

# **User's Manual for TL-404C Laser Mix Cutting Control System**

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# Part 1 Overview

## 1.1 System Overview

Thank you very much for using laser mix cutting control system of our company!

This system can be used for metal and non-metal laser mix cutting machine, meets your different requirements for processing.

- Use High-Performance 32-Bit CPU with Single-Precision Floating-Point Unit (FPU), the main frequency is up to 150MH.
- Height following control system and laser cutting control system are integrated into one control card. It greatly reduces wiring difficulty and improves the installation simplicity, and greatly reduces the production cost.
- With autofocus function, it uses the PID control algorithm for height following control (Z axis), realizes the infinite speed control, with good effect.
- Setting device parameter out of PC completely. All coupler completely isolated from outside interference, the system is reliable.
- Support USB2.0 port, U disk reading and writing, support U disk system upgrade; Support network , PC-communication is more convenient, safe, and reliable.
- With 64MB storage, work independently form PC, which is useful for the quantities of cutting production.
- Support 4 axes motion control(X Y Z U, XY is for laser cutting control, Z is height following control axis).
- S-shape acceleration and deceleration and adjustable velocity profile, meet the demand of smooth cutting and high speed working.
- Support scale cutting, automatic blowing, automatic focusing, foot switch, crash alarm protection, power-off cutting restoration, system lock, device management. Multiple types of laser can be controlled.

**Before using, please read our manual carefully, ensure to operate our system correctly.**

**Please keep the manual well, and it's convenient for your future references.**

**Because of different configuration, some devices have not some of the functions listed in the manual, the details subject to appropriate operation functions.**

## 1.2 Notes and Warning

- Prohibit the non-professionals to maintenance and debug the electrical system, if not, this will reduce device's safety performance, and expand failure, even cause accident and property loss.
- When system is working, please do not touch the sensor. Or there are damage to your body.
- When cutting metal, please notice the reflect laser beams from the metal surface. Some protection measure should be taken to avoid the body to be damaged.
- Sensor, the control card and the metal for cutting must be grounding.
- Please do not piles up debris on the control box, and in the course of using, regularly remove the dust of the control box surface and filters, to keep good ventilation.
- When users have to open the cover of the control box, must cut off the power after 5minutes and under the professionals' guidance, only can be allowed to touch the components in the electrical control box!
- Prohibit touching any motion parts or opening the control equipments when the machine is working, or it maybe bring about the accident and machine can't work.
- Prohibit using the electrical equipment in the damp, dust, corrosive gas, flammable gas area, or it maybe cause the electrical shock or fire!

## 1.3 Work Environment

- Ventilation, sanitation, and less dust
- Storage temperature: 0-50℃
- Work temperature: 5-40℃
- Work relative humidity: 30%-90%(no condensation)

## 1.4 Power Supply and Grounding

### 1.4.1 Power supply requirements

- Core power supply: DC 5V, 3A; External power supply: DC 5V, 3A
- According to different machine configurations, power consumption is between 0.1-0.2KW

### 1.4.2 Grounding requirements

- In order to prevent electrical equipment due to leakage, over-voltage, insulation etc causes of the electrical shock or fire, please make the electrical control reliable grounding.

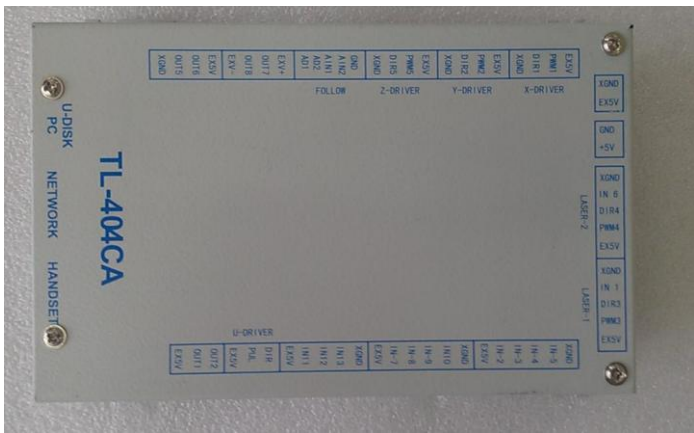
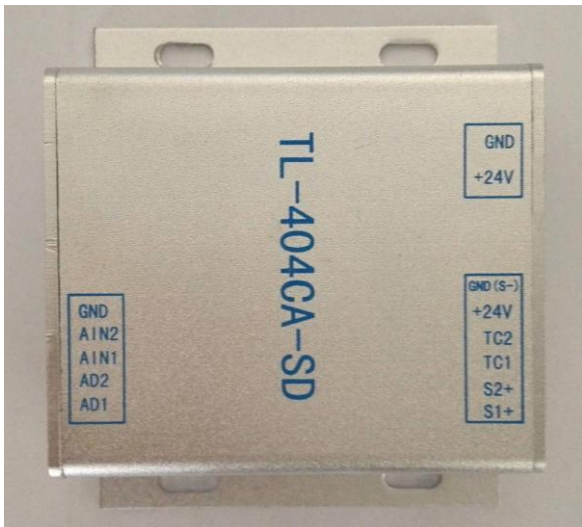

Grounding resistance is less than 100 ohms; the length of wire cable is within the 20meters, the cross-sectional area of the wire cable is larger than 1.0 mm<sup>2</sup>.





## 1.5 Accessory List


The Laser Mix Cutting Control System-TL-404C contained the accessories as below:

Name	Qty	Introduction	Photo
Operation Panel	1	For user operation	



Controller	1	The Motion Control Card	
Signal switching board	1	Signal switching board for connecting controller and the sensor	
Capacitive sensor (optional)	1	Height feedback sensor	

Connection cable	4	<p>1.Panel Connection cable for connecting controller and panel.</p> <p>2.USB communication cable for connecting controller and PC</p> <p>3.USB communication extended cable</p> <p>4.Communication cable for controller and signal switching board</p>	   
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<p>Crossover Ethernet Cable</p>	<p>2</p>	<p>1.Crossover Ethernet Cable 2.Network communication extended cable</p>	
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## Part 2 Wiring Installation Instruction

### 2.1 System Wiring Diagram

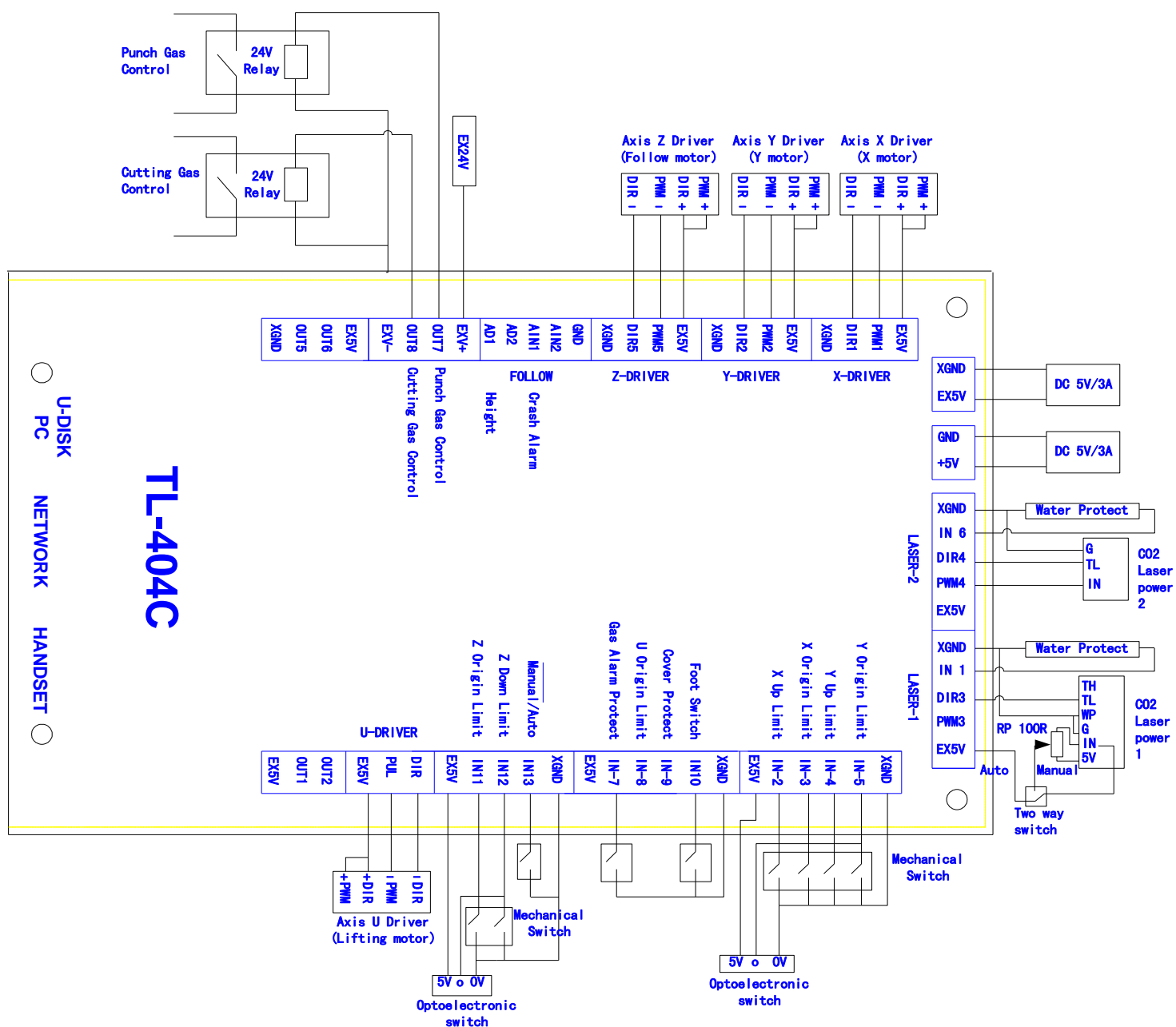


Fig. 2-1

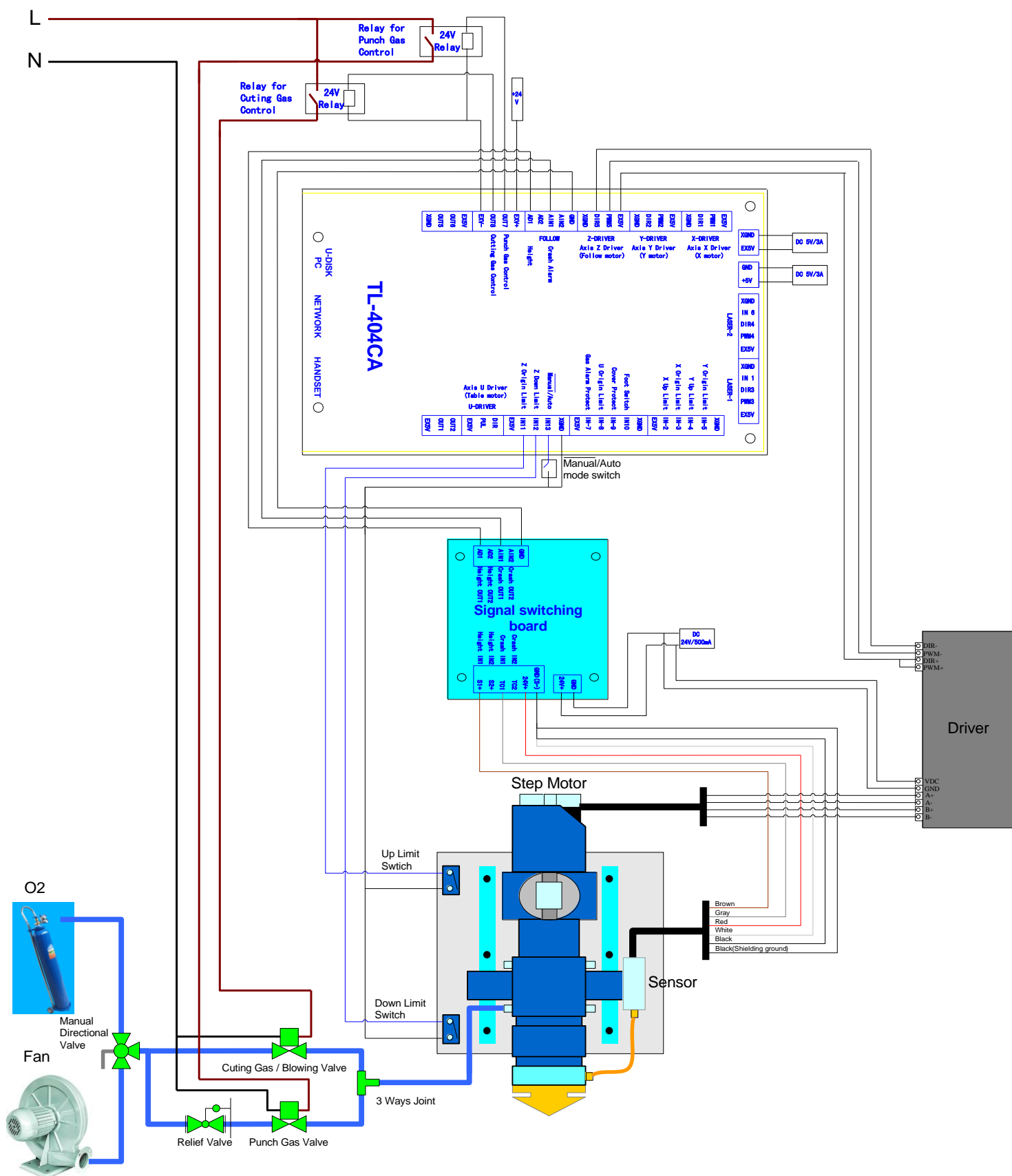


Fig.2-2

## Auxiliary gas wiring

Auxiliary gas has two aspects, blowing air for cutting nonmetal, blowing oxygen for cutting metal. Air and oxygen switch has two solutions.

Plan 1: Through a manual directional valve, as shown in figure 2-2, when cutting nonmetal, transfer manual directional valve to the air pipe, when cut metal, transfer to oxygen side.

Plan 2: Through a manual/automatic switch (single pole double throw switch), two relays and two electromagnetic valve control as shown in figure 2-3, when cut metal, switch to automatic mode, INT13 input high impedance state, oxygen valve control relay turns on, oxygen electromagnetic valve is opened, oxygen output to the 3 ways joint. When cutting nonmetal, switched to manual mode, INT13 input low level, the air valve control relay turns on, air electromagnetic valve is opened, compressed air output to the 3 ways joint.

