
HCA1002

PLASMA HEIGHT TORCH CONTROLLER



1、 Introduction

1.1、 Product Name & Model:

HCA1002 (upgrade) CNC Plasma Torch Height Controller

1.2、 Basic Parameter

- Working Voltage: AC24V \pm 5%, 50Hz/60Hz
- Lifter motor- up/down: DC24V motor
- Driver mode: PWM
- Output Current: 1A-4A, Max.:6A, Load Capacity: 100W,
- Working Temperature: -10 \sim 60 $^{\circ}$ C
- Divide-voltage ratio: 100:1
- Control Accuracy: \pm 1V \sim \pm 3V
- Size: Length * Width * Height: 320mm*260mm*90mm
- The speed of lifting: 1000M/S \sim 4000M/S (Contact the supplier if it exceeds the range of speed)

1.3、 Application:

HCA1002 supports mostly all plasma cutting machine on worldwide market like Hypertherm, Thermal Dynamics etc. It includes HD Plasmas like HPR130, 260, Ultra-cut series.... And it supports all CNC cutting controllers also. Like Hypertherm, Burny, and industrial level controller or MACH3 such DIY controllers, because it can start Auto Height Control with or without auto enable signal from CNC. But with Auto enable/disable signal from CNC, THC would be work better.

1.4、 Components

HCA1002 includes follow parts:

- A. HCA1002 Control module;**
- B. Voltage Divider;**
- C. All related connectors.**

1.5、 Basic Functions:

A、 Automatic Initial Height Sensing (IHS):

Torch Retaining Cap HIS and Proximity Switch HIS (NPN and PNP), Proximity Switch HIS is backup for Torch Retaining Cap HIS for cutting dirty/rusty workpiece, needing the Anti-Collision Fixture(breakaway kit).

B、 Torch Anti-Collision Function:

We designed Touch-up circuit for Anti-collision function. No matter it is on Auto Control Model or Manual Control Model, when torch head touches the workpiece, THC would automatically lift torch up to HIS height, **so with HCA1002, even in Manual Control Model, user doesn't need to worry about torch head crashing.**

C、 Freeze Auto Height Control on Corner Signal

It can recognize Corner Signal From CNC and Freeze Auto Control Model on receiving this signal, and we have a unique design to backup this function. **We set 30V (adjustable) as Turning Point according to our years practice.** When the Actual Arc Voltage is higher than set Arc Voltage over 30V, THC Auto Control Mode freezes to avoid torch head diving, until it goes back to 30V range. This Over Voltage protection can avoid torch diving on voltage spikes (Corner Tuning, Kerf Crossing) Effectively.

D、 Lifter Torch Up on HIS Disabled Status

On HIS disabled status, Jogging torch head down until it reaches workpiece, when Arc Starts, Torch head would lift up automatically to the Set Height set via the button SET-HIS.

E、 Lifter Torch Up on TURN ON or ARC Off

When CNC is TURN ON or Plasma Arc Off, THC would lift torch up for 2 seconds, **please notice this Function during commissioning, avoiding the possible damage of limit switch or lift device.**

F、 Set Pierce Delay Time

Set Button Set-PIERE (set Pierce delay time), to delay output this signal, it is a

switch signal, set to detect arc voltage lead in THC. Once THC detect arc lead in, it send arc ok signal to CNC to start cut.

Dynamic Pierce works by receiving plasma's Dynamic Pierce signal (Kjellbery plasma has this signal) or plasma's arc feedback signal. After HIS, THC controls plasma start arc, and it lifts torch up when arc strikes. It is to protect the torch tip and electrode; consumables can work longer in this way.

G、 Manual Operation

Many functions can be Manually operated on Operation Panel of ADT-HC1002, Such as, Set Auto/Manual Mode of THC, manually control torch Up and Down, HIS test, Arc Start test etc.,

H、 Arc Voltage Divide

Isolation Voltage Divide, the voltage divide ratio is 100:1 or 50:0. Once Isolation voltage divide function damaged, user can also use Non-Isolation Voltage Divide on your voltage divider.

1.1、 Basic Functions:

1.6.1 Work with HIS

When CNC send out Arc Start Signal(HIS enabled), THC starts with HIS, then send Arc Start signal to plasma, after plasma start, THC delay lead in arc voltage from plasma (Set pierce delay time), THC send arc feedback (Arc ok) Signal to CNC to Start Cut after arc voltage lead in. If THC is on auto model, and CNC auto Control enabled, the cutting is under THC Auto control.

