SF-HC30A0 Cutting Torch Controller

User Manual V1.0

目 录

1 Preface

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

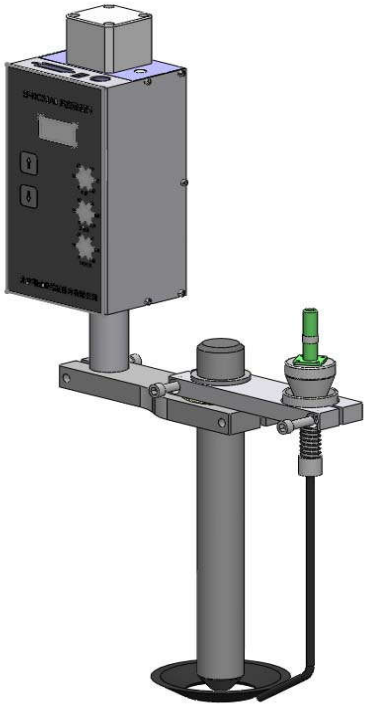


Fig. 1-1 SF-HC30A Flame/Plasma Cutting Torch Height Controller

1.1 Object

The SF-HC30A Flame/Plasma Cutting Torch Height Controller is a specially designed cutting-torch automatic height-control block with integration of mechanical lifting and electrical control for portable flame and plasma cutter.

The SF-HC30A Flame/Plasma Cutting Torch Height Controller is easy to use, simple to commissioning and cheap, have our traditional feature “performance of imported products, price of domestic products”. It is the ideal supporting product for welding-cutting equipment manufacturers.

1.2 Important Announcement

- There may be difference between real product and manual picture of SF-HC30A Flame/Plasma Cutting Torch Height Controller, the actual product is standard. The product or accessories are subjected to changes without prior notice. Please refer to the updated information.
- Please read the safety warnings and notes carefully, to avoid the dangerous accidents for misuse.
- Before installing and using the product, operate strictly according to the detailed description of product manual, to assure correct application.
- If the SF-HC30A Flame/Plasma Cutting Torch Height Controller and such manual contents are used illegally, it does not represent the views of our company; we will refuse to take the legal responsibility, the users should be responsible for all consequences.
- The safety warning items protect the human and property from damage.
- During using the SF-HC30A Flame/Plasma Cutting Torch Height Controller, if there is any quality issue, the users can call our product service center, authorized offices, distributors or agencies to get corresponding product services.
- Any information in such manual can not be duplicated, reprinted or used without our written permission, and the violators should take all responsibility for the caused loss.

1.3 Caution

For safety operation, achieving designed control accuracy and avoiding any damage to such product, carefully read and strictly follow the following cautions.

- The installation persons should be technicians in related industry or with related experience.
- Carefully read such manual before installation.
- Confirm the power supply has same specifications as required.
- It is forbidden to install, insert or draw the plus with power-on.
- The installation location should be as far as possible from the heat sources.
- The controller enclosure should be well grounded, to avoid the electric-shock or affect normal operation of controller.
- The cut steel plate should be well grounded, and well connected with the controller enclosure, to ensure the accuracy of height control.

Note: If the controller enclosure and the cut steel plate are not well grounded, the height control can not work normally.

- Handle carefully, do not impact or shake intensely to avoid damaging the product..
- Do not arbitrarily disassemble the cutting-torch height controller or change its internal structure, to avoid occurrence of accidents or failures.

2 General Description

2.1 Technical Characteristics

- **Use stepper motor instead of traditional DC motor**

  The SF-HC30A Flame/Plasma Cutting Torch Height Controller adopts the stepper-motor control technology and subverts the traditional DC-motor height adjusting mode; the new control mode is quick and smooth, and greatly increase the product service life.

- **Integration of Mechanical Lifting Device and Height Controller**

  The integrated design of detector, controller and driver realizes high integration of product; the adjusting travel is 10 cm.

- **All-digital Technology**

  The circuit adopts the SMT without any adjustable elements; the all-digital technology assures the high reliability of product.

- **Application in Severe Environment**

  The closure adopts the air-, interference-, water- and moisture-proof design, is especially suitable for the severe environment of high temperature and high electromagnetic interference of flame cutting and plasma cutting.

- **Various Interfaces, Easy to Use**

  The interfaces are simple and easy to control, suitable for all numerical control system of flame / plasma cutting, and can also use alone.

2.2 Main Technical Parameters

- Power Supply: DC 24V±2 V 3 A

- Applicable Motor: 17hs (42) Serial Stepper Motor
- Manual Adjusting Scope: 0～100 mm
- Automatic Height Adjusting Control Scope: 3～30 mm
- Automatic Height Adjusting Speed: 3000 mm/min
- Control Accuracy: ±0.5 mm
- Case Dimension: 155×87×71 mm
- Working Environment Temperature: -10～50 ℃
- Weight: 1.5 Kg
- Detecting System: Capacitance Detector, Arc Voltage Height Detector

3 Installation

3.1 Mechanical Installation

- For the names and positions of related components of height controller, please see Fig. 3-1.
- Among the components, the adaptor of capacitive sensor is equipped for flame cutting only.

Flame Cutting Torch

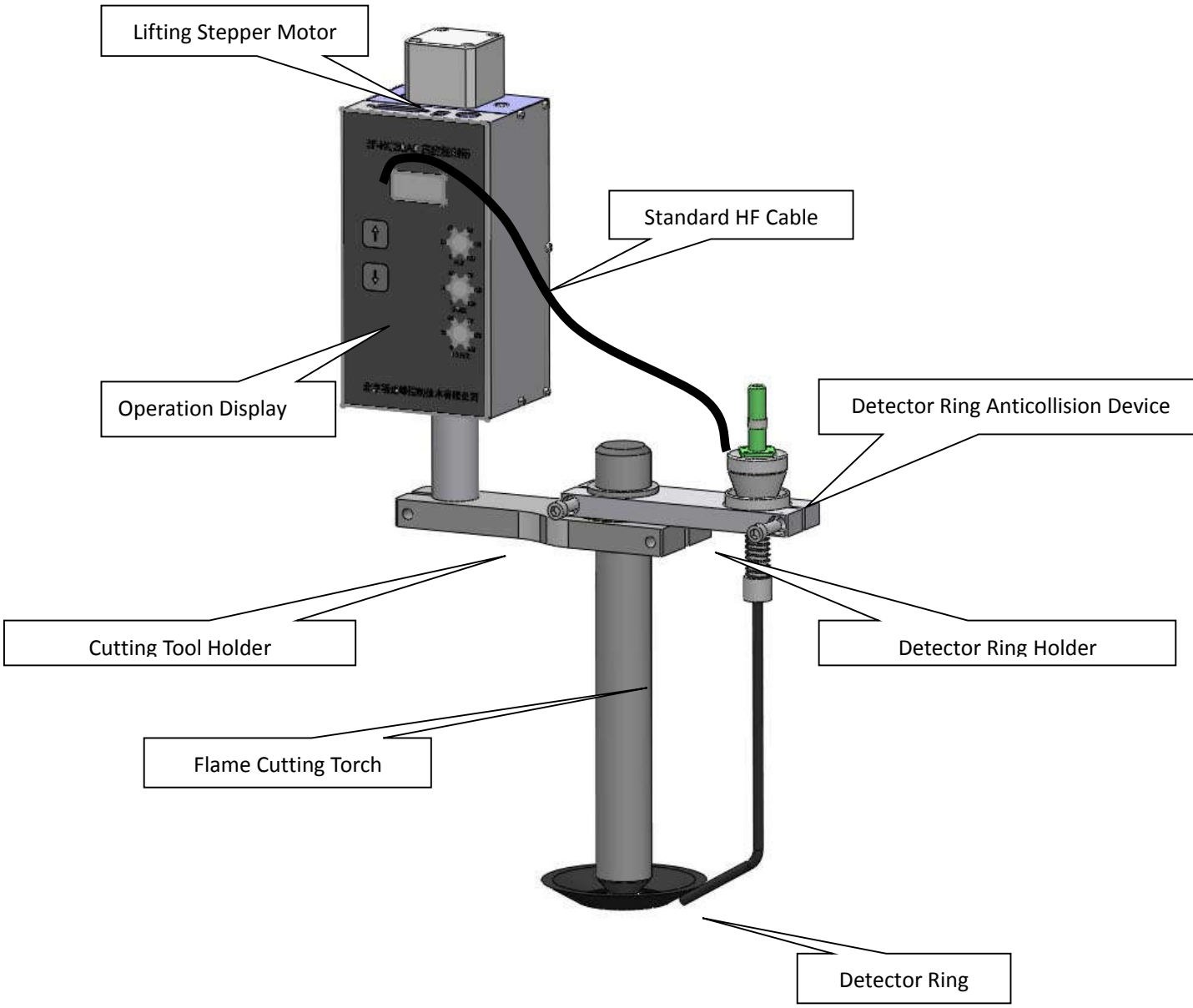


Fig. 3-1 Each Component Position, Name and Function of Controller

- The 6 pieces of M6 screw holes at back of height controller are used to fix the closure to frame. The positions and dimensions of them are shown in Fig. 3-2.

