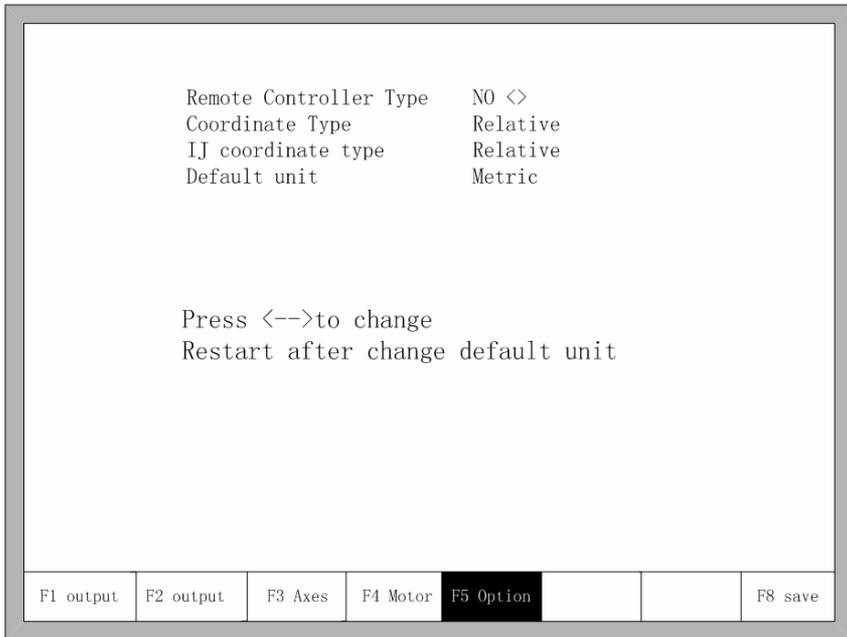


Fig 5-55 Option

Move cursor to Remote Controller Type, the Type can be changed in NO, P2P,8421 by pressing Left or Right key.

5.8.7.6.2 Coordinate Type and IJ coordinate type

As fig 5-56, default coordinate and IJ can be changed between Relative and Absolute.

5.8.7.6.3 Metric and Inches

As fig 5-56, Default unit can be Metric or Inches.

5.8.7.7 Language

In the main interface , Press **【F5Diagnose】**, **【F8Systemdef】**, **【F6Lan】** , the language can be changed within Chinese , English and French.

5.9 Graph

In the main interface, press **【F1】** (ShapeLib) to enter graph interface, shown as follows:

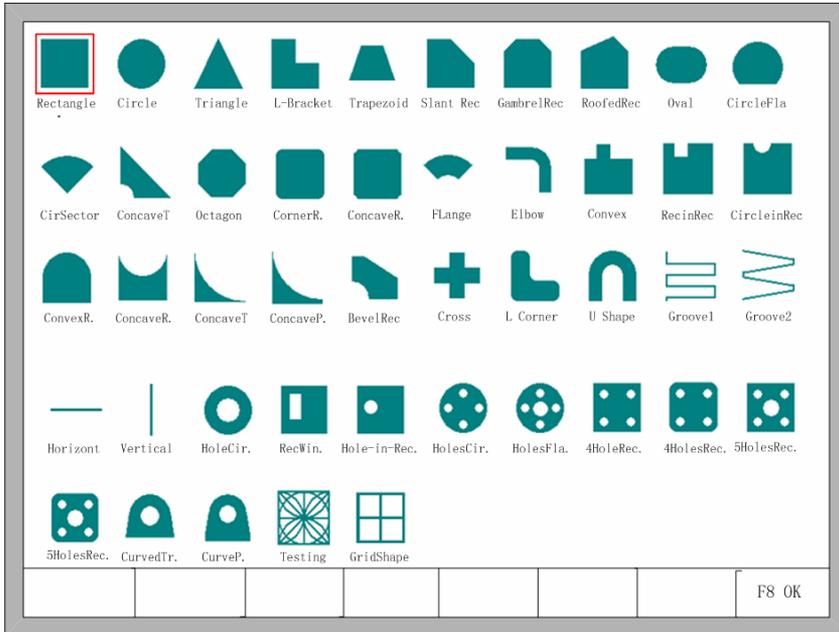


Fig 5-56 first page of graph

You can press **【↑】**, **【↓】**, **【←】**, **【→】** to choose different graph.