We don't recommend work without IHS

2、 Commission & Set

2.1、 Operation Panel Introduction

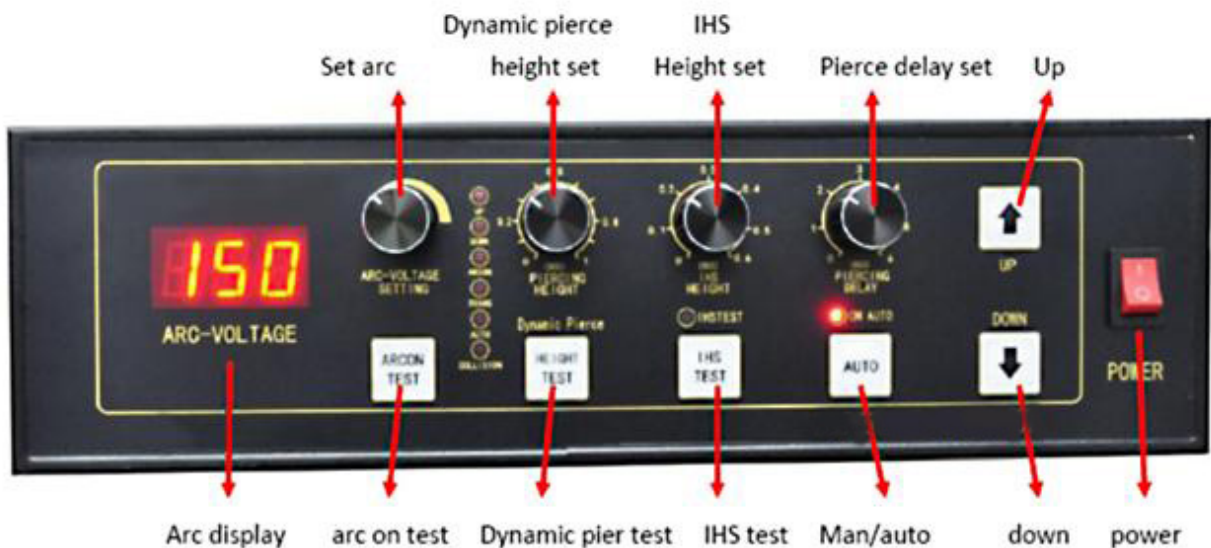


Figure 2-1 operation panel

Arc Voltage

Before Arc Start it shows the Set Arc voltage, after it shows the Actual Arc Voltage.

Arc-Voltage Setting

Based on the thickness of steel plate being cut and cutting speed, it shall be set according to the parameter offered by plasma, and it will be showed on operation panel. Set arc voltage decides the torch height during cut; the higher the arc is the higher the torch height will be. On auto mode, adjust the set voltage means adjusting the torch height.

Pierce HEIGHT

Increase on clock –wise turn, decrease on anto-clockwise. Pierce height means torch lift up height after receiving dynamic pierce signal from plasma or arc feedback signal from plasma. It is used on cutting thick material. If the dynamic pierce signal is disconnected, this function is disabled.

HIS HEIGHT

Set Initial Height, Turn clockwise, the height increase

PIERCING DELAY

Set the Delay Time from plasma start to CNC start cut (delay lead in arc voltage into THC), the arc feedback (Arc ok) signal would be sent to CNC only after arc voltage is detected by THC.

HIS –Test

Press one time, it would check HIS on time, which is used to check whether it is a workable HIS or not.

AUTO

Set THC Auto or Manual mode. Meanwhile enables the Auto Signal between connectors of CNC and THC, (for EDGE system, the Auto signal shall be connected as Normally Closed).

ARCON TEST

Press and hold, to test the Plasma Start, during test, Torch lifts up and HIS height.

Up and Down

Manual operation button of Up and Down, It is effective on any mode.

Indicators

Down Indicator: Turn on when torch lift down.

Collision Indicator: Turn on when torch touch workpiece or proximity switch effective.

TRANS Indicator: Turn when THC receives arc feedback signal, and sent out Arc OK signal to CNC.

AUTO Indicator: On means THC is on Auto Mode, Four Conditions have to be completed:

1. CNC Auto Height Control (THC) enables;

2. THC is on Auto Model;
3. Arc voltage has been lead in THC;
4. Actual Arc Voltage not higher than Set Arc Voltage over 30V.

Note:

- A. When THC on Auto Mode, the 5 indicators all should be ON, if anyone is OFF, that means Auto Mode failed, please check the reason according to indicators.**
- B. There are 6 indicators on Operation panel, demo THC from Torch down - Touch workpiece - arc start-arc feedback - Auto on, please check the failure reason from the one by one step.**

2.2、 Voltage divider

Our Voltage Divider offers tow modes of Voltage Divide; None Isolation Voltage Divide is backup for Isolation Voltage Divide.

2.2.1 None Isolation Voltage Divide

Note: Plasma Output positive pole is GND, negative pole connected with electrode in torch. DO NOT mis-connected, or THC will be Un-effective.

As none isolation voltage divide is directly connected with plasma power supply, to enable THC escape from interference caused by the HF during Plasma Arc Start, the Divide Arc Voltage guided into THC is Time-Delayed.

It just needs to prolong the time of lead Arc Voltage into THC, the interference can be avoid effectively.

