

# XPTHC-100

## Manual of PLASMA Arc Voltage Controller



**ADTECH (SHENZHEN) CNC TECHNOLOGY CO.,LTD**

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## **1、Brief Introduction**

### **1.1、Product Model:**

**XPTHC-100**

### **1.2、Chinese Name:**

**弧压高度控制器**

### **1.3、Applied Scope:**

Apply to most of the import machine or state-owned machine because of the high controlling of Plasma incision machine with the feature of constant current or the feature of constant current in certain voltage scope.

### **1.4、Working Principle:**

The working principle of XPTHC-100 Plasma controller is using the constant current of the Plasma power to attach the high controlling for the incision cutting torch through checking the change of voltage to check the high changing of cutting torch in the incision process.

### **1.5、Basic Principle:**

#### **A、Automatic IHS:**

Divide into checking method of Torch Retaining Cap IHS and Proximity Switch IHS checking method which has NPN and PNP two types.

#### **B、Anti-bump of Torch:**

After cutting torch bumps into the steel plate in any condition, when examines the electric circuit movement, will make the cutting torch promote to height.

#### **C、Automatic High Controlling.**

#### **D、Display the Monitoring Function Of the given arc voltage and the actual arc voltage:**

Arc voltage table demonstrates the given arc voltage before the Plasma arc on, and Arc voltage table demonstrates the actual arc voltage after the process of getting up the arc and perforation time delay .

#### **E、All the function of above-water incision and under-water incision of automatic IHS method:**

The first invention from our company is under-water incision of Torch Retaining Cap. The normal order has no special function about this except our clients request it.

**The cutting torch lifts and the Plasma gets up the arc when we have no IHS:** When we don't use the automatic IHS function we can make the cutting torch reach the steel plate directly; When we carry on the arc operation, the cutting torch can promote to be separated from the steel plate

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automatically and we can use SET-IHS to set the height above the steel plate.

**The function of boot-strap and cutting arc:** After the boot-strap and cutting arc, In order to avoid the limit switch and the cutting car being damaged, please note that the controller will make the cutting torch move up for 2 seconds automatically When you debug.

**F、 The Arc-voltage enables the output:** Through setting the SET-PIERE potentiometer on the panel, delay the output signal which is fulfilled by checking the existence of arc voltage and which is the switch quantity.

**G、 Manual Operation Function:** We can attain a lot of functions on the operation panel such as automation, manual-up&down,IHS

**H、 Automatic Operation:** After the signal was given by the incision procedure, the arc-voltage complete the process: IHS—Starting Arc---Arc-voltage released the signal. When the signal is accepted by CNC controller then the machine tool begin to cut.

**1.6 、 The examination method of arc-voltage:** Insulate and voltage-divided, the division ratio is 100:1.

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## 2、technique parameter

- working voltage: AC24V $\pm$ 5%, 50Hz/60H z
- Down/Up Motor: DC24V DC MOTOR
- Drive:PWM
- Output Current: 1A-4A,
- output power: 100W,
- Working temperature: -10 $\sim$ 60°C adjusting-hei machine-10 $\sim$ 60°C
- IHS method:

Proximity switch IHS

IHS of Torch Retaining Cap

- running transmission method: Check the arc voltage to make sure fulfill the output
- Divide-VOLT ratio :100:1
- Precision :  $\pm$ 1V $\sim$  $\pm$ 5V
- shape size : length Xwidth X height: 320mmX260mmX90mm
- The speed of upgrading: 1000mm/min $\sim$ 2000mm/min (Contact the supplier if it exceeds the range of speed)

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### **3、 Working Process :**

#### **3.1、 Method 1 :**

When the arc-beginning signal link with the 4<sup>th</sup> stitch of the 10 chip aviation socket, firstly, the adjusting-height machine must be in a good IHS, then the machine reveal the power signal to make the CNC controlling system work. And when the adjusting height machine display the signal to the Plasma the arc voltage of the delay controller goes into adjusting height machine system.

#### **3.2、 Method 2 :**

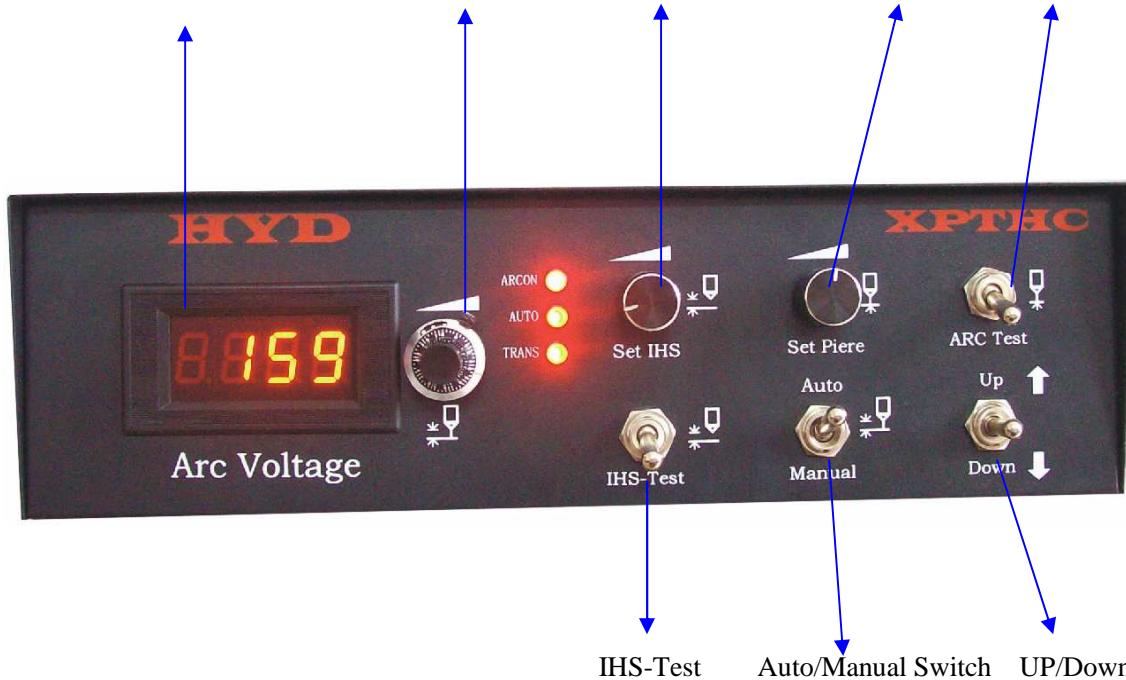
When the arc-beginning signal link with the 5<sup>th</sup> stitch of the 10 chip aviation socket, adjusting-height machine has no IHS but control the Plasma arc-beginning and the cutting torch at the height of SET-HIS which can produce a signal to make the CNC system to do cut work.