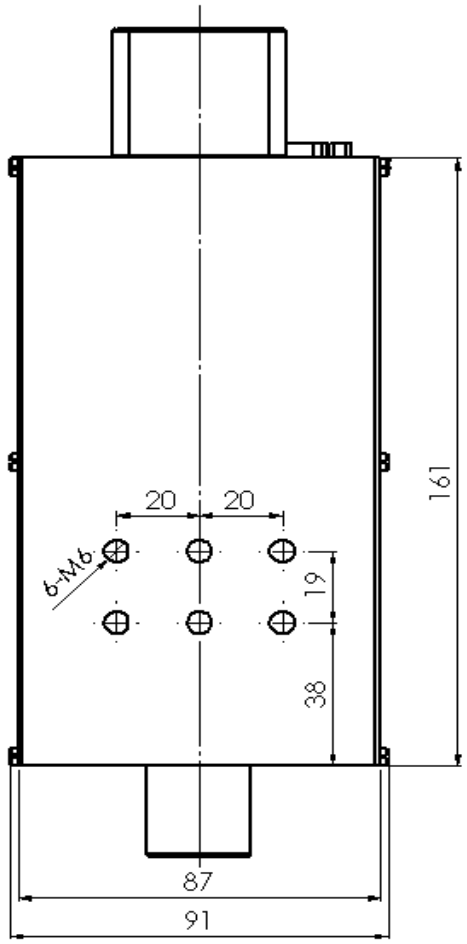


Fig. 3-2 Positions of Installation Screw Holes at Back of Controller

- For left installation view and related dimensions of height controller, please view Fig. 3-3.
- For back installation view and related dimensions of height controller, please view Fig. 3-4.

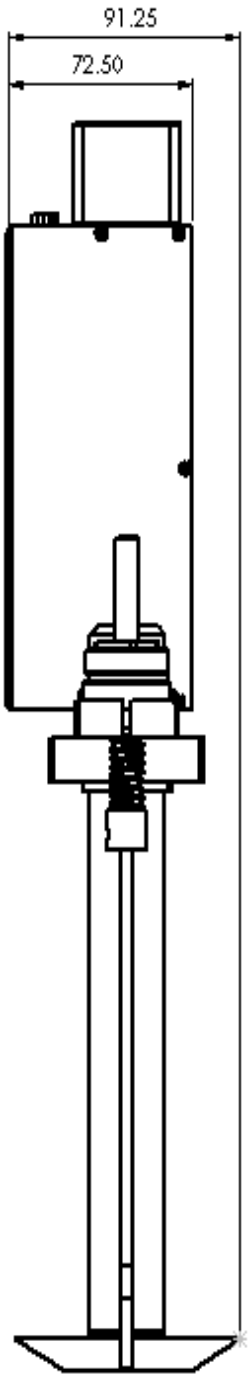


Fig. 3-3 Height Controller Right View

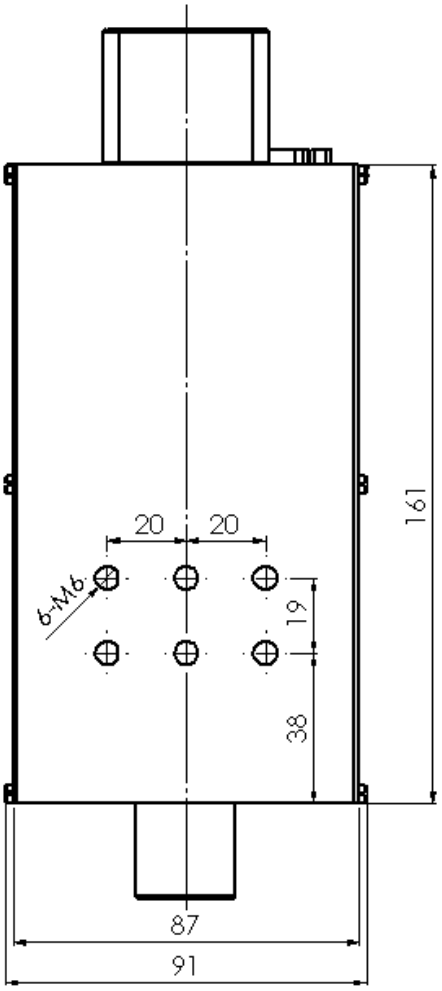


Fig. 3-4 Height Controller Back View

- For installation sketch of height-controller connecting pieces, please view Fig. 3-5.

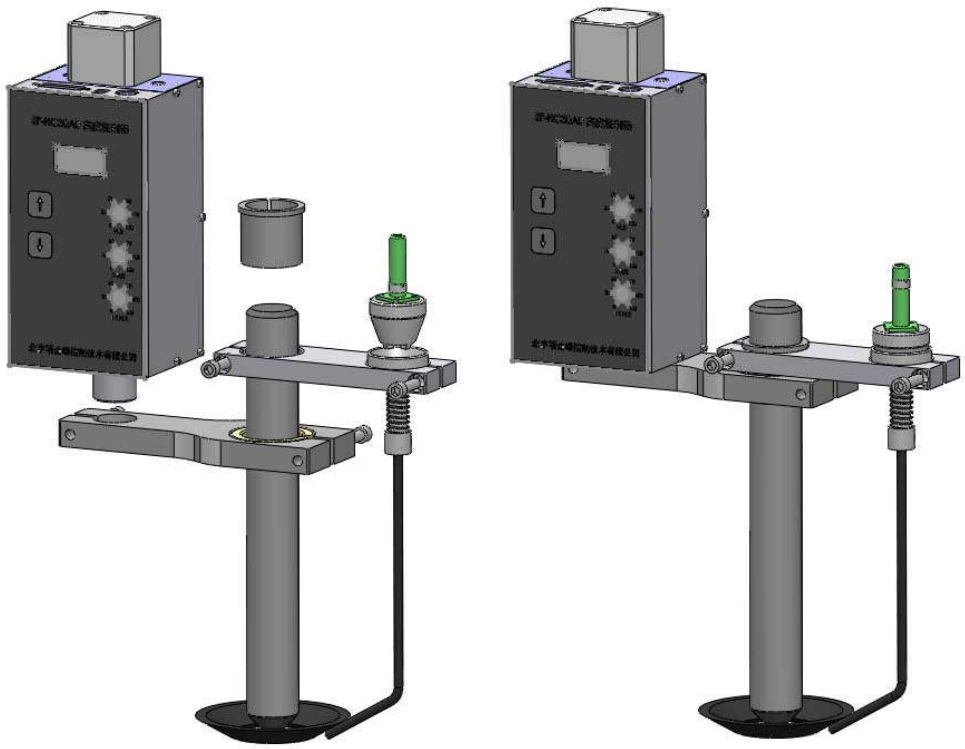
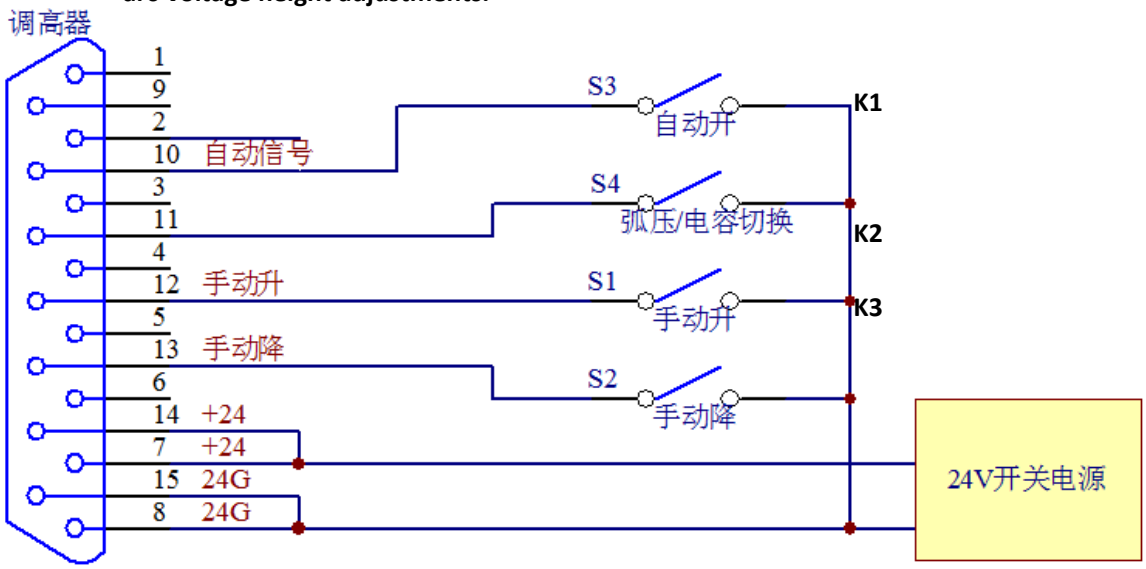