As shoed in figure 2-2

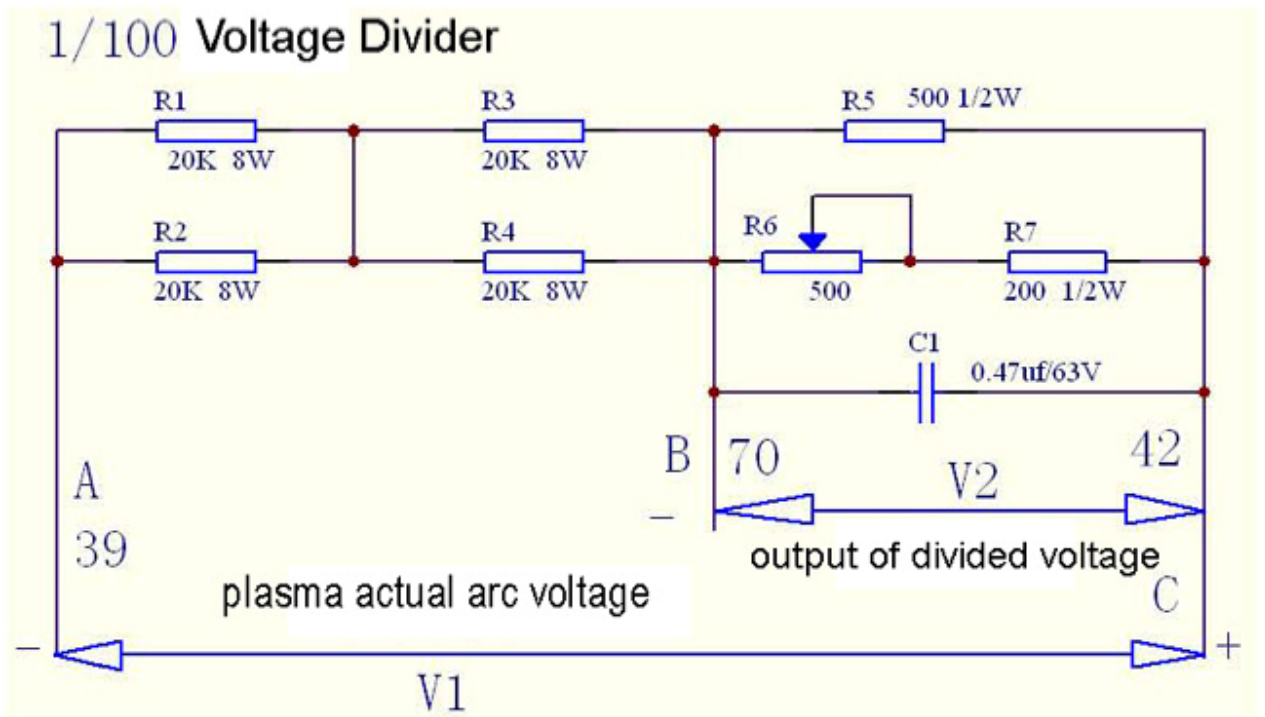


Figure 2-2

2.2.1 None Isolation Voltage Divide

Plasma Arc Voltage is divided by Voltage Divider (offered with THC) on 100:1 none isolate voltage divide, lead into THC after processed by Isolation Circuit. Arc Voltage has little effect on THC after Isolation Circuit. This voltage divider can be connected as Isolation Voltage Divider or Non Isolation Voltage Divide mode.

