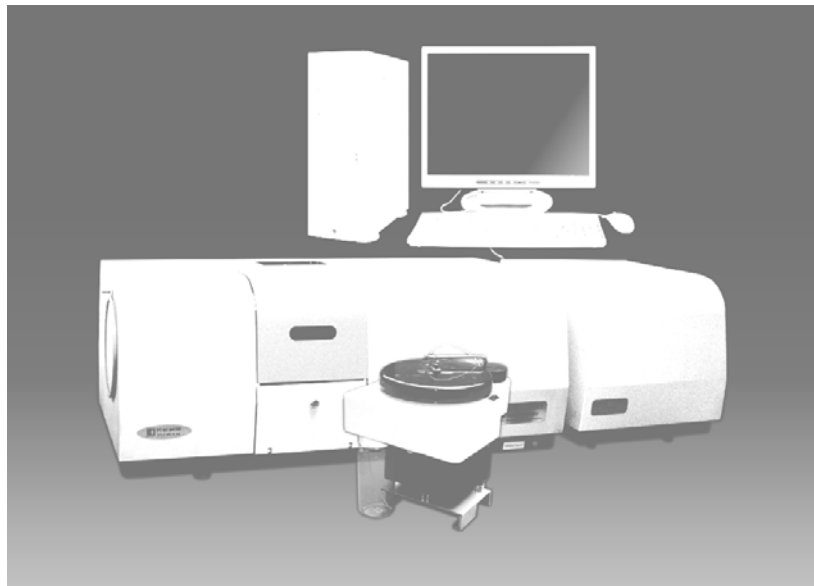


PG-990 Atomic Absorption Spectrophotometer



Service Manual

❖ Announcement :

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❖ Serial number:

"[S/N Number]"

❖ Version number:

August 11th, 2004

"[Version No.]"

Our company

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Warning:

Please read the following safety consideration to avoid injury as well as the damage of equipments connecting with the instrument.

Only the qualified technical personnel can service the instrument.

Atomic absorption spectrophotometers take the acetylene as the combustion gas, so the operator must strictly observe the safety rules for acetylene operation to avoid incidents.

Make sure the power supply is secure earthing, and the earthing resistance should be less than 4 Ω . Check the power supply carefully during installation and maintenance.

Please observe the manual strictly to maintain the instrument.

Please contact with your local dealer if there are any quality problems.

overview

The PG-990 Atomic Absorption Spectrophotometer is a full automation intelligence-type instrument for flame and/or graphite furnace analysis developed by our company. It is a user-friendly, easy-to-use instrument controlled by PC with MS windows as the operation system. The PG-990 Atomic Absorption Spectrophotometer incorporates two background correction functions, the deuterium lamp method and the self-reversal method. By use of advanced electronic circuits and RS-232 serial communication port control, the unit allows you to make an automatic setting or adjustment for wavelength scan, peak-search, slit width switch-over, element lamp turret switch back and forth, height/position parameter setting and adjustment of the atomizer, the fuel and supporting gas flow rate, lamp current and as well as the negative voltage of the photomultiplier etc. It also provides referential operating parameters in different measurement modes for all the analyzed elements. Users may modify these parameters according to their individual requirements for analysis, save them together with the calibration curve and the measurement results, and recall them for use when needed. The instrument switches flame/graphite furnace atomizers automatically, and also supports the flame/graphite furnace auto-samplers.

PG-990 atomic absorption spectrophotometer provides configuration options of flame and graphite furnace analysis at your own discretion. Manual and automatic switching of the atomizer are also provided. There are four kinds of configuration:

1. Flame;
2. Graphite furnace;
3. Manual switching of flame / graphite furnace;
4. Automatic switching of flame / graphite furnace;

Users can choose flame auto-sampler and graphite furnace auto-sampler according to their instrument.

The manual introduces the working principle, structure, maintenance, typical problems and troubleshooting. It is for service engineers, hoping to help them install, operate and maintain the instruments.

Contents

1	Specifications and performance	1-1
2	Working principle.....	2-1
2.1	The components of testing system.....	2-1
2.2	Overall structure.....	2-2
2.3	Measurement principle.....	2-5
2.4	Optical principle.....	2-5
2.5	Working principle and components of electric circuit.....	2-6
	Signal processing board PC2.....	2-10
	HCL control board PC3.....	2-11
	Power board PC4.....	2-12
	Motor board PC5.....	2-13
	Alarm board for acetylene leak PC10.....	2-14
2.6	Software diagram.....	2-15
3	Maintenance.....	3-1
3.1	Points for attention.....	3-1
3.2	Daily care.....	3-1
4	Troubleshooting.....	4-1
4.1	Replacing the parts.....	4-1
4.2	Troubleshooting.....	4-1
5	Spare parts for maintenance	5-1
6	Drawing 1	6-1
7	Drawing 2	7-1

8	Drawing 3	8-1
9	Drawing 4	9-1
10	Drawing 5.....	10-1
11	Drawing 6.....	11-1
12	Drawing 7.....	12-1
13	Drawing 8.....	13-1
14	Drawing 9.....	14-1

1 Specifications and performance

The tables below introduce the specifications, performance, testing methods, and testing standards of the instrument.

Table1: Specifications

Name	Specifications	Description
Instrumental dimensions	110cm×50cm×45cm	
Dimensions of graphite furnace power	50cm×50cm×45cm	
Weight	145Kg	Main unit 75Kg, graphite furnace 70Kg
Power	220V, 50Hz	Main unit: 150W; Graphite furnace : Maximum instantaneous power 7KW

Table 2: Specifications

Type		Specifications
Wavelength range		190 - 900nm;
Light Source	Type	Hollow cathode lamp, deuterium lamp;
	Modulation mode	Square wave pulse;
	Modulation frequency	100Hz(self-reversal background correction), 400Hz(D2 background correction);
Optical System	Model	C-T;
	Chromatic/optical dispersing component	Planar diffraction grating;
	Grating	1800 grooves/mm;
	Blazed wavelength	250nm;
	Focus	300mm;
	Bandwidth	0.1、0.2、0.4、1.0、2.0nm;
	Scan mode	Automatic;
Photometric mode		Split beam;
Data processing system	Measurement mode	Absorbance, concentration, transmittance, emission intensity;
	Read-out mode	Continuous, peak height, peak area;
	Display mode	On-line instrument operating status and measurement results display, calibration curve, signal profile, print parameters and all kinds of graphics etc.;

	Data processing functions	Standard calibration method, standard addition method, interpolation method ; sampling delay (0-20 seconds), number of standard samples (1-8), number of samples (0-100); slope, mean, standard deviation, relative standard deviation etc., correlation coefficient, concentration values;
	Data storage	Analytical results, parameters, and calibration curves can be stored in the hard disks of computer;

2 Working principle

2.1 The components of testing system

The complete testing system consists of atomic absorption spectrophotometer instrument, PC control system, gas source, cooling water system, power, and auto-sampler etc. as shown in Fig.2-1. The service manual mainly introduces the troubleshooting and repairs of the instrument, but will refer to other equipments if necessary.

The atomic absorption spectrophotometer consists of optics system, electric circuit system and machinery system.

PC control system consists of PC and AAWIN software.

Gas source includes air compressor free from oil and high purity acetylene for flame analysis, and high purity argon for graphite furnace analysis.

Cooling water system refers to the automatic temperature controlled circulating cooling water system.

Power means power supply, including power supply and regulator.

Auto-sampler includes flame auto-sampler and graphite furnace auto-sampler.

In addition, the hydride generator is also a frequently used accessory.



Fig.2-1: The components of testing system

2.2 Overall structure

The atomic absorption spectrophotometer consists of optics system, electric circuit system and machinery system. The main parts of the main units are shown in Fig.2-2 and Fig.2-3.

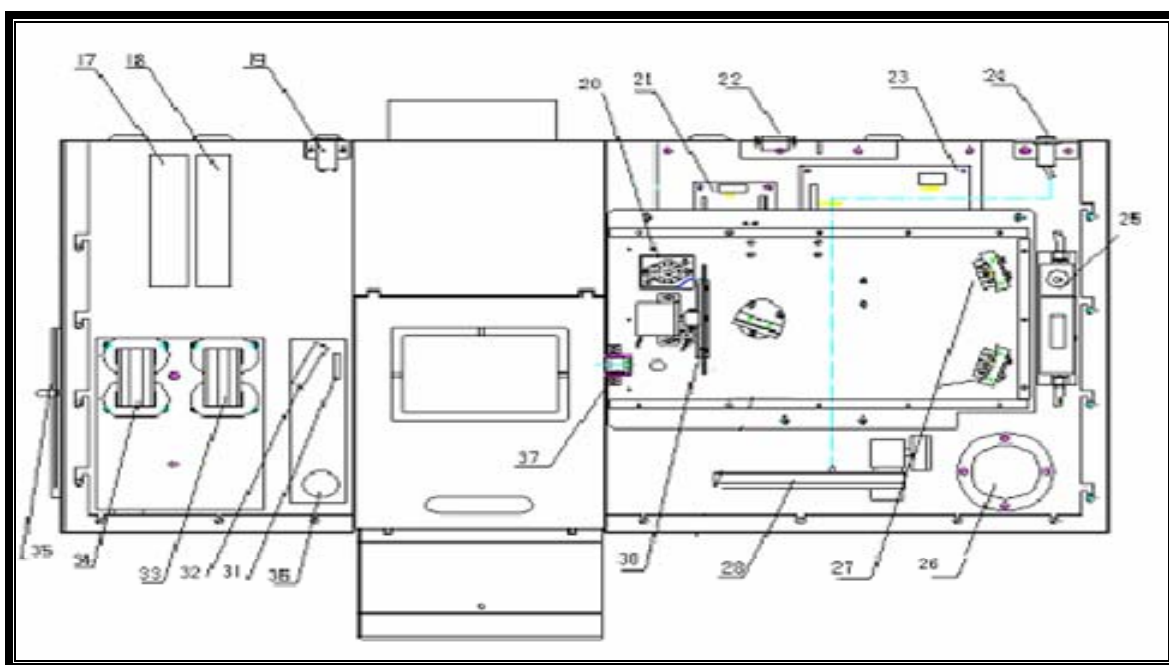


Fig.2-2: Overall structure diagram

- | | | |
|---|-----------------------------------|------------------|
| 1. Element lamp socket | 2. Lamp turret | 3. Element lamps |
| 4. Half-transmitting-half-reflecting mirror | 5. Flame detector | |
| 6. Flame burner head | 7. Acetylene blow head | |
| 8. Slits | 9. Grating table | |
| 10. Collimator | 11. Mass flow meters | |
| 12. Gas collector | 13. Control board for gas circuit | |
| 14. Nebulizer | 15. Regulated supply | |
| 16. Circuit board | 17. Control board for lamps | |
| 18. Power boards | 19. Power cable | |
| 20. Photomultiplier sockets | 21. Control board for motor | |
| 22. Serial interface | 23. PC board | |
| 24. Inlet for gas circuit | 25. Mass flow meters | |