5.9.1 Choose Graph

In home interface of graph, move the cursor to the required graph, press **【F8】** to confirm, shown as Fig5-57:

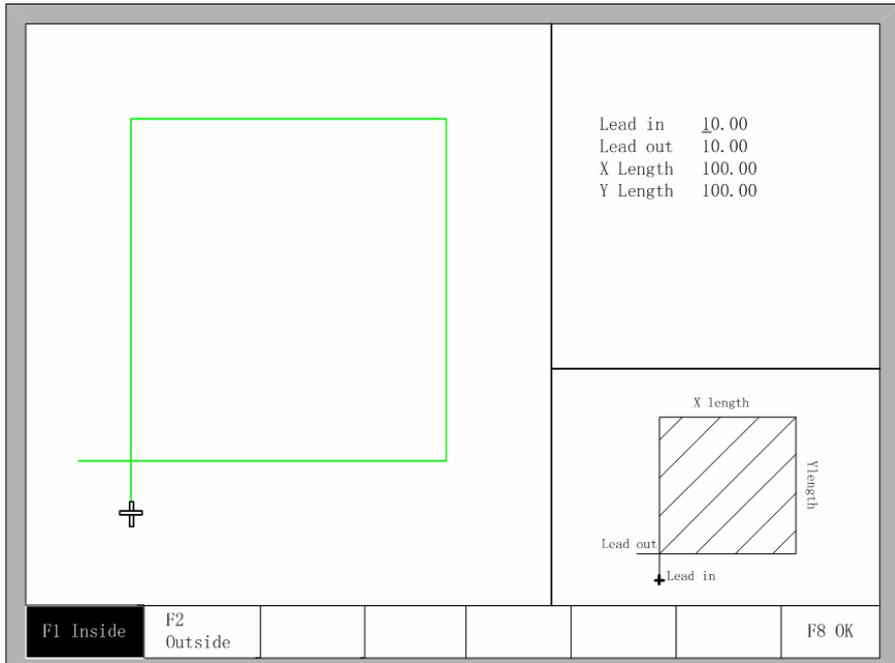


Fig 5-57 Chip size interface

You can press **↑**, **↓**, **←**, **→** to modify sizes, after modification , press **F8** to confirmed.

Press any key to return to graphics processing interface as shown in Fig 5-10.

5.9.2 Film/Hole Size

In Fig 5-58 interface, you can press **F2** to choose hole size, shown as Fig 5-58:

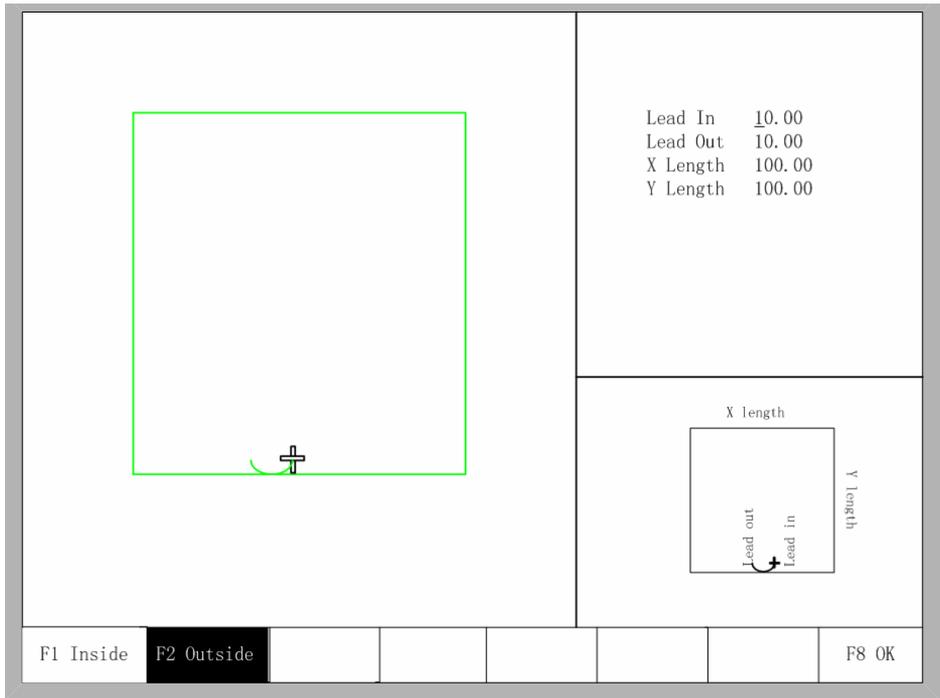


Fig 5-58 hole size

Modify sizes like modify chip sizes.

After modification , press **【F8】** to confirmed.

Press any key to return to graphics processing interface as shown in Fig5-10.

Note: The following graphics don't have hole sizes:

Straight line groove, Bevel groove, Straight line kerf, Vertical kerf, Hole-in- Rotundity, Rectangle window, Hole-in-Rectangle, Four-holes in Rotundity, Holes in flange, Four-holes in rec, Four-holes in Filleted corner rec, Five-holes in rec, "Five-holes in Filleted corner rec, Curved trapezoid, Curved polygon, Testing Shape, Grid Shape.

5.10 The use of BIOS

When the system powers on, it will display as shown in Fig 5-59.

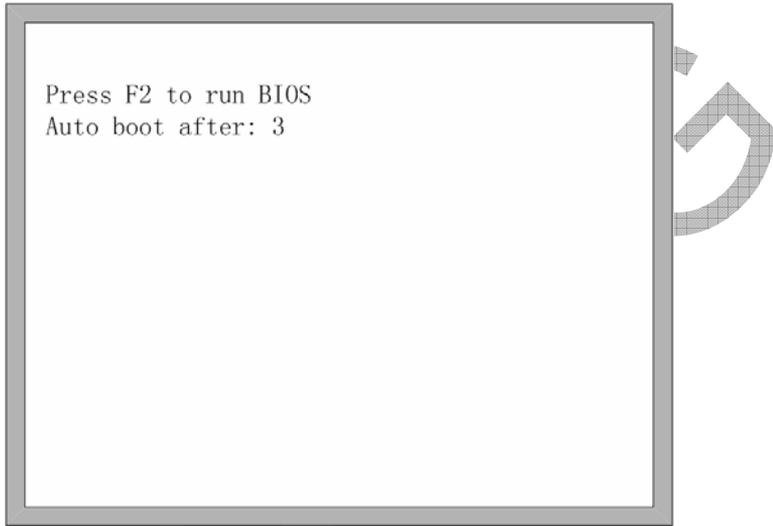


Fig 5-59 power on

When press F2 before the system counts down to 0, the system will enter the BIOS. If other keys are pressed, the system will enter in before counting down to 0.

- F1 - 系统升级(System software update)
- F2 - 欢迎界面升级(Welcome picture update)
- F3 - 运动控制升级(Motion update)
- F4 - 系统备份(System backup)
- F5 - 系统还原(System recovery)
- F6 - 启动系统(Start system)

Fig 5-60 BIOS interface

5.10.1 System upgrade

After entering BIOS, press F1 to upgrade the system, it should satisfy the following conditions:

Flash Disk is connected to the system.

There should be the UserApp.exe upgrade file in the root folder of the flash disk.

Pressed F1 to upgrade when the conditions are satisfied, when completing the upgrading, press F6 to reboot.