As showed in figure 2-3

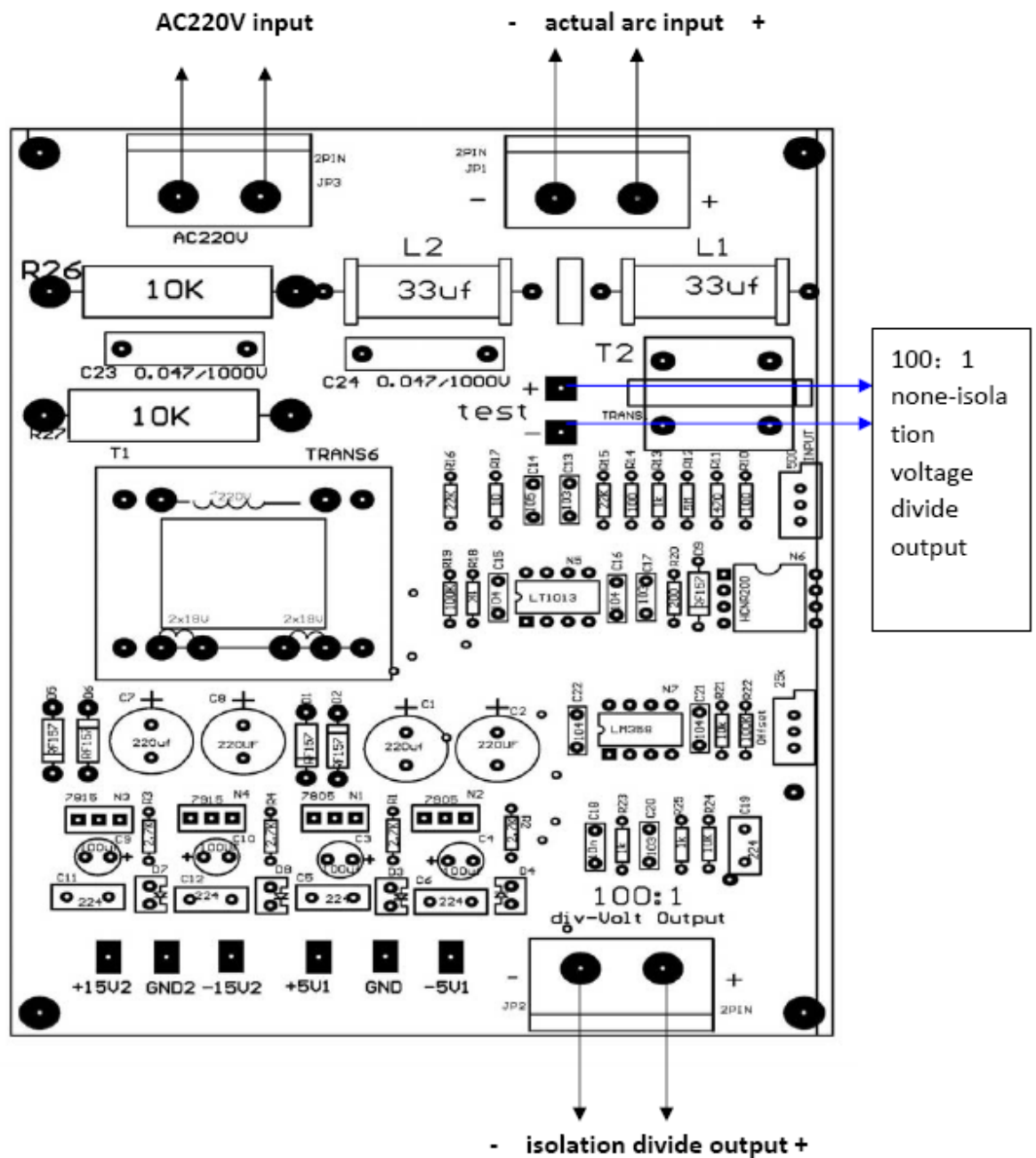


Figure 2-3

Note: Non Isolation Voltage Divide is backup for Isolation Voltage Divide. On Non Isolation Voltage Divide, AC220V power can be unconnected; but it must be connected on isolation voltage divide.

2.3 HIS

2.3.1 None Isolation Voltage Divide

The Torch Retaining Cap should be metal, so the metal can be electrically conducted with steel plate. It has a piece of Isolated HIS plate that can be fixed in the THC directly, the connection showed as Figure 2-4 below:

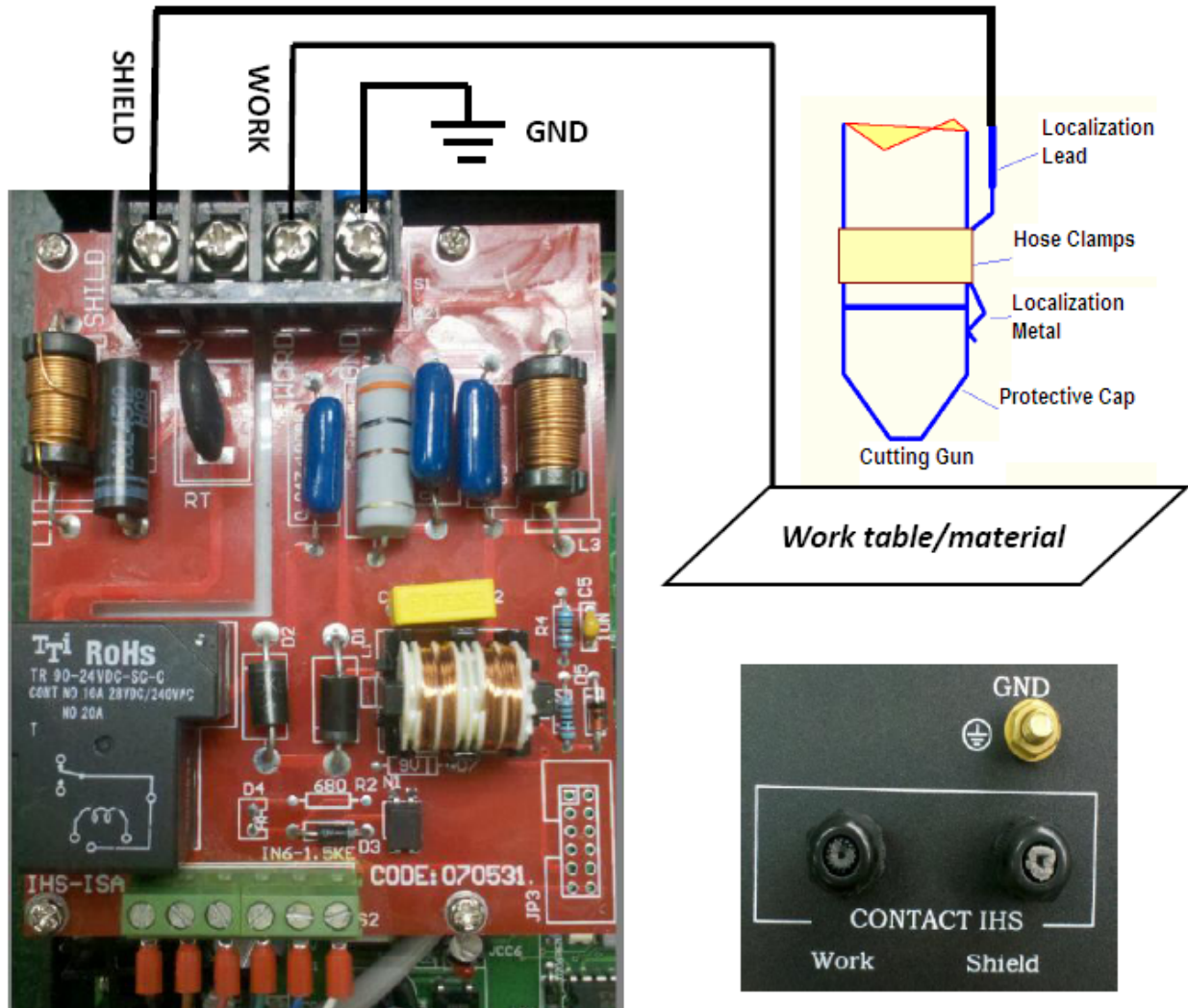


Figure 2-4

Torch Retaining Cap HIS

THC receives arc start signal from CNC, lift torch down, when torch retaining cap torches steel, THC lift torch up to set HIS height, After HIS, THC control plasma to start arc.

Note:

- A. The cable from SHIELD (marked as shield on THC) to torch retaining cap.**

- B. The GND must be well grounded WORK must connected with ground, and the grounding cable must be > 4mm²**
- C. The cable connected to retaining cap must be Height Voltage cable.**

2.3.2 Proximity Switch HIS

HCA1002 supports torch retaining cap HIS and proximity switch HIS both. We recommend proximity switch HIS, which can be HIS and anti-collision function job both, especially cutting rusty/painted steel,

Proximity switches HIS uses 3-pin connector, named on THC “Switch HIS”, Pin definition as follow:

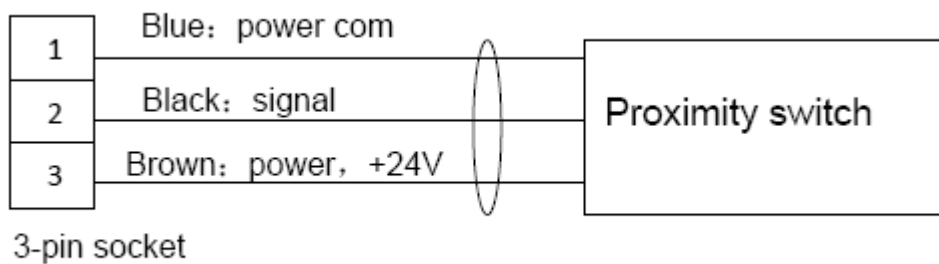


Figure 2-5

It uses 2 Proximity switch connected as above drawing, any one of them effective, THC can receive this signal, as figure 2-6 shows:

Note: In side THC, a 250mA Recoverable Fuse is installed at the power supply of proximity switch, to avoid damage of power when proximity switch failed.

Work Process: Once THC received Arc Start signal from CNC, torch moves down, when it reaches workpiece, Proximity Switch leaves proximity position, THC receives the signal, lifts torch to the set height,(proximity Switch recovers during lifting). After HIS, THC drives plasma Start Arc.

Proximity Switch HIS is suitable for all plasma HIS

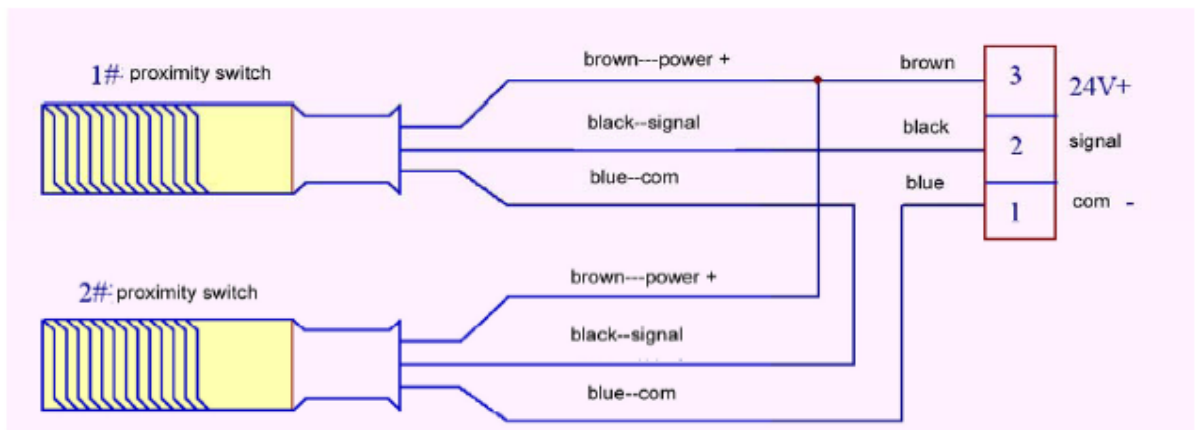
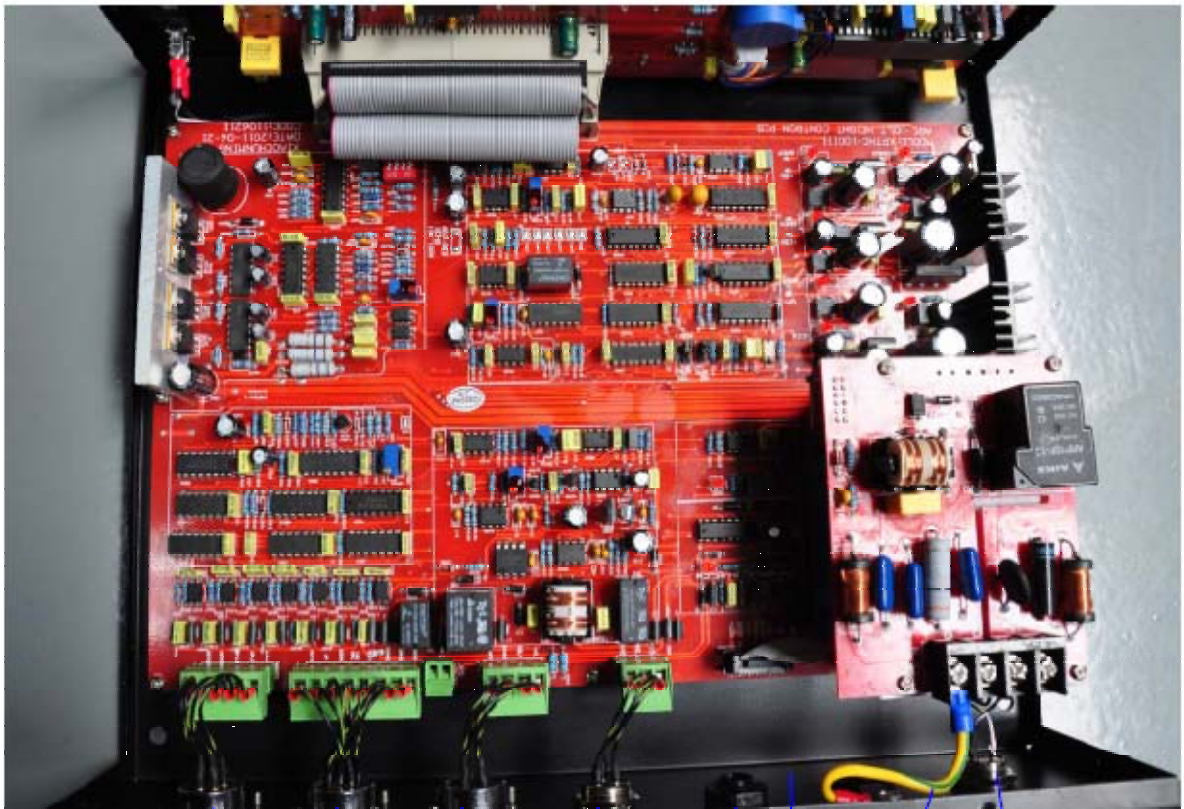


Figure 2-6

3、 Wiring Introduction:

Introduction HCA1002 Connector's wiring details,



TO-TORCH TO-CNC TO-PLASMA SWITCH-IHS WORK SHIELD GND POWER (AC24V)

Figure 3-1

3.1、 Power

HCA1002 works under AC24V

Socket as right picture **Power**



3.2 Motor Port

HCA1002 use DC24V motor as drive output,

Socket shows as right picture **TO TORCH**



3.2.1 TO TORCH

Pin(s)	Signal	Description
1 , 2	DC Motor Drive (Output)	DC motor drive output Drive DC24Vmotor directly Max 100W PWM
3	Down LIMIT (Input)	Down limit input Limit switch normally closed Short connect pin3 and 5 (optical ISOLATED)
4	Up LIMIT (Input)	Up limit input Limit switch normally closed Short connect pin4 and 5 (optical ISOLATED)
5	LIMIT COM	COM

Figure 3-1 TO MOTOR

3.2.2 Drive Current & Set

The relationship between adjusting the SP2 current and the ON/OFF of Switch

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

Figure 3-2

3.3 To CNC

HCA1002 connect to CNC via a 10-pin socket

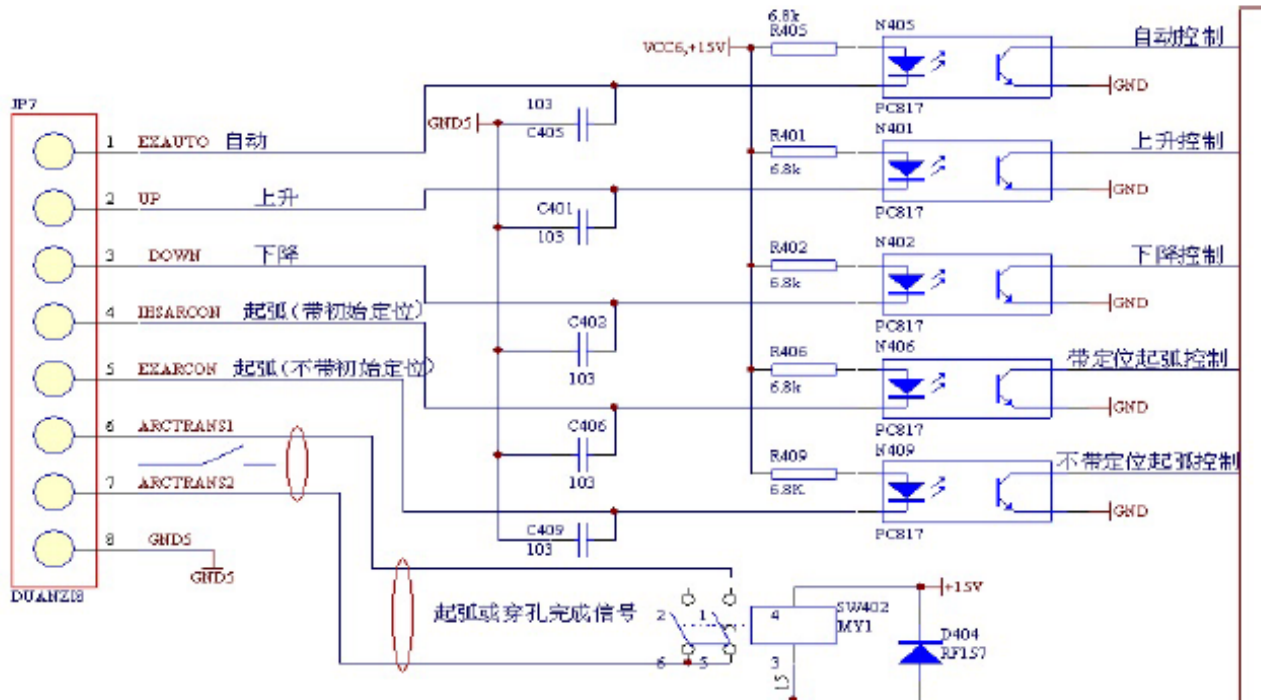
Shows as right picture To CNC



TO CNC Figure 3-3 TO CNC

Pin(s)	Signal	Description
1	AUTO	Auto signal, low-level effective, Controlled by CNC's corner signal or THC enable signal, pin8 is control Com
2	UP	Up signal, low-level effective pin8 is control Com
3	DOWN	Down signal, low-level effective pin8 is control Com
4	ARC ON with IHS	Arc start with IHS, low-level effective pin8 is control Com
5	EX ARC ON	Arc start without IHS, low-level effective pin8 is control Com
6, 7	Arc ok signal RELAY OUT (dry Contact)	Connect to CNC's arc feedback signal input Relay output (dry contact)
8	Control COM	Isolation control COM
9 10	Dynamic pierce port	Switch signal or PWM control input

TO CNC uses optical isolation, as follow picture shows,



3.4 To plasma

**HCA1002 Connects to Plasma via 4-pin socket,
Marked as TO PLASMA**



TO PLASMA		
Pin(s)	Signal	Description
1 , 2	Plasma start out	Plasma start signal output (Relay out, dry contact)
3	ARC + Input	Plasma input after voltage divide+
4	ARC - Input	Plasma input after voltage divide -

Figure 3-5

3.5 Proximity Switch HIS Port

HCA1002 Proximity switch HIS port is 3-pin socket,

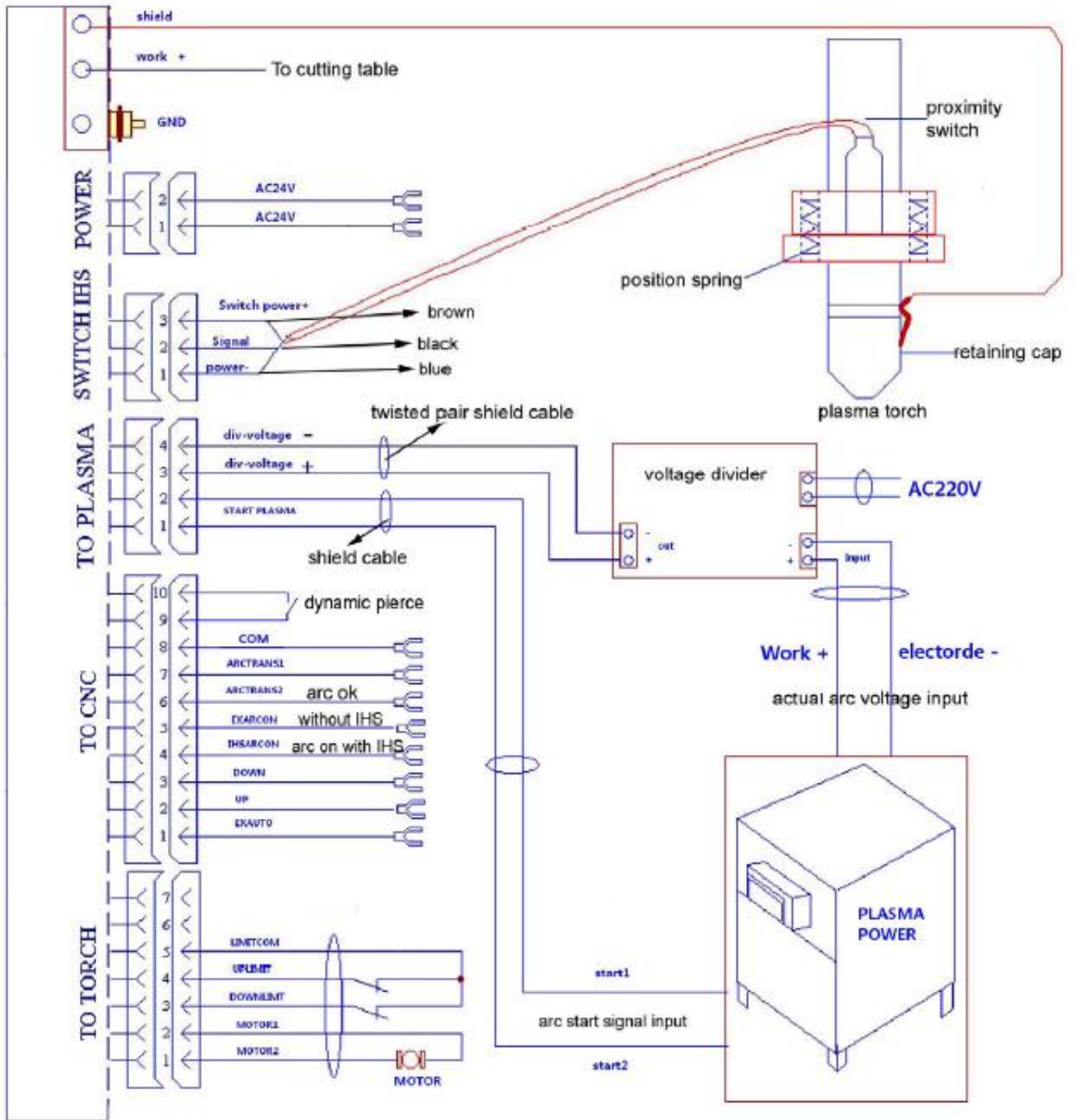
Marked as SWITCH HIS,



SWITCH HIS		
Pin(s)	Signal	Description
1	Switch Power -	proximity switch power negative port
2	Signal Input	Proximity switch signal
3	Switch Power +	proximity switch power positive port

Figure 3-6

4、 THC wiring diagram



HCA1002 Wiring Diagram

5、 Maintenance

5.1, Trouble shooting

Serial Number	Malfunction	Cause	Solution
1	No display, black screen	No +5V voltage on the voltage meter	Check +5V voltage VCC3
2	No rotation of motor 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 turn on, cutting torch keeps lifting. (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 Start 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 arc voltage	1、 check the connection with earth 2、 check the water-proof 3、 over-sensitive	

6	CNC starts to work before the accomplishment of Arc Start	Setting time of SET-PIERE is too short	1、 increase SET-PIERE time 2、 adopt the arc feedback signal of Plasma itself
7	Plasma Arc Start before the IHS	using the EXARCON signal, the delay-time of CNC controlling is too short	Prolong the delay time of CNC IHS
8	Cutting torch can not start arc	1、 Confirm the working situation of Plasma power 2、 Check the height of IHS 3、 Check the cutting torch fittings	
9	Arc of Torch can not transfer to work piece	1、 Check the connection of working lead 2、 Check the cutting torch fittings	
10	Cutting torch move before piercing hole completed	Prolong the time of piercing hole in the CNC system	

11	CNC control starts, cutting torch heads down immediately	<ol style="list-style-type: none">1、 Increase“ Set Arc Voltage”2、 Prolong the automatic time in the CNC system3、 Decrease the Over Voltage Protection No.(30V)4、 Check the situation of Auto signal or Corner signal of CNC system
12	Plasma arc out after the arc transferring and piercing hole	<ol style="list-style-type: none">1、 Delay-time is too long
13	During IHS, the cutting torch touches the steel plate but no movement upwards.	<ol style="list-style-type: none">1、 Time of HIS is too short2、 Induced lead connect with protection badly

14	Cutting torch keeps heading down after touching work piece, and no Arc Start	1、 Weak contact between detecting cable and retaining cap. 2、 Proximity switch is damaged 3、 “ WORK” in THC is bad connection with earth
15	Cutting torch move unsteadily on Auto mode	1、 THC is over sensitive , turn RP501 anti-clockwise 2、 THC damaged
16	THC is too slow on tracking, on auto-state	1、 THC is low sensitive , turn RP501 clockwise
17	Arc off during the cutting, and Arc Voltage Enable signal keeps sending out, machine still runs	problem : THC can not stop immediately since it works with arc voltage signal. solution : adopt the Arc OK signal of Plasma itself

Figure 5-1

5.3 Some Advice

1. When Torch Retaining Cap HIS adopted, we suggest customers use Anti-Collision Fixture to fix cutting torch and lifter and connected it with Torch Retaining Cap. In practice, when the contact between Retaining Cap and workpiece is weak (especially the workpiece is Rusty or Dirty still plate,) Proximity Switch HIS takes effect; it is more effective to protect cutting torch. If Torch Retaining Cap HIS and Proximity Switch HIS both installed, both will be active during cutting.
2. When it is using proximity switch function, we suggest try some more proximity switches, and all switched by outside circuit.
3. **The cable connecting Voltage divider and THC must be SHIELD cable, and shall**

be separated away from Arc Start cable.

4. When it is HF Plasma, Please use shield cable on To Torch Connection port (connect motor). One side of shield connects to socket, another side connects to torch. And it should be away from torch cutting cable. To avoid lead in plasma high voltage into THC control circuit.



Figure 5-2