26. Gas collectors

27. Concave mirrors

28. Control board for gas circuit

29. Preamplifier board

30. Slits

31. No.1 Lens

32. Half-transmitting-half-reflecting mirror

33. Voltage transformer for power supply

34. Voltage transformer for lamp

35. Lamp chamber door

36. Deuterium lamp

37. NO.2 Lens

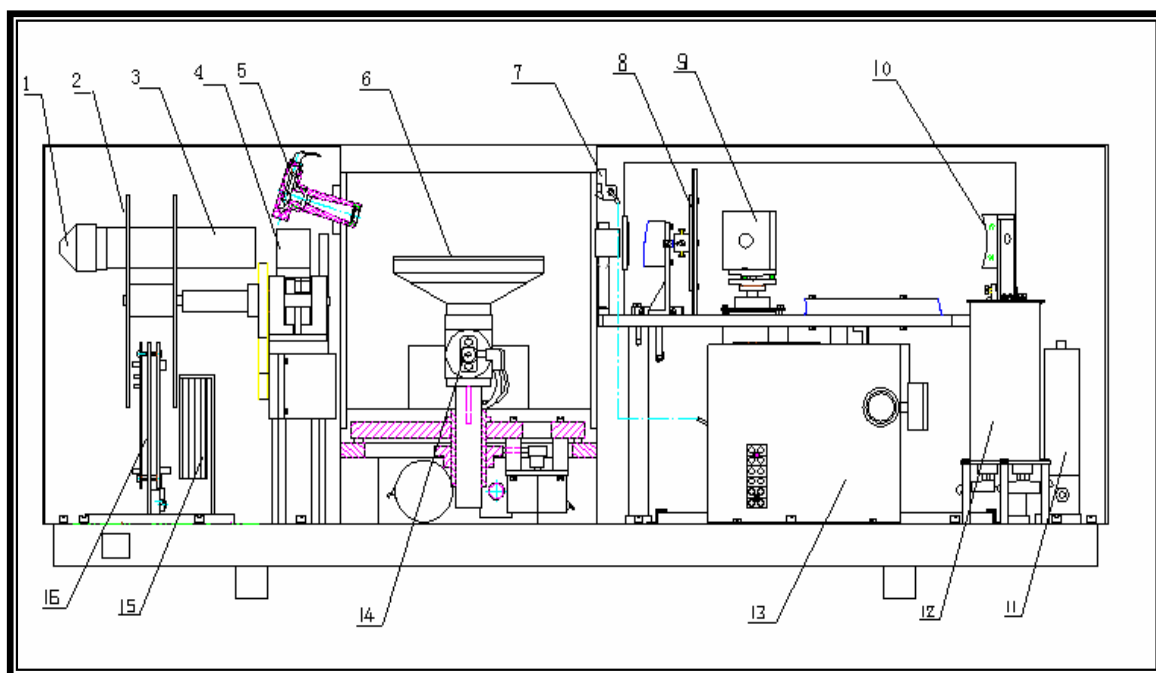


Fig.2-3: Overall structure diagram

Note: the graphite furnace etc has not been marked in the diagram. And some parts in the diagram will be different from the actual parts for the products upgrading.

2.3 Measurement principle

The light emitted from the hollow cathode lamp passes the atomizer unit and is absorbed by the atoms at ground state in sample. The instrument can give the content of the element to be determined through measuring the characteristic light absorbed by the sample. There are two background correction methods, deuterium lamp method and self-reversal method.

2.4 Optical principle

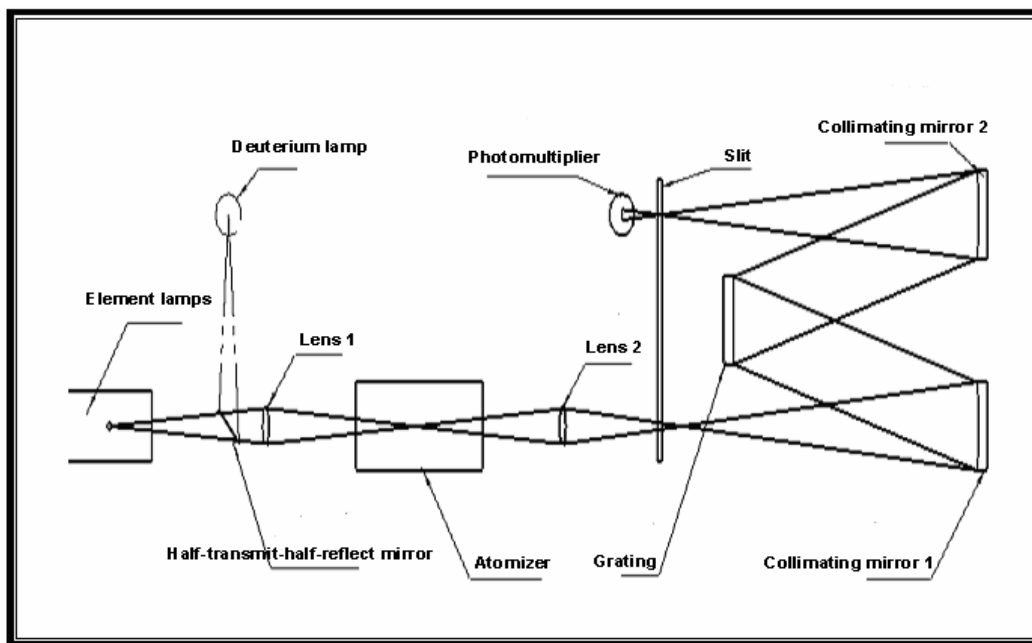


Fig. 2-4 working principle of optical circuit

The light from element lamp and deuterium lamp goes through the first lens and focuses on the center of the atomizer. Through the atomizer, it goes through the second lens, then enters into the monochromator, focuses on the exit slit and is received by the photomultiplier.

2.5 Working principle and components of electric circuit

1. The electric circuit principle diagram and description

See Fig.2-5, lamp pulse signal produced by signal processing board PC2 transmits to HCL control board PC3, which drives HCL and deuterium lamp. The light from HCL and deuterium lamp goes through optics system and received by PMT, and converts it into current signal then transmits to signal processing board PC2. And then it transmits to microprocessor board PC1 after amplified and power frequency conversion. The microprocessor board converts it into digit signal and sends it to computer by RS232 serial port. The computer will complete mathematic calculation.

During the operation procedure, the computer transmits the control signal to microprocessor board PC1 by RS232 communication port. The control signal of microprocessor board will search the switch signal and control the stepper motors etc.

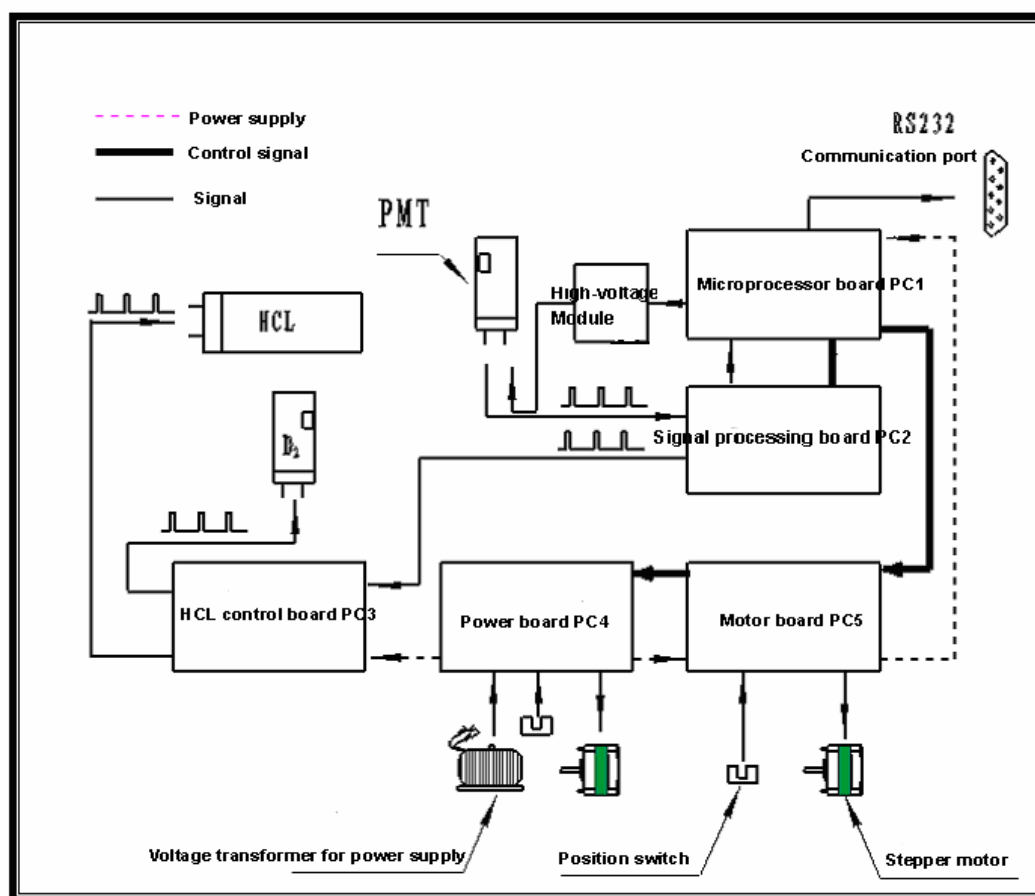


Fig. 2-5 working principle of electric circuit

Position switch means standard position switches of all the auto-adjustable parts

Stepper motor means the drive motors of all the auto-adjustable drive motors.

Signal means the drive of the photo call and the switching signal circuit.

2. The main components of electric circuit

The electric circuit includes the microprocessor board PC1, signal processing board PC2, HCL control board PC3, power board PC4, motor board PC5, graphite furnace control board PC8, high voltage board for UV tube PC9, alarm board for acetylene leak

PC10, HCL connection board PC13, overall circuit connection, mass flow meters, high-voltage ignition device, high-voltage module, photomultiplier, deuterium lamp, elements lamps, various motors, voltage transformer for power supply.

Microprocessor board PC1, signal processing board PC2, motor board PC5, alarm board for acetylene leak PC10, and high-voltage module are installed in the drawer under the monochromator; HCL control board PC3, power board PC4, regulated supply, and voltage transformer for power supply are installed under the lamp-exchanging device.

We will mainly introduce PC1-PC5, PC8, and PC10.