**,PS: When the CNC system can not receive the signal from arc-beginning voltage you should control the CNC running by using time-delay method.**

## 4、Function of Panel Operation

Sketch map one of the panel

display arc-voltage      fix on arc-voltage      first height setting      pierce time      Arc test



**Figure 1:Panel**

### Arc Voltage:

**Before the arc-beginning it shows the given arc voltage after it it shows the actual arc voltage.**

**The arc voltage:** Based the depth and speed of the incision material and the parameter information we can find the arc voltage. The larger the arc voltage is given and the higher the incision height will attain.

**(Set IHS):** Increase the height through clockwise, the height is set by time-delay method.

From the re-set switch, every time we dial it up once, the checking IHS is given, which is useful to examine whether it's suitable for incision.

**Set-piere:** Set the time from Plasma to CNC controller starting, only the arc voltage can give the signal.

**Auto/Manual:** The adjusting-height machine is automatic, dial the switch at the location of automation, meanwhile, CNC controlling system and interface of adjusting height machine start to work.

**ARC-test:** From the re-set switch, still press it and wave up to make it work. The action is to

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test the Plasma arc-beginning and move the cutting torch up at a certain IHS height.

**up/down:** Move up and down by hand.

**ARCON :** When the lamp is bright it means that it is already start the arc, note: the ARCON is dark until finish the signal and reach the IHS.

**AUTO :** When the lamp is bright that is mean the adjusting-height machine is automatic, getting the light bright must satisfy 4 requirements: 1, the automatic signal has been added; 2, the automatic signal which connect with CNC system is work; 3, it has arc voltage introduced; 4, actual arc voltage has not exceeded the arc voltage 30v. Note: the protection of over-voltage is 30v, it can be adjusted through RP104 according to customers' actual requirements.

**TRANS:** When the lamp is bright it means arc voltage has been detected and the same time send the working signal.

## 5、Voltage-Divided Board

We must check the movement of Plasma arc voltage when we do the controlling of arc voltage. The voltage of Plasma arc must be same as the voltage between electrode and earth. The positive port of Plasma power output should be connected with earth, the negative end should be connected with electrode inside the cutting torch. So the voltage on the electrode is electronegative. The absolute value of the arc voltage when do the incision exceeds 100v, so we must divide the voltage in order to control in the circuit.

### 5.1、None Isolation Voltage-Divided

The simplest way to divide the voltage is none-Isolation voltage-divided that is resistance divide the voltage directly. Use the Figure below to divide the voltage since the XPTHC-100 already has a 1:1 circuit of voltage-divided.

Figure2: none-Isolation voltage-divided circuit

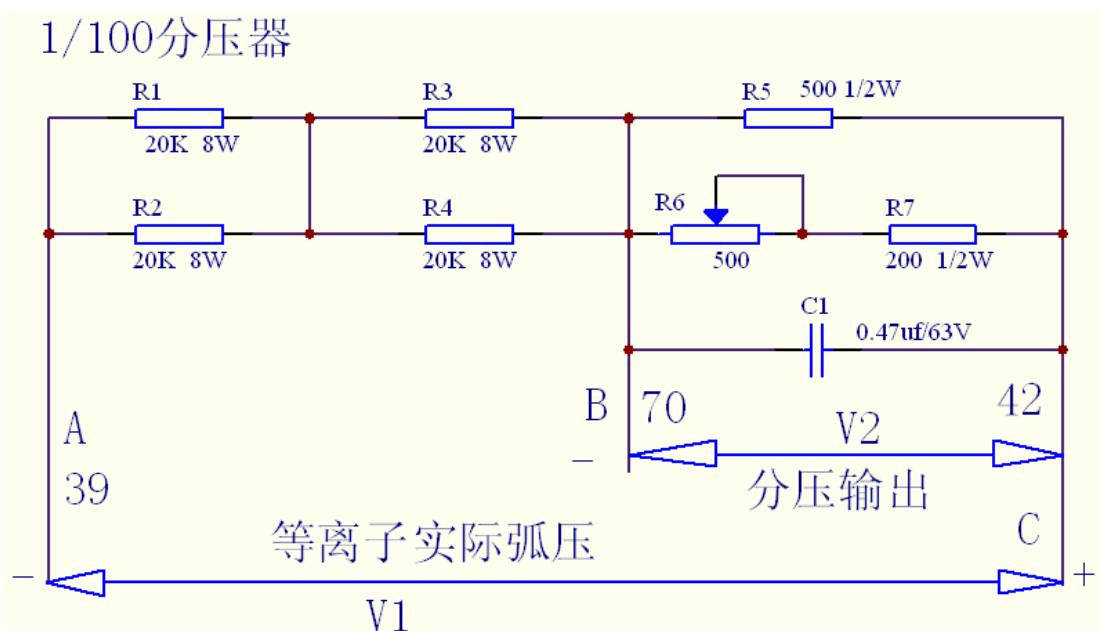


Figure 2: none-Isolation voltage-divided circuit

Note: The arc voltage which goes into adjusting-height machine is electronegative, if the electrode is contrary, the automatic high adjusting is ineffective.

As the method of none-Isolation voltage-divided is linked with Plasma power( can not do the Isolation for the HF when the arc is introduced), so the disturbance for the high adjusting machine is maximal, but the cost is the minimal.