Fig. 3-5 Installation Sketch of Controller Connecting Pieces

3.2 Electrical Installation & Connection

3.2.1 Control Modes of External Switches

The control modes of external switches are applicable for capacitance and arc-voltage height adjustments.



调高器 height controller
自动信号 Automatic Signal
手动升 Manual Rising
手动降 Manual Falling
自动开 Automatic Open
弧压/电容切换 Arc-Voltage / Capacitance Switching
手动升 Manual Rising
手动降 Manual Falling
24V开关电源 24V Switch Power Supply

Circuit Diagram of External Switch Control

When the S3 is closed, the height controller enters automatic mode; when the S3 is open, the height controller enters manual mode.

When the S4 is closed, the height controller enters capacitance mode; when the S4 is open, the height controller enters arc-voltage mode (the capacitance mode should be customized).

When the S1 is closed, the height controller can rise with set speed.

When the S2 is closed, the height controller can fall with set speed.

3.2.2 Input / Output Control Mode (I/O Control) of Numeric Control System

Electrical Installation of Height Controller with Capacitance Detecting Mode

- For the electrical installation diagram of such controller, please view Fig. 3-6.
- The high-frequency (HF) cable and connectors are special fittings; the HF cable can be provided 1000 mm according to various requirements.
- The connectors which connect Height Controller (15-Core connector) with Numeric Control System (25-core connector) are prepared by users. The Fig. 3-7 shows the connection; the detailed definitions of 15-core connector and 25-core connector are provided in Table 3-1 and Table 3-2.

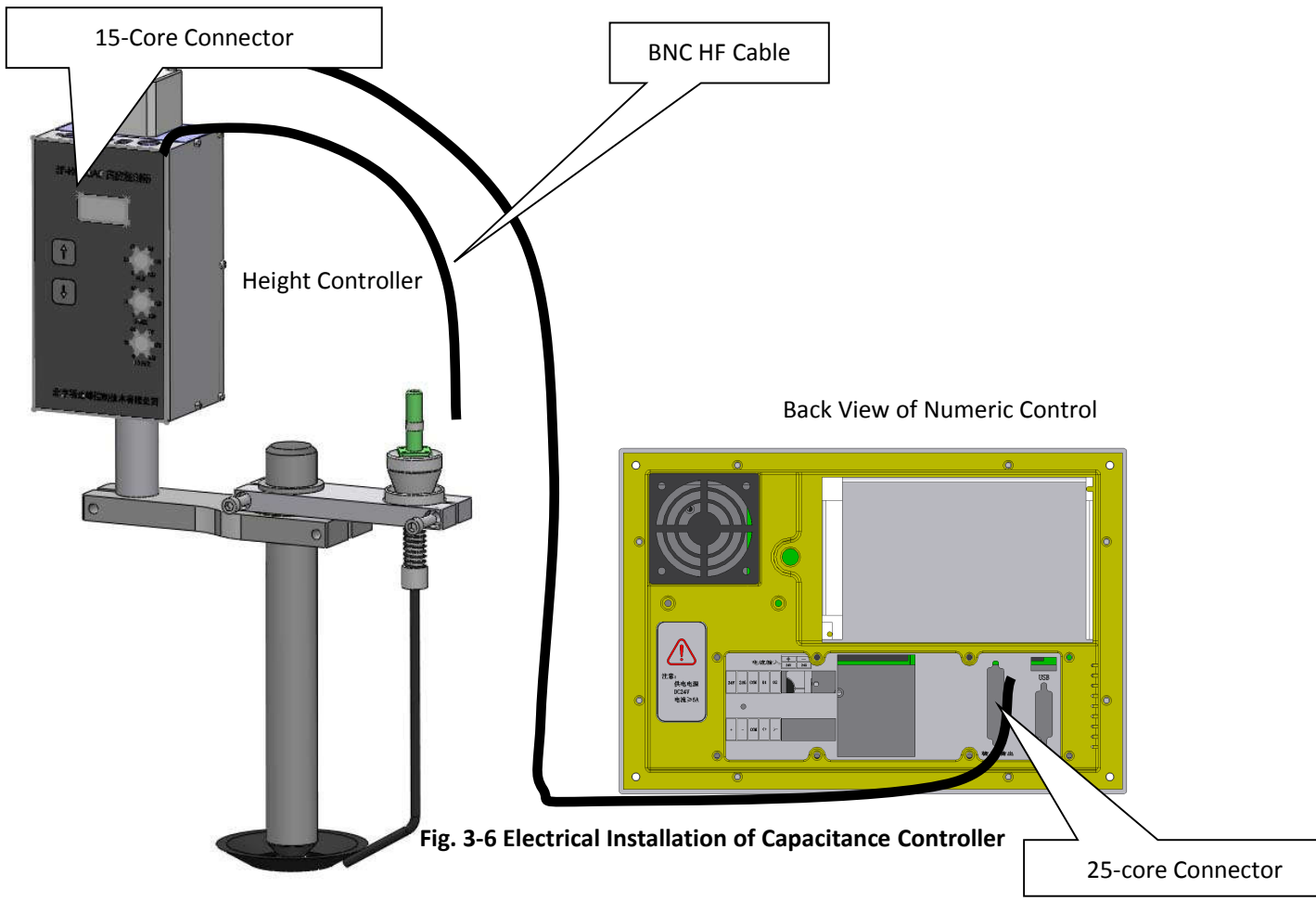


Fig. 3-6 Electrical Installation of Capacitance Controller

Note: The cross-sections of 24V power-supply cable and ground cable should be over 0.75 mm².

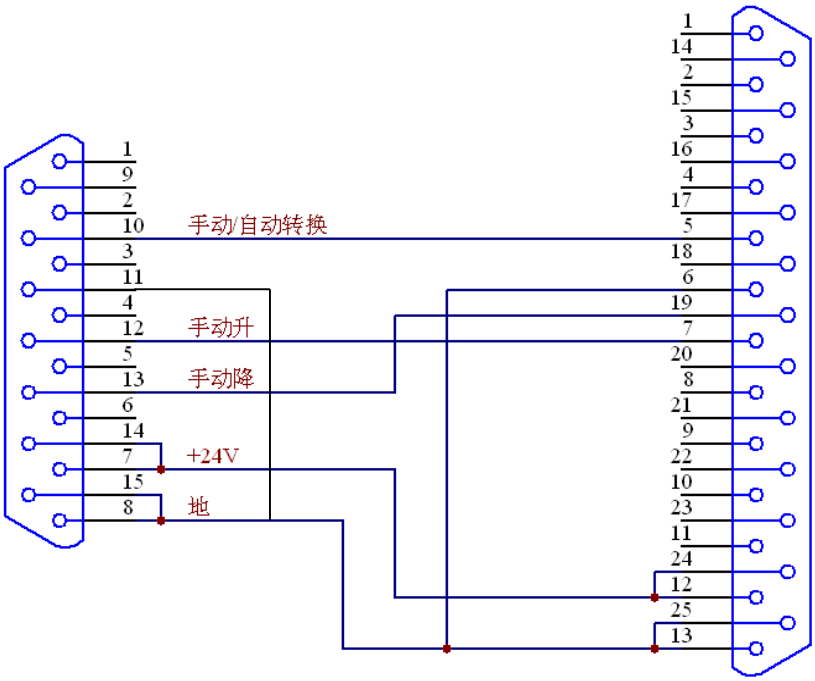


Fig. 3-7 Diagram of Capacitance Height Controller Connecting to Numeric Control System

手动/自动切换 Manual / Automatic Switching；手动升 Manual Rising

手动降 Manual Falling ；地 Ground

Table 3-1 Pin Definition of 25-core Connector

No.	Usage	Description
5	Output	Manual / Automatic Selection Signal
6	Power Supply	24V ground, supply power to height controller
7	Output	Manual rising signal, drive cutting torch to rise
12, 24	Power Supply	24V +, supply power to height controller
19	Output	Manual falling signal, drive cutting torch to fall
13, 25	Power Supply	24V -, supply power to height controller

Note: the Numeric Control System 25-core connector without pin numbers can not be used.