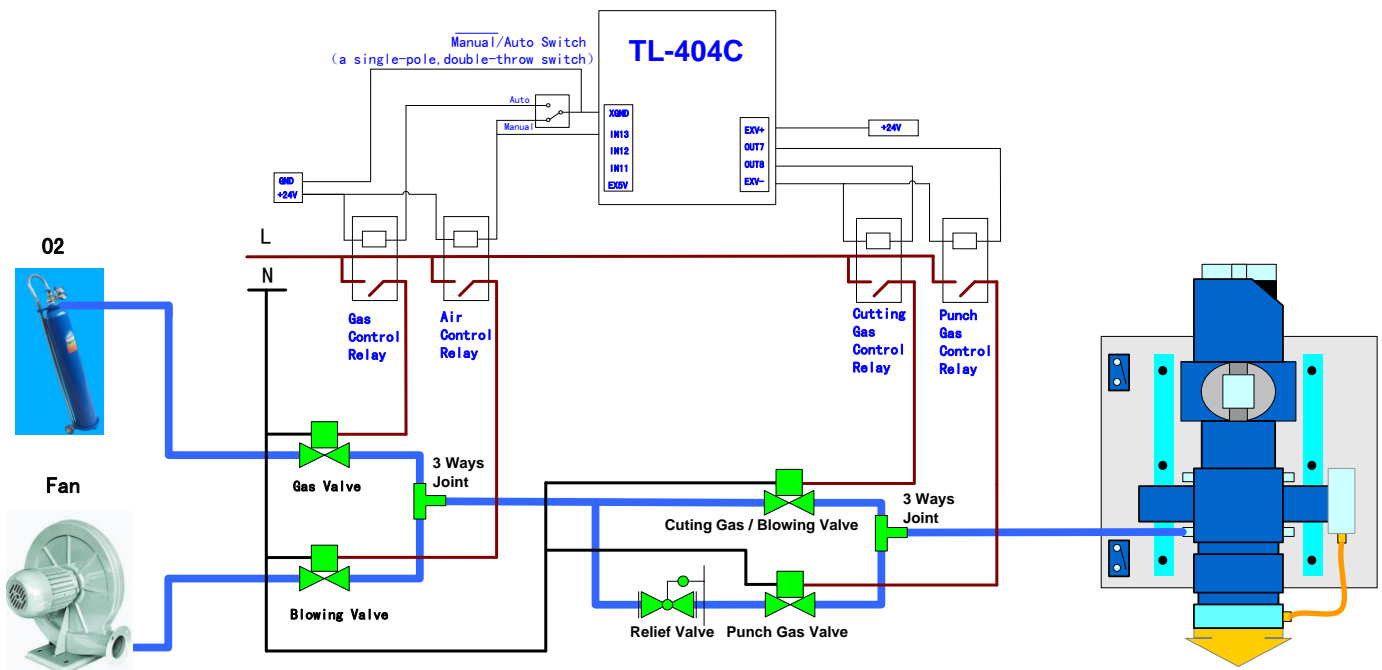


Fig. 2-3

**Note:** when cutting metal, in the equipment parameters of control card, if set the "Punch Gas Enable" to "Yes", when punching, OUT7 outputs high level, low pressure oxygen valve control relay turns on, low pressure oxygen punch electromagnetic valve is opened, low pressure oxygen output to a 3 ways joint. After the completion of the punch, OUT7 outputs low level, low pressure oxygen valve control relay turns off, electromagnetic valve is closed. OUT8 outputs high level, high pressure oxygen control valve relay turns on, high pressure oxygen cutting electromagnetic valve is opened, the high-pressure oxygen output to a 3 ways joint, begins to laser cutting. If you don't need low pressure perforation, the "Punch Gas Enable" parameter is set to "No", OUT7 has been output low



**Bottom:**

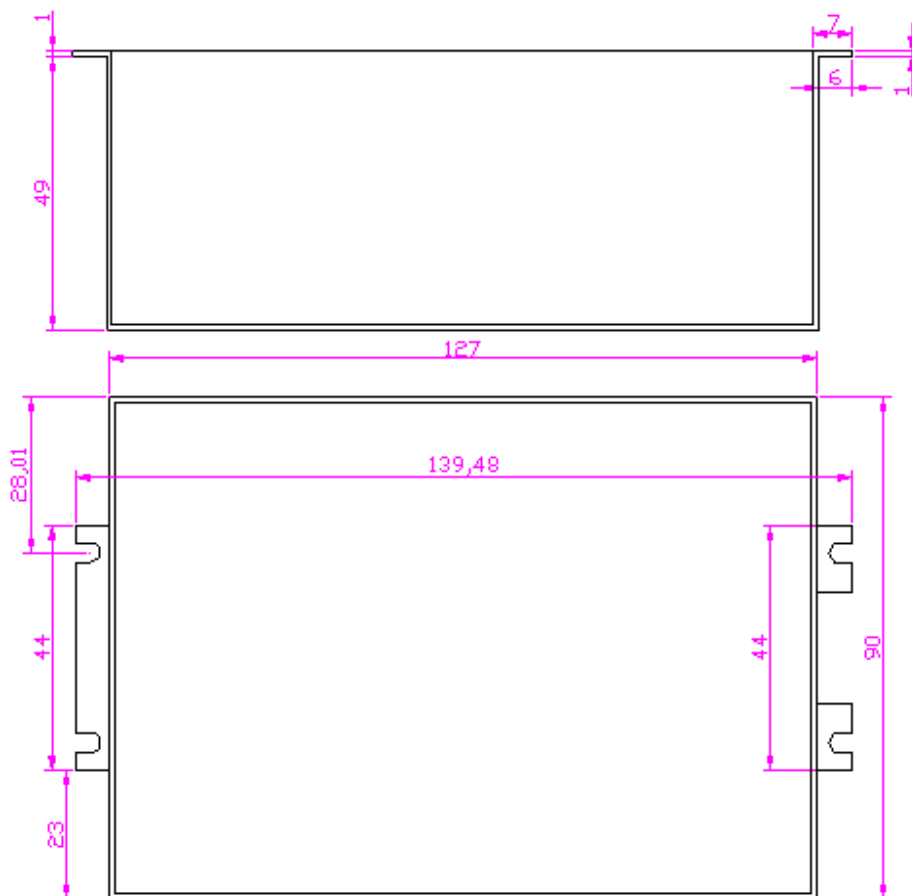


Fig. 2-5

## 2.2.2 Main board

The installation dimension of mainboard (the unit is MM):

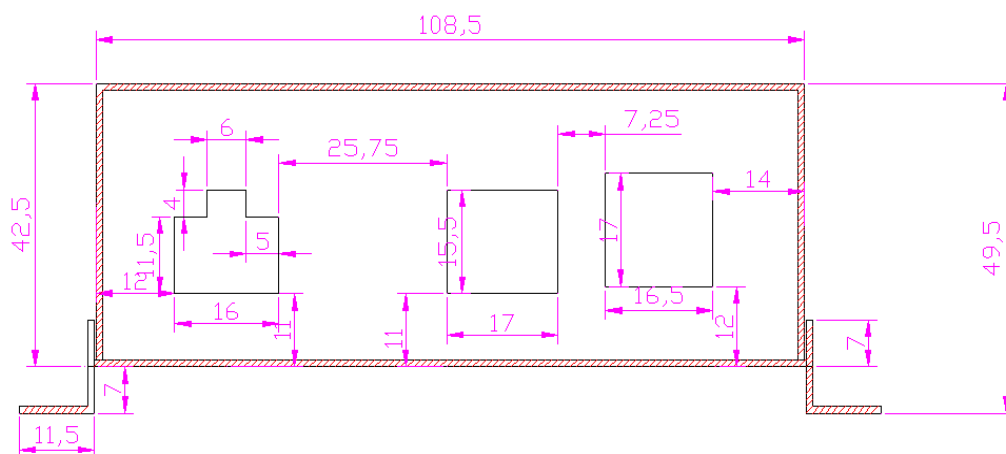


Fig.2-6



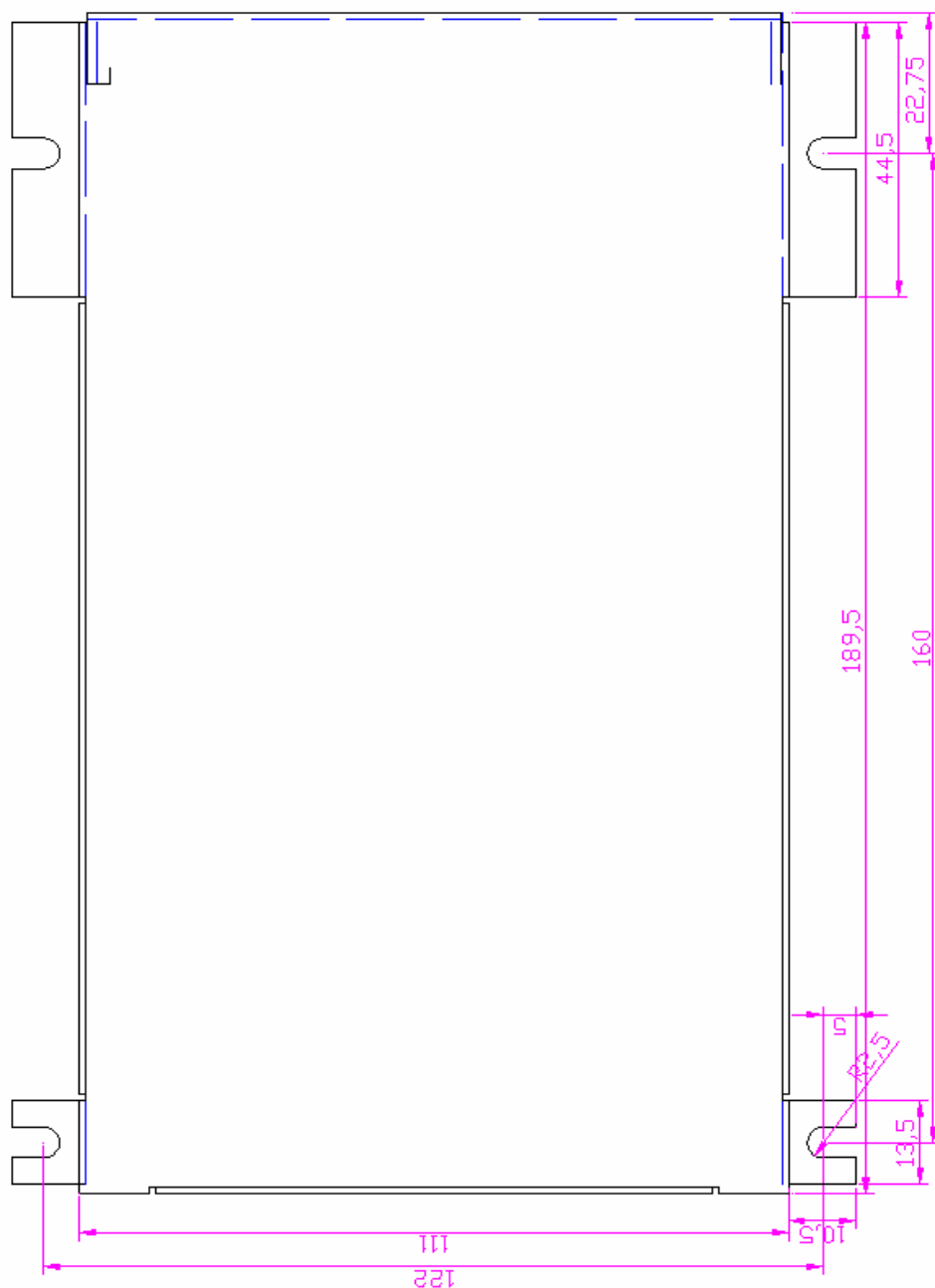


Fig.2-7

## 2.3 Wiring Instruction

### 2.3.1 Interface Board

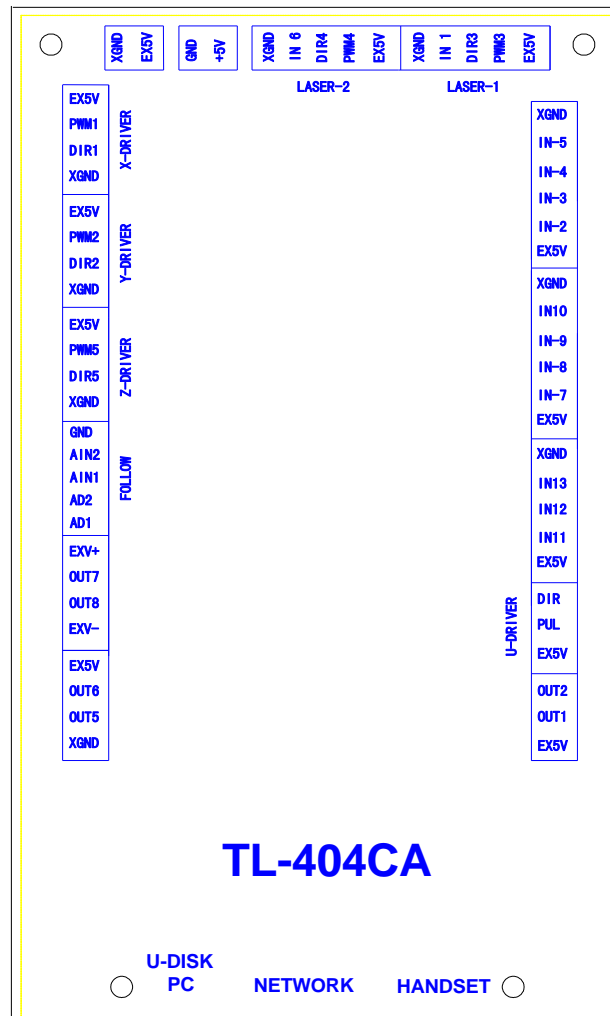


Fig. 2-8

### 2.3.2 Wiring Diagram

#### 2.3.2.1 Motor Wiring

The following is X axis motor wiring, other axis are similar.