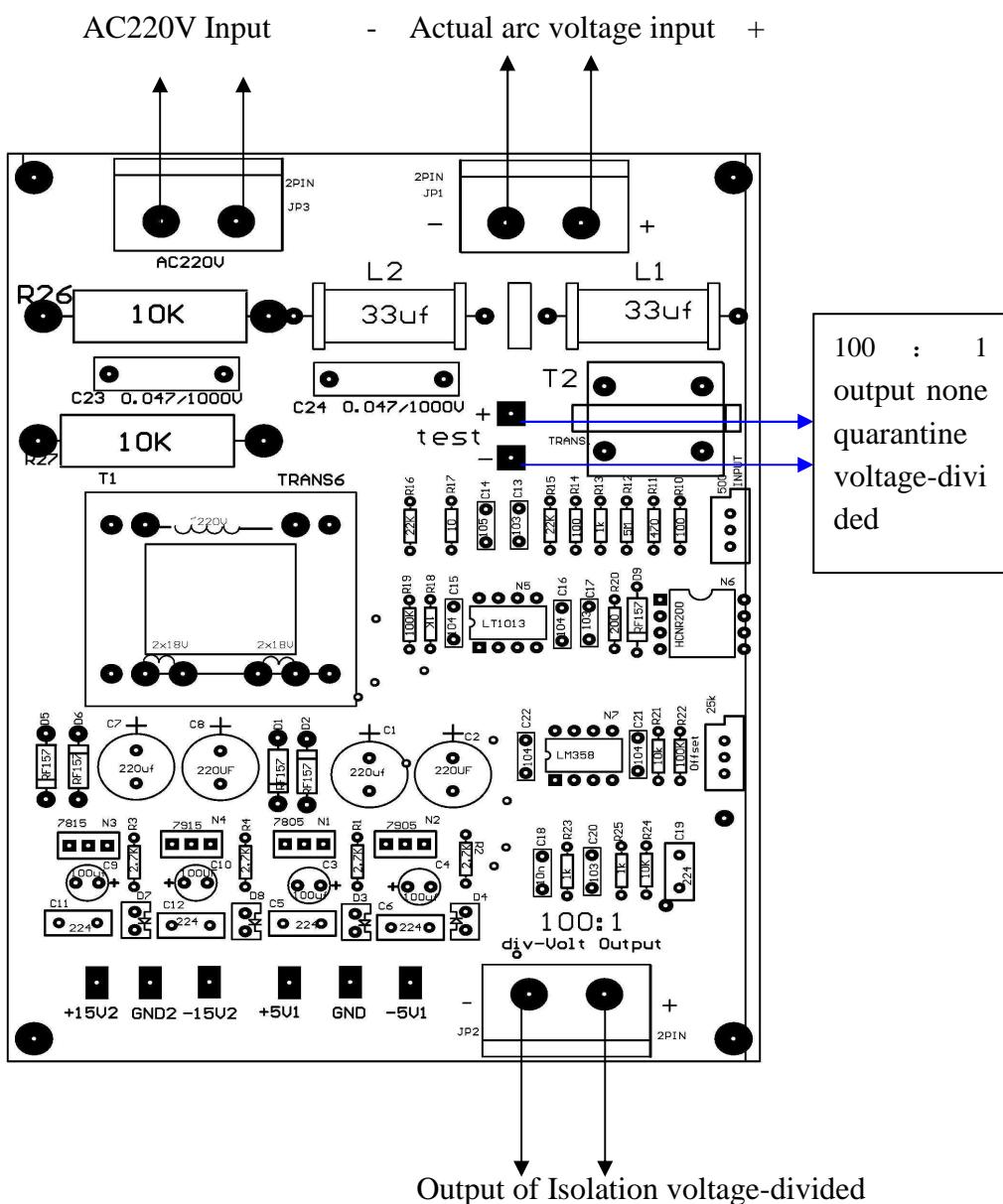
During the practice work, as the arc voltage after voltage-divided is delayed to go to the controlling circuit, the influence is very limited.

For the Plasma which touch the introduced arc voltage, it is no influence for the high adjusting machine by using none-Isolation voltage-divided; when using the HF introduced arc voltage increase the time of taking arc voltage to avoid the process of introducing arc voltage.

## **5.2、 Isolation Voltage-Divided**

Isolation voltage-divided machine has limited disturbance since it make the Plasma arc voltage get the none Isolation voltage-divided of 100:1 and connect to high adjusting machine after processed by Isolation circuit.

Diagram of working principle of Isolation voltage-divided machine.



**Figure 3: Isolation Voltage-Divided Connection**

Note: If you adopt the method of none Isolation voltage-divided, you can not use AC220V power, use the 220v power when you adopt Isolation voltage-divided.

## 6、 Initialization IHS

Our company had designed two methods for high adjusting machine.

### 6. 1、 IHS Check method of Torch Retaining Cap.

Adopt this method require the metal construction for the Torch Retaining Cap, so the metal can be electric with steel plate. XPTHC-100 has a piece of Isolation IHS plate that can be fixed in the controller directly, the connection way as Figure 4 below shows:

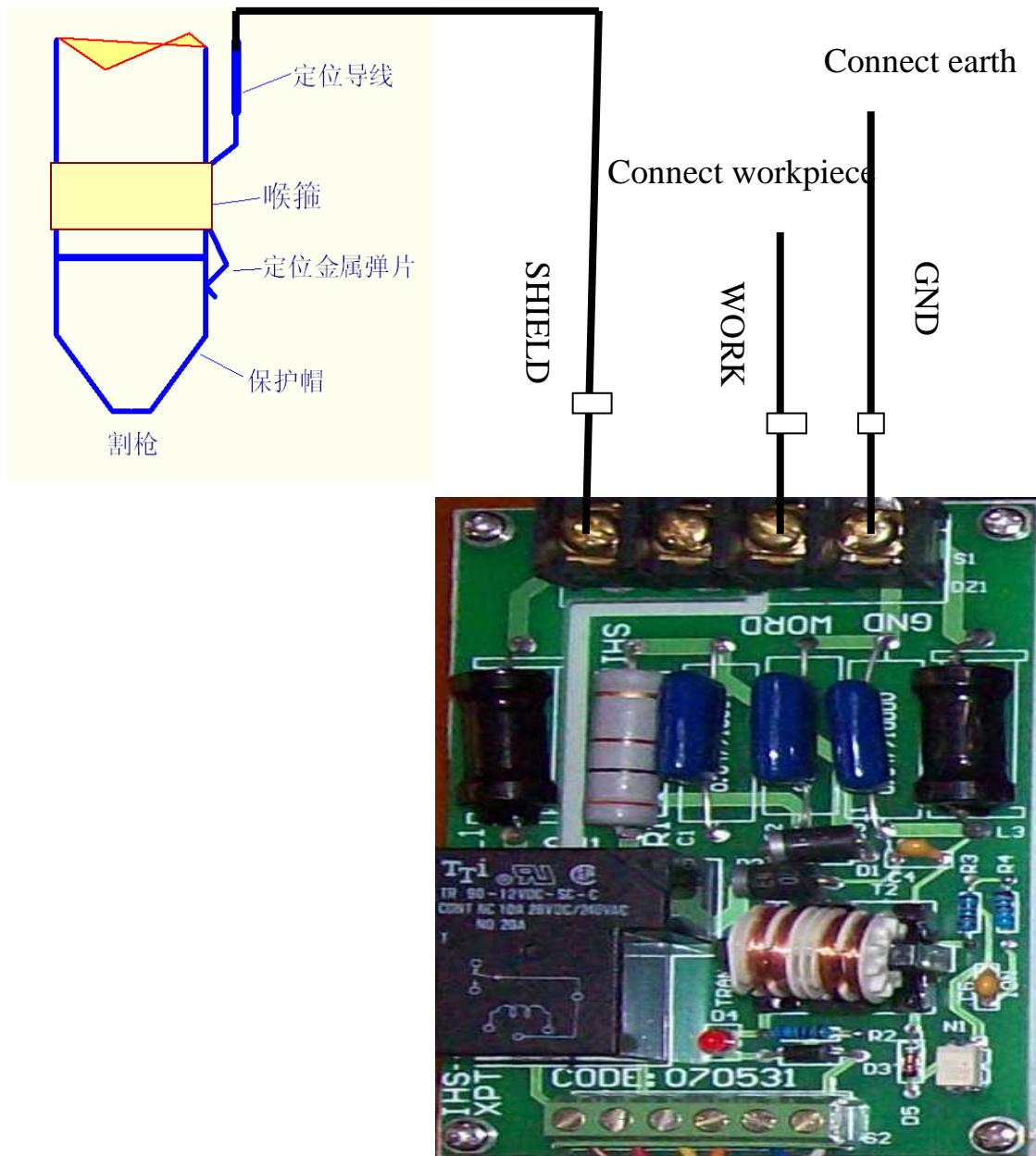


Figure 4: connection of Torch Retaining Cap HIS

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State:

- A、 The TORCH RETAINING CAP port on the Isolation-IHS plate connect to the Torch Retaining Cap directly through pressing-wire hole(label: TORCH RETAINING CAP).
- B、 The WORK port on the Isolation-IHS plate connect to the material-shelf directly through pressing-wire hole(label: WORK).
- C、 GND must be linked with earth perfectly, the area of earth lead must exceeds 4 mm<sup>2</sup>.
- D、 When the Plasma without HF arc, the WORK and GND can be linked with each other directly.
- E、 Connect the JPT2 on the controlling plate to PNP when you adopt the method of Torch Retaining Cap IHS. As Figure 5 shows(JPT1 was selected the mode of IHS , JPT2 was selected the type of Proximity Switch )

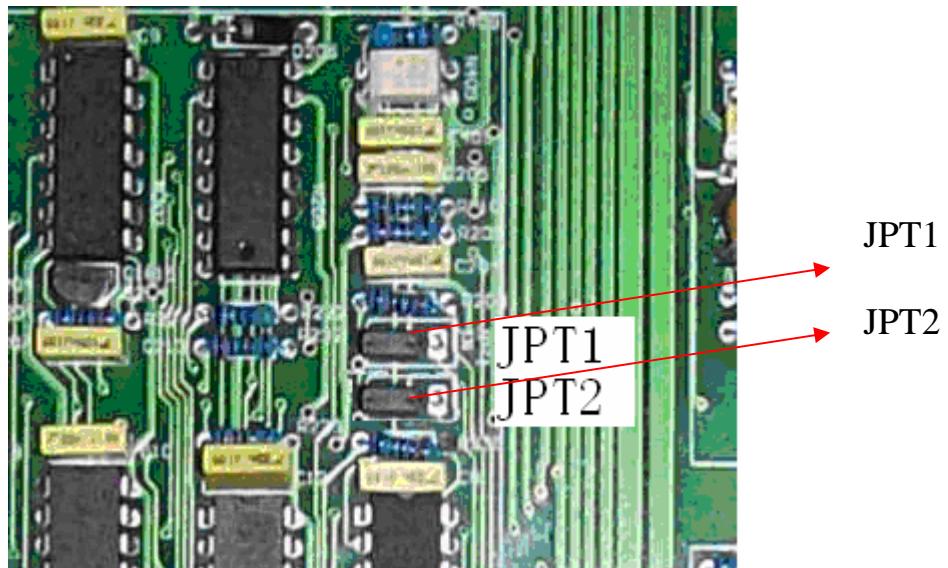


Figure 5: JPT1 Setting of Slip Wire

**Working Process of Torch Retaining Cap IHS:** After the high adjusting machine receive the arc signal from the CNC system, the cutting torch come down immediately; when the protection reach the steel plate, the high adjusting machine receive this signal then control cutting torch to a setting height, when it finish, the high adjusting machine control the Plasma arc automatically. You can adopt the touching-arc Plasma also HF arc

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Plasma. Both above water incision and under water incision are feasible. Note: You must satisfy the following requirements when you use multimeter to measure the resistance quantum of the water.

depth of measure: 50mm

space between two pens: 10mm

measuring resistance > 1.5K

The parameter is decided by the examination in the salty water.

## 6. 2、Switch IHS Method of NPN、PNP

All the IHS of Plasma no matter above-water or under-water incision can adopt this IHS method.

You can check the clamp sketch map in appendix.

Before IHS, Proximity switch is in the situation of approaching, once depart, the cutting torch will climb immediately.

**working process:** After the high adjusting machine received the arc signal from CNC system, the cutting torch descend at once and when it touch the steel plate the Proximity switch will depart the approaching point then the high adjusting machine receive the signal to make the cutting torch at a setting certain height. This way is suitable for all the IHS of Plasma.

Proximity switch connect to the Proximity switch through SWITCH-HIS in the high adjusting machine.