Table 3-2 Pin Definition of 15-core Connector

No.	Usage	Description	Remarks
4	Input	Arc-voltage (cutting nozzle height) signal	
5			
7, 14	Power Supply	24V +, supply power to height controller	
8, 15	Power Supply	24V -, supply power to height controller	
10	Input	Manual / Automatic Selection Signal	The upper is manual; The lower is automatic.
11	Input	Plasma / Flame Selection Signal	The upper is plasma; the lower is flame.
12	Input	Manual rising signal, drive cutting torch to rise	
13	Input	Manual falling signal, drive cutting torch to fall	

Note: the height controller 15-core connector without pin numbers can not be used.

Electrical Installation of Arc-voltage Height Controller

- For the electrical installation of arc-voltage height controller, please view Fig. 3-8.
- The cables for connecting height controller (15-core connector), Numeric Control System (25-core connector) and voltage-dividing plate (9-core connector) are prepared by user; for the pin definition of 15-core, 25-core and 9-core connectors, please refer to Table 3-4, Table 3-5 and Table 3-6.

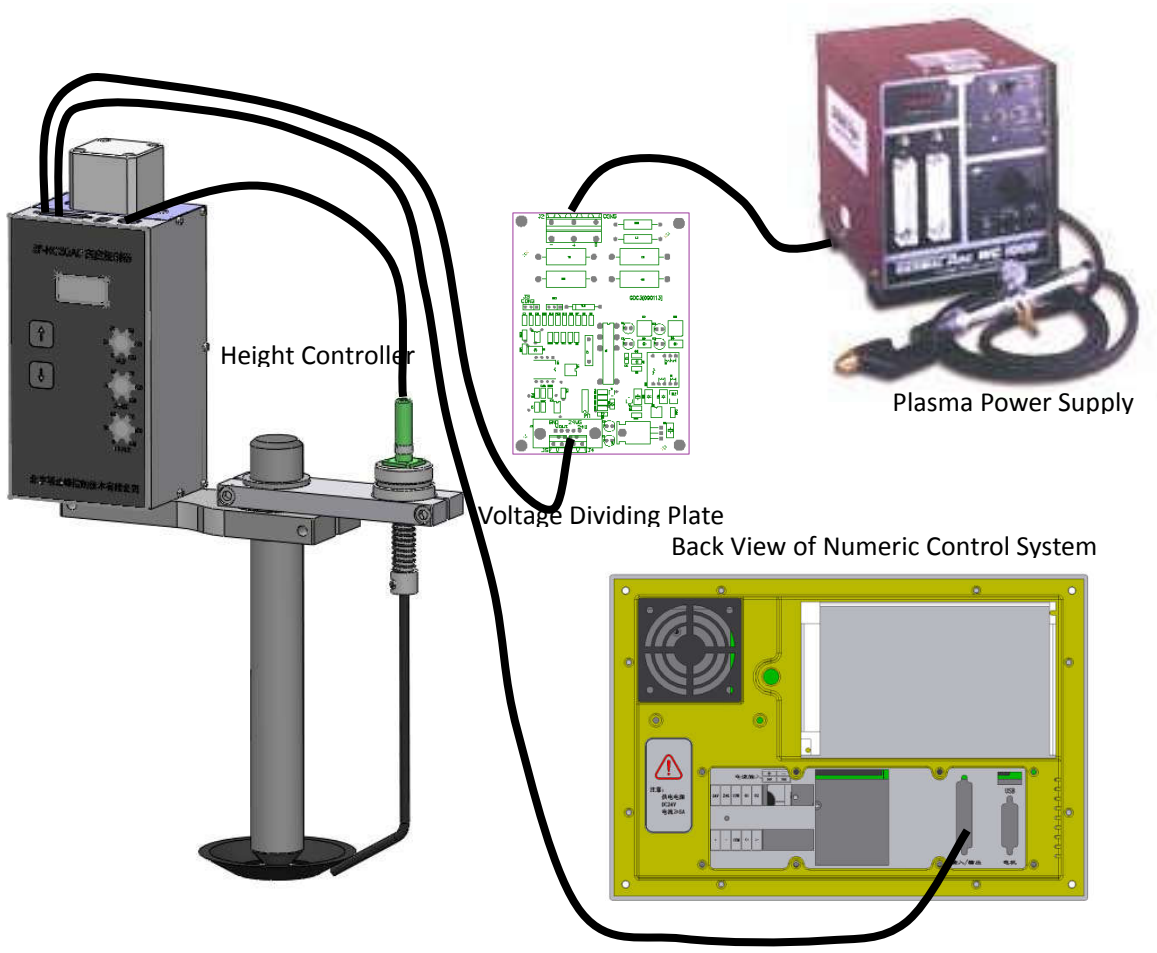
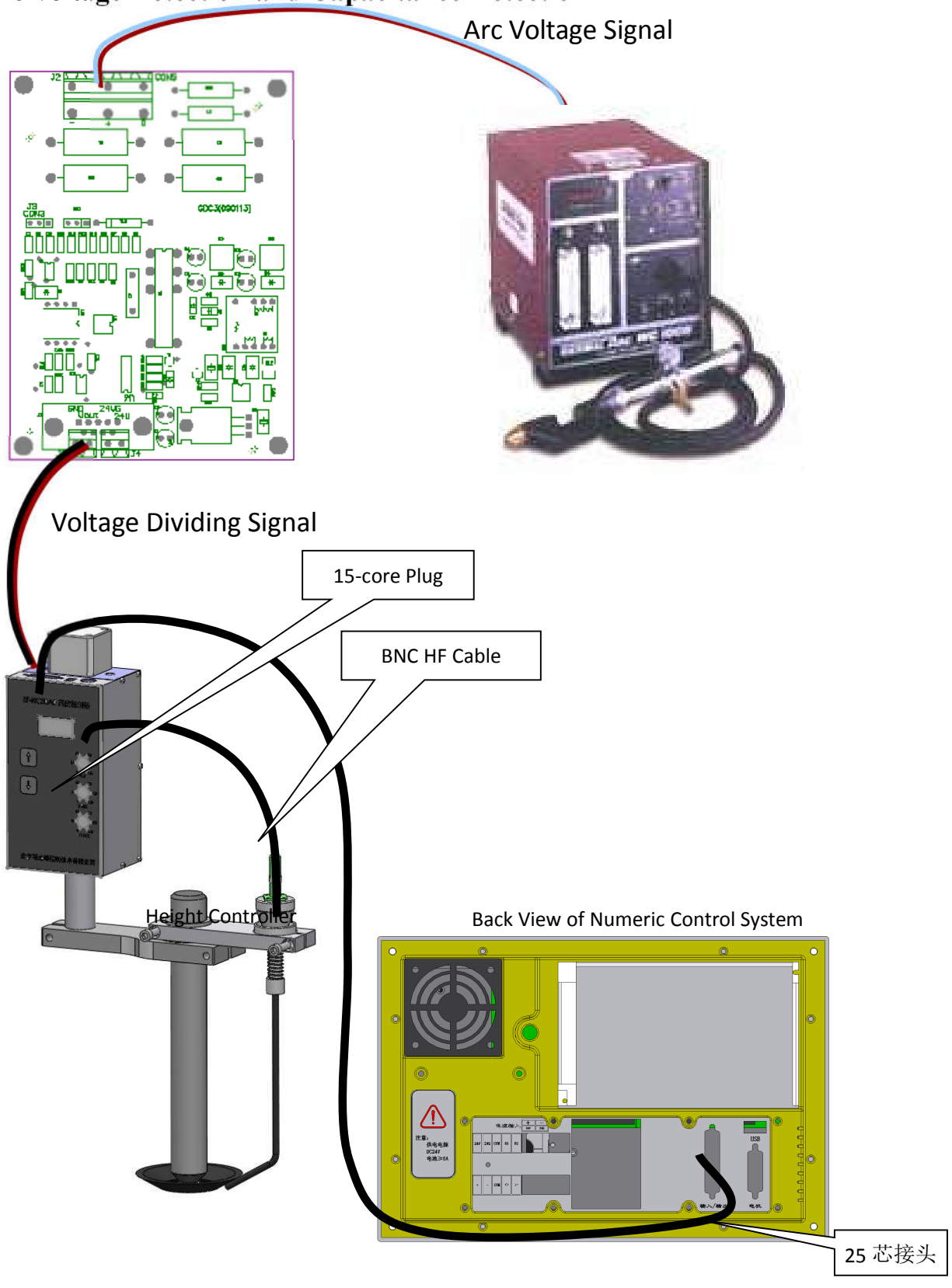
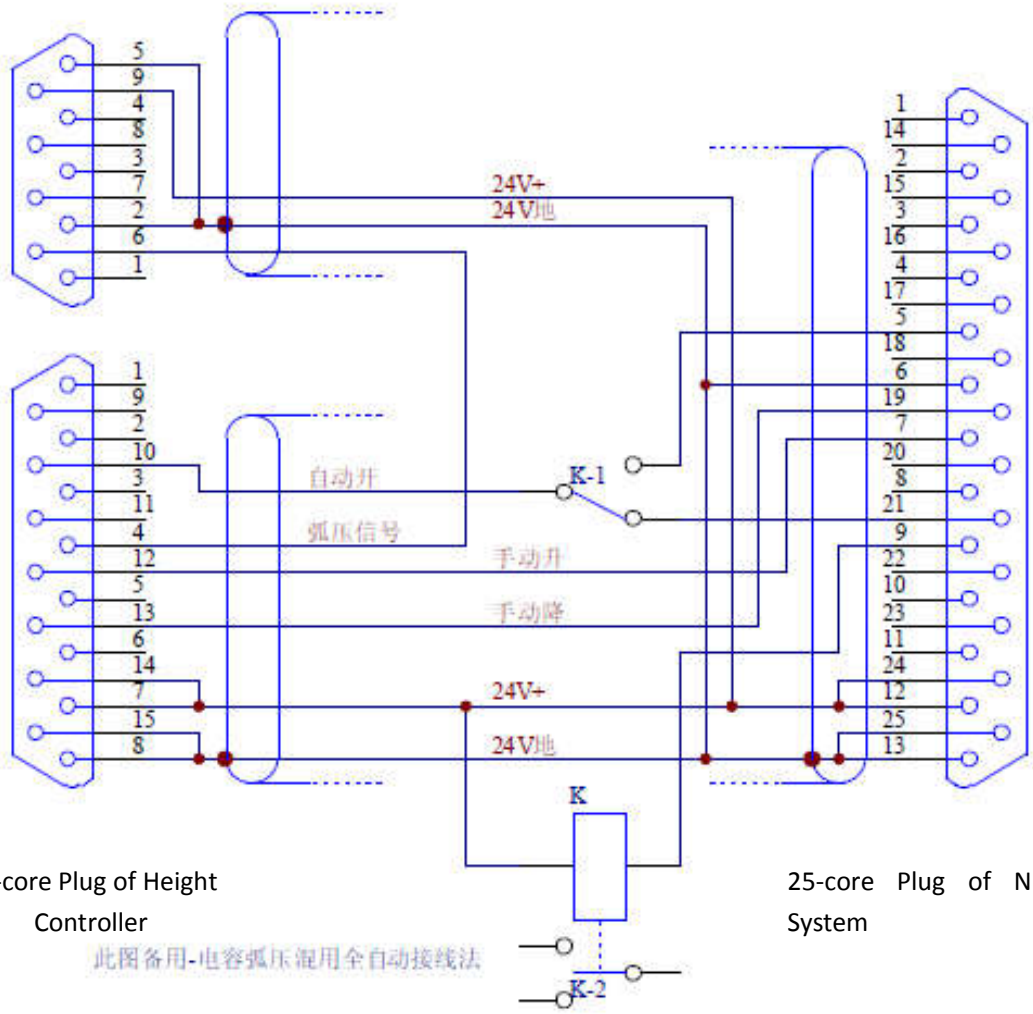