##### 1. Step Motor Wiring

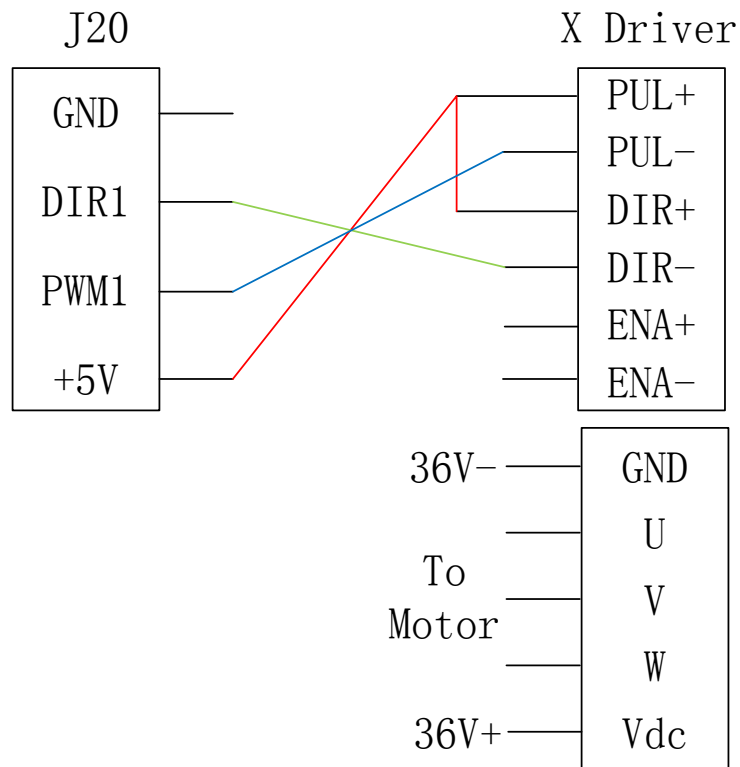


Fig. 2-9

## 2. Panasonic Servo Wiring

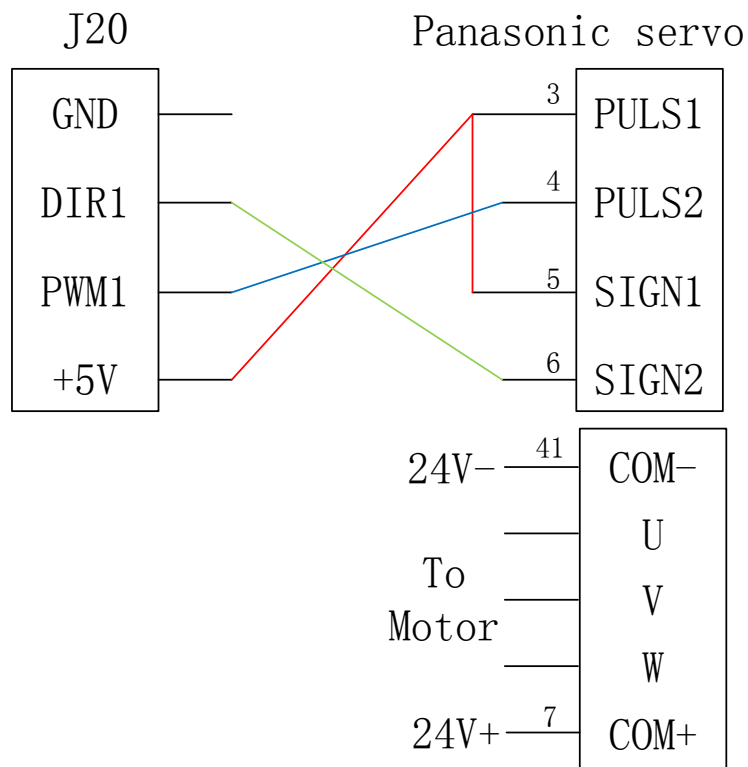


Fig. 2-10

### 2.3.2.2 Laser Power Supply Wiring

## 1. CO2 Laser Power Supply Wiring

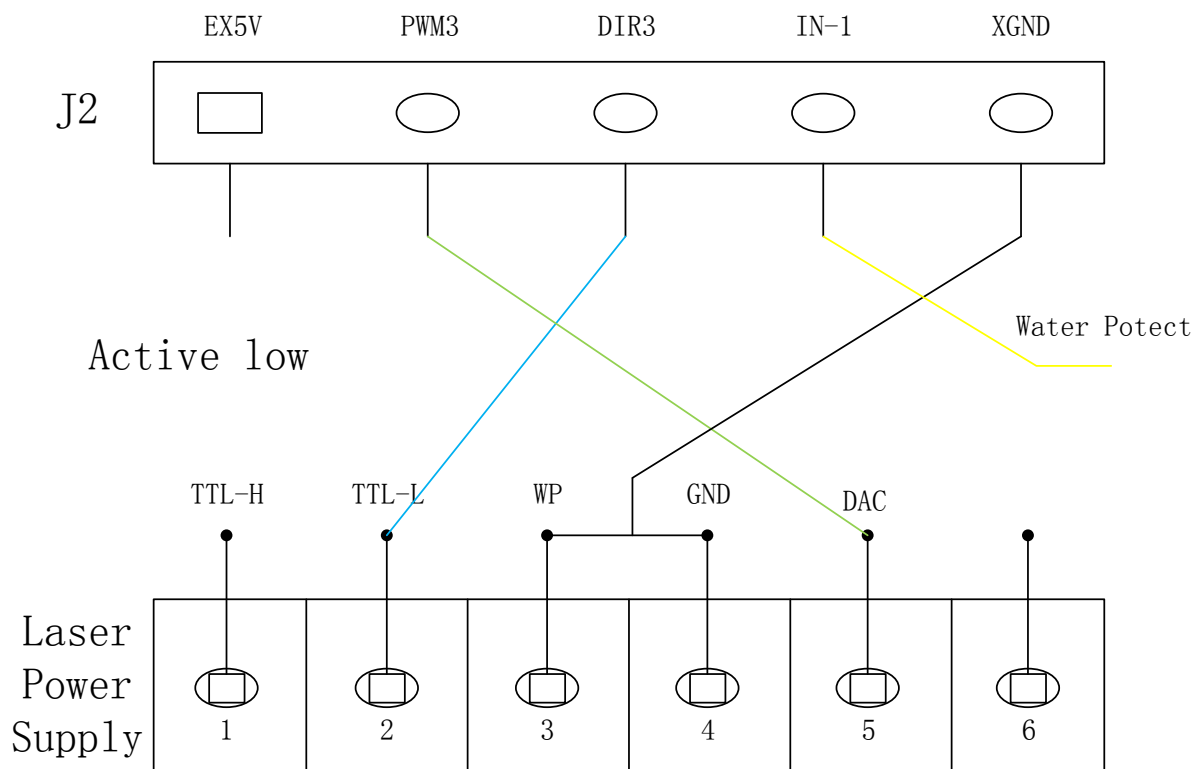


Fig. 2-11

## 2.RF Laser Wiring

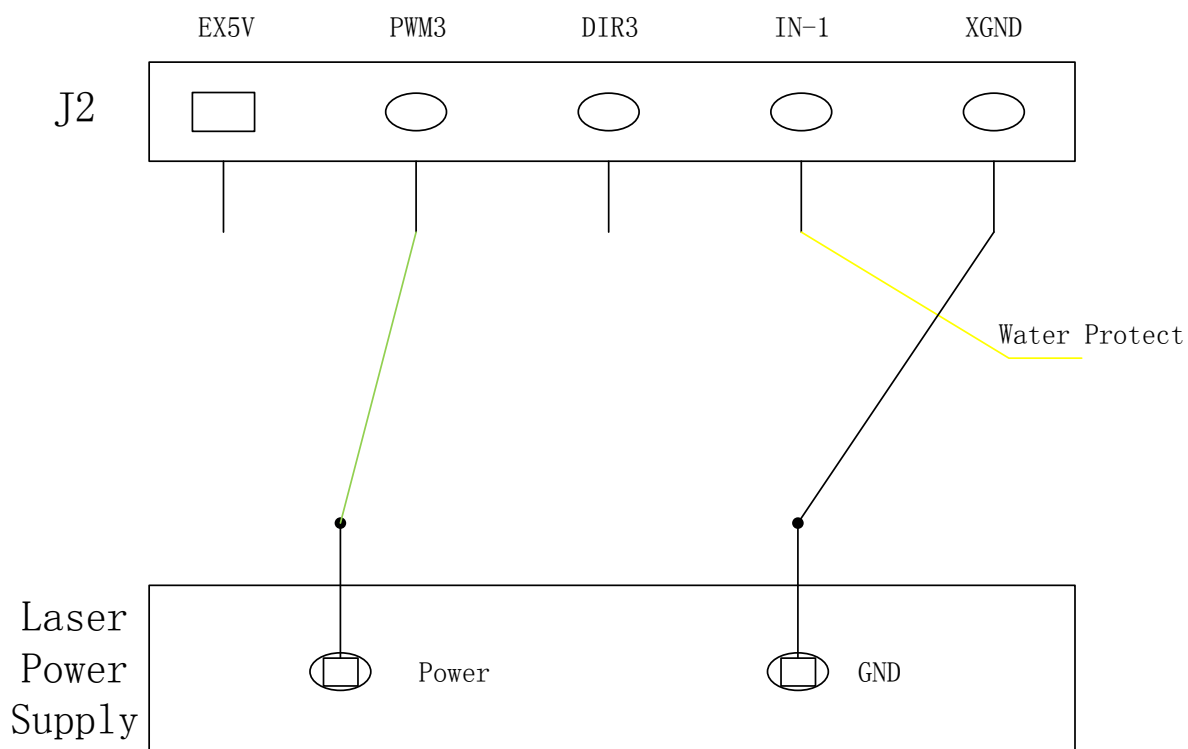


Fig. 2-12

The wiring of laser 2 is similar.

**Note:** When “RF1 or RF2” is selected, please set the PWM Frequency according to the data sheet of the laser. Generally, PWM Frequency is 5000Hz. And set the Laser Max parameter not larger than 95%, especially not to set as 100%, otherwise it works improperly.

### 2.3.2.3 High Pressure Oxygen Cutting Signal Wiring

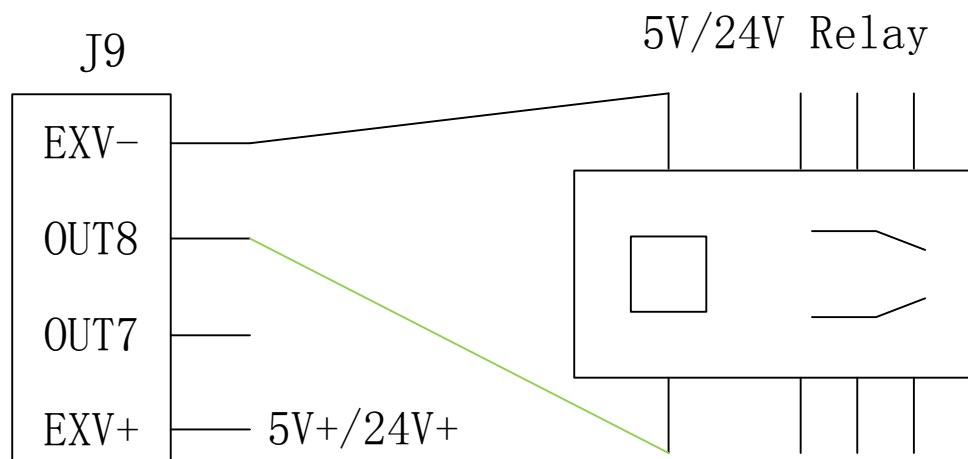


Fig. 2-13

### 2.3.2.4 Low Pressure Oxygen Punch Signal Wiring

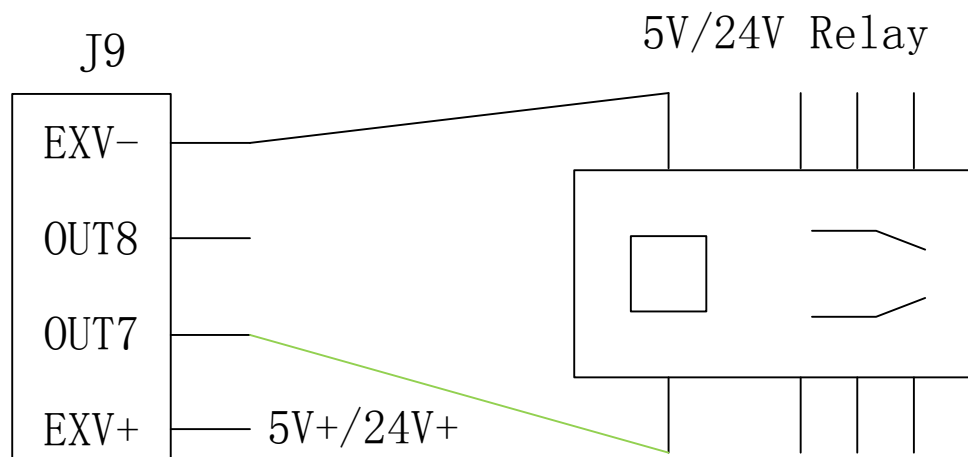


Fig. 2-14

### 2.3.2.5 Limit Switch Signal Wiring

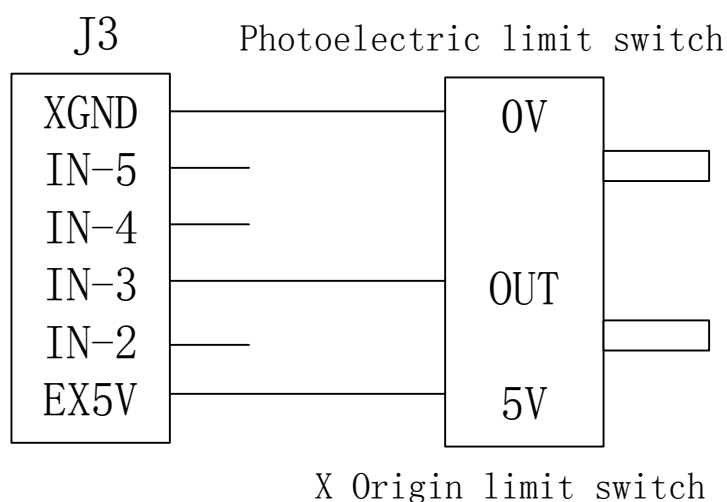


Fig. 2-15

Other limit switch wirings are similar.

## 2.4 Interface Instruction

### 2.4.1 Power Signal

- The system is dual 5V power supply
- The system internal 5V power interface J24 (switching power interface)

Pin	Definition
1	+5V Internal 5V power source positive (input)
2	GND Internal 5V power source grounding (input)

- The system external power interface J23 (switching power interface)

Pin	Definition
1	EX5V External 5V power source positive (output)
2	XGND External 5V power source grounding (output)

## 2.4.2 U-DISK Port

Label U-DISK, can directly insert the U disk to read and write.

## 2.4.3 PC Connection Port

Label PC connection port, can connect PC to read and write with USB.

## 2.4.4 NETWORK Port

Label NETWORK, can connect PC to read and write by network.

## 2.4.5 Output

### *The driver interface*

- X axis interface J20

Pin	Definition	
1	EX5V	External 5V power source positive (output) PUL+, DIR+
2	PWM1	Step pulse (output) PUL-
3	DIR1	Direction signal (output) DIR-
4	GND	External 5V power source grounding (output)

- Y axis interface J18

Pin	Definition	
1	EX5V	External 5V power source positive (output) PUL+, DIR+
2	PWM2	Step pulse (output) PUL-
3	DIR2	Direction signal (output) DIR-
4	GND	External 5V power source grounding (output)

- Z axis interface J21

Pin	Definition	
1	EX5V	External 5V power source positive (output) PUL+, DIR+
2	PWM5	Step pulse (output) PUL-
3	DIR5	Direction signal (output) DIR-
4	GND	External 5V power source grounding (output)

- U axis interface J11

Pin	Definition	
1	EX5V	External 5V power source positive (output) PUL+, DIR+
2	OUT3	Step pulse (output) PUL -
3	OUT4	Direction signal (output) DIR--

### ***The general output interface***

- The general IO output interface J17

Pin	Definition	
1	EX5V	External 5V power source positive (output)
2	OUT1	Work finish output signal
3	OUT2	Reserved

- The general IO output interface J10 (expansion port)

Pin	Definition	
1	EX5V	External 5V power source positive (output)
2	OUT5	Automatic following signal (metal cutting)
3	OUT6	The rising signal (metal cutting)
4	XGND	External 5V power source grounding (output)



The relay control signal interface J9

Pin	Definition
1	EXV+ Connect to pin 1 of J10 or external 5V/24V power source
2	OUT7 Low pressure oxygen blowing punching signals, high effective, connect to the relay coil “+” side
3	OUT8 High pressure oxygen blowing punching signals, high effective, connect to the relay coil “+” side
4	EXV- Connect to the relay coil “-” side

The input voltage of relay has many kinds, such as 5V, 12V, 24V, but the 5V is the best.

## 2.4.6 Laser Power Interface

- The interface of laser power 1 – J2

Pin	Definition
1	EX5V External 5V power source positive (output)
2	PWM3 Be used to control the laser When the laser is RF laser, used to control the power intensity and light of the laser. When the laser is domestic glass tube, used to control the electric current.
3	DIR3 Laser enable control (DIR3 jumper to H, the signal is high and effective, to L, the signal is low and effective.) When the laser is RF laser, used to control the enable function of laser. When the laser is domestic glass tube, used to control laser On/Off.
4	IN-1 Laser status, the corresponding instruction is LED D1 When the laser is RF laser, used to the state input of laser.



		When the laser is domestic glass tube, used to the state input of water conservation (active low).
5	XGND	External 5V power source grounding(output)

- The interface of laser power 2 – J5

Pin	Definition	
1	EX 5V	External 5V power source positive (output)
2	PWM4	Be used to control the laser When the laser is RF laser, used to control the power intensity of the laser. And Put the Jumper of s2/s4 to far away to battery. When the laser is domestic glass tube, used to control the electric current.
3	DIR4	Laser enable control (DIR3 jumper to H, the signal is high and effective, to L, the signal is low and effective.) When the laser is domestic glass tube, used to control laser On/Off.
4	IN-6	Laser status, the corresponding instruction is LED D6 When the laser is RF laser, used to the state input of laser. When the laser is domestic glass tube, used to the state input of water conservation (active low).
5	XGND	External 5V power source grounding(output)

## 2.4.7 Input

### *The limit interface*

- X, Y axis limit interface J3

Pin	Definition
-----	------------



1	EX 5V	External 5V power source positive (output)
2	IN-2	X upper limit, axis movement to the max coordinate limit sensor input
3	IN-3	X origin limit, axis movement to the minimum coordinate(0)limit sensor input
4	IN-4	Y upper limit, axis movement to the max coordinate limit sensor input
5	IN-5	Y origin limit, axis movement to the minimum coordinate(0)limit sensor input
6	XGND	External 5V power source grounding (output)

- Z, U axis limit interface J7

Pin	Definition	
1	EX 5V	External 5V power source positive (output)
2	IN-7	Gas alarm protect input, When installing the gas pressure detecting switch, and the input is low, the work will be pause
3	IN-8	U origin limit, axis movement to the minimum coordinate(0)limit sensor input
4	IN-9	Cover protection alarm input
5	IN-10	Foot switch signal input
6	XGND	External 5V power source grounding (output)

### ***The general input interface***

- Input interface J4

Pin	Definition	
1	EX 5V	External 5V power source positive (output))
2	IN-11	Z origin limit, axis movement to the minimum coordinate(0)limit sensor input, and it also as Z upper limit switch input
3	IN-12	Z down limit, axis movement to the max coordinate limit sensor

	input	
4	IN-13	Manual/automatic switch input, external switch input; One terminal of the switch connects to GND. The other terminal of the switch connects to the input.; When switch is closed, it is manual mode, cutting head does not follow automatically, can be cutting non-metal material; When switch on , it is automatic mode, cutting head follow automatically, can be cutting metal
5	XGND	External 5V power source grounding (output)

Follow input J28

Pin	Definition	
1	GND	Reference GND
2	AIN2	Crash alarm protection input 2, corresponding to TC2, when crash happens, input is high; Once receive the collision alarm, it immediately lift the cutting head to prevent damaging the cutting head
3	AIN1	Crash alarm protection input1, corresponding to TC1, when crash happens, input is high; Once receive the collision alarm, it immediately lift the cutting head to prevent damaging the cutting head
4	AD2	Height of sampling input 2, corresponding to S2 + input, the range is 0 ~ 3 v, the smaller the distance from cutting head to the sheet metal, the lower the voltage
5	AD1	Height of sampling input 1, corresponding to S1 + input, the range is 0 ~ 3 v, the smaller the distance from cutting head to the sheet metal, the lower the voltage

When using the single laser control, the water protection signal of another laser must be shorted with XGND, otherwise, the machine don't work.

***The connection ways of switch input signal:***

- When using approaching switch, the corresponding parameters of upper PC must be set as "Negative" by NPN; the corresponding parameters of upper PC must be set as "Positive" by PNP.

- When using straight or magnetic induction switch, the corresponding parameters of upper PC must be set as “Negative” while receiving signal XGND; the corresponding parameters of upper PC must be set as “Positive” while receiving signal + EX5V.