**Note: NPN method:** Insert the JPT1 slip stitch in the location of NPN, the similar as PNP insertion for JPT1.

## 7、 Interface Circuit

Figure 6 shows the mainboard sketch map

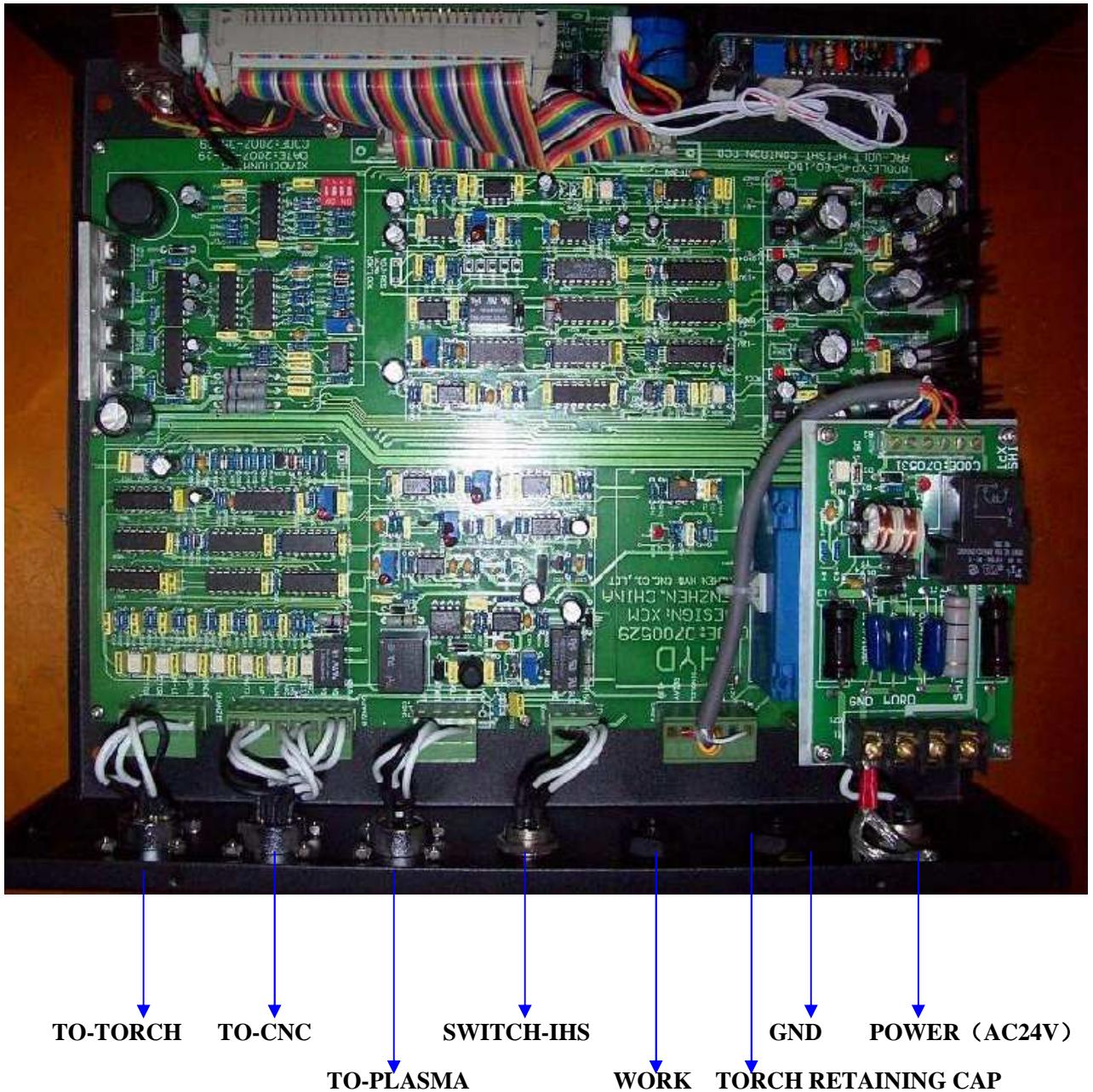


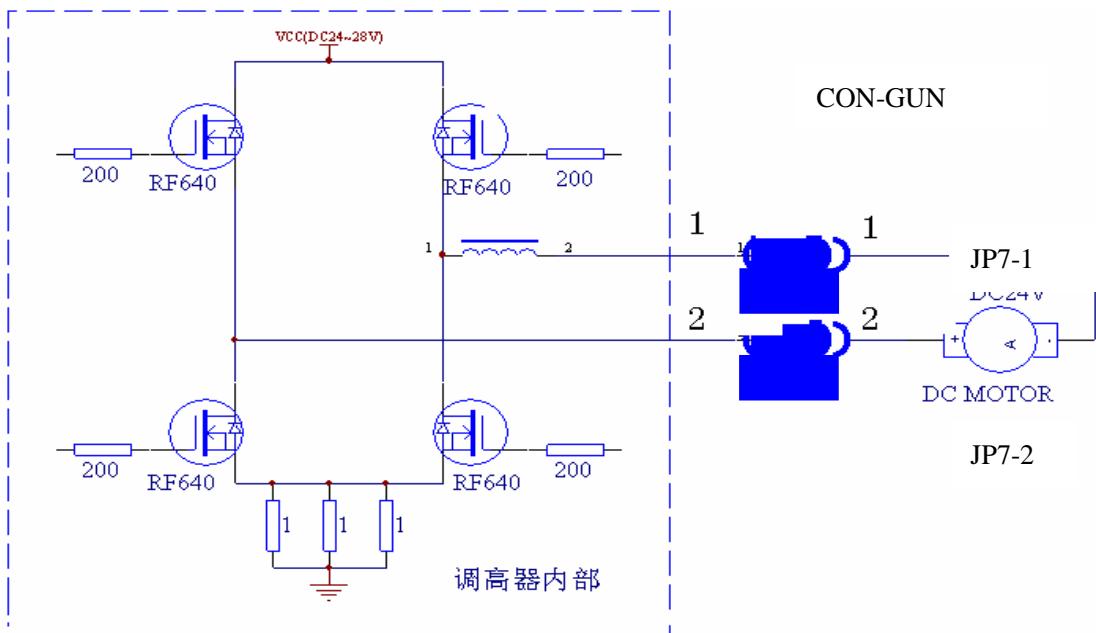
Figure 6: Mainboard Sketch Map

### 7.1、 Power Supply Interface.

The power supply of the XPTHC-100 is AC 24V, connect to JP1 of the high adjusting machine by using “power” aviation socket.

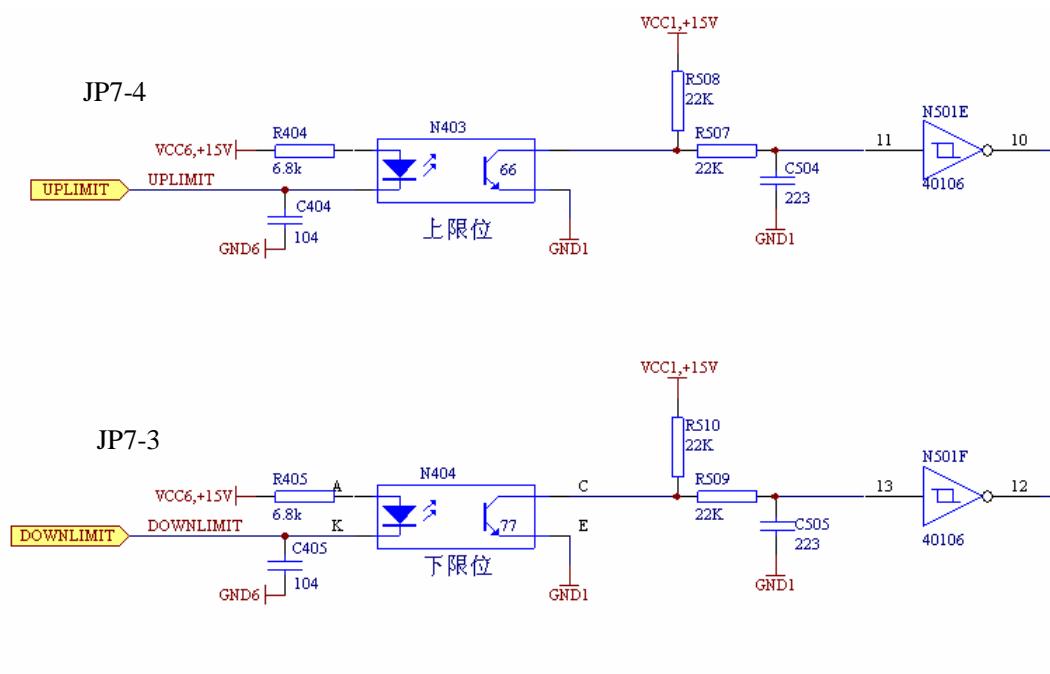
### 7.2、 Up and Down Interface.