Microprocessor board PC1

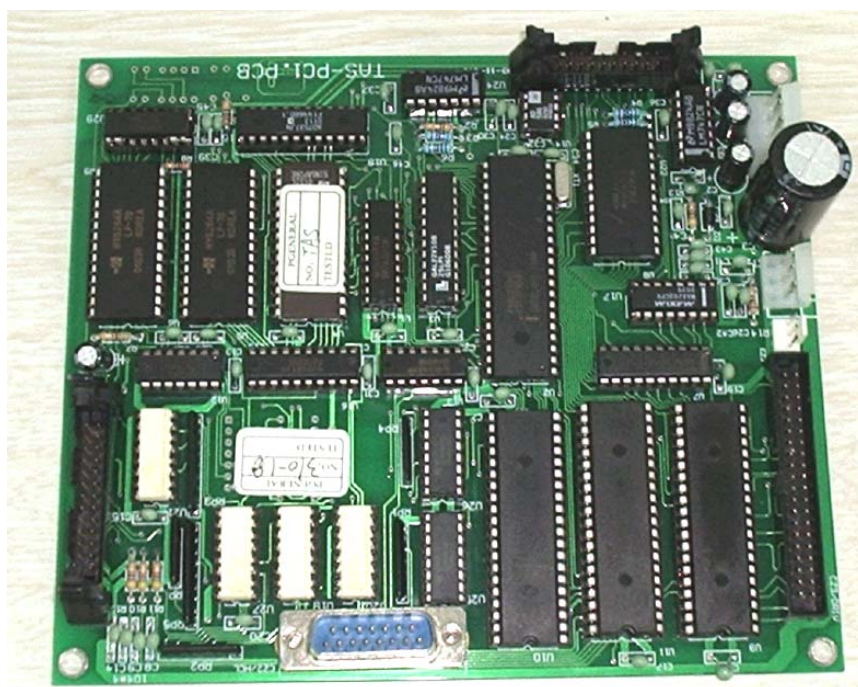


Fig. 2-6 Microprocessor board PC1

The functions of microprocessor board:

1. Communication: communicate with PC. Receive command from PC, and transfer the working parameters of the main unit.
2. Signal processing: complete signal switching, and process it according to the mathematic

module.

- D/A conversion of the high voltage, HCL current, current of deuterium lamp, current of self-reversal lamp, acetylene flow rate, high voltage, and graphite furnace.
 - A/D conversion of the HCL signal, signal of deuterium lamp, self-reversal signal, and photometric measurement of temperature signal. Calculate the digit signal.
3. Control: collect all the position signals to produce the control pulse of motion mechanism.
- Search the zero positions of lamp-switching mechanism, half-transmit-half-reflect mirror, wavelength motor, motor of flame height, motor of atomizer, and test the signals of flame monitoring, cooling water flow rate of graphite furnace, protection gas pressure of graphite furnace.
 - Produce the motion pulse of lamp-switching mechanism, half-transmit-half-reflect mirror, wavelength motor, motor of flame height, and motor of atomizer.
 - Produce the motion signals of ignition etc.

Signal processing board PC2

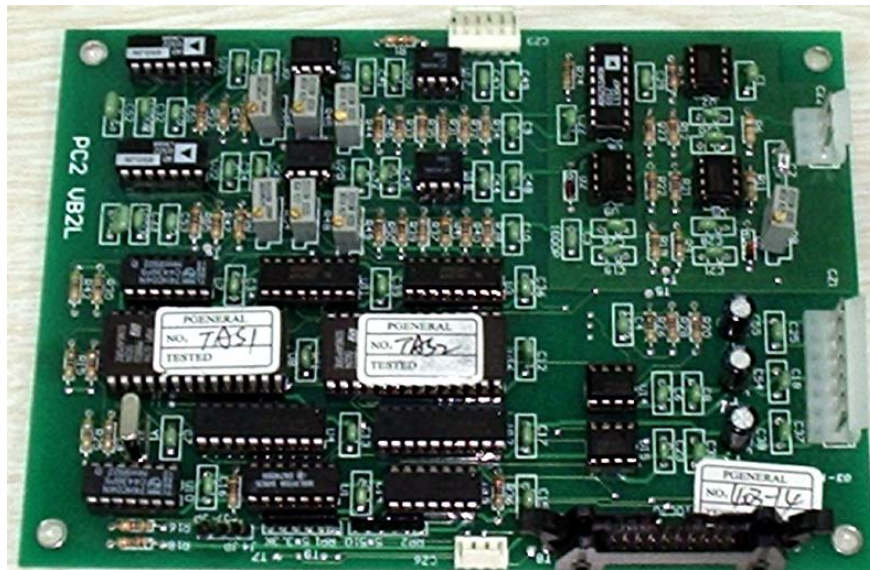


Fig. 2-7 Signal processing board PC2

Functions of signal processing board PC2:

1. Signal processing: amplify the signals of element lamps, deuterium lamp, self-reversal, photometric measurement of temperature. Then transmits to board PC1.
2. Signal pulse generator: produce the pulse of element lamps, deuterium lamp, and self-reversal, as well as 10ms interruption pulse and sync-pulse of signal processing.

HCL control board PC3

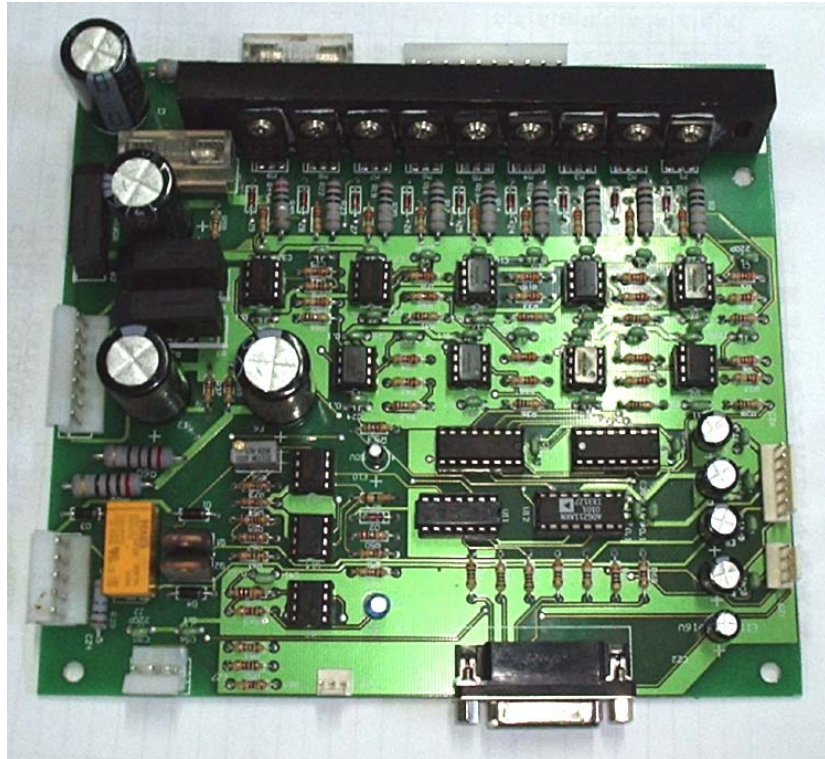


Fig. 2-8 HCL control board PC3

Functions of HCL control board PC3:

1. Lamp power: produce the working power for element lamps and deuterium.
2. Constant current control of element lamps and deuterium lamps.
3. Flame monitor: produce signals of flame working status according to UV tube signals.

Power board PC4



Fig.2-9 Power board PC4

The functions of power board PC4:

1. Power: produce +/-15V,+5V,+12V, +24V direct power.
2. Motor drive: drive the motors of the element lamps, deuterium lamps, and exchanging motor of atomizer.
3. Position inspection and signal switching: inspect the position and switch the signals of element lamps, deuterium lamp and flame atomizer.

Motor board PC5

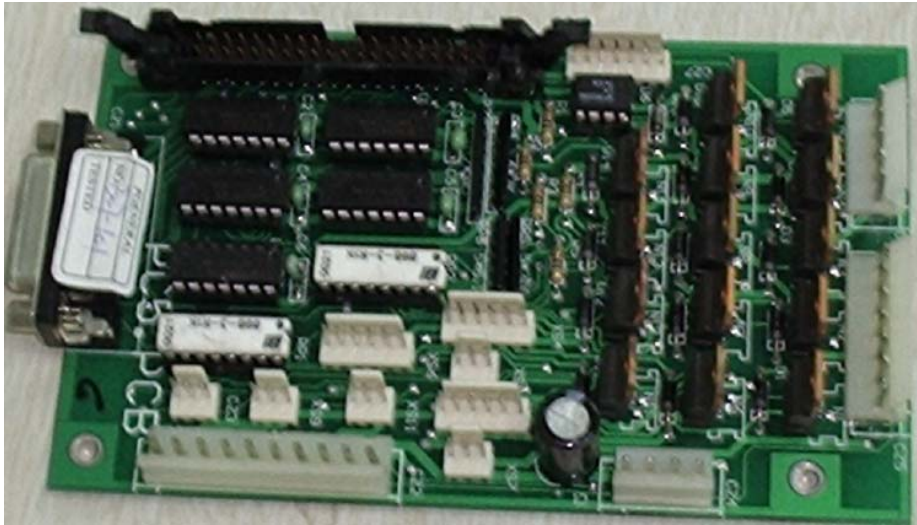


Fig. 2-10 Motor board PC5

The functions of motor board PC5:

1. Motor drive: drive motors of wavelength, flame height, and slits.
2. Position inspection and signal switching: inspect the positions and switch the signals of wavelength, flame height, slits and graphite furnace.
3. Output signals of current flow: output the amplified signal transmitted by PC1.

Alarm board for acetylene leak PC10

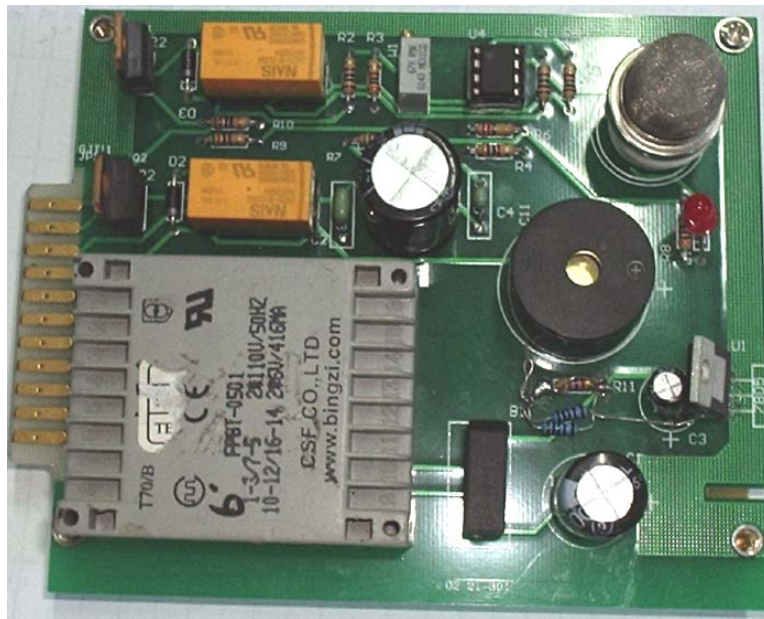


Fig. 2-11 Alarm board for acetylene leak PC10

The functions of alarm board for acetylene leak PC10:

1. Monitoring the acetylene leak: when it turns on, monitor the acetylene leak all day long.
2. Alarm signal: as long as check leak, voice alarm and electric contact output would start working.

The board, concerning with safety, should be checked periodically.

2.6 Software diagram

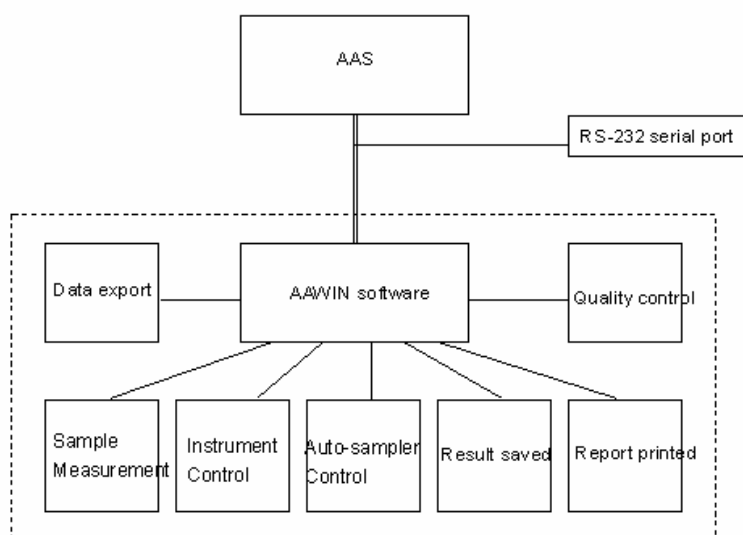


Fig. 2-12 software diagram

3 Maintenance

PG-990 atomic absorption spectrophotometer is a precise optic instrument. Careful assembling and final test have been done before delivery. Appropriate routine attention and maintenance will not only ensure the reliability and stability of the instrument but also extend its service lifetime.

3.1 Points for attention

- Follow the procedures described in the instruction manual.
- Since the instrument has been adjusted to its optimum conditions before delivery, users are neither allowed to adjust it by themselves nor dismount parts from the instrument. Pay special attention not to touch and damage the surfaces of optics or to wipe the surfaces carelessly.
- Do not pour corrosive solution on the surface of the instrument. If it poured by accident, users should correct and timely clean it.

3.2 Daily care

- A good environmental condition should be provided according to the installation requirement.
- Keep the instrument clean. The instrument should be covered with anti-dust cover.
- Check the gas circuit including gas cylinder periodically to prevent leak.
- After flame analysis, spray DI water on the nebulizer system at least five minutes to clean it.
- Use soft paper to clean the combustion slot. Do not use hard tools.
- Turn off the gas circuit and electric circuit after measurement.
- Check the performance of the instrument periodically, and contact with manufacturer if any problem emerged.
- When the instrument has not been used for a long time, pay attention to the temperature and humidity of the storage environment.

4 Troubleshooting

4.1 Replacing the parts

1. Replacement of the nebulizer

- Turn off the acetylene, and operate when the flame is off.
- Turn off the air compressor.
- Disassemble air tube.
- Disassemble the nebulizer fixing screws, and put the disassembled nebulizer in a safe place.
- Take out the pre-assembled nebulizer carefully.
- Check the appearance of the nebulizer.
- Install the O-ring on the combining site of the metal surface and glass.
- Fix the nebulizer on the instrument.
- Insert the air tube into the metal joint of the nebulizer.
- Turn on the air compressor to check the joint firmness of the air tube.

2.replacement of the graphite tube

- Click the graphite tube, and open the graphite furnace;
- Put the graphite tube into the graphite furnace by using tweezers;
- Adjust the installation angle of the graphite tube;
- Click “confirm” to close the graphite furnace.

4.2 Troubleshooting

Phenomena	Possible Causes	Action
Energy is low (can't get zero-level spectrum)	1.The element lamps is not installed	1.Install the element lamps correctly
	2. The optical path is blocked	2. Remove the obstacle
	3.No high voltage control signal output	3.Check and remedy the related circuit of board PC1
	4. The facula of zero-level spectrum can't go through the slit	4. Adjust the optical circuit to make the facula go through the slit
	5. The photomultiplier aged and its energy is too low	5. Replacing the photomultiplier
	6. The signal amplication circuit is broken	6. Replacing the related circuit chip of board PC2
	7. The lens in the optical path are dirty	7. Replacing the lens or wipe them
Energy is low when peak-picking	1. The element lamps are not installed	1. Install the element lamps correctly
	2. The element lamps aged and its energy is too low	2. Replacing the element lamps
	3. The optical path is blocked	3. Remove the obstacle
	4.Upside-down installation of element lamps	4. Install the element lamps correctly
	5. The setup of element lamps is wrong	5.Set the correct element symbols
	6. The wavelength is not accurate	6. Adjust the wavelength
Can't be ignited	1.The flame protection setup is in protection status	1.Meet all the working requirements
	2.The acetylene cylinder is not open	2. Open the acetylene cylinder
	3. The instrument is not high voltage lit	3. Check the related circuit of ignition control signals and the ignition gun may be damaged
	4. The instrument is flaming but can not be ignited	4. Flame detector, flame circuit and mass flow meter may be damaged
	5. Strong light shine on the flame detector	5. Remove the strong light
	6. The export pressure of acetylene is too low	6. Range: 0.05-0.1Mpa , 0.07 is recommended

	7. The flaming of ignition gas circuit is too strong	7. Adjust the throttle of the ignition gas circuit
	8. The solenoid valve of the main gas circuit can't be open	8. Check the related circuit
	9. Mass flow meter is broken	9. Replacing the mass flow meter
Main unit can't operate in PC mode	1.the communication cable is loose	1. Connect the communication cable securely
	2. The software is not fitted with the communication port	2. Choose the correct communication port, and connect with PC again
	3. The serial port of PC is broken	3.Replacing the serial port
	4. The instrument doesn't transfer communication signals to PC	4. The related circuit is broken (board PC1, board PC2)
	5. The working voltage is abnormal	5. Check the power voltage (+5、 $\pm$ 15V)
Nebulizer doesn't work well	1. The sensitivity is not good	1. Adjust the nebulizer (under instruction)
	2. The glass etc. are broken	2.Replacing them (under instruction)
Motor shaking	1. All the motors are abnormal	1. 12V power is low
	2. Single motor is abnormal	2. Look for the defect of the motor
Element lamps is not lit	1. Element lamps are not lit	1. The circuit related with board PC3 is broken or the connection is not connected well 2. The element lamps are broken 3. The lamp socket is broken
	2. All the element lamps are not lit	1. The power supply connection doesn't connected well or the fuse is broken 2. No lamp modulating signal 3. The high voltage circuit of PC3 board is damaged 4. 7726 of PC1 board is damaged

Element lamps always lit (the lamp board is fuming)	1. One element lamps is always lit	1. The circuit related with board PC3 is damaged
	2. All the element lamps are always lit	2. -15V power is abnormal (7915 damaged)

The instrument troubles and troubleshooting methods are described in the following:

Troubles

Trouble phenomena:

1. Can't display the complete toolbar
2. The main unit can't be in PC mode after starting computer program
3. Self-checking doesn't pass
4. Element lamps not lit or abnormal
5. Low energy when picking peak and negative high voltage over maximum
6. Unstable baseline and large noise
7. Inaccurate wavelength
8. Main unit doesn't perform the operation given by computer
9. The flame is not ignited after pressing the ignition key.
10. Abnormal ignition or extinction
11. Abnormal mode of graphite furnace when heating
12. Furnace body doesn't open automatically or close when replacing the graphite tube
13. No energy or the energy is too low when selecting deuterium background
14. No energy or the energy is too low when selecting self-reversal background

Solutions:

1. Can't display the complete toolbar

The problem may emerge when you operate the software under the first edition of Windows95 or Windows98, because the edition of the file comctl32.dll is low. The solution is that finding the file comctl32.dll over 5.0 edition, turning off the system and returning to MS-DOS mode, then copying the file to the contents of system covering the original file. The file can be found in the second edition of Windows98

or Internet Explorer5.0 as well as in the installation disks of AAWin software.

2. The main unit can't be in PC mode after starting computer program

- Check if the plug on power cord or the communication cable are loose or out;
- The communication port of the software setup and the communication port in use are not fitted; change the “communication port-port” of “setup”-“item” offline;
- Check if the direct current working volt of each circuit board is normal, and check the power of each circuit board according to the drawing;
- The problems existing in other circuits.

3. Self-checking doesn't pass

Self-checking for TAS series Atom Absorption Spectrophotometer contains the following steps:

1. Deuterium lamp motor initialization
2. Element lamps motor initialization
3. Atomizer motor initialization
4. Burner head height motor initialization
5. Slit motor initialization
6. Wavelength motor initialization

For PG-990, the atomizer motor initialization and burner head height motor initialization are cancelled. You can implement the atomizer motor initialization when you adjust “atomizer position” for the first time after using the software. Burner head height motor initialization can be implemented when you first adjust the “height” of “burner parameter” after using software.

The reasons why the motors doesn't pass is as follows:

- The motor doesn't run; you can judge according to the sound;
- The communication between the main unit and the computer system is

- broken, e.g. it has not responded for a long time;
- No voltage output of power board motor; use the multimeter to check the voltage of the motor (method: measure CZ2 of board C4 to check whether the voltage of Pin3 is 12V);
 - There is something wrong with the positioning coupler or the microswitch, or the light barrier deviates or the connection cable of the positioning photoswitch or the microswitch is tip-off; open the shell of the instrument to check;
 - There is no signal for the motor drive circuit or there is something wrong with the drive circuit:
 - There is something wrong with every functional circuit in the main unit.
- If one motor doesn't rotate or the shake, you can change the circuit board directly.

If there is something wrong with the wavelength self-check, you should check step by step:

- Check if the element lamp is lit, and if the facula injects into the optical circuit; you can observe the facula in front of the second lens by using a piece of paper.
- If the wavelength motor doesn't run, check if the wavelength motor goes zero and if there is the process of slow searching zero-order spectrum; you can judge the sound by putting your ears near the cover of the monochromator.
- There is no high voltage of the photomultiplier; you can use the multimeter to check the control voltage of the high-voltage block and the high voltage exported to the photomultiplier socket.
- Check if the lubrication between the lead-screw and the nut is enough and if the resistance is too large. Way to solve it: Rotate the shaft coupling furiously (large gear)—make the lead-screw rotate—make the nut leave the lead-screw base (whichever side) until the nut has left the original position. Put a little lubricating oil on the leading-screw (Note: The lubricating oil must be clean senior one such as the lubricating oil for clocks. Otherwise it will destroy the scanning mechanism.). Thus the resistance will be reduced so that the mechanism will run steadily.

-
- If the researching zero-order is running all the time, the software will wait all the time. It is because one of U5, U6 (6264) of microprocessor board PC1 is broken, you can change the chip directly.

Note: The 6262 chip is RAM chip, saving and exchanging the working data, its damage can result in:

- **Offline**
- **Online but offline abruptly when working**
- **Wavelength motor is always running when online**
- **Stop heating when graphite furnace heats.**

3. Element lamps are not lit

Solutions:

- Element lamps are broken; replacing the element lamps;
- Check whether the connection cable of the lamp power tip-off or broken;
- Lamp socket tip-off or broken;
- Check if the working voltage of the lamp board is +15V, -15V, and +5V, using multimeter to test;
- Check if the lamp pulse control cable is tip-off or broken (connecting line between PC2-CZ6 and PC3-CZ1);
- Check if the lamp current is input. Input the lamp current again;
- No control voltage signal output of PC1;
- High voltage circuit of PC3 is damaged.

Generally speaking, there is much chance of PC3 damage.

4. Element lamps is lit all the time

- The -15V supplied by the power is damaged;
- PC3 is damaged

5. **Low Energy when picking peak and the negative high voltage over maximum**

- There is no element lamps in the corresponding lamp holders;
- Do not install the element lamps in their corresponding positions;
- The element lamps are not lit, see 4;

- Check if there is any light barrier in the optical circuit; check the facula entering into the grating by using a piece of white paper;
- The element socket doesn't run at their positions;
- The slit doesn't stop at the corresponding position. Solution: Self-checking;
- Check if the optical circuit is correct and the wavelength error is bigger than the wavelength accuracy. The way to check: Scan within the scope of the characteristic wavelength $\pm 50\text{nm}$ and see if there is the corresponding characteristic spectrum on the spectrum.

6. Unstable baseline and large noise

- Check if the voltage of the power supply fluctuates largely by using multimeter. Purification regulated power supply is recommended;
- Energy is low and voltage is high; select "advanced adjustment" to adjust the locations of the element lamp motor and wavelength motor by single step positive rotation or single step reversal rotation; the higher energy, the better. And you can also increase the lamp current to decrease the negative high voltage.
- Check if the element lamps are stable. If they are not stable, replace with a new one and test again. You can use Cu lamp to test.
- Check if the noise from the DC working power supply changes largely or unstable. Disconnect the rear cover of the instrument and use multimeter to test +5V, $\pm 15\text{V}$, observing whether they change largely;
- Check whether there is violate vibration around the instrument;
- Check whether there are equipment consumes large power;
- Check if there is something wrong with the circuit;
- Check if the sensitivity of the photomultiplier has reduced too much.

7. Inaccurate wavelength

Correct the wavelength by selecting "wavelength correction". Make sure that the mercury lamp is on its socket when correct wavelength. Select "wavelength correction". You can correct the wavelength for a second time, if

the deviation is large, please contact the supplier.

8. Main unit doesn't perform the operation given by computer

- Check if the computer and the main unit are off-line; you can observe the status bar to see whether it is off-line;
- Check if the main unit is running other operations and haven't finished;
- Check if the computer is down;
- Other reasons.

9. Misfire

(1) If there isn't high voltage ignition after ignition, please check.

① check whether the flame safety system is in protection status. The safeguard and points for attention are shown as following:

A. Gas leaking beeper (PC10) :

The combustible gas sensor designs the gas leaking beeper, near the gas inlet in the instrument. It begin to work when switch on the external power (no matter whether the instrument power is on or not). It provides audible alarm in addition to alarm safety chain protection.

Warning: whenever it alarms, please turn off the acetylene first, find out the reasons and solve the problems thoroughly, then turn on the instrument again.

Daily care: you must check the acetylene alarm system within a month; the method is as follows:

- Facing the rear cover of the instrument, disassemble the lower leftmost bolt, which is used to fix the cover of the instrument in the vertical orientation.
- Electrify the instrument. Two minutes later, take out saturation alcohol

gas *5ml.

- Insert the injector into the hole of the disassembling bolt, then inject.
- The audible alarm will start to work in two minutes.

*** saturation alcohol gas: Refers to the gas in the alcohol bottle. (the alcohol concentration is more than 99%)**

B. Air pressure monitoring:

When the provided air pressure is lower than 0.2Mpa, the instrument will be not lit.

C. Burner head position monitoring:

Check whether the burner head is installed in the right place, or the instrument will not be lit.

E. Waste liquid level monitoring:

Check whether the waste liquid is enough.

F. Flame monitoring:

If the flame extinguished abnormally, the instrument will give an alarm.

If the circuit is broken or the light shining is too strong, it may give a signal of ignited, it also may cause misfire.

G. Extinguishing the flame in emergency:

If the abnormal situation emerged, press the button of extinguishing flame in emergency, and turn off the acetylene valve as soon as possible. Then the flame can't be ignited.

Points for attention:

1. The safety system of flame atomizer is effective when starting ignition and in flame working mode. When all the safety mechanisms

are in the normal conditions, it can begin to work;

2. The flame will be extinguished safely as long as there are any abnormality existing in safety system, and the display screen will provide automatic alarm signal;

(2) Something wrong with the solenoid valve

- A. 24V on PC4 power board is not supplied with power or the connection is loose
- B. No control signal.

① Strike fire with high voltage but can't be ignited:

- A. No flaming:
 1. The export pressure of acetylene cylinder is low; the export pressure should be 0.05Mpa-01Mpa. It is always set around 0.07Mpa.
 2. The pipeline of acetylene is too long. It can be solved by ignition time after time. It only appears when the instrument is just installed or exchanging of the tube.
- B. Flaming but not on fire
 1. The light diaphragm of flame detection is fell off or circuit of flame detection doesn't work;
 2. There is no voltage signal of flow control of PC1 or PC5
 3. The acetylene mass flow meter is damaged;

10. Abnormal extinction

- Check the flame safety system; see the description of safety mechanism in 10.

Check whether the gas flow is enough. If it is not enough, increase it by ignition again (e.g. if the gas flow is 1000ml/min, you can change it into 1500mL/min. Method: choose "burner parameter" under "instrument", then input flow directly).

11. Abnormal mode of graphite furnace when heating

- The power of graphite furnace doesn't power on;

- The fuse of the rear board of the graphite furnace power supply has blown. Note: the switch indicator light of graphite furnace is still working, but the switch can only control the power of the circuit.
- The computer will indicate you how to check and repair;
- Open the furnace body to check whether the graphite tube is installed;
- Confirm the heating procedure again; Note: sometimes the instrument can be normally heated after confirming the heating procedure.
- Check whether the control cable connecting the graphite furnace and the main unit loosens;
- The great cable loosens; **Note: the connection between the great cable and the graphite furnace must be firm. If it loosens, the loose part may be flaming and burned.**
- The graphite furnace body is not good. Typical phenomenon: There is no low current. It only begins to heat when the current reaches to a certain value.
- 6264 damaged. (See the preceding description)
- There is no control voltage output of PC1.

12. Furnace body doesn't open automatically or close when replacing the graphite tube

- Check the pressure of argon gas is between 0.4~0.5Mpa;
- Check the control cable connecting graphite furnace power and the main unit is installed firmly;
- Check if the reversal valve is normal.

13. Low energy for background or no energy when selecting deuterium background

- Check if the deuterium lamp is lit; observe the facula of the deuterium lamp;
- The wavelength is over 400nm, and the application range of deuterium background is between 190nm-400nm.
- Check if the half-transmitting-half-reflecting mirror for the deuterium lamp rotates to the proper angle so that the deuterium facula and the element lamp facula overlap. Observe it with a piece of white paper

blocking in the optical circuit. Adjust the counter rotation and contrarotation by single step of the deuterium lamp motor to make two faculas overlap. If the faculas don't overlap, then open the left cover of the instrument and adjust the setting screw to make the faculas overlap.

- Low current of deuterium lamp;
- The setup of slit is too narrow.

14. Low energy for background or no energy when selecting self-reversal background

- The current of narrow pulse is low.

Testing troubles

Trouble phenomena:

- 1.Low Abs value or no Abs value when using flame method
2. Unstable flame when testing
3. The high voltage changes, but the energy doesn't change
4. The computer down or the communication interrupted when ignition
- 5.Low Abs value or no Abs value when using graphite furnace method
6. The temperature of furnace body is too high
7. The service life of graphite tube is too short
- 8.Abs is too high

solutions:

- 1.Low Abs value or no Abs value when using flame method
 - The sample content in the solution is too low, beyond the sensitivity of the instrument;
 - The combustion slot deviates from the center of the optical path; you can set the burner position to make the facula over the burner head;
 - Check whether the wavelength is in the range of the characteristic wavelength of the element;
 - The lamp current is too high;
 - The nebulizer is jammed or damaged;
 - The burner height is not proper, you can adjust it by setting the burner height.
 - Flame conformation is not proper, such as Cr must be tested in the rich combustion status (the acetylene flow over 2500ml/min).
2. Unstable flame
 - The export pressure of the air compressor is not stable. You can observe the pressure gauge of the air compressor.

-
- The air outlet is with water. It is suggested that users should always discharge water of the air compressor or add filtering equipments such as a separator etc.
 - Unstable acetylene flow; you can judge it by observing whether the flame is flouncing;
 - The pressure of acetylene cylinder is low; its service is expired;
 - The combustion slot is jammed by some crystal substance; you can clean it by filter paper etc;
 - The waste fluid in the waste fluid pipe can't move smoothly or jammed;
 - Check whether the ventilation quantity is too large;
 - Check whether there is wind around the instrument to blow the flame the dithering (pay attention to air-condition wind).

3. The high voltage changes, but the energy doesn't change

- Check whether the main unit and the computer is off-line;
- Check if there is energy or the energy is saturated;

4. The computer down or the communication interrupted when ignition

- Check whether it is ignited between the ignition needle and panel; you can observe the ignition needle to check it.

5.Low Abs value or no Abs value when using graphite furnace method

- The sample content in the solution is too low, beyond the sensitivity of the instrument;
- The facula of the element lamp deviates from the center of the graphite center;
- Wrong position of the characteristic line; you can check whether the element lamp is correct, then search peaks again;
- The setup of lamp current is too high;
- The setup of graphite furnace heating procedure is not reasonable;
- The main gas isn't turned off; you can observe the heating procedure and change the setup;
- The graphite tube is aging; you can observe the appearance of the graphite

tube.

6. The temperature of furnace body is too high

- The setup of cooling down time is short;
- Water-cooled electrode bar unilateral jammed causes great temperature difference of two water-cooled electrode bars;
- Check whether the water flow is less than 1L/MIN, and check whether the water flow switch is damaged.

7. The service life of graphite tube is too short

- The service life of the graphite furnace is between 300—500 times. But it also varies with the acidity, purification of argon gas, and temperature of the solutions. acid, sulfuric acid and temperature over 2600°C can accelerate the damage of the graphite tube.
- The disconnection of the protection gas is one of the main reason causing the damage of graphite tube.

8. Abs is too high

The high concentration causes low energy; you can dilute the solution.

5 Spare parts for maintenance

Table 1: Spare parts for service

No.	Name	Note
0111-16-902-50	Nebulizer (with packing carton)	Fig. 5-2
0986-30-035-00	Micro processor board PC1	Fig. 2-6
0986-30-036-00	Signal processing board PC2	Fig. 2-7
0998-30-037-00	Element control board PC3	Fig. 2-8, can be exchanged with PC3 of 986
0986-30-038-00	Power board PC4	Fig. 2-9
0986-30-039-00	Motor board PC5	Fig. 2-10
0986-30-013-00	Regulated power supply connection	Fig. 5-3
0111-29-424-01	*Mass flow meter	
0998-30-018-00	Position switch connection of burner head	
	Dowser	Used to adjust the light when use flame method, Fig. 5-4

The mass flow meter can be replaced by the mass flow meter produced by our company (0992-00, Fig. 5-1).

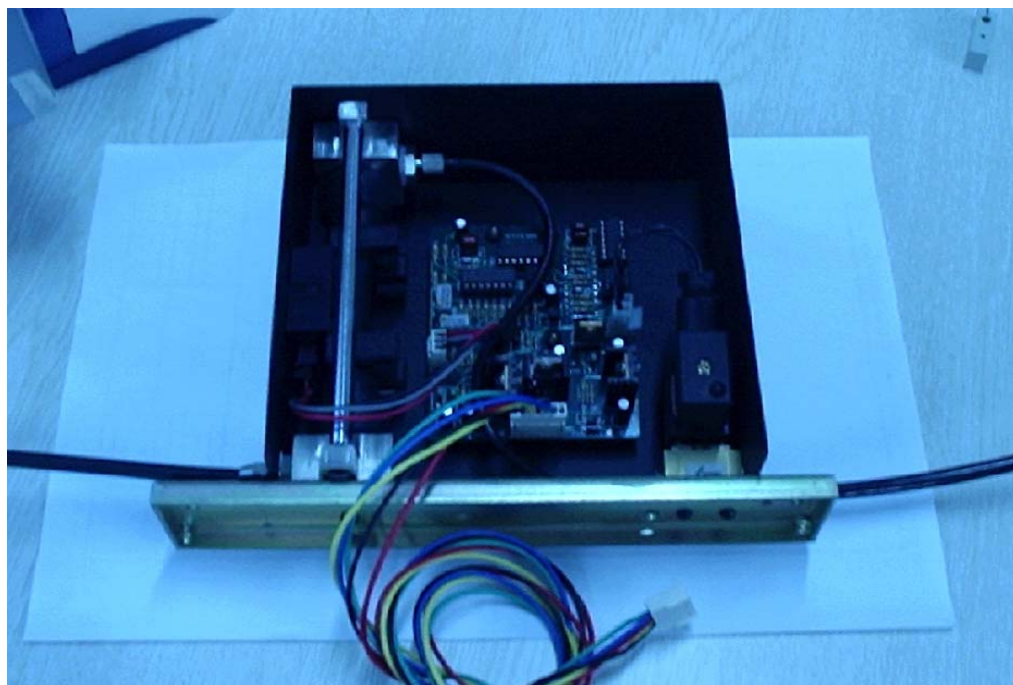


Fig.5-1 the mass flow meter produced by our company (with wires)

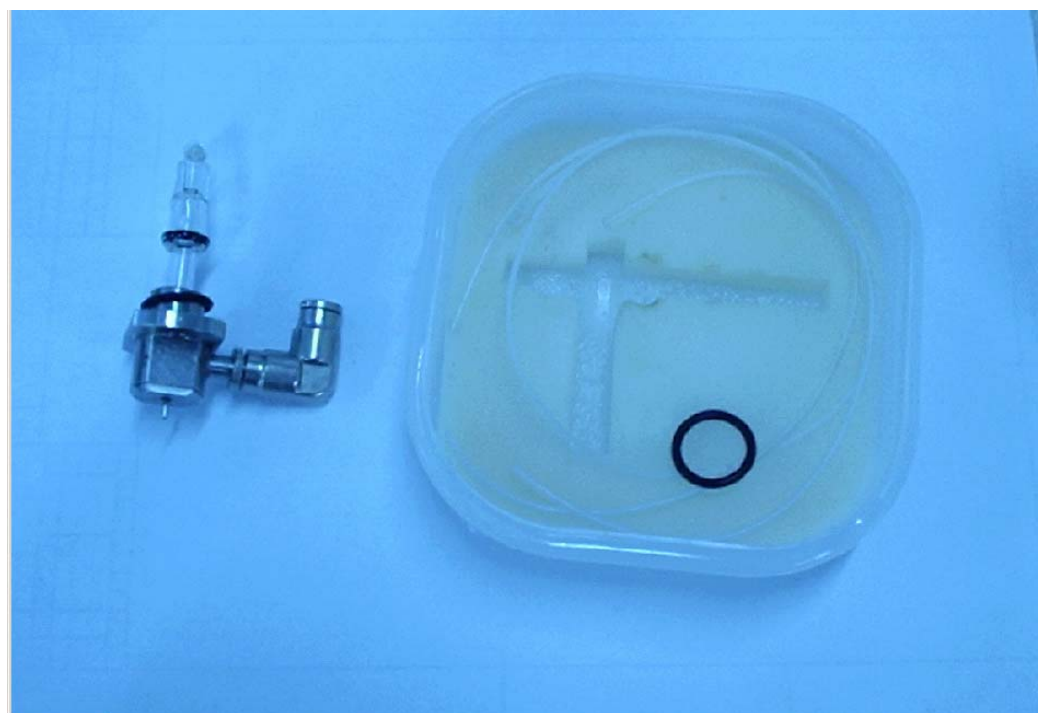


Fig.5-2 Nebulizer

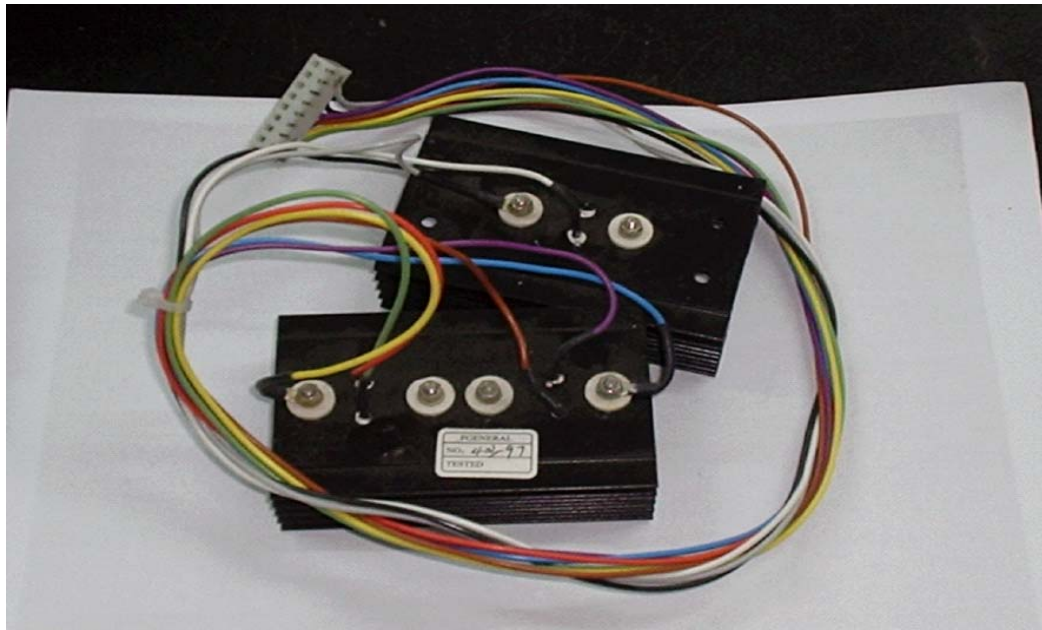


Fig. 5-3 Regulated power supply connection



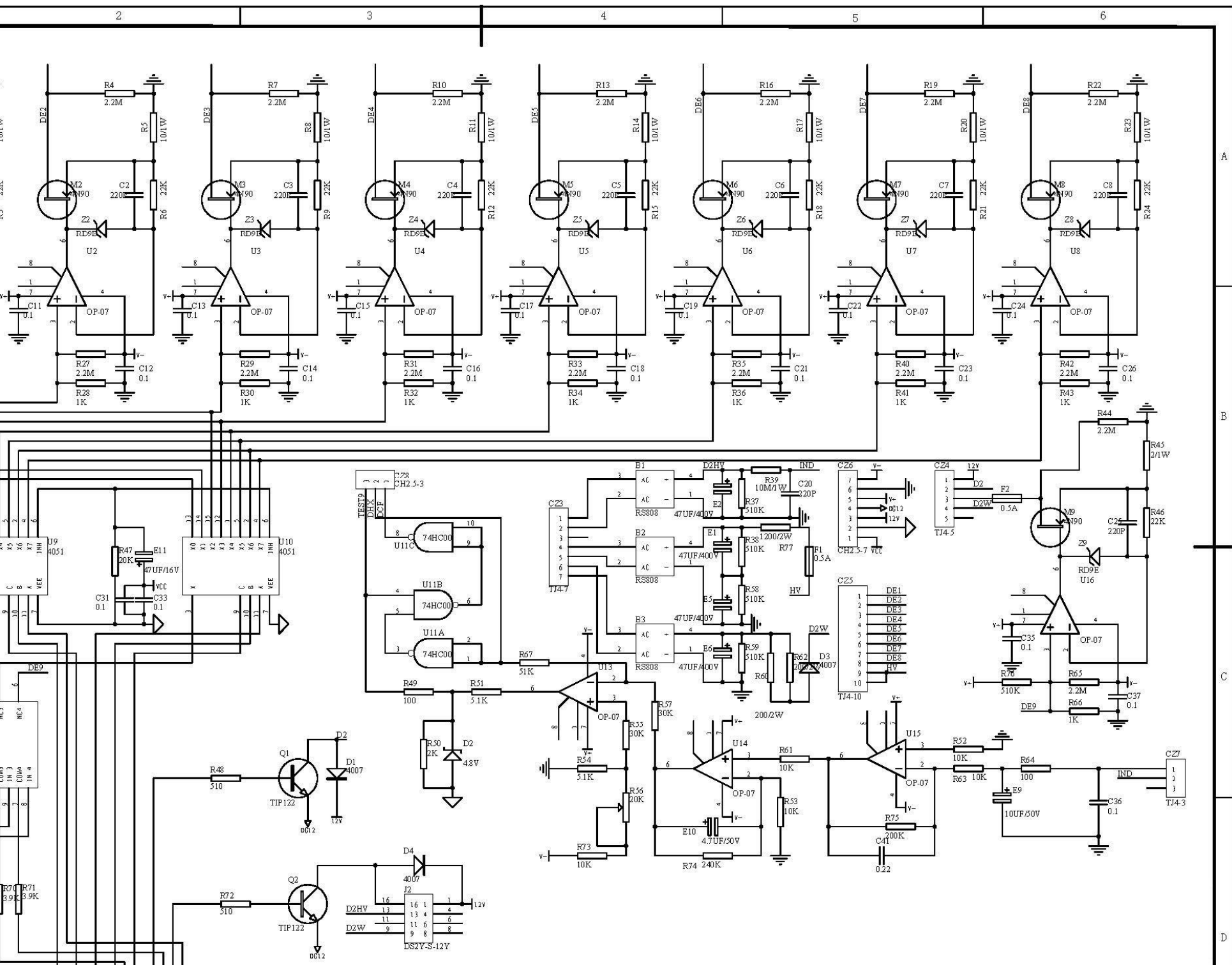
Fig.5-4 Dowser

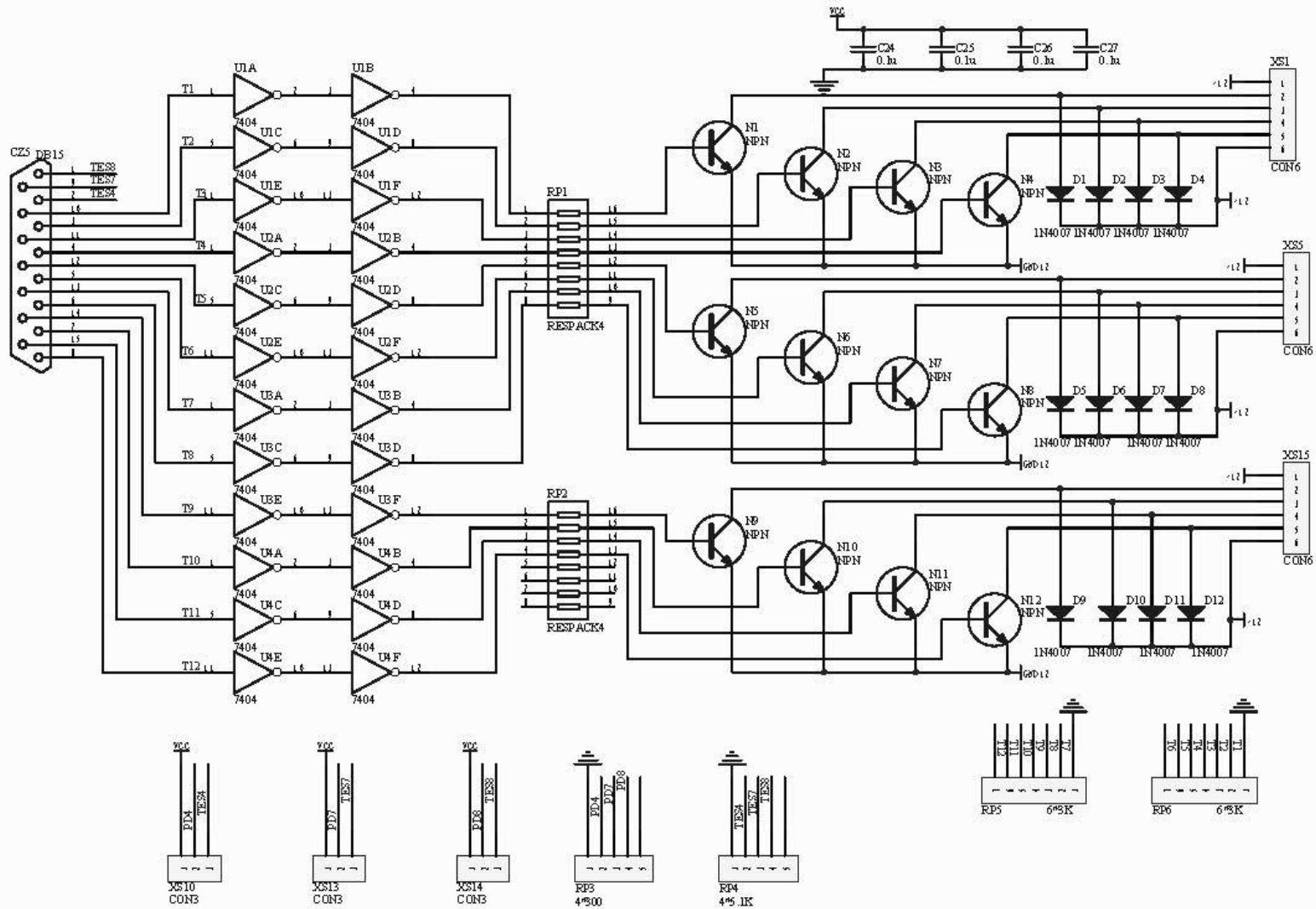
Table 2: Tools for service

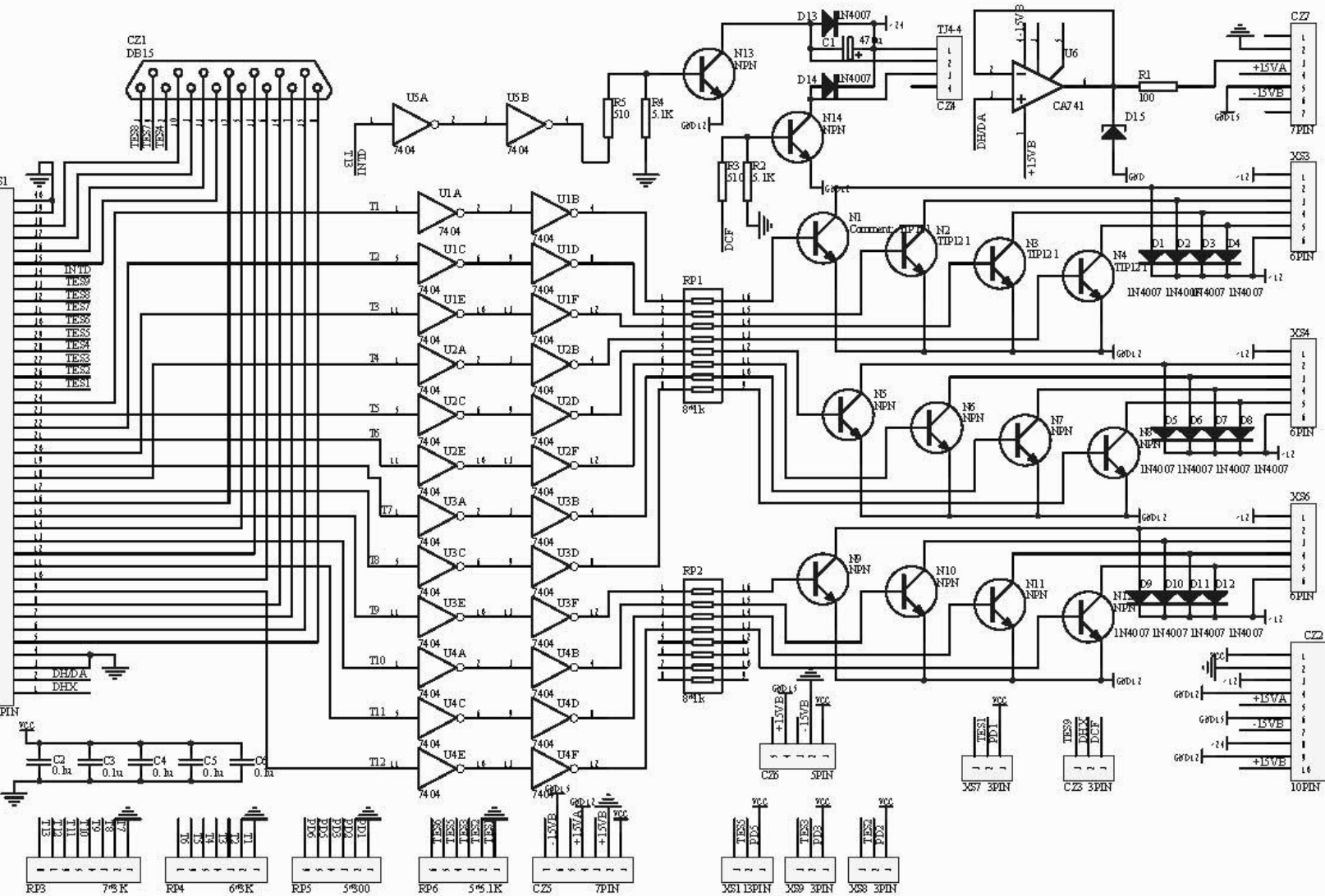
Name	Specifications	Note
Multimeter		With the function of clip style meter
Socket screw wrench	Used for the socket head screws of M4	
Socket screw wrench	Used for the socket head screws of M4	Used for adjusting the flame sprayer
Plus screwdriver		
Sharp nose pliers		
Schematic diagrams of electric circuits	PG-990	One set



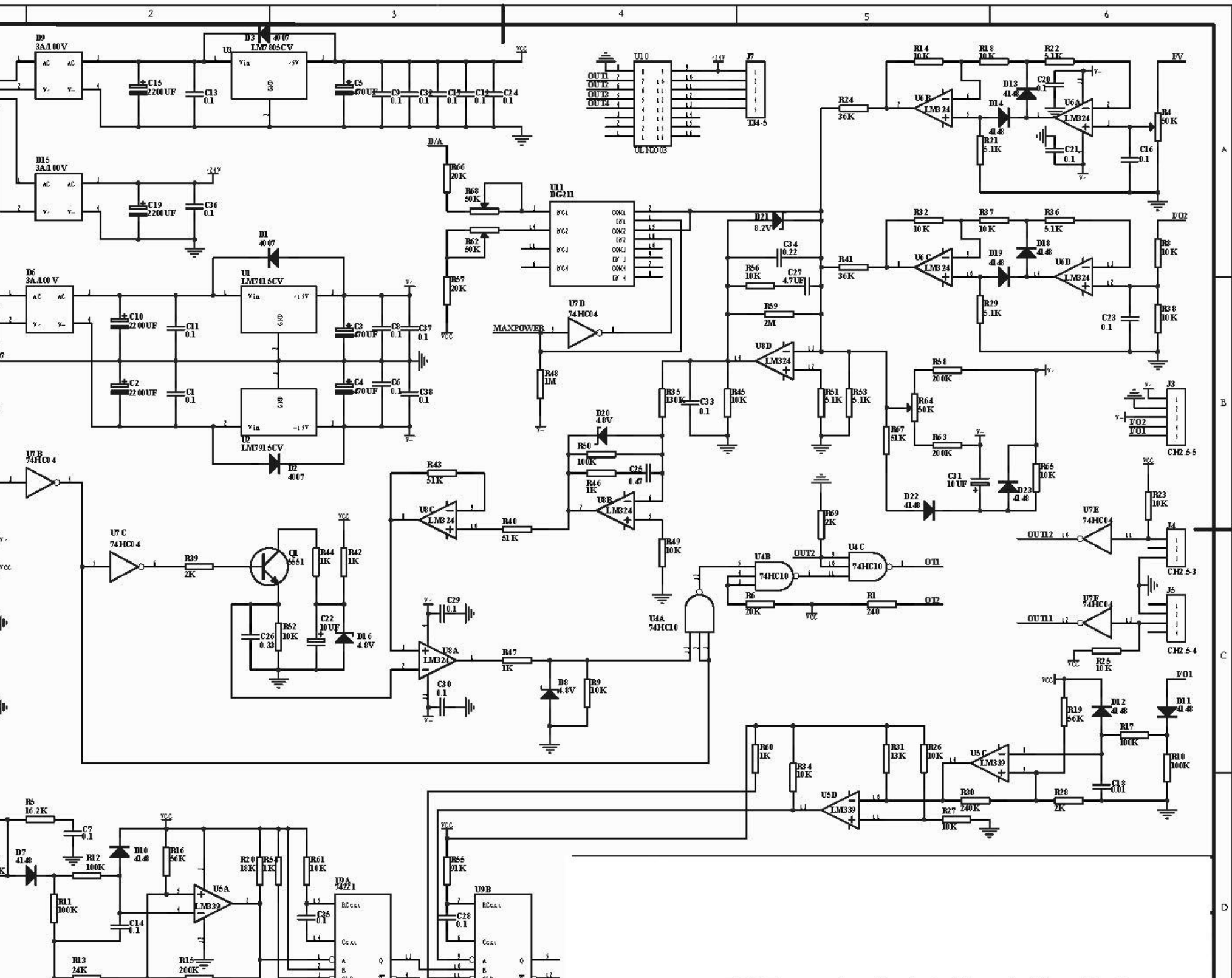


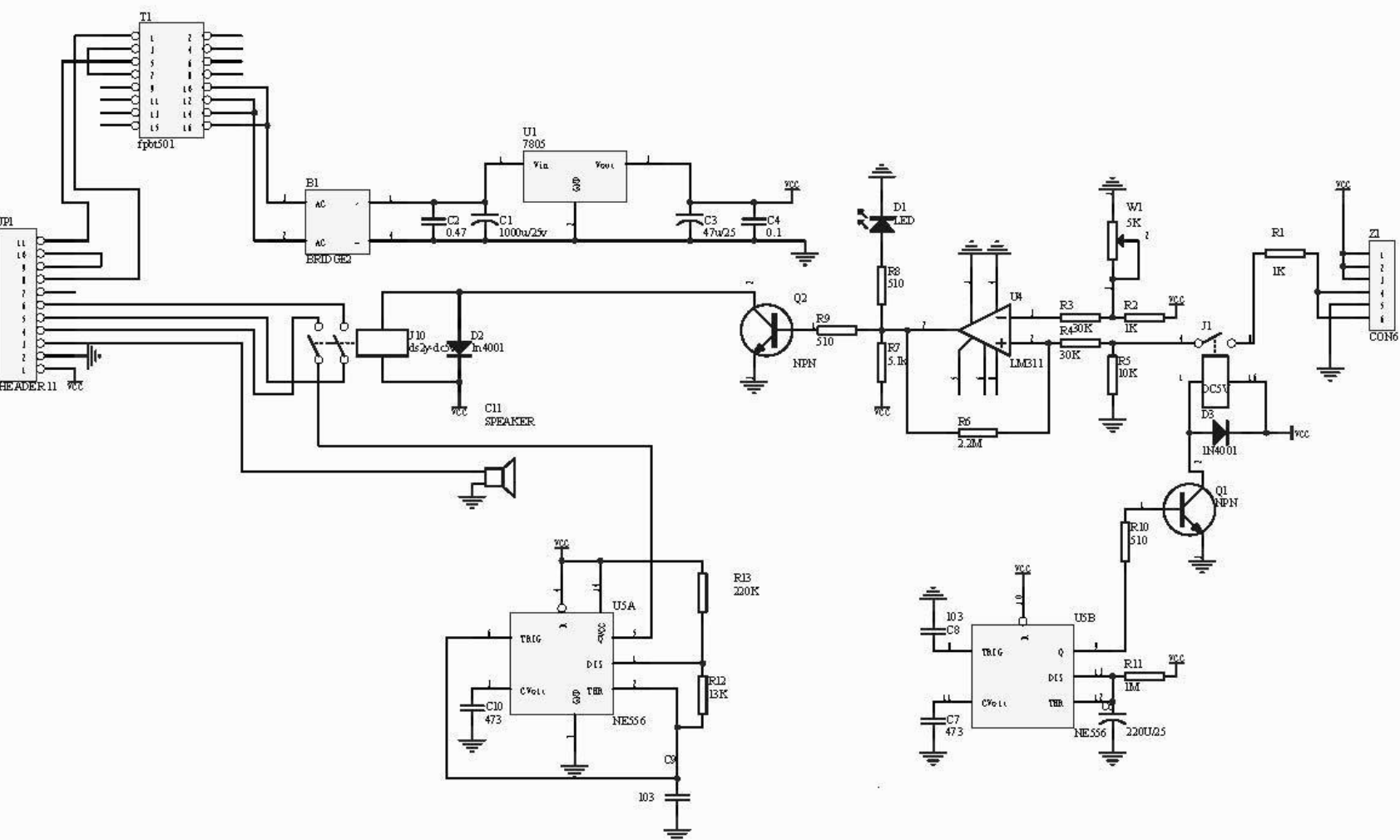


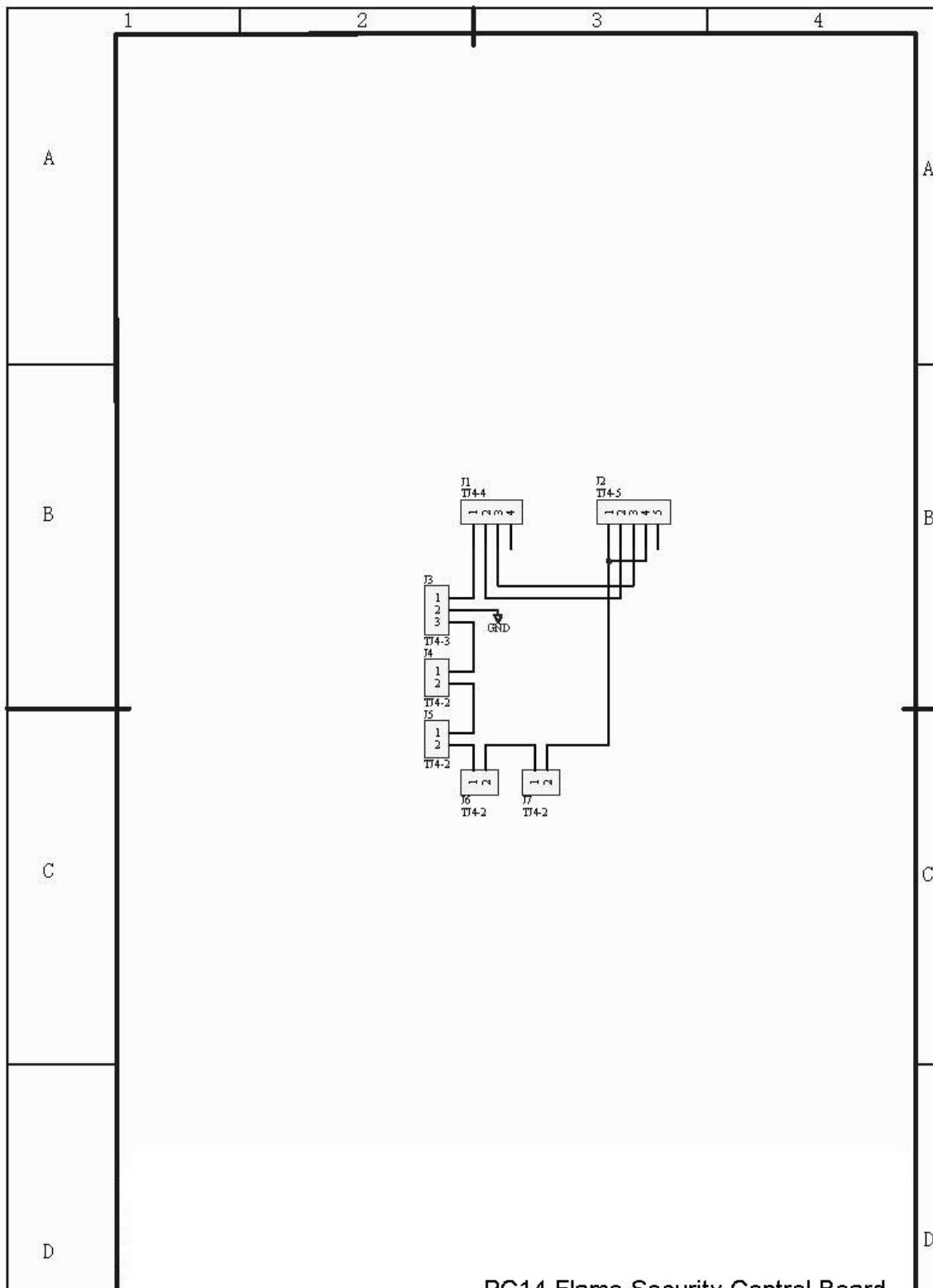




PC5 Motor Board







PG14 Flame Safety Control Board