## 2.4.8 Input Signal Diagram

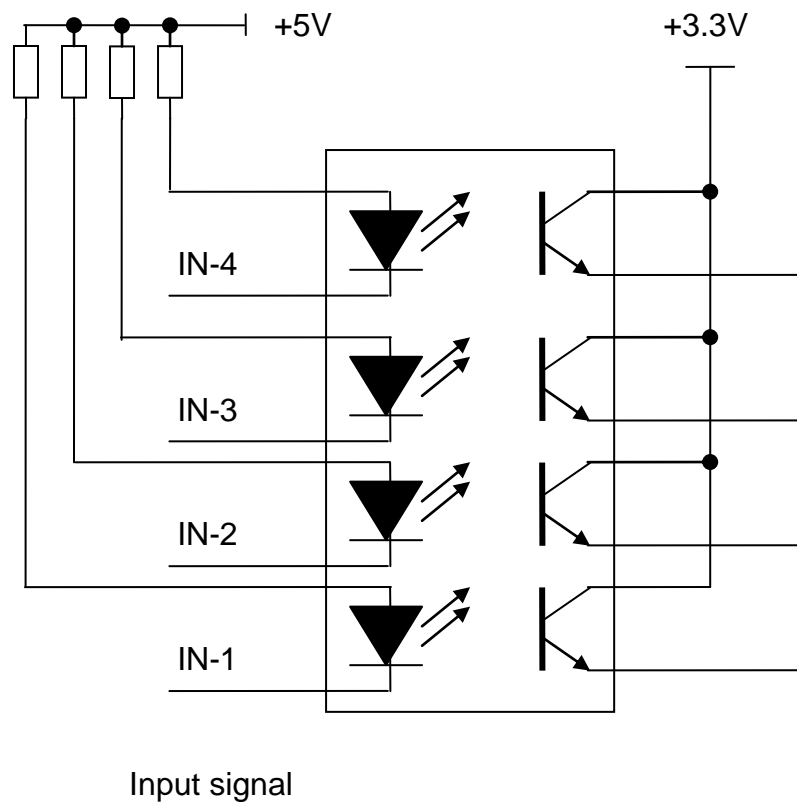


Fig. 2-16

## 2.5 Signal Switching Board

### 2.5.1 Installation Dimension

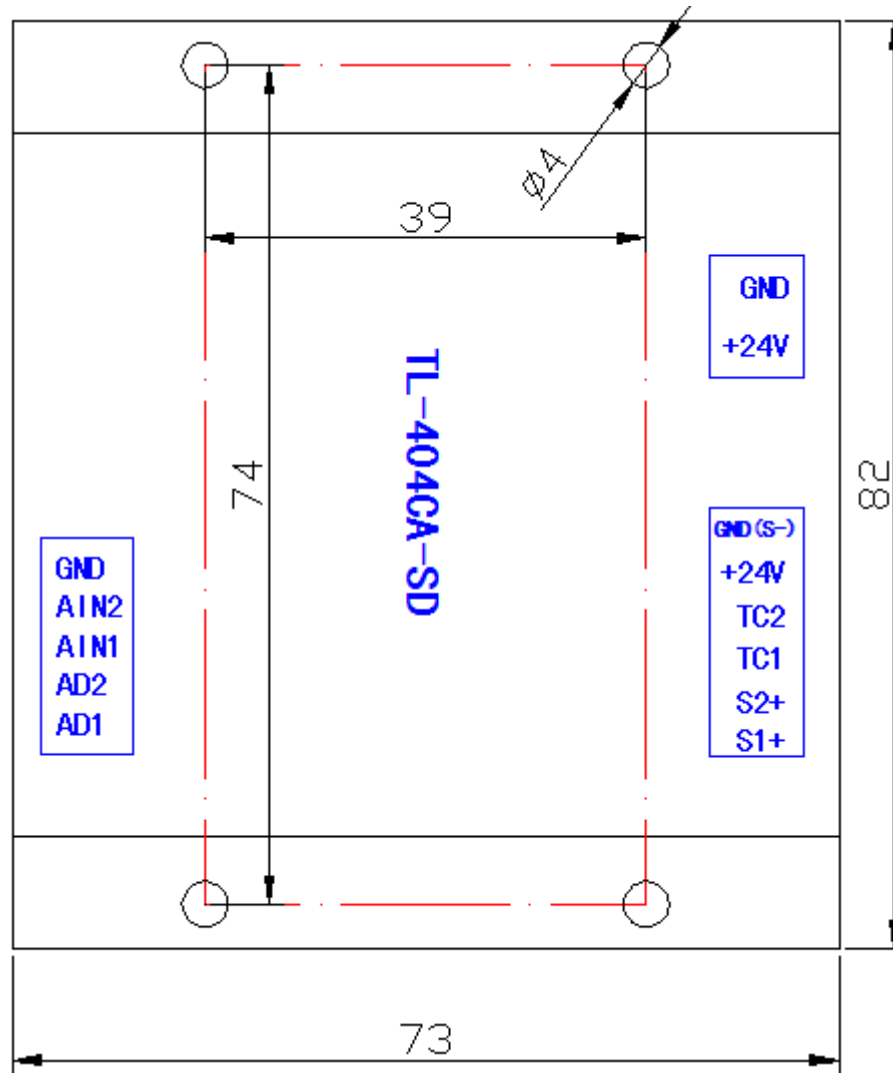


Fig. 2-17

## 2.5.2 Wiring Instruction

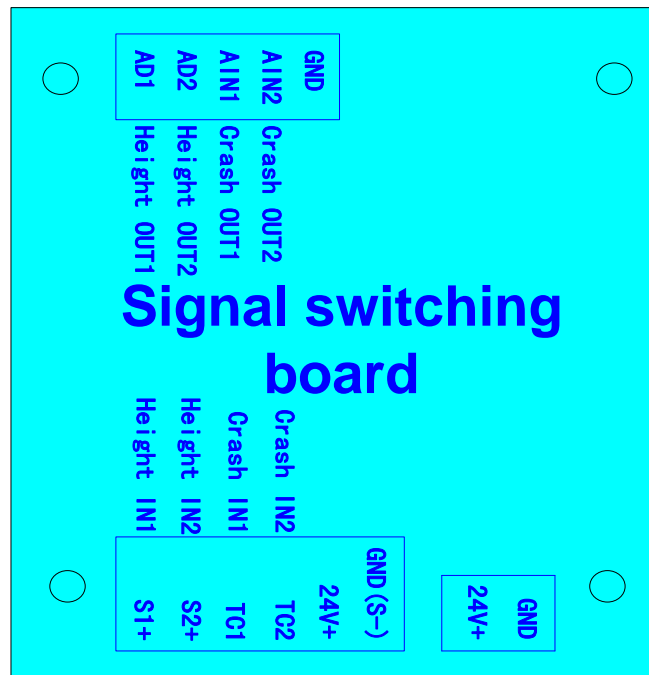


Fig. 2-18

Input J1 (Capacitive sensor INPUT)

Pin	Definition	
1	S1+	Height of sampling input 1, the range is 0 ~ 10 v, the smaller the distance from cutting head to the sheet metal, the lower the voltage
2	S2+	Height of sampling input 2, the range is 0 ~ 10 v, the smaller the distance from cutting head to the sheet metal, the lower the voltage
3	TC1	Crash alarm protection input1, when crash happens, input is high; To prevent damaging the cutting head
4	TC2	Crash alarm protection input2, when crash happens, input is high; To prevent damaging the cutting head
5	24V+	24V+ Output, for capacitive sensor power supply
6	GND	24V+ source grounding

Signal switching board with + 24 v power supply.

+24V power supply input J2

Pin	Definition	
1	+24V	24V power source positive (input)
2	GND	24V power source grounding (input)

Output interface J3 (To Controller)

Pin	Definition	
1	GND	Reference GND
2	AIN2	Crash alarm protection output 2, corresponding to TC2, when crash happens, output is high
3	AIN1	Crash alarm protection output1, corresponding to TC1, when crash happens, output is high;
4	AD2	Height of sampling output 2, corresponding to S2 + input, the range is 0 ~ 3 v, the smaller the distance from cutting head to the sheet metal, the lower the voltage
5	AD1	Height of sampling output 1, corresponding to S1 + input, the range is 0 ~ 3 v, the smaller the distance from cutting head to the sheet metal, the lower the voltage

## 2.6 Capacitive Sensor

### 2.6.1 Basic Functions

The capacitance sensor can be used with variety of capacitive sensing heads to measure relevant physical property, such as distance, pressure, temperature, thickness, liquid level, etc. Sensitivity and range of measurement can be modified accordingly.

When the sensor head touches the object surface, the LED indicator light will turn red; at the same time, it outputs collision signal (+24V).



## 2.6.2 Principle

The capacitance sensor transforms the sensor head capacitance variation according to relevant physical properties changes to electrical signal. The signal then be processed via amplifier, modulator, filter etc. and turns to strong and clean analog signal.

## 2.6.3 Technical Specifications

1 Supply voltage: DC  $24V \pm 20\%$ ,  $\geq 0.5A$ , Ripple noise  $< 240mVp-p$

2 Gap setting range:  $0.1 \cdots 20mm$  when the diameter of nozzle end  $< 5mm$ . The gap can be adjusted up to 400mm or more depending on nozzle structure.

3 Measurement repeatable accuracy:  $< \pm 0.05mm$

4 temperature drift:  $< 0.5\%/^{\circ}C$  (within 1mm gap)

5 Output voltage:  $0 \cdots +10VDC$ , The sensitivity can be adjusted.

6 Response time:  $< 5ms$

7  $\Phi 9$  socket provides 24 volt DC power input and analog signal output.

8 Electrical box dimensions:  $43mm \times 50mm \times 20mm$

9 Working conditions:

Electrical box operating temperature:  $-40^{\circ}C \cdots 60^{\circ}C$ ;

Relative humidity  $< 80\%$ ;

No strong electromagnetic interference;

10 Alarm protection and Status output:

When the sensor tip touches the surface to be measured, the LED will turn red and collision signal Status outputs 24V.

## 2.6.4 Capacitive Sensor Diagram

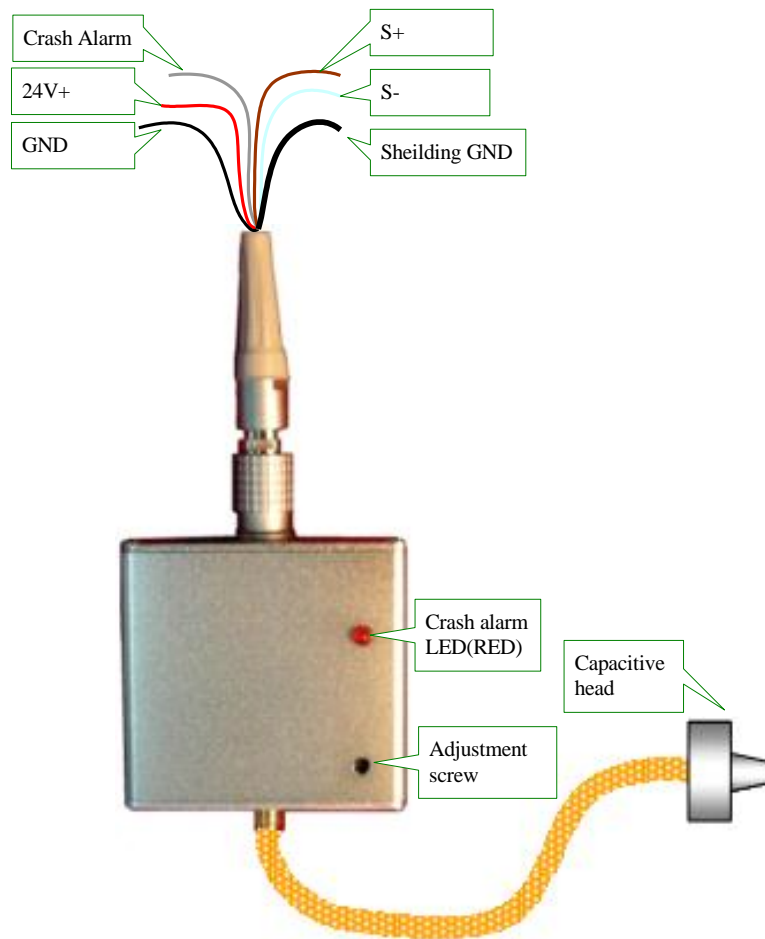


Fig. 2-19

Signal	Define
Red	DC 24V power supply input
Black	GND
Brown	S+ output
White	S-, Signal GND
Gray	Crash alarm output, the distance between the sensor head and the surface to be measured is less than 0.1mm or in touch, the indicator LED will turn to red and at the same time output 24V
Black(Blod)	Shielding GND

### Attention:

1. The measure range of the sensor is preset to 0.1~5mm; if you want to change

the measurement range or sensitivity, you can do so by adjusting “sensitivity/measurement range adjustment screw”.

Turn the screw counterclockwise, reduce the sensitivity, and the measurement range will be larger;

Turn the screw clockwise, increase the sensitivity, and the measurement range will be smaller.

2. Each sensor will be shipped with a matched RF cable. When exchanging to other RF cable, the measurement range and the sensitivity will likely to be changed, please adjust it accordingly.

3. When certain parts of the sensor are changed, please tune the sensor according to Note 1.

## Part 3 The Operation Panel

### 3.1 The Panel Operation and Buttons Function Introduction

#### 3.1.1 The Panel

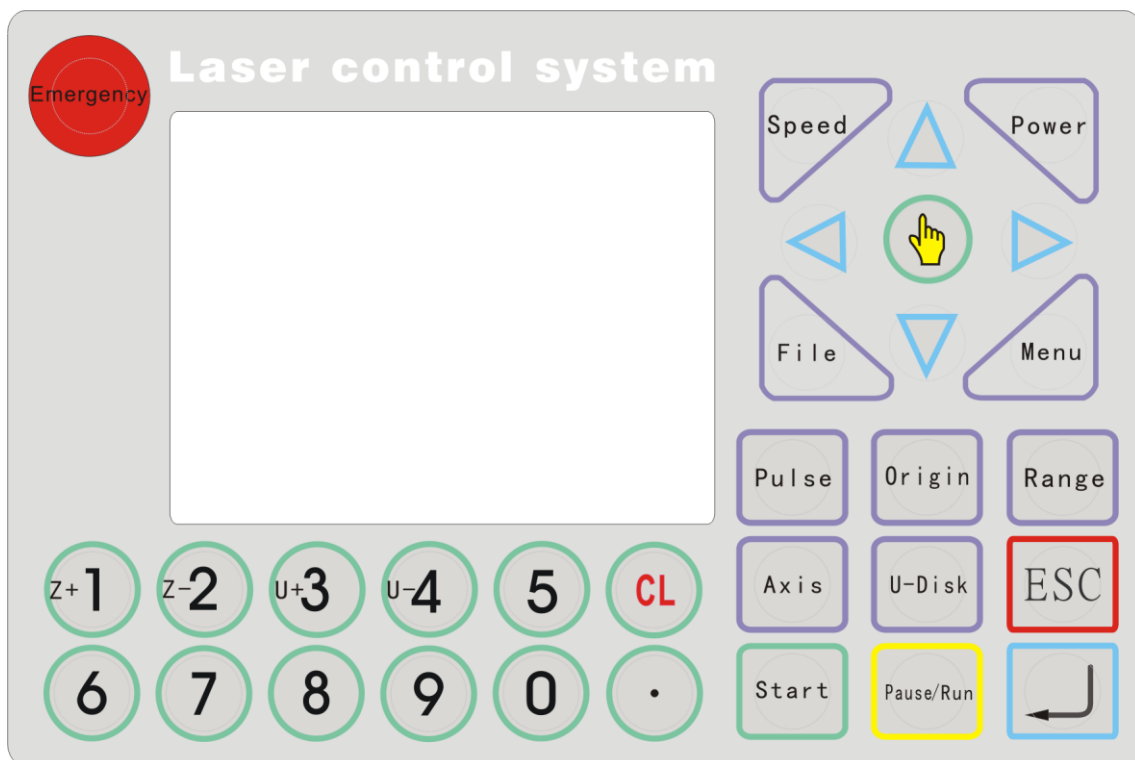










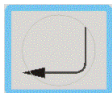















Fig. 3-1

#### 3.1.2 Buttons Function Introduction

1.  “Emergency Stop” key: no matter what state the machine, click the key, it’ll be into reset state, then return the origin point.
2.  “Speed” Key: Set the speed.



3.  “Power Light Intensity” Key: Set the laser powers.
4.  “Menu” Key: Press the key into the main menu interface.
5.  “File” Key: Into the memory file selection interface.
6.  “U Disk” Key: Into the U disk file selection interface.
7.  “Range (frame)”Key: The range previewed interface.
8.  “Pulse” Key: Use to test, touch a time, light a time, used to test the optical path.
9.  “Origin” Key: Can set the start point from which the machine runs. The  
“Origin” can be freely chosen on the Machine setting parameters. If choose the  
“Mechanical Origin”, after the machine reset, it’ll return the origin, the coordinate  
is “0, 0”. If choose the “Regression Point”, after resetting, it’ll return the current  
coordinate that machine operated last time.
10.  “Single Axis” key: into the single axis movement interface.
11.  “Enter” Key.
12.  “ESC” Key.
13.  “Start” Key.

14.  "Pause/Run" Key: press the key to pause at the working state, again press, it'll go to running. On the Pause state, after moving the X or Y axis, touch a time, it'll be automatically return the origin to continue working. On the Stop state, press the key, the laser head will automatically return the regression point.
15.   Number Keys, change the data the selected area, also can directly press the key to choose the current menu.
16.  Decimal Key.
17.  Delete key.
18.   Z axis moving key, in the Processing and Event into interface to move the Z axis.
19.   U axis moving key, in the Processing and Event into interface to move the U axis
20.  Direction key, used to move the X, Y axis, in the other interfaces, used to move the curse to choose menu.
21.  Choose key, change the axis speed in the standby interface, in the other interface, used to change the parameters besides the numbers.

## 3.2 The Main Interface Introduction

### 3.2.1 Power Interface

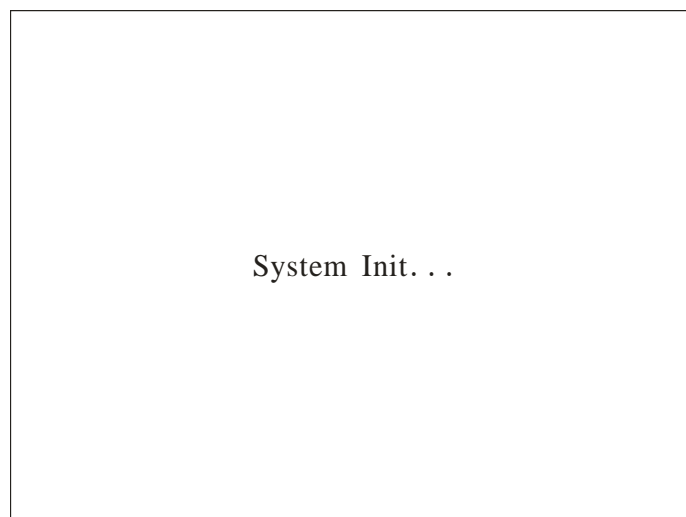


Fig.3-2

The system is initializing, please wait...

### 3.2.2 Standby Interface

After initialization, it'll into the standby interface, show as:

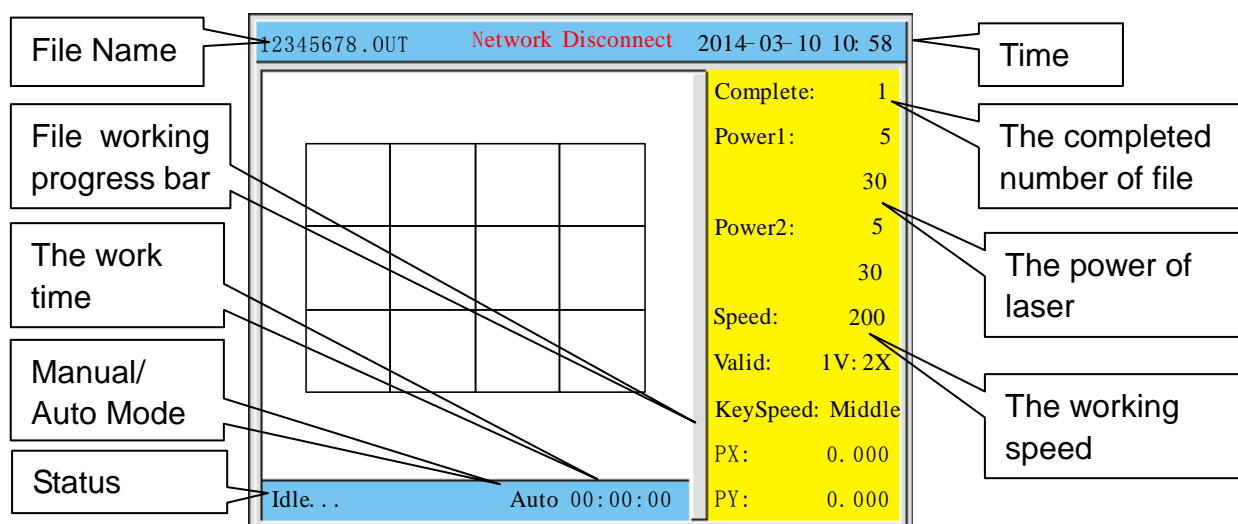


Fig. 3-3

The top of the interface shows the file name, network status, the date and time. The white area shows the preview of the selected file. And the yellow area shows the

complete times, default power ,speed of the machine., the water protect status ,the speed of key moving, and the position of axis x and axis y. And at the bottom left of the interface, it shows the machine status, auto/manual mode and the last working time.

The parameters are described below:


- **Machine Status:** When no processing it displays "Idle...". Processing, it displays "working...". When work is suspended, it displays "Pause". Status displays "Crash Alarm...", it means the head hit the metal material, processing will be suspended at this time. Status displays "Follow Error Alarm!", it means that there was no sheet metal cutting head below, or sheet metal concussion is too big, lead to follow spacing increases suddenly, processing will be suspended at this time. Status displays "Cover Protect", it means cover protection alarm trigger, processing will be suspended at this time. Status displays "Limit Switch On...", it means that the Z axis limit switch has been trigger.
- **Manual/Auto Mode:** When INT13 input is low electricity level, the system switches to manual mode, when cutting the cutting head don't follow, can cut non-metal, status is shown as "Manu". When INT13 input is not low electricity level, the system switches to automatic mode, when cutting the cutting head to follow, metal cutting, status is shown as "Auto".
- **Network status:** If connect the network, it'll show the IP address 196.168.0.100. Otherwise, it shows Network disconnect.
- **Complete:** The complete times of the selected file.
- **Power1:** The power of Laser 1. The above value is min power value. The following value is the max power value.
- **Power2:** The power of Laser 2. The above value is min power value. The following value is the max power value.
- **Speed:** It shows the work speed.
- **Valid:** The water protection status. In the figure, the water protection is 1X: 2X, 1X means water protection 1 not connected, 2X means water protection 2 not connected. If connect, it'll show 1V:2V.
- **Key Speed:** Manually move axis speed, can press the "Select" key to change the speed, there are "Fast", "Middle", "Slow".
- **PX, PY:** The coordinate in the current place.

When there is no file Selected, It displays the default power and speed. When selecting the file, it shows the power and speed in the first layer of the file. When processing, it shows the power and speed of the current processed layer.

When the machine is processing, if you want to modify the speed of the current layer, press the pause button, then press speed button, you can modify the speed of the

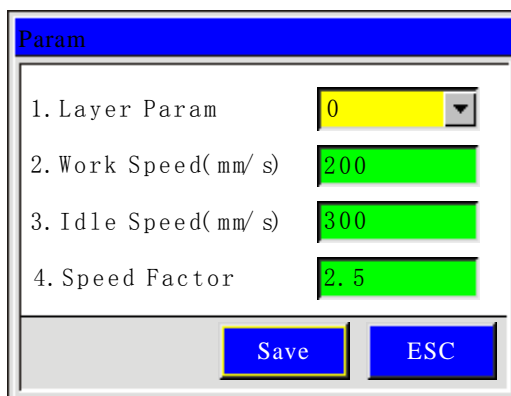


current layer. In the same way, press power button to modify the min/max power. If machine is processing, press “Left/Right” button, can immediately reduce or increase the laser power. Press once, plus or minus 1%. Left for reduce, Right for increase. When changed the speed of power during working operation, after the completion of processing, it prompts whether to save the changes of the speed and power value.

In standby mode, press  to clear the completed number of selected file.

### 3.2.3 Speed Setting Interface

After initialization, press the “Speed” key, show as:




The screenshot shows a software window titled "Param" with a blue header. Inside, there are four settings:

- 1. Layer Param: A dropdown menu showing "0".
- 2. Work Speed(mm/ s): A green input field showing "200".
- 3. Idle Speed(mm/ s): A green input field showing "300".
- 4. Speed Factor: A green input field showing "2.5".

At the bottom right, there are two buttons: "Save" and "ESC".

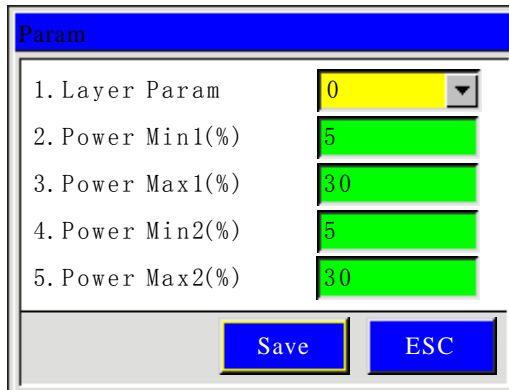
Fig. 3-4

This shows the speed setting is effective when the speed of working file set as defaulted.

- **Layer Param:** When one file is selected, press  button, to choose the layer number.
- **Work Speed:** When one file is selected, it shows the work speed in current layer. Otherwise, it shows the system default speed value. The unit is mm/s.
- **Idle Speed:** The default move speed when laser is off. When one file is selected, it shows the idle speed in current layer. Otherwise, it shows the system default speed value. The unit is mm/s.
- **Speed Factor:** It is applied to improve the smoothness of movement. The range is 0.00-5.00. The smaller the factor, the slower of planned speed of lines in work file, and then the smoother of movement when turning corner. Normally it is set to 2.5. If the smoothness is high demanded, set the factor to less than 1.

### 3.2.4 Power Light Intensity Interface


After initialization, press the “Power” key, show as:



Param	
1. Layer Param	0
2. Power Min1(%)	5
3. Power Max1(%)	30
4. Power Min2(%)	5
5. Power Max2(%)	30

Save ESC

Fig. 3-5

- **Layer Param:** When one file is selected, press  button, to choose the layer number.
- **Power Min:** When stroking curves, this power intensity applied for line start and the corner of the curve .Or it applied for the top depth when gradient carving. The range is 0.00~100.00%.
- **Power Max:** When stroking curves, this power intensity is applied as the work speed was reached. Or it applied for the bottom depth when gradient carving. The range is 0.00~100.00%.

Power Min1 is the min light power of LASER-1. Power Min1 is the max light power of LASER-1.It is the same as Power Min2 and Power Max2 of LASER-2. When no file is selected, the power value is the system default power value. When pulsing, the Power Max will be used.

### 3.2.5 Range Preview Interface

After initialization, press “Range” key, show as:

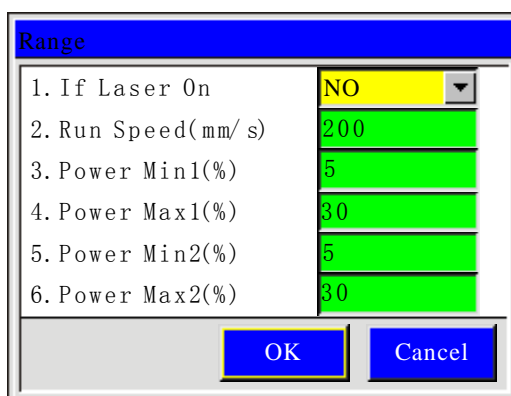


Fig. 3-6

- **If Laser On:** Set run scale with or without laser on. Press “Choose” key to set the value.
- **Run Speed (mm/s):** The speed of running scale, unit is mm/s.
- **Power:** When cutting the scale, it uses the system default power which is shown here. The min power intensity applied for line start and the corner of the curve. The max power intensity is applied as the run speed was reached. Power Min1 is the min light power of LASER-1. Power Min1 is the max light power of LASER-1. It is the same as Power Min2 and Power Max2 of LASER-2.

### 3.2.6 Single Axis Movement Interface

After initialization, press “Axis” key, show as:

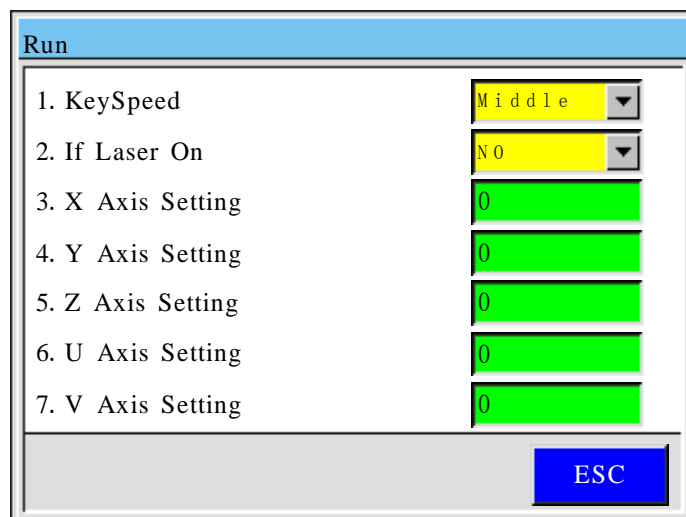


Fig. 3-7

Press the “Up/Down” key to choose the needed operation:

- **Key Speed:** fast, middle, slow.

- **If Laser On:** Yes or No?
- **X Axis Setting:** Press “Right/Left” key to move X axis, when stop, it'll show the current coordinate. The other axis operation is similar.

When If Laser On parameter is set as Yes, it uses the system default power to cut. No selecting file and press Power button to modify the system default power.

### 3.2.7 File Selection Interface

Press “Menu” key into the main menu, and select the Memory File button. Also can directly press “File” to enter, show as:

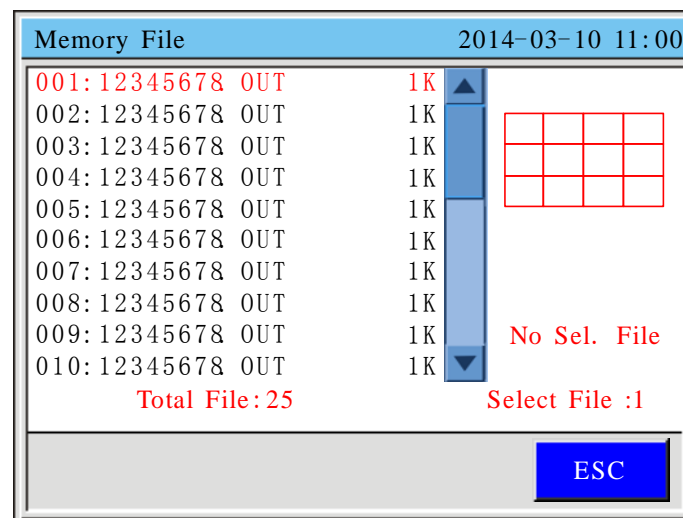


Fig. 3-8

Press “Down/Up” to choose the file, press “Select” key to find the current file, press “ESC” to quit, press “Enter” to operate, show as:

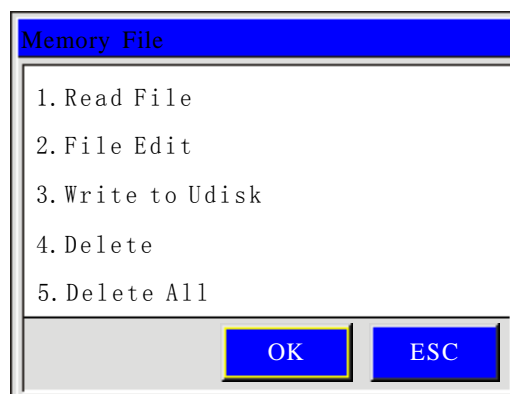


Fig. 3-9

- **Reading File:** Select this file to work.

- **File Edit:** Edit the file parameters like speed and power.
- **Write to U Disk:** Copy the file into U disk
- **Delete:** Delete the current file
- **Delete all:** Delete all memory files.

### 3.2.8 U disk File Interface

Press “menu” key into the main menu, and select the U Disk file. Also can directly press “U disk” to enter, show as:

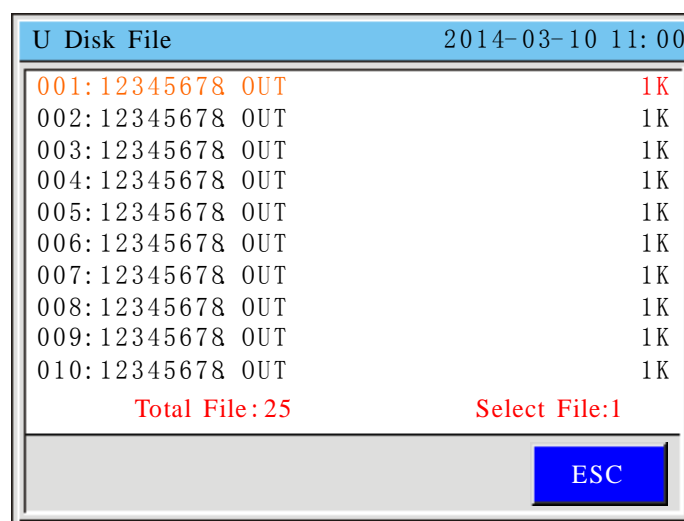


Fig. 3-10

Press “Down/Up” to choose the file, and press “Select” key to point the current file, then click “Enter” key or “ESC” to quit, show as:

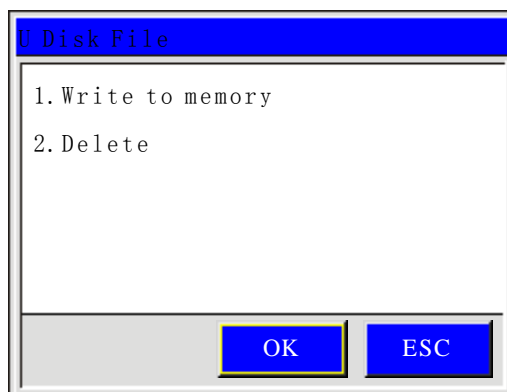


Fig. 3-11

- **Write into memory:** Copy file from U Disk to control card.
- **Delete:** Delete file.

### 3.2.9 The Main Menu Setting

Press “Menu” into the main menu, show as:

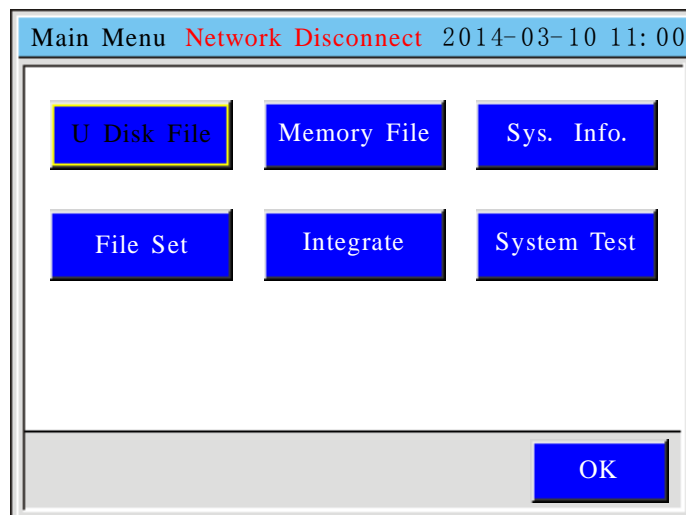


Fig. 3-12

Press the “Up/Down/Left/Right” key to choose the needed setting, “Enter” to operate, and “ESC” to quit.

### 3.3 File Setting

After starting, press “menu” into the main menu, choose the “File Set”, then press “Enter”, show as:

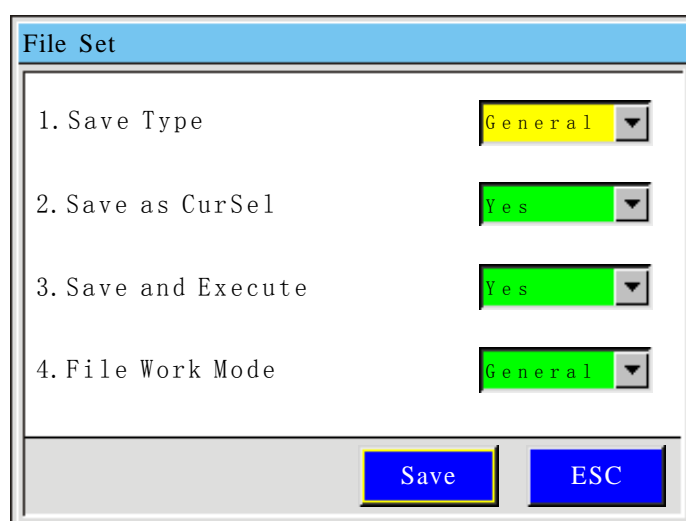


Fig. 3-13

Press “Up/Down” to choose the required operation, click “Select” key to change setting,

press “Enter” to save the setting, click “ESC” to quit.

- **Save Type:** General or Temp Save. Temp Save means the received file is temporary file. It will be replaced by the new received file. General means the received files will be saved one by one, not be replaced.
- **Save as CurSel:** Once a file is finish downloading, it will be select as current file.
- **Save and Execute:** Once a file is finish downloading it will be executed.
- **File Work Mode:** General or Cyc. Cyc means All the Files will be executed one by one in cycle.

### 3.4 The Integrate Settings

After finishing the start, press “Menu” key into the main menu interface, choose “Integrate”, then press the “Enter” to enter, show as:

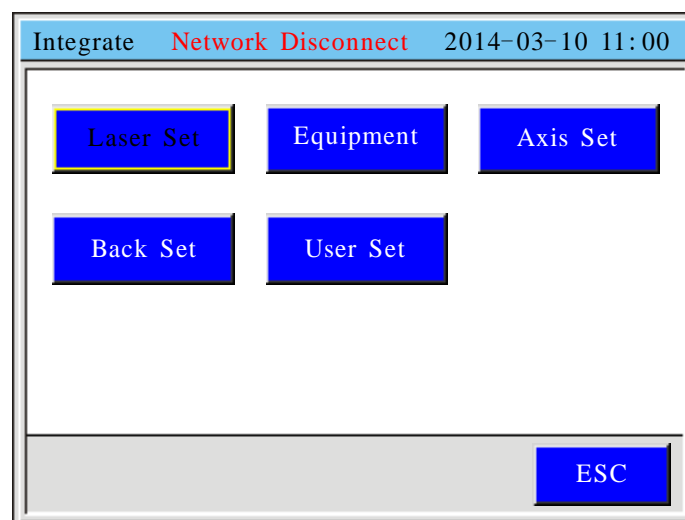


Fig. 3-14

Press the “Up/Down, Right, Left” to select the needed operation, click “Enter” to enter, click “ESC” to quit.

#### 3.4.1 Laser Set

In the Integrate Setting interface, choose “Laser Set” to enter, show as:

Laser Set		2014-03-10 11:00
1. Laser Type	CO <sub>2</sub>	
2. PWM Frequency (HZ)	20000	
3. Laser Min (%)	1	
4. Laser Max (%)	100	
5. PWM DIR	Positive	
<div>Save</div> <div>ESC</div>		

Fig. 3-15

Press the “Up/Down” key to select the needed operation. Press the “Choose” key to change setting, “Number” keys to set the value.

- **Laser Type:** The common laser (CO<sub>2</sub> glass tube), RF1, and the RF2. RF1 is for RF laser without pre-ionize. RF2 is for RF laser with pre-ionize that will output 1us tickle pulse.
- **PWM Frequency (HZ):** Press the “Number” keys to change the PWM.
- **Laser Min/Max (%):** Range:  $0 \leq \text{the min duty ratio} \leq \text{the max duty ratio} \leq 100$ .
- **PWM DIR:** Press “Choose” to change the PWM DIR. If you found when you set power bigger, the intensity of laser beam is stronger. Then you should change the PWM DIR.

**Attention:** if laser type is RF1 or RF2, set the PWM Frequency to 5000, Laser Max to 95%, not to 100%, otherwise the laser would always be on or off.

### 3.4.2 Equipment Set

In the Integrate interface choose “Equipment” to enter, show as:



Equipment Param		2014-03-10 11:00
1. Equipment Type	Mix Cut	
2. Crash Alarm Enable	Yes	
3. Gas Alarm Enable	Yes	
4. Punch Gas Enable	Yes	
5. Follow Height(mm)	1	
6. Work Rise Height( mm)	10	
7. Finish Rise Hgh( mm)	25	
<div>Save</div> <div>ESC</div>		

Fig. 3-16



Equipment Param		2014-03-10 11:00
8. Tolerance	100	
9. Long Size (mm)	30	
10. Follow Alaram(mm)	5	
11. Follow Alm Delay( ms)	50	
12. Voltage Show Correct	3.43	
13. Filter Factor	8	
14. Buzzer Setting	3	
<div>Save</div> <div>ESC</div>		


Fig. 3-17

Press the “Up/Down” key to select the needed operation. Click on the “Choose” key to change setting, “Number” keys to set the value.

- **Equipment Type:** Mix Cut.
- **Crash Alarm Enable:** Yes.
- **Gas Alarm Enable:** When installing the gas pressure detecting switch, select Yes. When the Gas Alarm Protect input is low, the work will be pause.
- **Punch Gas Enable:** if Yes, when punching, OUT7 outputs high level, an external low-pressure oxygen relay turns on, low pressure oxygen valve opens, the low-pressure oxygen outputs. When cutting, OUT8 outputs high level, the external high-pressure oxygen relay turns on, high pressure oxygen cutting valve opens, the high-pressure oxygen outputs. If No, OUT7 always output low level, when

punching or cutting, OUT8 output high level, high pressure oxygen outputs.

- **Follow Height:** The focus length of Laser. It is the target height the system will keep when working. The range: 0.5 ~ 60 mm. The default value is 1mm.
- **Work Rise Height:** It is the height that the cutting head move up after laser turn off during working. The range is: 0~60mm. The default value is 10mm.
- **Finish Rise Height:** It is the height that the cutting head move up after working. The range is 0~60mm. The default value is 25mm.
- **Tolerance:** It is the parameter to set the response sensitivity of following of height. The smaller the tolerance, the more sensitive of response, the more jitter would happen. The smaller the tolerance, the less sensitive of response, the lag phenomenon is more obvious. Normally it is set to 100. The range is 20~500.
- **Long Size:** If needs to cut more than two graphic, Define the distance that the previous graphic's end point to the following graphic's start point as A. If A is greater than the Long Size parameter, the laser head will move up after finish cutting first graphic. And then move to position of the next graphic's starting point. And then move down to the focus position to cut the second graphic.
- **Follow Error Alarm (mm):** it means follow error alarm maximum height, when following error is greater than this parameter, and the duration is more than follow error alarm delay, it triggers excessive follow error alarm, processing will be suspended. Such as cutting out of sheet metal border, or sheet metal volatility, it will produce the alarm. Generally set to 5~10 mm, range: 5~60 mm.
- **Follow Error Alarm Delay (ms):** when the following error is greater than the following error alarm maximum height, and time is greater than the delay value, it will produce excessive follow error alarm. General set for the 50 ms, range: 20~1000 ms. Note: The delay value should not be set too small, otherwise the alarm may happen frequently.
- **Voltage Show Correct:** For calibration of the following voltage display value in follow test interface. When display voltage value is different from actual voltage between the input port "S1 +" and "GND", adjust the calibration parameter to calibrate the display value. Specific methods, set **Follow Height** to 1 mm, **Finish Rise Height** to 0, press "  " to auto focus. Then press "  " to follow test.

When the testing dialog displays, press "  " again, system is in the lifting status. Record the following voltage value, such as " 6.8V ". At the same time use multimeter measuring signal switching board input port "S1 +" and "GND" between voltage, such as "6.5 V". In the Equipment Set interface, select " **Voltage Show**

**Correct**" press "  " to pop-up Settings interface. In the **Show Value**, input the

following testing interface displays voltage value of 6.8. In the **Actual Value**, input the actual value of voltage of 6.5, press “Enter” to automatically calculate calibration factor, then press “Enter” to save the settings.

- **Filter Factor:** The bigger the factor, the smoother the movement of the height following. Otherwise, the smaller the factor, the quicker of the movement.
- **Buzzer Setting:** Press “Number” keys to set the times.

### 3.4.3 Axis Set

In the Integrate Setting interface, choose “Axis Set” to enter, show as:

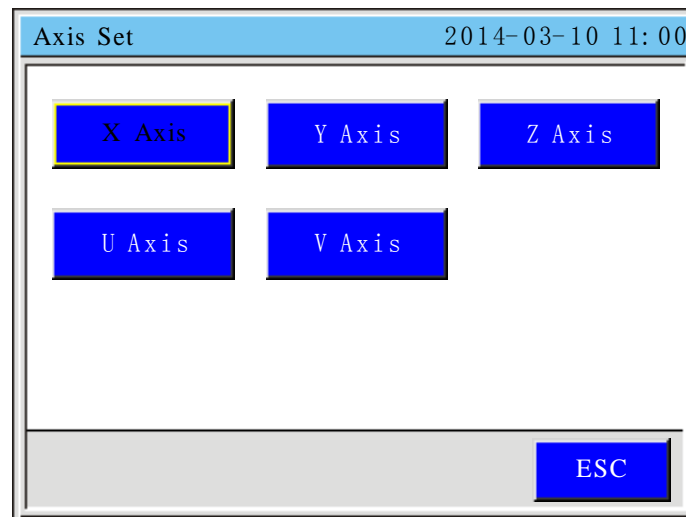


Fig. 3-18

Press the “Up/Down” key to select the needed operation, for example, the X axis setting:

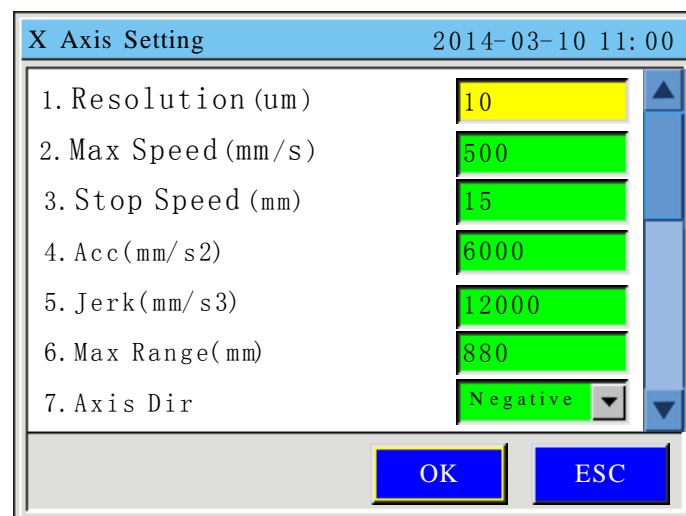


Fig. 3-19

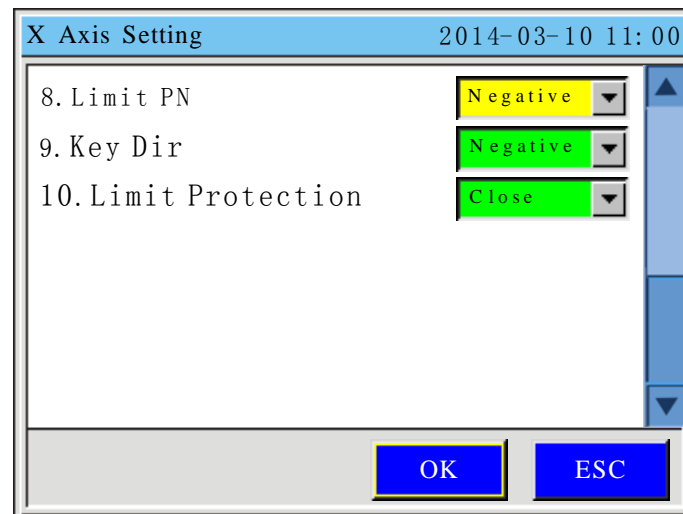


Fig. 3-20

Press the “Up/Down” key to select the needed operation. Click on the “Choose” key to change setting, “Number” keys to set the value.

- **Resolution:** the resolution = the length that the laser head moving when the motor rotate a cycle  $\times 1000$  / the pulses that the driver output when the motor rotate a cycle.

About measurement:

Draw a 30\*30 rectangle to calculate the resolution. When measuring, the width of the laser beam needs to be considered. The processed rectangle is as shown in figure below. Take the measured value of the X axis 34mm, and input 34 into the Want Size edit box and 30 into the Want Size edit box. Click ok the program will calculate out the right resolution. Other Axis is similar. When calculate the resolution of Y, the Real Size is the length of trace the beam moved.

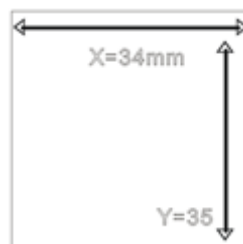


Fig. 3-21

- **Max Speed (mm/s):** The maximum speed allowed for single-axis movement. This value decides the max. engraving speed and cutting speed.
- **Stop Speed (mm/s):** The speed of start or stop during single-axis motion, i.e., the motion stops speed.
- **Acc (mm/s<sup>2</sup>):** The Max acceleration of this axis, the bigger the acceleration, the

shorter the work time, and the stronger jitter of motion.

- **Jerk (mm/s<sup>3</sup>):** The acceleration of the acceleration change from the minimum acceleration to upgrade to the maximum acceleration—Or the changed from the maximum acceleration reduce to minimum acceleration during slowdown..The smaller the jerk, the weaker the jitter of motion, the slower of acceleration and deceleration. Otherwise, the jitter is stronger, the accelerating and decelerating is the faster.
- **Max Range (mm):** Maximum distance for axis can move.
- **Direction Polarity:** Classified into positive and negative, when the motion direction of the motor disaccords with the direction control buttons on the keyboard, you can change the direction polarity to make them consistent with each other.
- **Limit Polarity:** Classified into positive and negative, when the motor cannot return to the original position, you can change the limit polarity to make it normal.
- **Key Polarity:** The buttons on the control panel correspond to directions of the motion of the axes, if it moves to the right when you press the left, change the polarity.
- **Limit Protection:** Enable or disable detecting the axis limit switch. When it is opened and the limit switch is on, it will stop the motion.
- **Reverse the polarity of the pulse:** In the Axis Set, press “12344321” to display the setting window of the polarity of the pulse. Press “Enter” to reverse. Otherwise, press “ESC”.

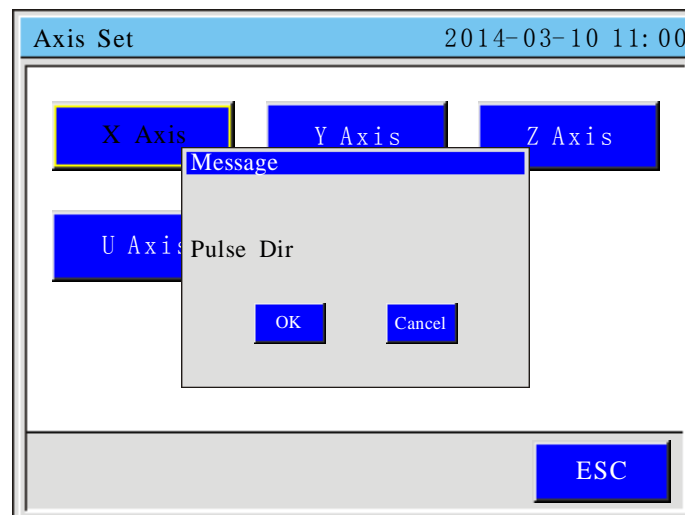


Fig. 3-22

### 3.4.4 Back Set

In the Integrate Setting interface, choose “Back Set” to enter, show as:

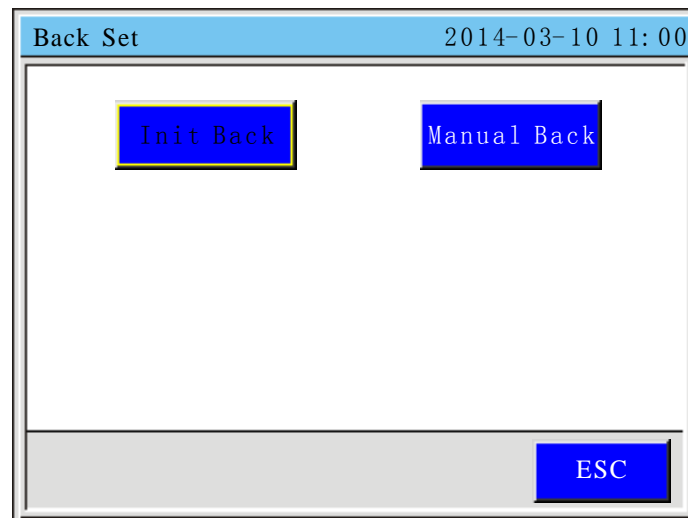


Fig. 3-23

- **Init Back:** Set which axis goes back to origin after power up.
- **Manual Back:** Manually set single axis back to origin.

In initialization back operation interface, press “Up/Down” key to select the needed operation, “Choose” key to change setting. If the parameter set to Open, the axis automatically move back to origin after machine power up, and the coordinate will back to zero. If close, the axis moves none, and the stop position will be the origin of axis. Press “Enter” to save configuration, “ESC” to quit.

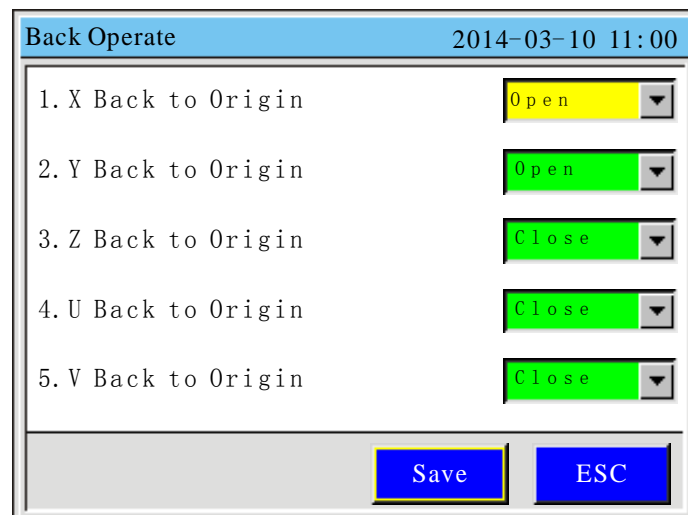


Fig. 3-24

In Manual Back interface, Press the “Up/Down” key to select the needed operation. Click on the “Enter” to set one axis back to origin.

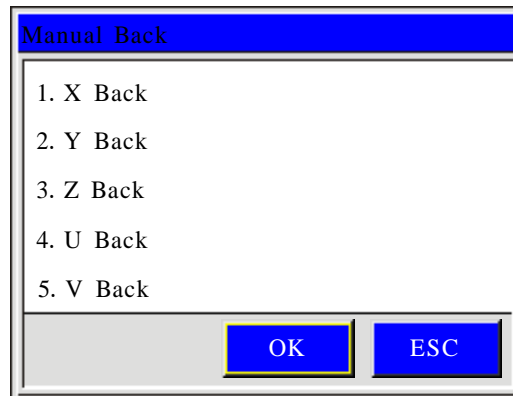


Fig. 3-25

### 3.4.5 User Set

In the Integrate Setting interface, press “Up/Down” key to select the “User Set” item. Press “Enter” key to go into User Set Interface as show below.

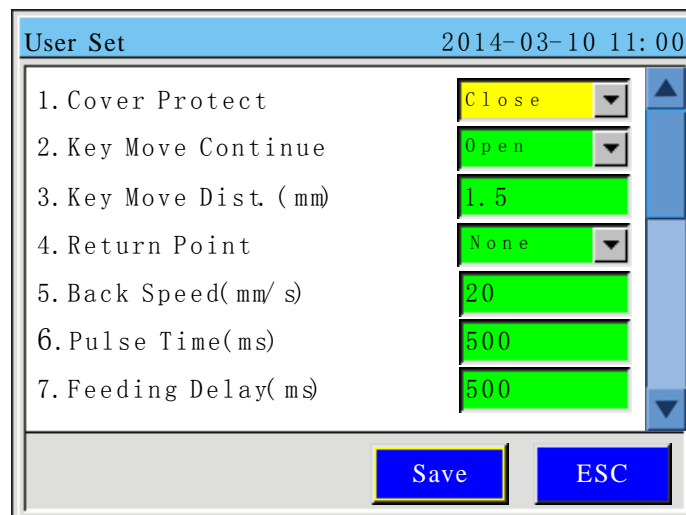


Fig. 3-26

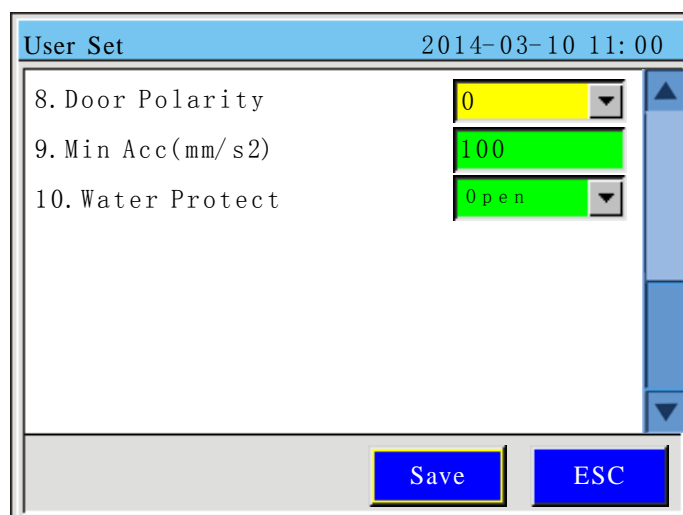


Fig. 3-27

Press “Up/Down” key to select the items, press “Choose” key to change the Combo Box, press the “Number” key to edit the value, press “Enter” to save the setting, press “ESC” to back.

- **Cover Protect:** When it is ON, system will detect the cover protect switch signal. While the signal is valid it would stop the working.
- **Key Move Continue:** When it is ON, Press the “UP/Down/Left/Right” arrow key or “Z+/Z-/U+/U-” to move the axis, Release these key to stop moving.
- **Key Move Dist.(mm):** When the “Key Move Continue” is OFF, the “UP/Down/Left/Right” arrow key or “Z+/Z-/U+/U-” to move the axis with the distance set by the “Key Move Dist”.
- **Return point:** Origin, None Set Point. The position which the system back to while work is finishing.
- **Back Speed (mm/s):** The homing speed.
- **Pulse Time (ms):** The time of laser is on when “Pulse” is press.
- **Feeding Delay (ms):** The delay time after feeding.
- **Door Polarity:** Change the parameter while the Cover Protect switch working in wrong way.
- **Min Acc.(mm/s2):** The min acceleration for start moving or stop moving. The less this value, the smoother the movement, the longer the working time. Normally, it is set to 400mm/s2, if a shorter work time is demanded, set the value no less than 850 mm/s2 (According to the actual machine to set this value).
- **Water Protect:** Enable or disable detecting the status of laser water cooling valve. “Open” means detect, “Close” means NOT detect.



## 3.5 System Information

Press “Menu” button into Main Menu, then select Sys. Info, press “Enter” key to enter system set interface.

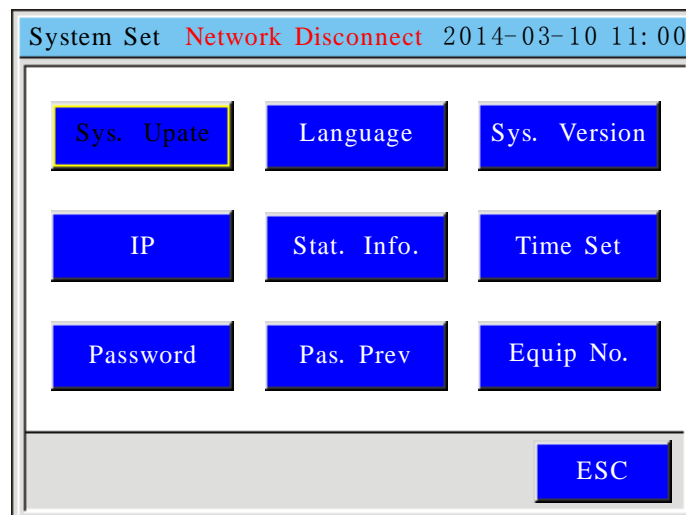


Fig. 3-28

Press “Up/Down/Left/Right” key to select item. Press “Enter” key to select.

- **Sys. Update:** We support an update file for user to update their system. Put the update file in the root directory of U Disk, and insert the U Disk to Card. Select the “Sys. Update” item then press “Enter” key to upgrade your system. If updated successfully, the system would reset. Otherwise an error would prompt up.  
**Attention: MAKE SURE NOT DO ANY OPERATION DURING UPDATING AND THE CONTROL CARD POWER IS STABLE. IF A FATAL ERROR HAPPENED, PLEASE CONTACT THE FACTORY.**
- **Language:** Chinese, English, Traditional Chinese, Korean, Russian, Italian, Spanish, Portuguese, Vietnamese is available. Press “Choose” to edit.
- **Sys. Version:** The version of control system.
- **IP:** The IP address of the control card. Press “Num” to edit. Press “Enter” to save. The IP of control card and the IP of connected PC must be in the same net section. For example, 192.168.0.xxx(x is number in 0-255). And the IP of control card must not be different from the IP of connected PC.
- **Stat. Info.:** Statistical Information includes:
  - **Uptime:** The power on time of the machine.
  - **Laser On Time:** The time of laser is on.
  - **Work Time:** The total work time.
  - **Process Times:** The total process times.
  - **X Travel:** The total distances axis X has moved.

- **Y Travel:** The total distances axis Y has moved.

Stat. Info.		2014-03-10 11:00
1. Uptime:	0:00:00	
2. Laser On Time:	0:00:00	
3. Work Time:	0:00:00	
4. Process Times:	0:00:00	
5. X Travel:	0	
6. Y Travel:	0	

OK
ESC

Fig. 3-29

In the Statistical Information interface, press “CL” key to go into Information Delete interface. Press “Up/Down” to select the item. Press “Enter” to delete.

- **Time Set:** Manage password is required. The default manage password is 00000000. In time set interface, it is able to set the date and time.
- **Password:** Manage password is required. Set the manage password and enable machine lock function if it is required.
- **Pas. Prev:** Manage password is required. After enable machine lock function, select “Pas. Prev” item to preview the passwords to unlock the machine.
- **Equip No.:** Manage password is required. Press “Number” key to set the equipment number for convenient management. If the machine is locked (The locked date was reached), the equipment number will be display. You should find the right unlock password to unlock the machine according to the equipment number.

### 3.5.1 The Password Setting

Choose "Password" to enter machine lock setting, show as:

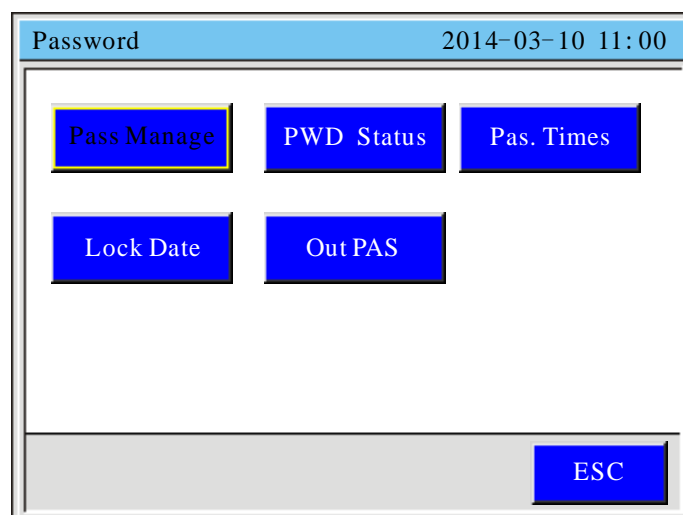


Fig. 3-30

Press the “Up, Down, Left, Right” key to select the needed operation.

- **Pass Manage:** To modify the manage password.
- **PWD Status:** When it starts, the staging password is working.
- **Password Times:** Set the password phases, a phase a month.
- **Lock Date:** The phase password is from the lock the date, the day range is 1-28.
- **Output Password:** Insert a U-Disk into the controller. Click the “Out Pass” button to save the password to the U-Disk. The file name is the equipment number.

**The lock Date must be set according to the system time.**

## 3.6 Auto Focus Setting

In the standby interface, execute auto focus program when pressing “.” dot button to. It shows a message box that if you want to reset the focus length. Press “Enter” button to auto focus. The cutting head will move down until it touches the metal. After touching the metal, it moves up to the max height of the follow error alarm. Then it moves down again until it touches the metal. After touching, it moves up to the follow height position, and record the position. Then it moves back to the position of “Finish Rise Height”.

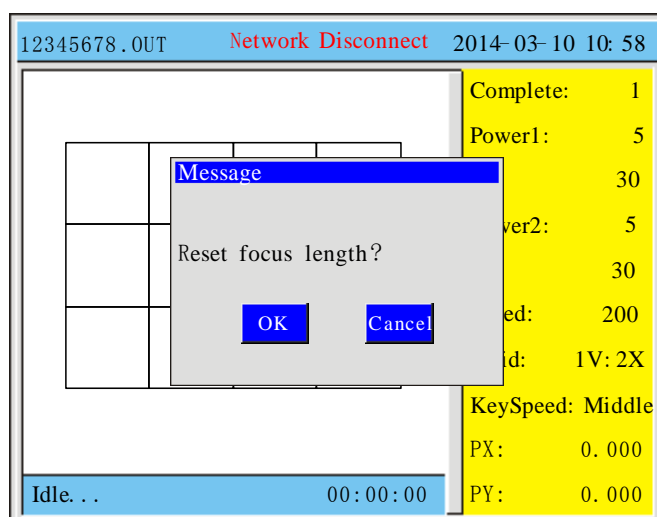


Fig. 3-31

If you see the movement is abnormal, press “Pause/Run” to stop.

After auto focus program finish, and the Manual/Auto Switch turn to auto mode-Metal cutting mode, press “CL” to test follow. It displays a testing dialog. The first line shows the follow feedback voltage value. And the cutting head moves down to position of follow height. Press “CL” again, cutting head move up to position of “Finish Rise Height”. Press ESC to cancel testing. Press “7” to open low pressure punch O2 pipe to test the pressure. Press “8” to open high pressure cutting O2 pipe, to test pressure. If you see the movement is abnormal, press “Pause/Run” to stop.

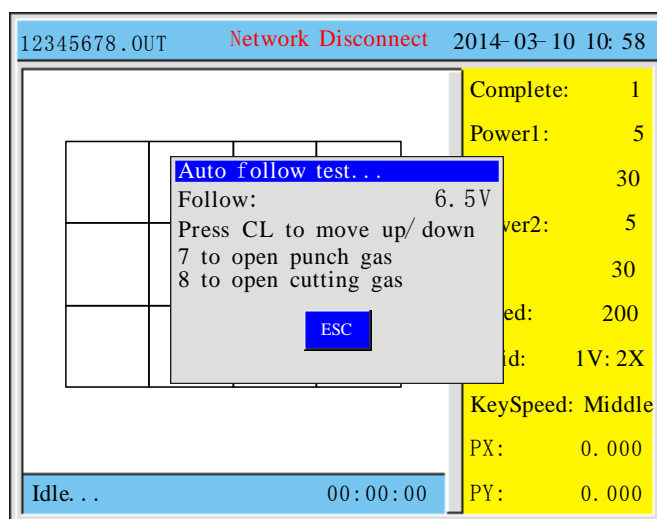


Fig. 3-32

## 3.7 System Test

After the starting, press "Menu" key into the main menu interface, choose "System Test" to enter, show as:

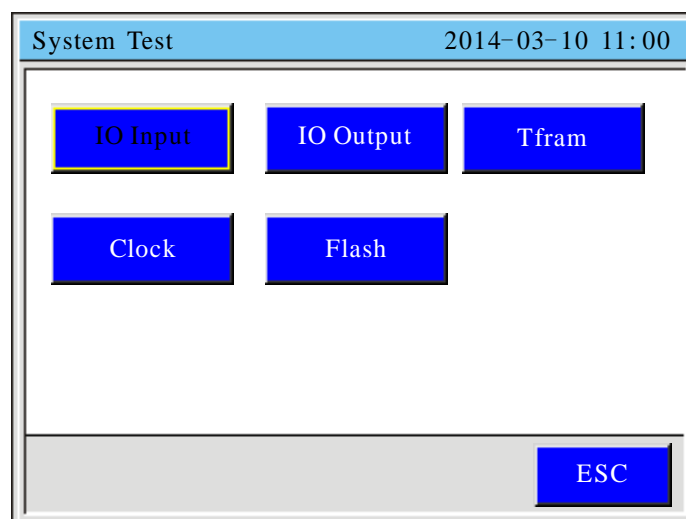


Fig. 3-33

Press the "Up, Down, Left, Right" key to select the needed operation.

1. IO Input: corresponding to the IO input low power, it'll display from Green to Red.
2. IO Output: connect the IO test board, can see all the output signals corresponding LED turn off.
3. After finishing the testing Tfram, Clock, Flash, it will show the result.

## Part 4 Mix Cutting Work Process

### 4.1 System Installation

Please install capacitive sensor and amplifier correctly according to the system wiring diagram in part 2. Amplifier should be installed in one side of the head, and ensure connection between BNC head and capacitance sensors are reliable. And the metal shell should be conducted with laser head. The cable between sensor amplifier and signal switch board should be not too long. If too long, remove part of it properly. Please ensure the cable connecting to the amplifier without great stress, forbidden to serious bending or pulling the cable, otherwise the signal will be interrupted.

### 4.2 System Test Run

After the system is powered on, waiting for the machine reset and the LCD displays the standby interface, turn off the manual/automatic switch which is set to automatic mode.

#### 1. Set the Z axis parameters in Axis Set (Axis of Height Following Control)

- **Resolution:** According to the pitch of screw and the motor PPR to calculate for example, the pitch is 4mm, motor PPR is 4000, resolution =  $4\text{mm}/4000 = 1\mu\text{m}$ . If pitch is 5mm, PPR is 4000, resolution =  $5\text{mm}/4000 = 1.25\mu\text{m}$ .
- **Direction Polarity:** Positive. Select the "Back Set /Manual Back / Z Back" item to test the direction of homing of Z axis. During homing, Press "Pause" to stop homing. If the cutting head not to move up, set the polarity negative. Or exchange each other for A+ and A - motor wiring directly, can change the rotating polarity of motor. The Z axis origin is the location of upper limit switch of the Z axis.
- **Limit Polarity:** According to the type of limit switch to set polarity. If low level is valid, set the polarity to negative, Otherwise, set to positive.
- **Key Polarity:** Positive. Press Z+, cutting head move down, press Z- to move up.
- **Max Range:** According to the machine to set. The Z axis movement range can't more than max range.

#### 2. Set the height following control parameters in equipment parameters

- **Crash Alarm Enable:** Yes.
- **Gas Alarm Enable:** When installing gas pressure detecting switch, select Yes.

- **Punch Gas Enable:** if Yes, when punching, OUT7 outputs high level, an external low-pressure oxygen relay turns on, low pressure oxygen valve opens, the low-pressure oxygen outputs. When cutting, OUT8 outputs high level, the external high-pressure oxygen relay turns on, high pressure oxygen cutting valve opens, the high-pressure oxygen outputs. If No, OUT7 always output low level, when punching or cutting, OUT8 output high level, high pressure oxygen outputs.
- **Follow Height:** The focus length of Laser. It is the target height the system will keep when working. The default value is 1mm.
- **Work Rise Height:** It is the height that the cutting head move up after laser turn off during working. The range is: 0~60mm. The default value is 10mm.
- **Finish Rise Height:** It is the height that the cutting head move up after working. The range is 0~60mm. The default value is 25mm.
- **Tolerance:** It is the parameter to set the response sensitivity of following of height. The smaller the tolerance, the more sensitive of response, the more jitter would happen. The smaller the tolerance, the less sensitive of response, the lag phenomenon is more obvious. Normally it is set to 100. The range is 20~500.
- **Long Distance:** If needs to cut more than two graphic, Define the distance that the previous graphic's end point to the following graphic's start point as A. If A is greater than the Long Size parameter, the laser head will move up after finish cutting first graphic. And then move to the position of the next graphic's starting point. And then move down to the focus position to cut the second graphic. The range is 0~65000mm. The default value is 30mm.
- **Follow Error Alarm (mm):** it means follow error alarm maximum height, when following error is greater than this parameter, and the duration is more than follow error alarm delay, it triggers excessive follow error alarm, processing will be suspended. Such as cutting out of sheet metal border, or sheet metal volatility, it will produce the alarm. Generally set to 5~10 mm, range: 5~60 mm.
- **Follow Error Alarm Delay (ms):** when the following error is greater than the following error alarm maximum height, and time is greater than the delay value, it will produce excessive follow error alarm. General set for the 50 ms, range: 20~1000 ms. Note: The delay value should not be set too small, otherwise the alarm may happen frequently.

### 3. Capacitive Sensor Calibration

Set the Follow Height to 1mm, Finish Rise Height to 0. Press"." dot key in standby interface to autofocus. The cutting head move downwards until it touches the metal. After touching metal, the sensor amplifier crash LED indicator turn on. Then the cutting head move upwards and it will stop at the follow error alarm maximum height. Again

the cutting head move downwards until it touches the metal. After touching metal, the cutting head move upwards and it will stop at the focal position. Measure the voltage value between "S+" and "GND" , if the voltage is greater than or less than 6.5 V, adjust the screw of the sensitivity in the sensor amplifier, to set the voltage to 6.5 V. Press the key again, the calibration is completed. Note: after the calibration, according to the height of the focal length of the laser set the Follow Height, and according to the need to set the Finish Rise Height.

#### 4. Height Follow Test

Turn off the "Manual/Auto Switch" to go in automatic mode. Press "CL" key to test the follow function. Then the cutting head move to the position of focal length. Press the key again, the cutting head move back to the position of Finish Rise Height. Press "7" to open low pressure punch O2 pipe to test the pressure. Press "8" to open high pressure cutting O2 pipe, to test pressure.

##### Note:

- **If cutting head was not following down, please check the following height is set too large (greater than 5 mm), or sensor feedback voltage is too big or too small, check the wiring is correct. And check the limit switcher is triggered or the crash alarm is triggered.**
- **If during the fall, a pause phenomenon happened, please check whether there is interference lead to abnormal voltage sampling of the sensor.**
- **If cutting head in the focal length position, Z axis motor rotate back and forth, the sensitivity may be too high. According to the step 3, calibrate the sensor. If correct, but the phenomenon still appears, increase the "tolerance", such as 200, reduce the response sensitivity.**

#### 5. Running

Before processing, please ensure that all the parameters set up correctly and connection is correct. Cutting metal material steps shown below

- 1) Turn off the "Manual/Auto Switch" to go in automatic mode.
- 2) Turn manual switch valve to the pipe of oxygen ( if Manual Directional Valve was used ).
- 3) In AutoLaser draw the processing graph, in the layer parameters, set the drilling parameters: the start delay of 0.5 s, intensity of 50%. At the same time set up processing parameters as shown in figure. Then download file to perform processing.



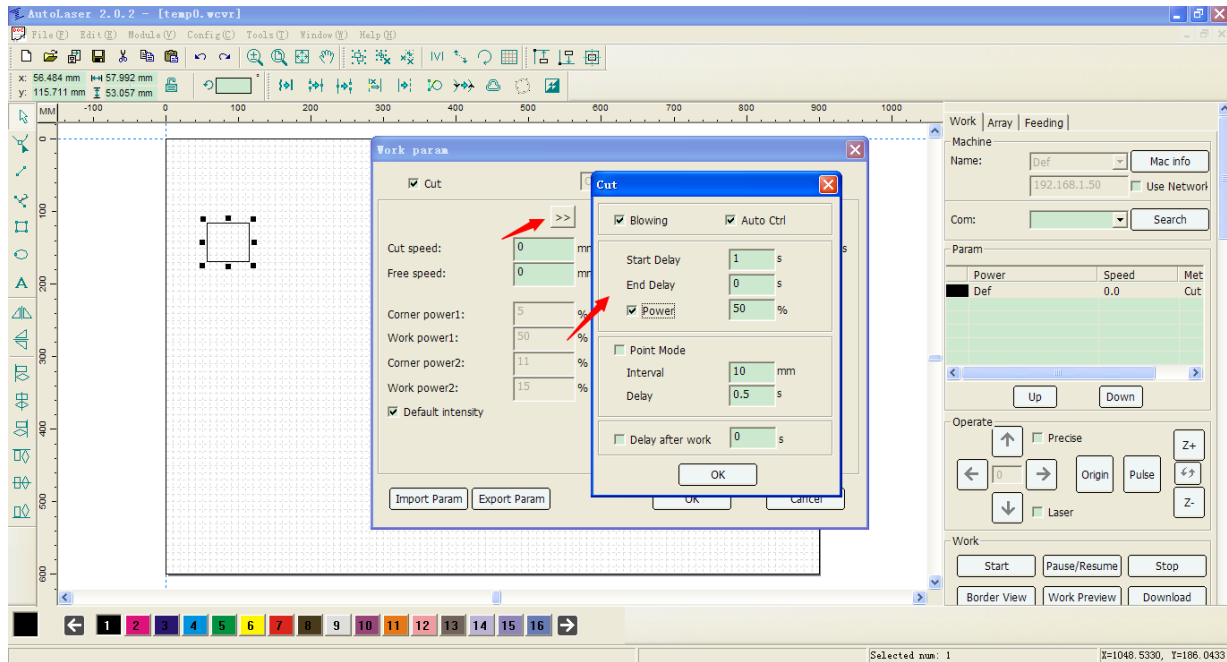


Fig. 4-1

- 4) Press "Start" key on the panel to process, the cutting head move down to the focal length position automatically, blow O<sub>2</sub> and drill according to the start delay parameter and laser intensity parameter. Then start to cut pattern. The cutting head follow automatically, keep in the focal length. When processing is completed, close O<sub>2</sub>, cutting head move to the Finish Rise Height position. If in the process of cutting, press "pause" or the head crash to the material, O<sub>2</sub> will be closed, the cutting head move up to the Work Rise Height position, the work is pause. If cutting head is in Work Rise Height position, and press the "pause" or crash alarm signal trigger, cutting head need not lift, the work is suspended.

Cutting nonmetal material:

- 1) Turn on the "Manual/Auto Switch" to manual mode. Press Z+/Z- to move the cutting head to the focal position.
- 2) Turn manual switch valve to the pipe of blowing air ( if Manual Directional Valve was used ).
- 3) In AutoLaser draw the processing graph, in the layer parameters, not set the drilling parameters—all the drilling parameters set to 0. Don't check the check box of intensity of drilling hole.
- 4) Download file to start process, now the cutting head will not to follow.

## Part 5 The Frequently Asked Question Help

### 5.1 Power-on Reset Question

Q: the system does not reset, buttons no response, and LCD no display.

A: the system reset error, the solution is:

First, click the “Emergency Stop” on the panel, and check the button normal.

Second, check the external 5V and internal 5V are within the normal.

Q: opening, the X, Y axis not move, the LCD display the main interface, can manual move the axis.

A: the power back to origin error. Into the “Power back to Origin” interface, set the X, Y axis as Opening.

Q: opening, the X, Y axis returns the origin, the LCD still shows “system initialization”.

A: the power back to origin error. Into the “Power back to Origin” interface, set the Z, U axis as Close.

Q: opening, X, Y slow-move a short distance, not reach to the limit point, and complete the reset.

A: the Limit Polarity error. Into the “Limit Polarity” interface, change the X, Y polarity.

Q: opening X, Y move to the opposite direction of limit switch,

A: the direction polarity error. Into the “Direction Polarity” interface, change the X, Y polarity.

Q: button moving, X, Y moving direction is opposite to the button moving.

A: the button polarity error. Into the “Button Polarity” interface, change the X, Y polarity.

Q: after the completion of reset, X, Y fast automatically moving.

A: the regression point setting error. Into the “Regression Point Setting” interface, set the regression point as mechanism origin point.

Q: the setting of power back to origin is close, after power, X, Y still automatically moving.

A: the regression point setting error. Into the “Regression Point Setting” interface, set the regression point as mechanism origin point.

## 5.2 The Laser Light Question

Q: Long light after power on.

A: view the enable signal of laser power is wiring, and see the jumpers of interface board DIR3 and DIR4, check whether they e keep the consistency.

Q: When the light power intensity is big, the idemitsu is small; when the light power intensity is small, the idemitsu is big.

A: the PWM polarity setting error, into the button polarity setting interface, changes the PWM polarity.

Q: PWM frequency is correct, light power intensity can be changed by line within 10% - 60%.

A: check the laser power supply model, it's 3.5 voltage, not 3.3V.

Q: Water protection invalid.

A: check the laser type, there are 3 types: 0 is CO<sub>2</sub> glass tube; 8 is coherent glass tube; 16 is RF tube. If the laser type is correct, please check the water protection directly shorted.

## 5.3 The PC Connection Question

### The Questions:

- Reading the parameters, can't open the port.

- Can't read the parameters.
- Transfer the file invalid.

**The Solutions:**

- Check whether the USB line is connected correctly, and the USB port is connected the PC.
- Check the USB driver is installed correctly.
- Check the USB port numbers on the device management, if it's more than 9, please change it within 3 – 9.
- The software output port need to be same with COM port.
- Insert a new and good port on the computer.
- Close the equipment power supply 3 minutes, than open again.
- Restart the computer, to ground the equipment and the computer.
- Replace a computer.

## 5.4 The Reading and Writing of U disk Question

Q: click the U disk file, show as "U disk is empty or error".

A: U disk error. Check the U disk port is correct. Replace a U disk.

Q: click the U disk file, show as "U disk reading...please wait", the indicator is off.

A: replace the U disk cable.