Figure 7 shows the generator output.



**Figure 7: Generator Output**

Figure 8 shows the Up and Down interface connection.



**Figure 8: Upper limit /lower limit digit connection**

Note: the limit switch should connect the NC

### 7.3、 Connect to Plasma Interface

The 4-chip socket of TO-PLASMA connect the JP5 port. The connection of Plasma as Figure 9 shows:

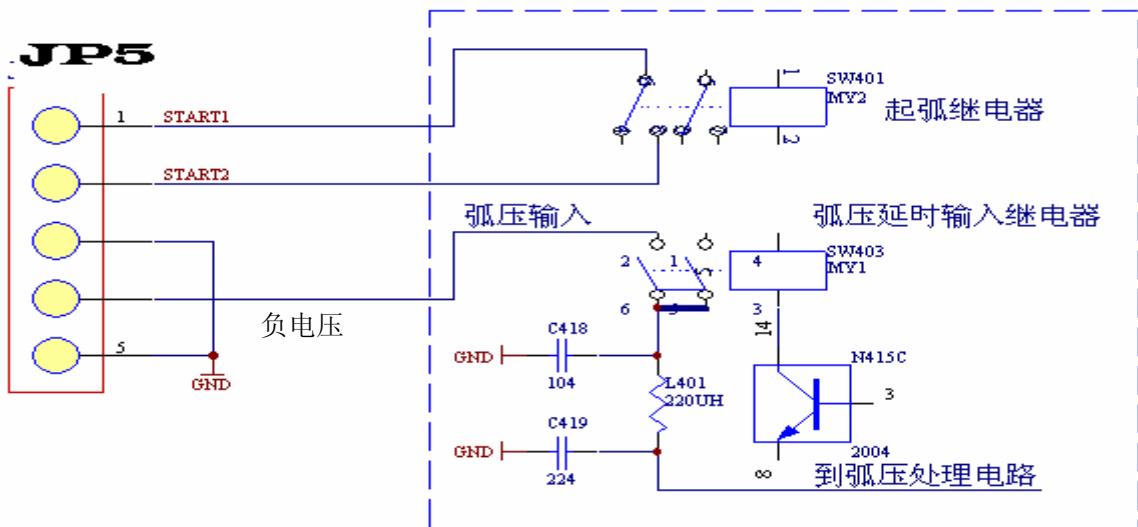


Figure 9: Mainboard Plasma connection

### Connect to CNC Control Interface

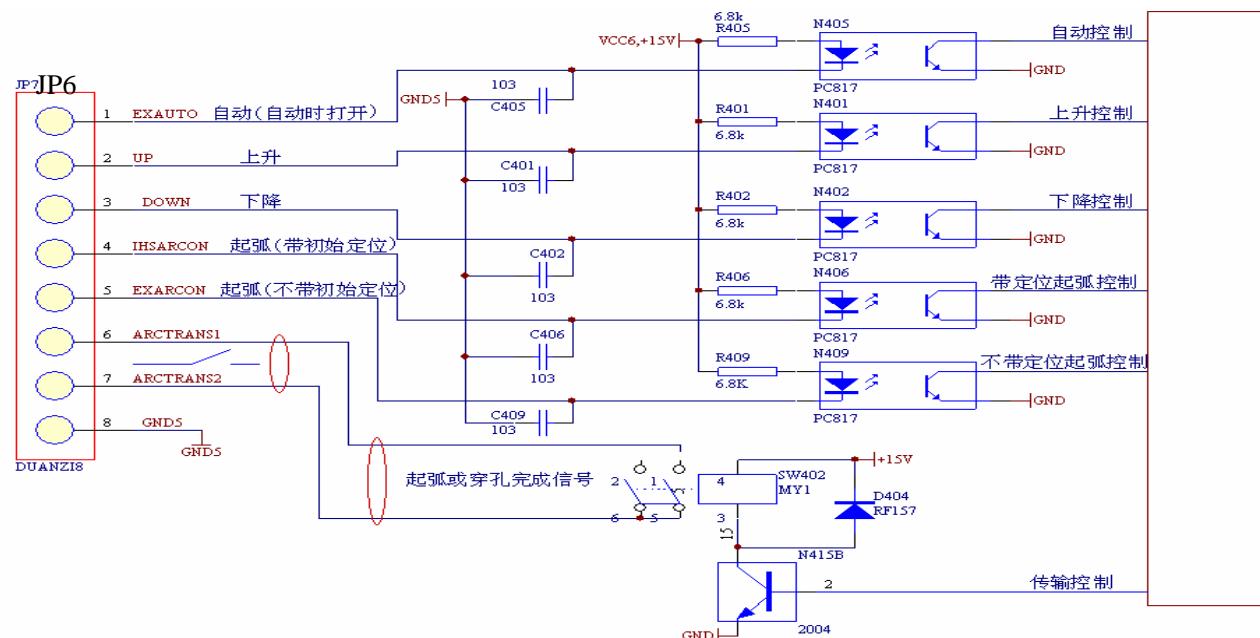


Figure 10: connection of high adjusting machine and CNC control

The connection of high adjusting machine and CNC control introduce the Isolation method of photoelectricity, it has 6 ports as below respectively:

A、(EXAUTO) Auto/Manual: The lower storage battery is automatic and the higher one is manual.

B、UP: Lower storage battery is up.

- C、DOWN: Lower storage battery is up.
- D、IHSARCON: Lower storage battery is work, but first we must do the IHS, the JP6 has finished the automatic arc-beginning.
- E、EXARCON: Lower storage battery is work, start the arc directly. Make sure the incision gun approach steel plate then do the arc-beginning.
- F、ARCTRANS1、ARCTRANS2: On-Off quantum send signal.