Fig. 3-8 Electrical Installation of Arc-voltage Controller

Electrical Installation of Height Controller with combination of Arc-voltage Detection and Capacitance Detection





15-core Plug of Height Controller

25-core Plug of Numeric Control System

3.3 Function Description of Voltage Dividing Plate

- The voltage-dividing plate is a function block which proportionally reduces the voltage after making arc of plasma cutting torch, then transform the voltage into a low-voltage signal reflecting the height between cutting nozzle and material plate, and it is necessary fitting for height control in plasma cutting. The voltage dividing scale of standard voltage-dividing pale of the product is 50:1.
- The description of each interface of voltage dividing plate is shown in Fig. 3-10.

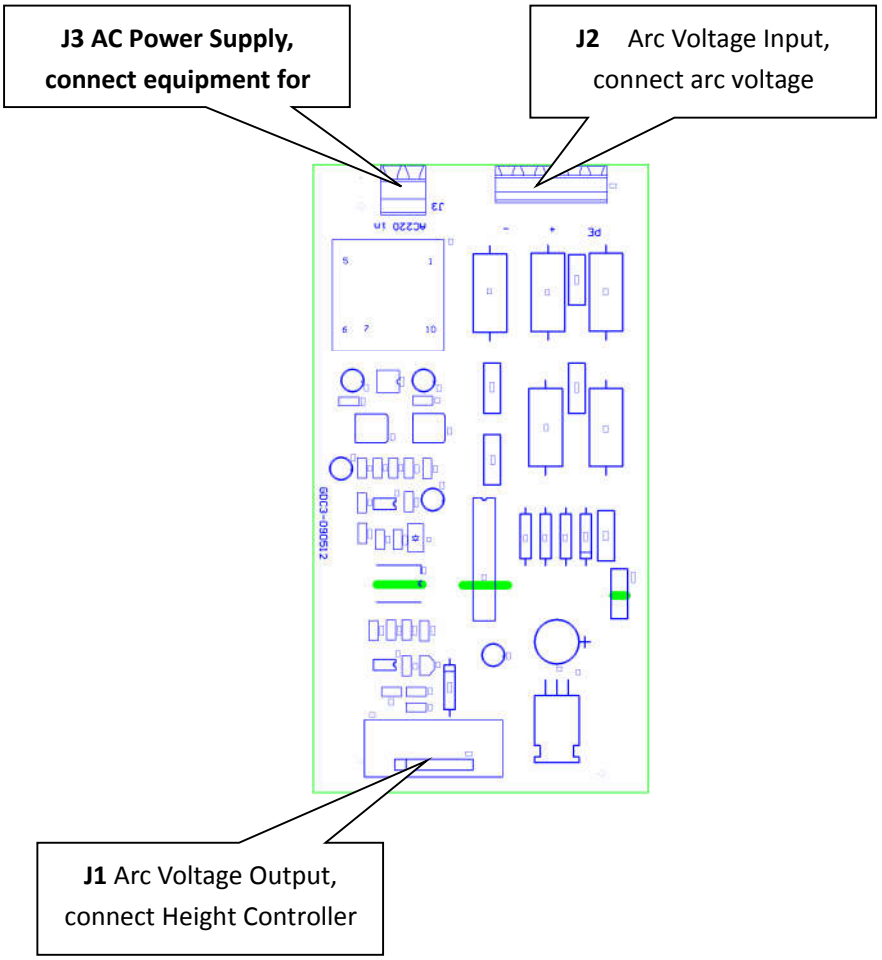


Fig. 3-10 Interface Description of Voltage Dividing Plate

- For the definition of each pin, refer to Table 3-4, 3-5 and 3-6.

No.	Usage	Green terminal	Description
2，5	Power Supply	24-	24V Ground, supply power to Height Controller
6	Output	V	Arc-voltage Signal, Signal of Plasma Cutting-nozzle Height
4	input	ST	THC or CNC controller give the arc-start signal
9	Power Supply	24+	24V +, supply power to Height Controller

Table 3-4 Pin Definition of J1 Connector

Note: the connector without pin numbers can not be used.