5.10.2 Welcome interface upgrading

After entering BIOS, press F2 to upgrade the welcome interface completely, it should satisfy the following conditions:

Flash Disk is connected to the system.

There should be the WELCOME.bmp upgrade file in the root folder of the flash disk. WELCOME.bmp file is 256 colors, 800x600 resolution.

Pressed F6 to upgrade when the conditions are satisfied, when completing the upgrading, press F6 to reboot.

5.10.3 Motion upgrade

After entering BIOS, press F3 to upgrade the motion algorithm, it should satisfy the following conditions:

Flash Disk is connected to the system.

There should be the MOTION.DSP upgrade file in the root folder of the flash disk.

Pressed F3 to upgrade when the conditions are satisfied, when completing the upgrading, press F6 to reboot.

5.10.4 System Backup

after entering BIOS, press F4 to backup.

5.10.5 System Restore

After entering BIOS, press F5 to return to the original system that has been backup.

Chapter 6 THC Introduction

For both flame cutting and plasma cutting, the stability of distance (height) between cutting nozzle and plate during cutting process is vital, such distance (height) can directly affect the cutting speed and cut quality.

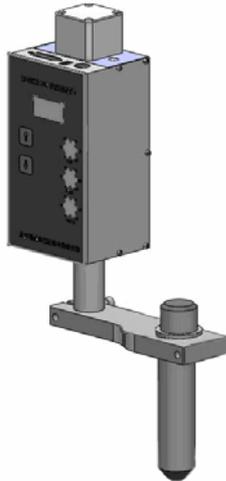


Fig. 6-1 SF-HC30A Flame/Plasma Cutting Torch Height Controller

6.1 Application Guide

After the height controller is started up, there are two states: manual and automatic modes.

6.1.1 Manual Operation

- * Mode Switching Signal: high voltage, arc-voltage mode; low voltage, capacitance mode
- * Manual/Automatic Signal: when it is high voltage, the controller is in manual mode
- * Manual Up Signal: high voltage, invalid; low voltage, cutting-torch moves upwards
- * Manual Down Signal: high voltage, invalid; low voltage, cutting-torch moves downwards

6.1.2 Automatic Operation

- * Manual/Automatic Signal: when it is low voltage, the controller is in automatic mode
- * In automatic mode, the controller automatically the height of cutting torch according to

defined height by user.

- * Rotate “Height” button clock-wisely, to increase height and enlarge cutting distance; and to reduce the distance in contrast.
- * Rotate “Sensitivity” button clock-wisely, to increase height and enlarge the dead band.
- * Rotate “HIS Height” button clock-wisely, to increase “initial positioning” height; and to decrease the height in contrast.

6.2 Controller Panel

There are the display and buttons on controller panel. With panel operation, the parameters can be changed and the operation state can be monitored.

6.2.1 Control Setting

- * **Height Value:** it is the expected value between cutting nozzle and steel plate, and set by user. For the setting scope, refer to Table 6-1.
- * **Sensitivity (Dead Band):** When the actual height is smaller than “Height” + “Sensitivity” and larger than “Height” - “Sensitivity”, the height of cutting torch will not be further adjusted. For the setting scope and factory value, refer to Table 6-1.
- * **HIS Height (Initial Height):** it is the lifting distance of height controller when the cutting torch goes downwards and contact the steel plate. For the setting scope, refer to Table 6-1.

Mode		Height	Sensitivity	Initial Positioning
Arc Voltage	Setting Scope (V)	60~160V	0-10	0~10
Capacitance	Setting Scope	160~310	0~10	

Table 6-1 Setting Scopes of Each Button

Note: In the plasma mode, just counter-clock-wisely rotate the sensitivity button to bottom!

6.2.2 Operation Panel

For the operation panel, refer to Fig. 6-2.

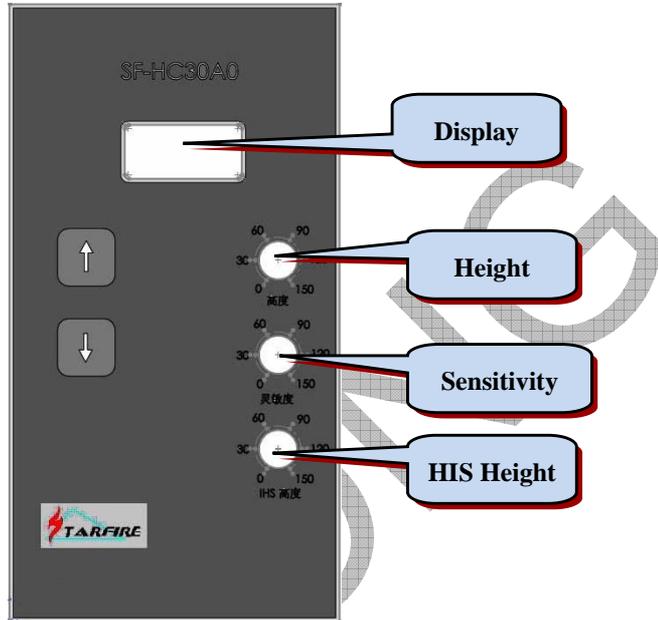


Fig. 6-2 Operation Panel

Display: the followings are the display functions:

Manual Operation State: operation mode, operation state, height (voltage) set value;

Automatic Operation State: operation state, and actual height (voltage) value.

6.2.3 Description of Displayed States

Manual Operation State: The first digit displays the operation mode and manual operation state, and the following three digits display the height (voltage) set value.

First Digit: when there is no operation, it displays U for arc voltage mode (plasma cutting) and C for capacitance mode (flame cutting). It displays  for manual up and  for manual down.

Last Three Digits: In arc-voltage mode, it displays 3-digit numbers which are smaller than 160, the numbers represent the set height (voltage) values which can be changed with rotating “Height” button, and the unit is V; in capacitance mode, it displays 3-digit numbers which are larger than 160, the numbers represent the set height (voltage) values which can be changed with rotating “Height” button.

Automatic Operation State: The first digit displays the current operation state, and the following three digits display the height (voltage) set value. The following is the detailed description of first digit:

-  Adjust cutting-torch upwards
-  Adjust cutting-torch downwards
-  The cutting torch is at suitable height, and remains standstill.
-  High Limit. When the height is beyond such value, the system alarms. The cutting torch can only move downwards.
-  Low Limit. When the height is beyond such value, the system alarms. The cutting torch can only move upwards.

6.3 Description of Initial Positioning Function

6.3.1 Positioning Mode

A collision-type positioning switch is equipped inside height controller. When the cutting torch moves downwards and collides with a cutting piece, the internal switch closes; it is unnecessary to equip the special cutting nozzle and “protection cap”, and there should be no electrical circuit between “protection cap” and working piece. Such mode is applicable for all plasma cutting torches.

How to use the positioning function: in plasma mode, the external control interface “manual down” signal is in effect, the cutting torch moves downwards and collides with steel plate, then the internal switch closes, and the internal controller of height controller automatically return upwards a certain distance, that the positioning action is completed.

Note: The moving-down signal delay of numeric control system is about 2 times of moving-up signal delay.

6.3.2 Setting of Positioning Height

The parameter B is positioning height, and the unit is mm; as there are some over-travel and deformation of working piece and cantilever during the collision test, the B value is usually set to be 5-12 mm. Rotate HIS Height button to set such height value: CW rotate to increase and CCW rotate to decrease.

Note: The above takes our cutting machines as examples.

6.3.3 Process

The initial positioning function does not demand to add the related processes and commands, just to increase the cutting-torch moving-down time of numeric control system; generally, the cutting-torch moving-down time is 2-6 s longer than moving-up time.

The numeric control system has a cutting-torch moving-up/down action before performing the punching process; the moving-down time is longer than moving-up time, that the cutting-torch can collide with a working piece, then the height controller can detect the collision and return a certain distance to realize the positioning. Note that even now the cutting-torch moving-down signal is not cancelled, the cutting-torch will not move downwards continuously. Wait for the completion of numeric-controlled cutting-torch moving-down delay.

Chapter 7 Trouble shooting

7.1 Common fault and how to check and correct, shown as table7-1;

Trouble	Check item	Solution
Motor does not run	Power	Turn on the power
	Power voltage	Check power source
	If motor over load	Reduce loading
No display	Power	Turn on the power
Upper limit alarm	Moving over the upper limit	Check the Upper limit switch
Lower limit alarm	Moving over the lower limit	Check the lower limit alarm
Signal is unstable	If workpiece is grounded	Ground firmly
Height are incorrect	Operating environment change	Do“ One-keystroke height calibration”
Shock drastically	Speed regulating zone is too small	Increase Speed regulating zone ‘d’
Tracking is too slow	Speed regulating zone is too large	decrease Speed regulating zone ‘d’
A slight concussion	Dead zone is too small	Increase Dead zone E
Accuracy is too low	Dead zone is too large	Decrease Dead zone E

Table(7-1)

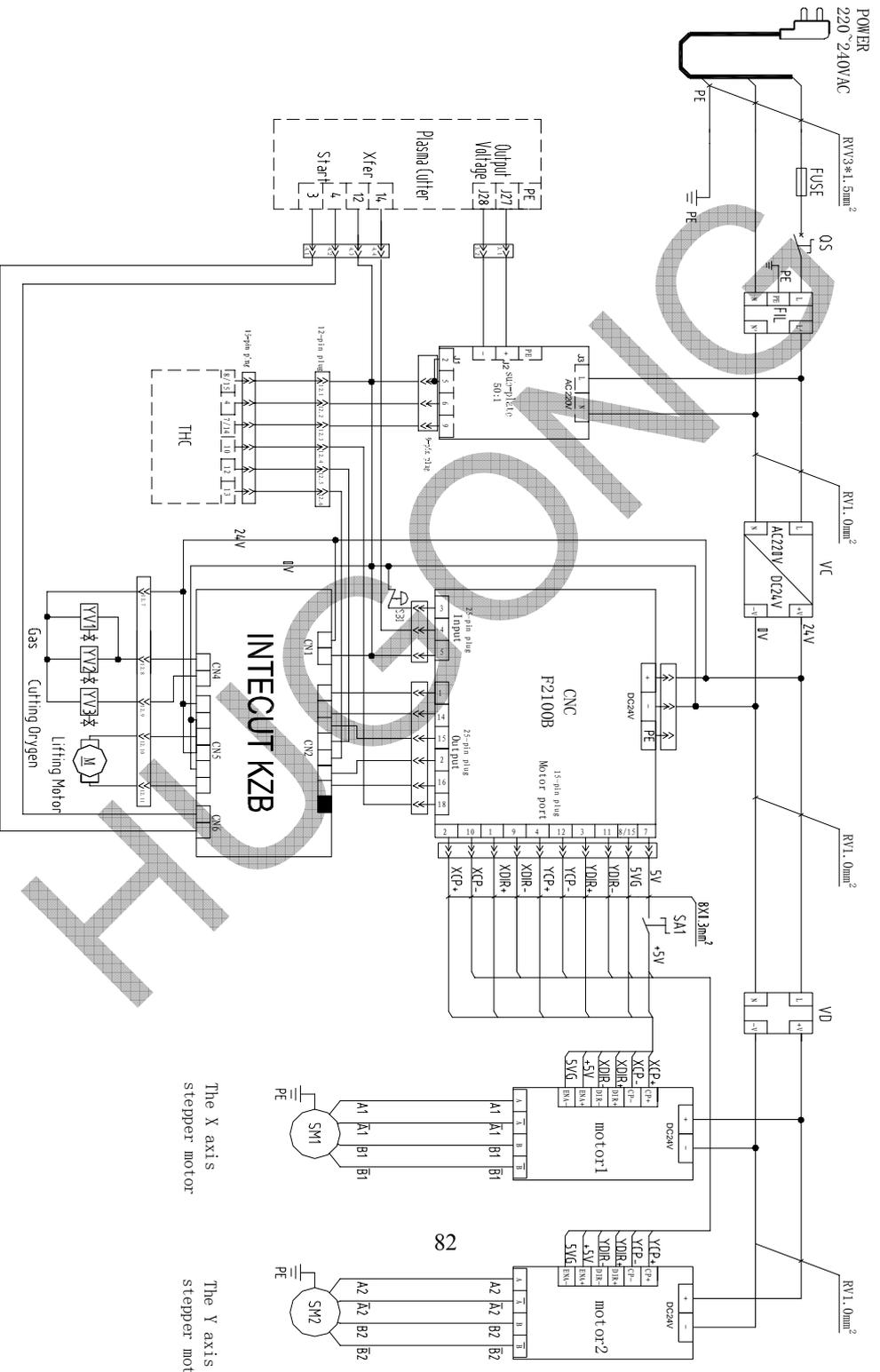
7.2 Cutting process failure analysis and troubleshooting, shown as table7-2

	trouble	analysis	Trouble shooting
1	The slag drops down from the cutting line	Fuel pressure is too low	Enlarge the pressure
		Cutting speed too fast	Slow down the cutting speed
		Work piece is too thick	Bigger cutting machine should be used
2	The cutting thickness can't reach the rated one	Fuel pressure is too high or too low	Adjust the pressure
		Cutting speed too fast	Slow down the cutting speed
		Work piece material and thickness cannot match the machine	Change other cutting machine
		Incorrect cutting nozzle	Change correct one
		Cutting line not vertical	Adjust the cutting line angle
		Gas leakage in gas system	Check gas system
		Nozzle is not vertical with work piece	Adjust the torch angle
3	Too wide cutting line	Too slow cutting speed	Speed up the cutting speed
		Incorrect cutting nozzle	Replace with correct cutting nozzle
4	Finished work piece size is too small	Gap between gear and rack is too big	Adjust the gap
		cutting line compensation is too small	Enlarge the cutting line compensation
5	Else		Contact with us

Table (7-2)

Chapter 8 Schematic circuit diagram

HUGOONG



The X axis
stepper motor

The Y axis
stepper motor

Chapter 9 Complete set specification

NO.	Details	quantity
1	INTECUT X CNC cutting machine	1pcs
2	Vertical rail	1pcs
3	Beam	1pcs
4	Product Manual and Certification	1pcs each
5	Allen wrench 3、4、5、6	1pcs each
6	Hexagon socket head cap head screw M8×40	8pcs
7	Support feet (INTECUT 3)	3pcs
	Support feet (INTECUT 4/5)	4pcs
8	FastCAM English standard software	1pcs
9	Electromagnetic valve connected wire	1pcs
10	Cutting nozzle (G03 1#—3#)	1pcs each
11	Vent needle	1set

Remarks: a) Above is for reference only, any changes please in kind prevail;

b) Order otherwise agreed in the contract the contract shall prevail;

Chapter 10 Transportation and storage

When transportation, the machine should be packed and fixed reliability.

When transportation, the transportation, the machine should be protected from rainy, snow.

Please pay attention on the package and transportation warning printed on the carton box.

Keep the place to store this machine dry, good ventilation, no-dust. No-rusty. Temperature should be $-25^{\circ}\text{C} \sim +55^{\circ}\text{C}$, and the relative humidity should not bigger than 90%.

After taking out of box and re-pack, please make sure the machine is packed in good condition.

It is better to use a plastic bag to cover the machine to prevent the dust etc.