## 7.5、Proximity Switch IHS Interface

As Figure 11 shows: Connect to JP3 Port through 3 chip aviation socket( label: switch HIS)

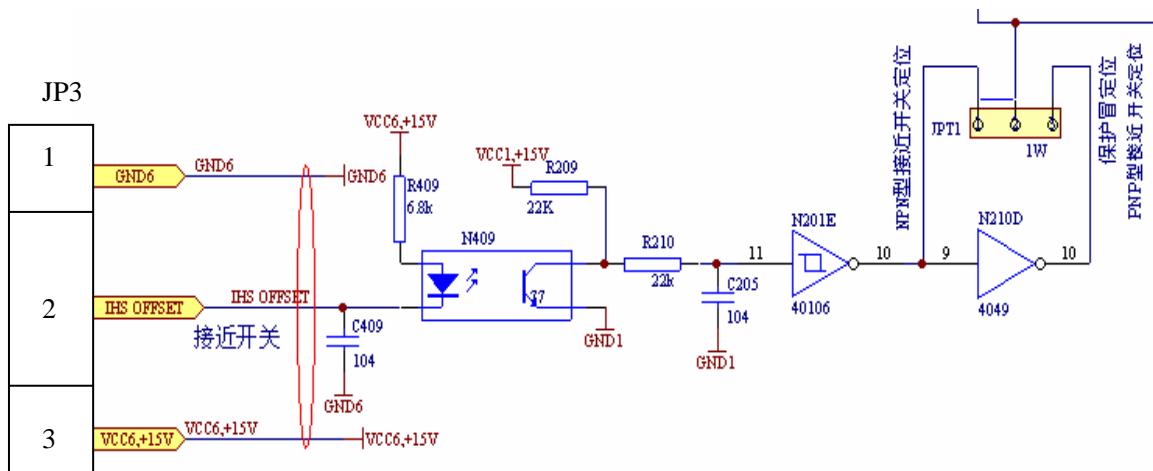


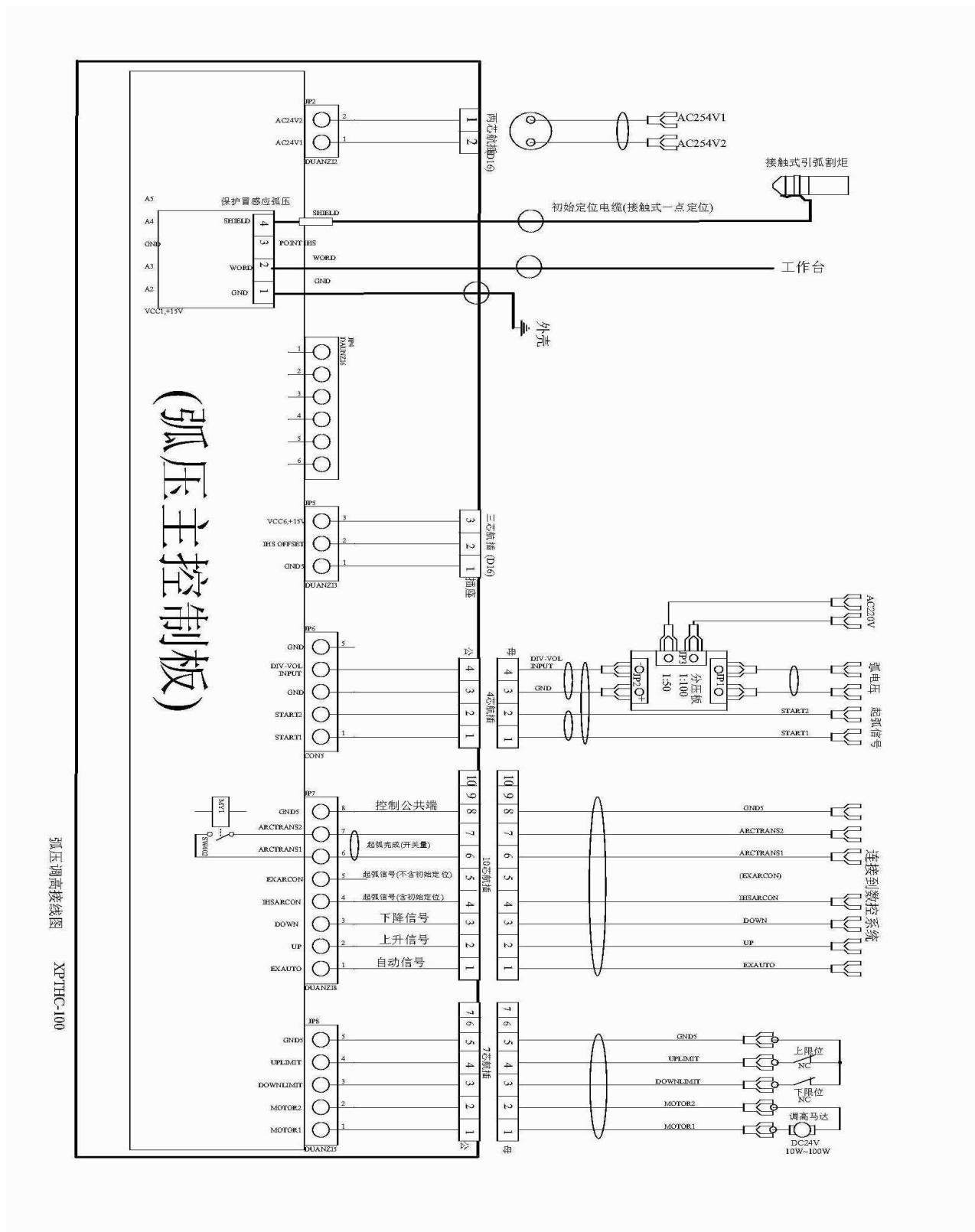
Figure 11: Proximity switch connection of IHS