Table 3-5 Pin Definition of J2 Connector

No.	Usage	Description
+	Input	Plasma Arc Voltage Terminal (+) (clamp for connecting steel plate)
-	Input	Plasma Arc Voltage Terminal (-) (arc voltage output)

Note: push the orange button, and insert the peeled cable into connection hole and release.

Table 3-6 Pin Definition of J3 Connector

No.	Usage	Description
1	Power Supply	～220V±10%
2	Power Supply	～220V±10%

-

- **Table 3-7 Pin Definition of J4 Connector**

No.	Usage	Description
1	output	Arc start output (Relay normally open contact)
2	output	Arc start output (Relay contact common)

The installation position of voltage dividing plate can be selected as necessary, but pay attention: J1 interface is used for low voltage signal, and J2 interface is used for high voltage signal. To avoid the HV & HF signal interfere with low voltage signal and improve system stability, the circuits of J1 and J2 should be separated.

4 Quick Operation Guide of Capacitance & Arc-voltage Height Controller

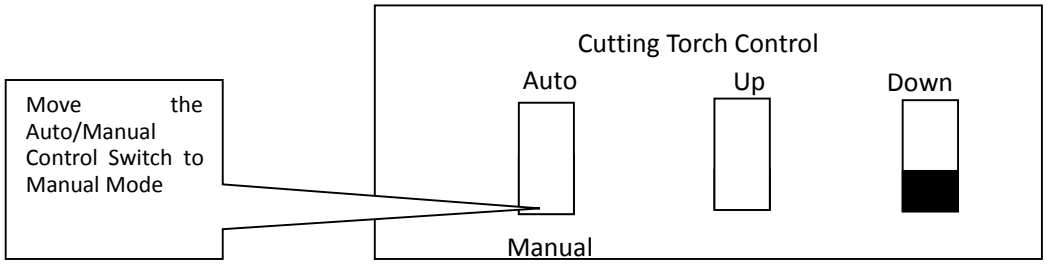
4.1 Operation Control with Electrical Operation Panel: (External Switching Mode)

For the electrical connection of capacitance-mode height control, refer to Section 3.2 "Electrical Connection".

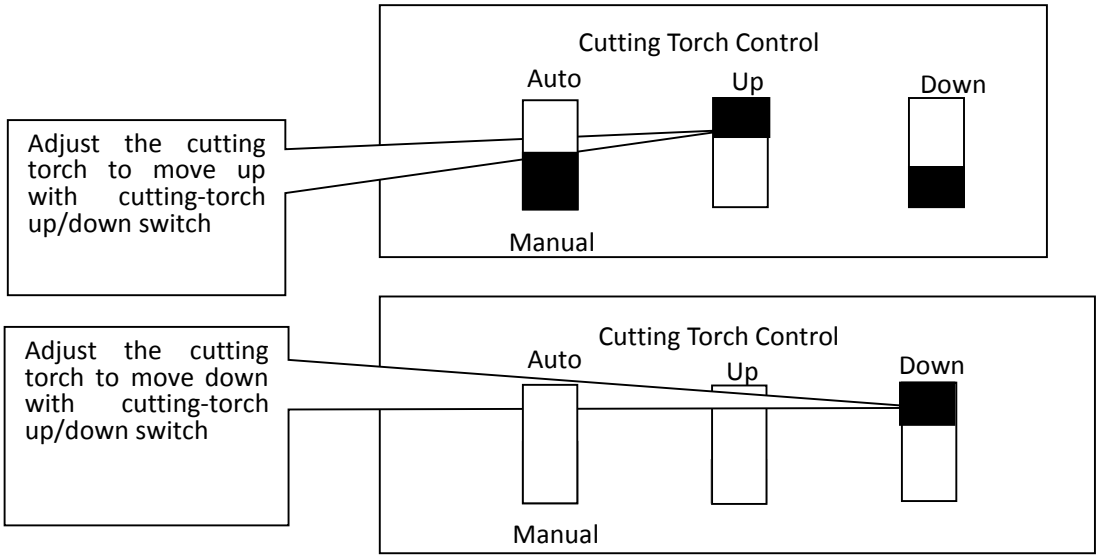
For the electrical connection of arc-voltage-mode height control, refer to Section 3.3 "Electrical Connection".

The followings are the operation processes:

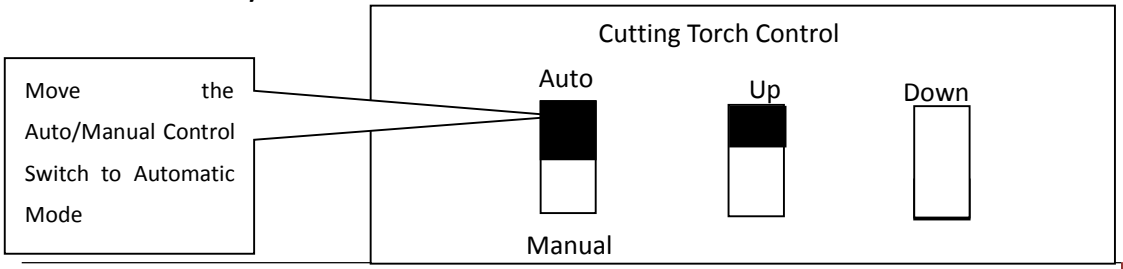
1. Move the Auto/Manual Control Switch to Manual Mode



2. Adjust the cutting torch to move up/down with cutting-torch up/down switch



3. Move the Auto/Manual Control Switch to Automatic Mode



Now, the height controller controls the mechanical lifting device to realize automatic height control. If the height of cutting torch is not applicable, repeat steps 1-3. In the automatic mode, the cutting-torch up/down switch is not available.

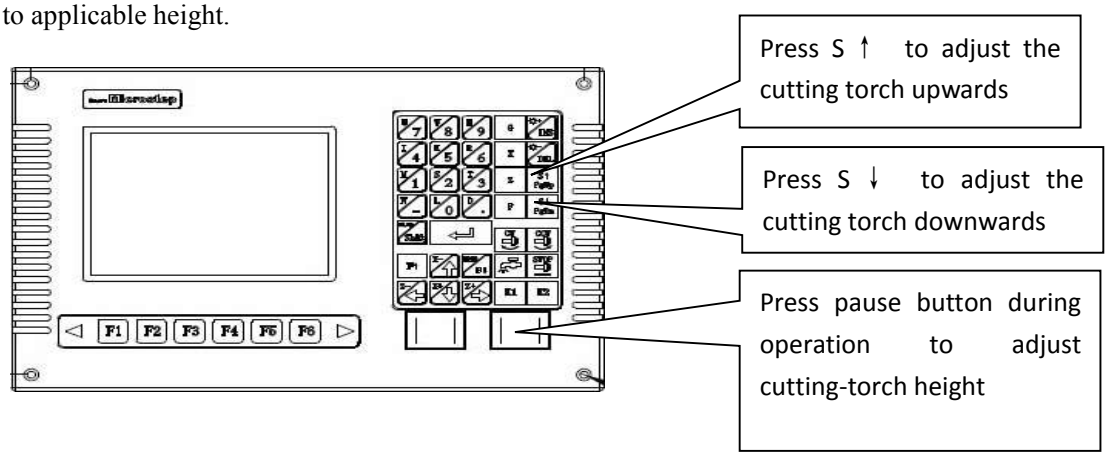
4.2 Operation of Numeric Control System Output Interfaces (I/O Control Mode)

For the electrical connection of capacitance-mode height control, refer to Section 3.2 "Electrical Connection".

For the electrical connection of arc-voltage-mode height control, refer to Section 3.3 "Electrical Connection".

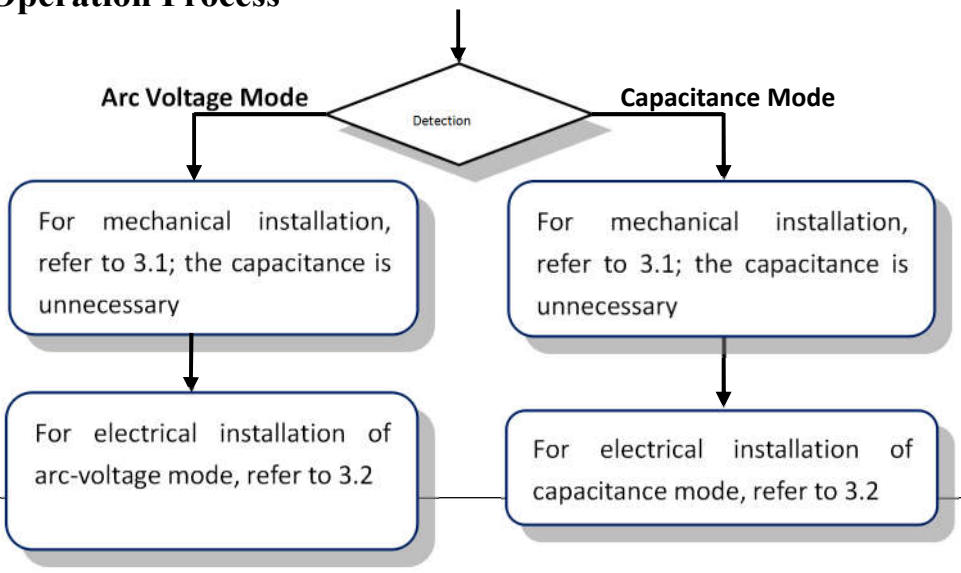
The followings are the operation processes:

Directly press the cutting-torch up/down keys on numeric control panel, to adjust the cutting torch to applicable height.



Usually, the I/O output of numeric control system is in manual mode of height controller, when the cutting process is started, the I/O output of numeric control system is switched to automatic mode of height controller. Now, the height controller controls the mechanical lifting device to realize automatic height control.

4.3 Operation Process



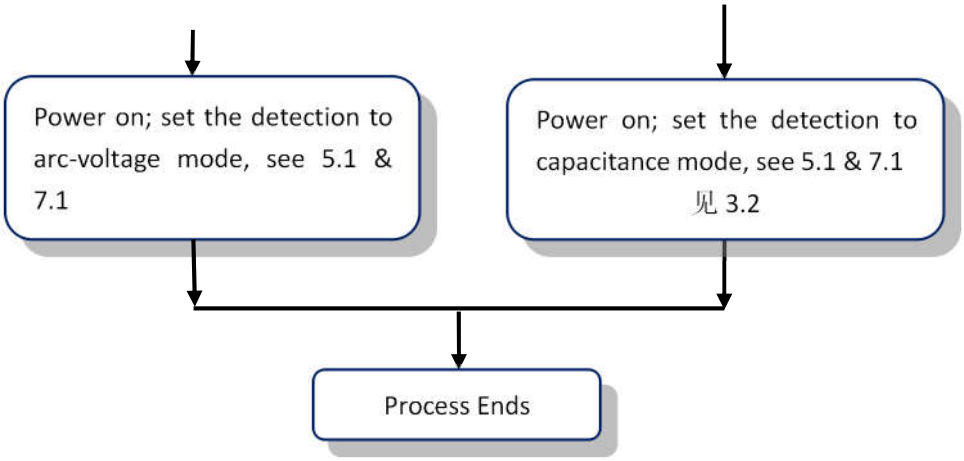


Fig. 4-1 Operation Process for First-time Using or Changing Detection Mode

4.4 Daily Operation Process

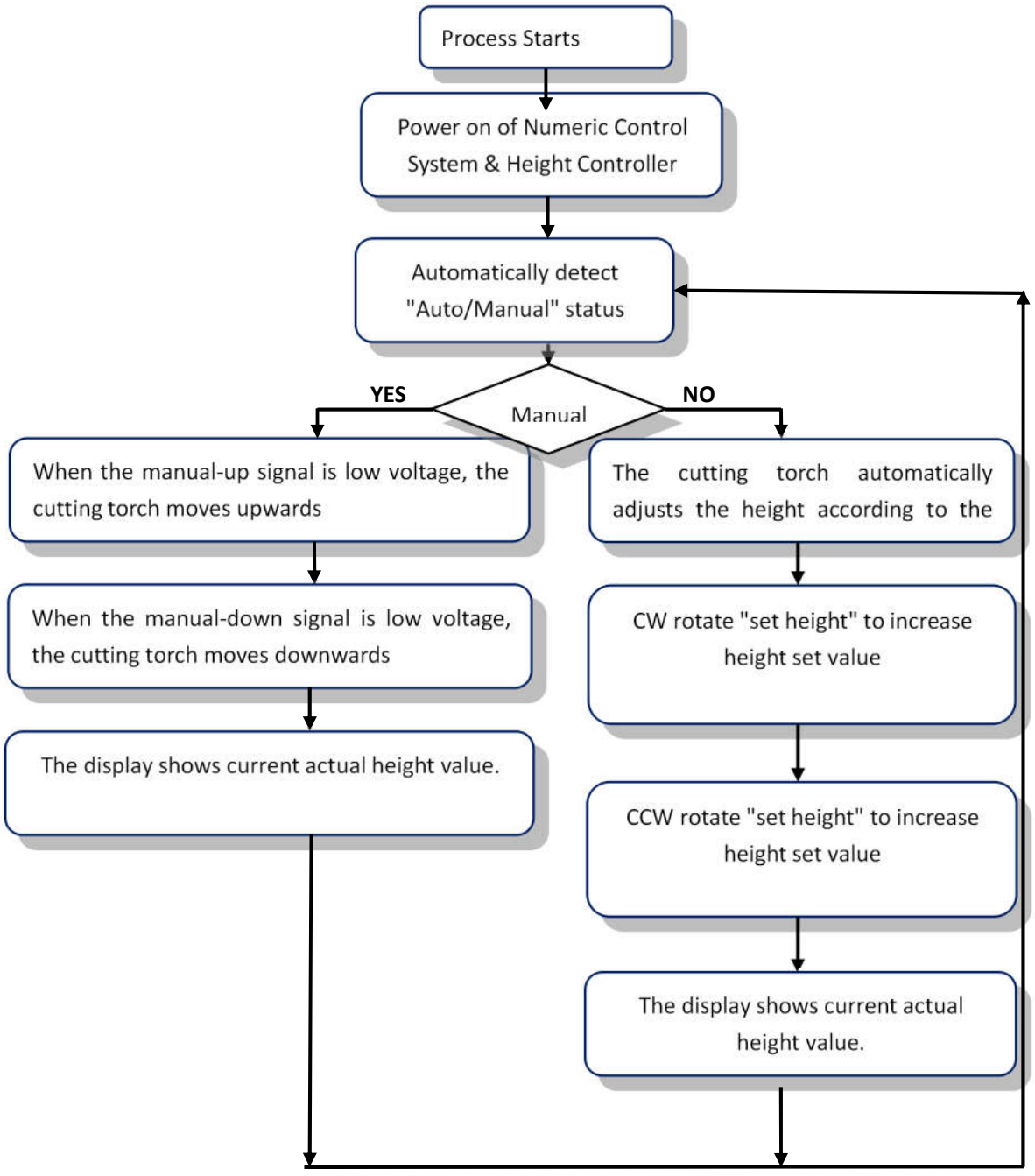


Fig. 4-2 Daily Operation Process

5 Application Guide

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

automatic modes.

5.1 Manual Operation

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

5.2 Automatic Operation

- Manual/Automatic Signal: when it is low voltage, the controller is in automatic mode
- In automatic mode, the controller automatically the height of cutting torch according to defined height by user.
- Rotate “Height” button clock-wisely, to increase height and enlarge cutting distance; and to reduce the distance in contrast.
- Rotate “Sensitivity” button clock-wisely, to increase height and enlarge the dead band.
- Rotate “HIS Height” button clock-wisely, to increase “initial positioning” height; and to decrease the height in contrast.

6Controller Panel

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

6.1 Control Setting

- **Height Value:** it is the expected value between cutting nozzle and steel plate, and set by user. For the setting scope, refer to Table 7-1.
- **Sensitivity (Dead Band):** When the actual height is smaller than “Height” + “Sensitivity” and larger than “Height” - “Sensitivity”, the height of cutting torch will not be further adjusted. For the setting scope and factory value, refer to Table 7-1.
- **HIS Height (Initial Height):** it is the lifting distance of height controller when the cutting torch goes downwards and contact the steel plate. For the setting scope, refer to Table 7-1.

Table 7-1 Setting Scopes of Each Button

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

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

6.2 Operation Panel

For the operation panel, refer to Fig. 7-1.

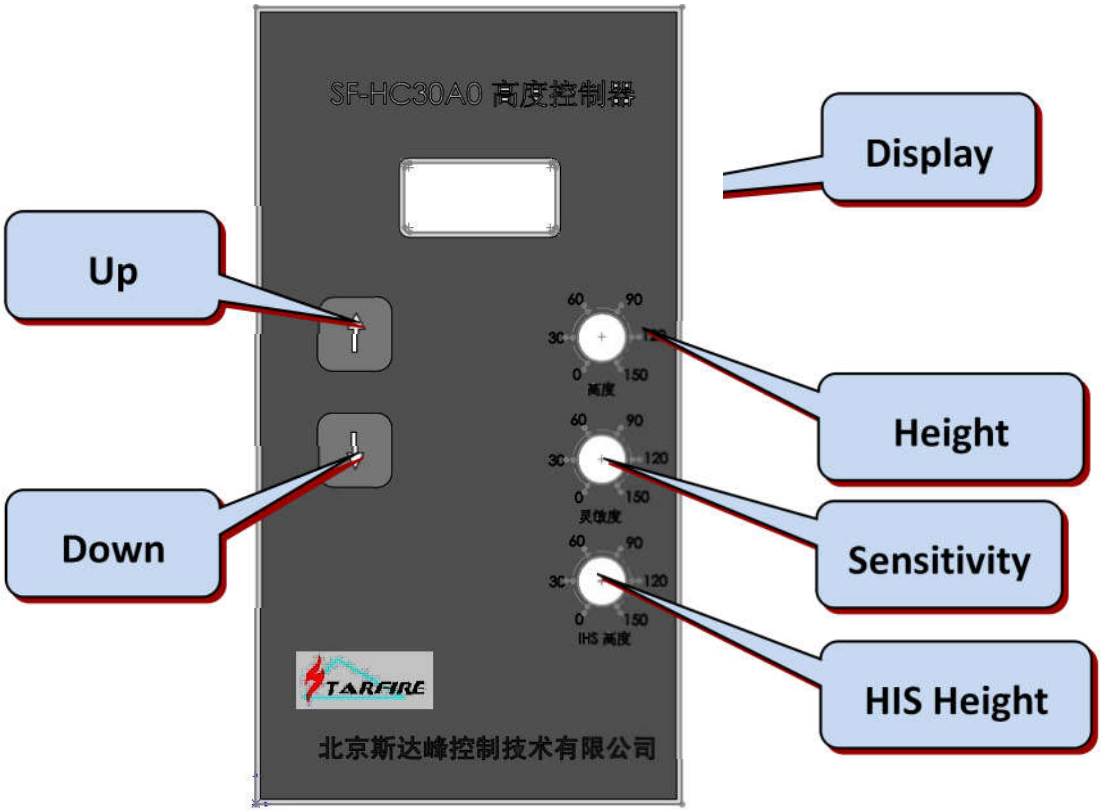


Fig. 7-1 Operation Panel

- **Display:** the followings are the display functions:

  1. Manual Operation State: operation mode, operation state, height (voltage) set value;
  2. Automatic Operation State: operation state, and actual height (voltage) value.

6.3 Description of Displayed States

- **Manual Operation State:** The first digit displays the operation mode

and manual operation state, and the following three digits display the height (voltage) set value.

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

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

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

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

7 Description of Initial Positioning Function

7.1 Positioning Mode

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

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

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

7.2 Setting of Positioning Height

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

Note: The above takes our cutting machines as examples.

7.3 Process

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

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

8 M Command Functions of Numeric Control System and Height Controller

8.1 Numeric Control System Directly Controlling M Functions of Output Terminals

M14/M15 **Cutting-torch Up** Switch, M14 (Open), M15 (Close)

M16/M17 **Cutting-torch Down** Switch, M16 (Open), M17 (Close)

M38/M39 **Height Controller Automatic/Manual Mode Switch**, M38 (Automatic), M39 (Manual)

8.2 Fixed Circulation of M Functions

M07 Fixed Function of Punching

The following is the operation sequence of flame cutting:

M07

1. If the gas (ethyne) valve is closed, open the valve to ignite;
2. The cutting-torch moves downwards (for delay of cutting-torch moving-down, refer to M71);
3. Open the oxygen preheating valve to start the preheating delay, if the preheating time is not enough, press 【Pause】 key that the time can be automatically delay 150 s; if the preheating is finished, press【Start】key to finish the preheating delay and automatically store the preheating time into the parameter - **Preheating Delay**;
4. The cutting-torch moves upwards (for delay of punching cutting-torch moving-up, refer to M72);
5. Open the cutting oxygen valve (M12), delay the punching delay time, then the cutting-torch move downwards (for delay of punching cutting-torch moving-down, refer to M73);
6. Start the height controller (M38) to run the following processes.

The following is the operation sequence of plasma cutting:

M07

1. The cutting-torch moves downwards (for delay of cutting-torch moving-down, refer to M71);
2. If the selected punching-positioning is available, the cutting-torch moves downwards and stops when it collide with lower-limit switch; and when the cutting-torch moves upwards, after the punching positioning delay, the cutting-torch stops;
3. Open the arc-striking switch;
4. Check the "Arc Voltage Success" signal, if the 0 arc-voltage is selected during

parameter setting, the arc-voltage checking is unnecessary; after the arc-striking succeeds, delay the punching delay time (second);

5. Start the height controller (M38) to run the following processes.

M08 Finishing the Cutting Fixed Circulation

The following is the operation sequence of flame cutting:

M08

1. Close the cutting oxygen (M13);
2. Shut the height controller (M39);
3. The cutting torch moves upwards (M70);

The following is the operation sequence of plasma cutting:

M08

1. Open the arc-voltage switch;
2. Shut the height controller (M39);
3. The cutting torch moves upwards (M70);

M50 Punching Action:

1. The cutting torch moves upwards (M72); the plasma operation does not have such action;
2. Open the cutting oxygen valve (M12); or, the plasma strikes arcs, and check "Arc Voltage Success" signal;
3. The cutting torch moves downwards (M73); the plasma operation does not have such action;
4. Start the height controller (M38)

M70 Fixed Circulation of Cutting-torch Moving-up:

Such action is used at the beginning of the process and after completion of a cutting process, lift up the cutting torch to quickly move to next cutting position. Operation Sequence: close the cutting-torch Up switch (M14), delay the cutting-torch moving-up delay time, then open the cutting-torch Up switch (M15).

M71 Fixed Circulation of Cutting-torch Moving-down:

Such action is used before punching, the function is in contrast with M70, but the value

is a little smaller; as for the gravity, moving-down is a little quicker than moving-up. Operation Sequence: close the cutting-torch Down switch (M14), delay the cutting-torch moving-down delay time, then open the cutting-torch Down switch (M17).

M72 Moving-up Circulation of Cutting-torch for Punching:

After the preheating is finished, finitely lift up the cutting torch, to avoid the splashing steel slags blocking the cutting nozzle during opening the cutting oxygen valve. Operation Sequence: close the cutting-torch Up switch (M14), delay the punching cutting-torch moving-up delay time, then open the cutting-torch Up switch (M15).

M73 Moving-down Circulation of Cutting-torch for Punching:

After preheating and the M72 action are performed, open the cutting oxygen valve, put the cutting torch to the cutting position; it is the contrast action of M72, but the value is a little smaller; as for the gravity, moving-down is a little quicker than moving-up.

Operation Sequence: close the cutting-torch Down switch (M14), delay the punching cutting-torch moving-down delay time, then open the cutting-torch Down switch (M17).

M75 Positioning Delay of Cutting Torch

For the positioning the plasma cutting torch, firstly, move down the cutting torch, when the cutting torch will stops (M17) when it touches lower limit position (see Input Interface 8 XXW). Then, close the cutting-torch Up switch, delay the cutting-torch moving-up delay time, and open the cutting-torch Up switch (M15).

9 Trouble Shooting

9.1 The Table 9-1 shows the common failures, inspections and corrections.

Table 9-1

Failures	Inspection Items	Corrective Actions
Motor does not rotate	**Is the power supply connected or not?**	Connect power supply
	Is the supply voltage is correct?	Inspect power supply
	Is the motor jammed?	Reduce load
No Display	Check power supply	Connect power supply
Upper Limit Alarm	The travel is beyond mechanical upper limit.	Check Upper Limit Switch
Lower Limit Alarm	The travel is beyond mechanical lower limit.	Check Lower Limit Switch
Unstable Signal	Is the grounding of steel plate reliable?	Ground reliabily
Vertical Oscillation	Sensitivity value too small	Increase sensitivity
Accuracy too low	Sensitivity value too large	Decrease sensitivity