## 7.6、Current Feedback Setting.

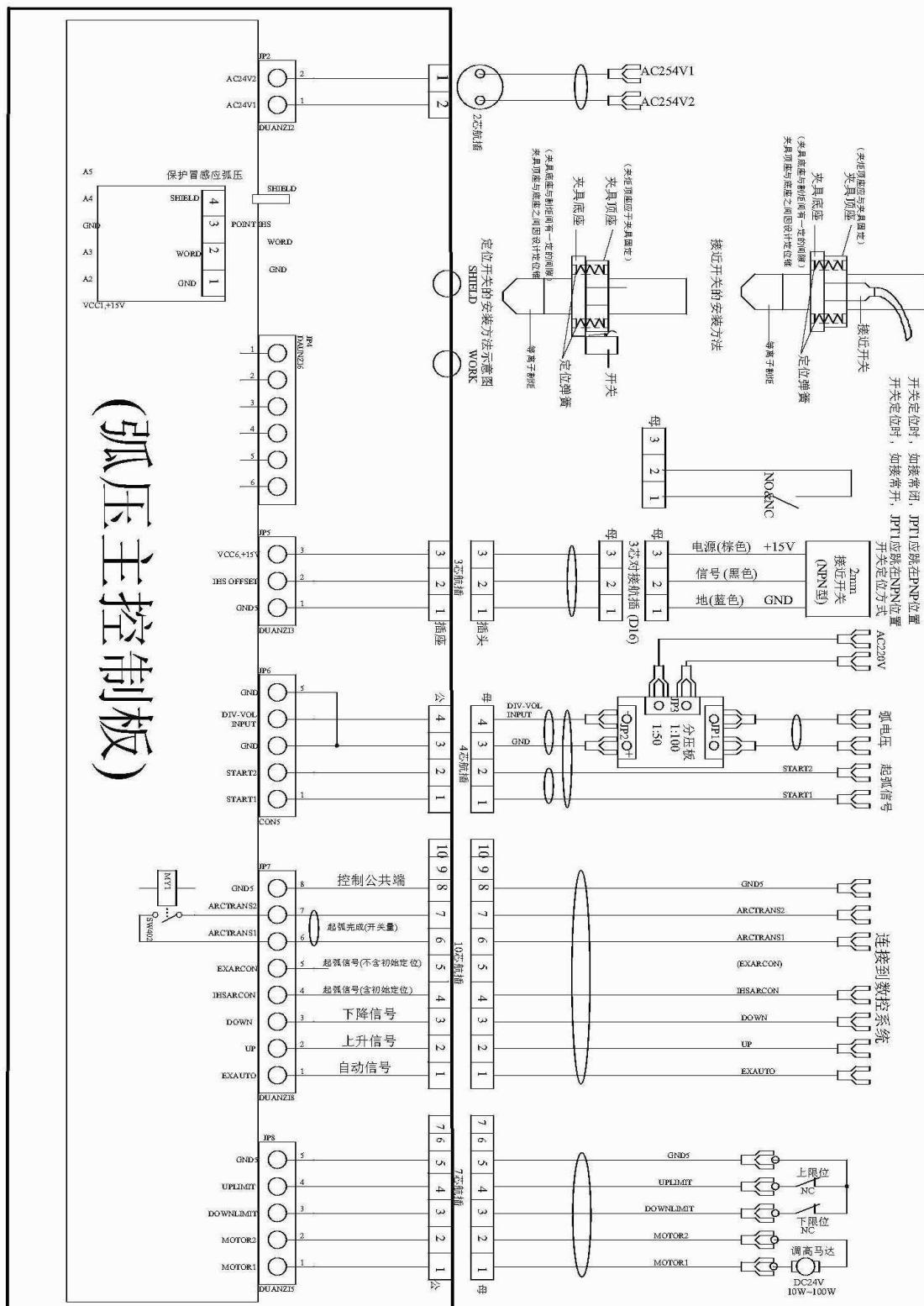
Current	1-8	2-7	3-6	4-5
4A	OFF: PWM=9KHZ ON: PWM=18KHZ	OFF	OFF	OFF
3A		OFF	OFF	ON
2A		OFF	ON	ON
1A		ON	ON	ON

## 8. Controlling Connection

### **8.1、 IHS Wiring Diagram of Torch Retaining CAP**



## **8.2、IHS Wiring Diagram of Switch**



水下切割开关定位 (NPN型接近开关定位)

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## 9、Fault Maintenance

### 9.1、Frequent Fault Examination

Serial Number	Malfunction	Cause	Resolution
1	No display, black screen	No +5V voltage on the voltage meter	Check +5V voltage VCC3
2	No revolution of generator or only one direction rotates.	1、 damage of drive IR2110	1、 replace IR2110
		2、 drive voltage +15V, failure	Check drive voltage VCC4
		3、 protection of over-current	D606 ~ D609 (IRF640) is damaged or mechanical blocked
3	Once open the power, the incision part continue to move up。 (NPN)	1. Proximity switch is not installed well in the open-circuit condition	Install the Proximity switch perfectly
		2、 damage of Proximity switch	Replace Proximity switch (signal: 2mm, NPN)
4	Can not produce arc automatically after the IHS	1、 damage of Proximity switch, no return signal	Replace Proximity switch
		2、 IHS time is too short, no return signal	Prolong the IHS switch
5	Instability of controlling voltage	1、 check the connection with earth 2、 check the air-proof 3、 over-sensitiveness	

6	The machine start to work before the accomplishment of arc-beginning	Setting time of SET-PIERE is too short	1、increase SET-PIERE time 2、adopt the arc feedback signal of Plasma itself
7	Plasma produce arc before the IHS	When we use the EXARCON signal, the delay-time of CNC controlling is too short	Prolong the delay time of CNC IHS
8	Cutting torch can not produce arc	1、Confirm the working situation of Plasma power 2、Check the height of IHS 3、Check the cutting torch fittings	
9	Plasma cutting torch can not transfer to workpiece	1、Check the connection of working lead 2、Check the cutting torch fittings	
10	Cutting torch move before the fulfillment piercing hole	Prolong the time of piercing hole in the CNC system	
11	The CNC control start move, the cutting torch then begin work	1、Increase the setting of “given voltage” 2、Prolong the automatic time in the CNC system 3、Decrease the setting of over-voltage 4、Check the situation of automatic signal or cornering signal of CNC system	
12	Plasma arc out after the arc transferring and piercing hole	1、Delay-time is too long	
13	When do the IHS, the cutting torch touch the steel plate but no movement upwards.	1、Time of HIS is too short 2、Induced lead connect with protection badly	
14	Cutting torch still press the steel plate downwards and no arc-producing	1、Bad checking cable and contact of the Torch Retaining Cap 2、Proximity switch is damaged 3、“WORK” in the high adjusting is bad connection with earth	

15	Cutting torch is unsteadily automation	1、High sensitiveness of high adjusting machine, regulate RP501 2、damage of high adjusting machine
16	High adjusting machine is too slow to follow in automation	1、High sensitiveness of high adjusting machine, regulate RP501
17	No arc during the incision, the are voltage is continued to produce and the machine is still work	cause: can not stop immediately since the high adjusting machine is are voltage signal. resolution: adopt the arc feedback signal of Plasma itself

## 9. 2、Cancel Extinguished Arc and Improve Function:

If the ascending function of cutting torch has not been installed properly the down-up is easy to block by boot-strap, you can cancel the function in the main control board.

There are two ways to cancel the function:

- 1、Cancel the R234 in the main board
- 2、Cancel the C218 in the main board

## 9. 3、Several Proposal

1、When we use the IHS of Torch Retaining Cap, install the anti-bump clamp and connect to protect the Torch Retaining Cap, in this way it is more useful to safeguard the cutting torch.

2、When we use the Proximity switch, we suggest to use the PNP model. The ways as below shows: