

Service Manual

UV-3100 spectrophotometer 4120021



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1. Preface

UV-3100 Spectrophotometer use spectroscopic element grating, the quasi-type spectroscopic system, single-beam optical structure. Advanced embedded computer control system, excellent signal processing and high-precision A/D converter-based, those provides a high-performance and high reliability for this series instruments. It reached the international advanced level of similar devices in specifications such as stray light, wavelength accuracy, transmittance accuracy and stability, and become an important analysis of the test equipment industry.

2. Specifications

Table 2-1 Specifications

	UV-3000	UV-3100
Optical System	Single beam, Grating 1200 lines/mm	
Spectral Bandwidth	4nm	2nm
Wavelength Range	190 – 1100nm	
Wavelength Accuracy	±0.5nm	
Wavelength Repeatability	≤0.3nm	
Photometric Range	0 – 200%T, -0.3 – 3.0A, 0 – 9999C	
Photometric Accuracy	±0.5%T or ±0.005A @ 1A	
Stray Light	≤0.05%T @ 220nm & 360nm	
Baseline Drift	±0.002A/h @ 500nm	
Baseline Flatness	±0.002A(200 – 1000nm)	
Light Source	Deuterium Lamp, Tungsten-Halogen Lamp	
Display	Graphical, 320×240 pixel backlit LCD	
Output	USB Port & Parallel Port(Printer)	
Power Requirement	AC 220V/50Hz or AC 110V/60Hz	
Dimensions	490×360×240mm	
Weight	14kg	

3. Appearance

The appearance of UV-3100 Spectrophotometer is as Fig.3-1, Fig.3-2. The cover is made of abs plastic, conjugate with steel mother board by bolt. The sample room is at the left part, the LCD and keypad is at the top-right.

Fig.3-1 UV-3100



4. Configurations

Describes the internal structure of instrument as shown in Fig. 4-1~Fig.4-4.

Fig. 4-1 Base Board (Top view)

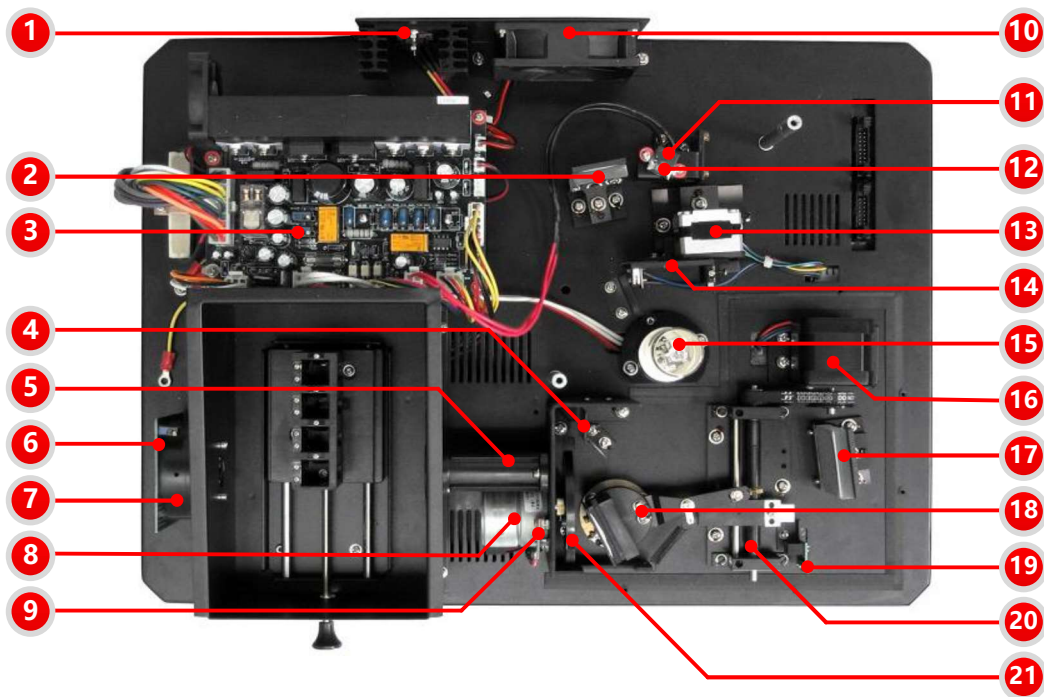


Fig.4-2 Base Board (Bottom View)

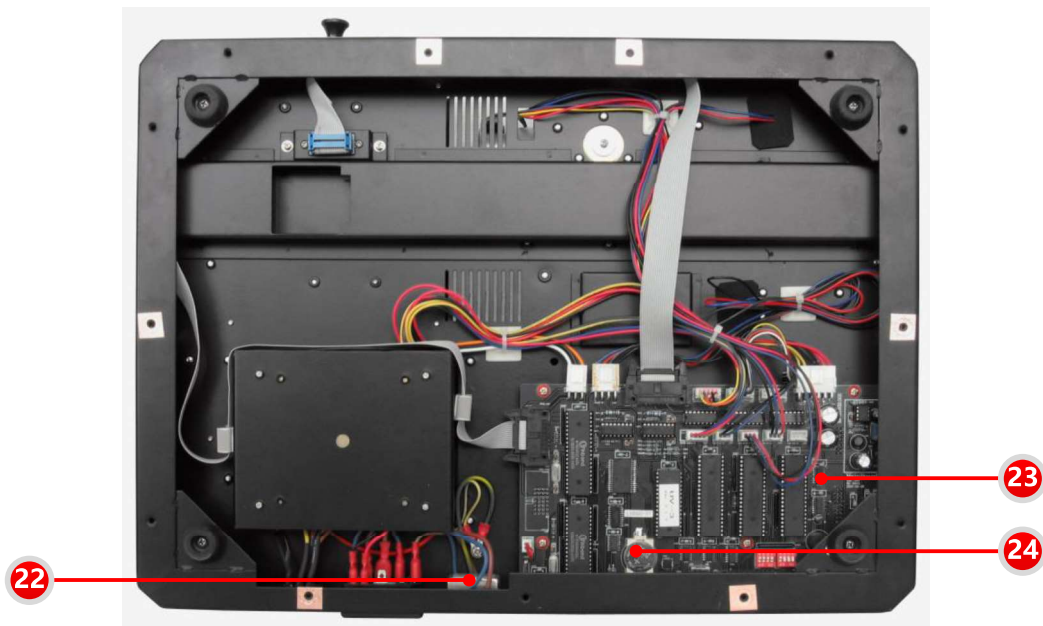


Fig. 4-3 Base Board (Back View)



Fig. 4-4 Shell (Top View)



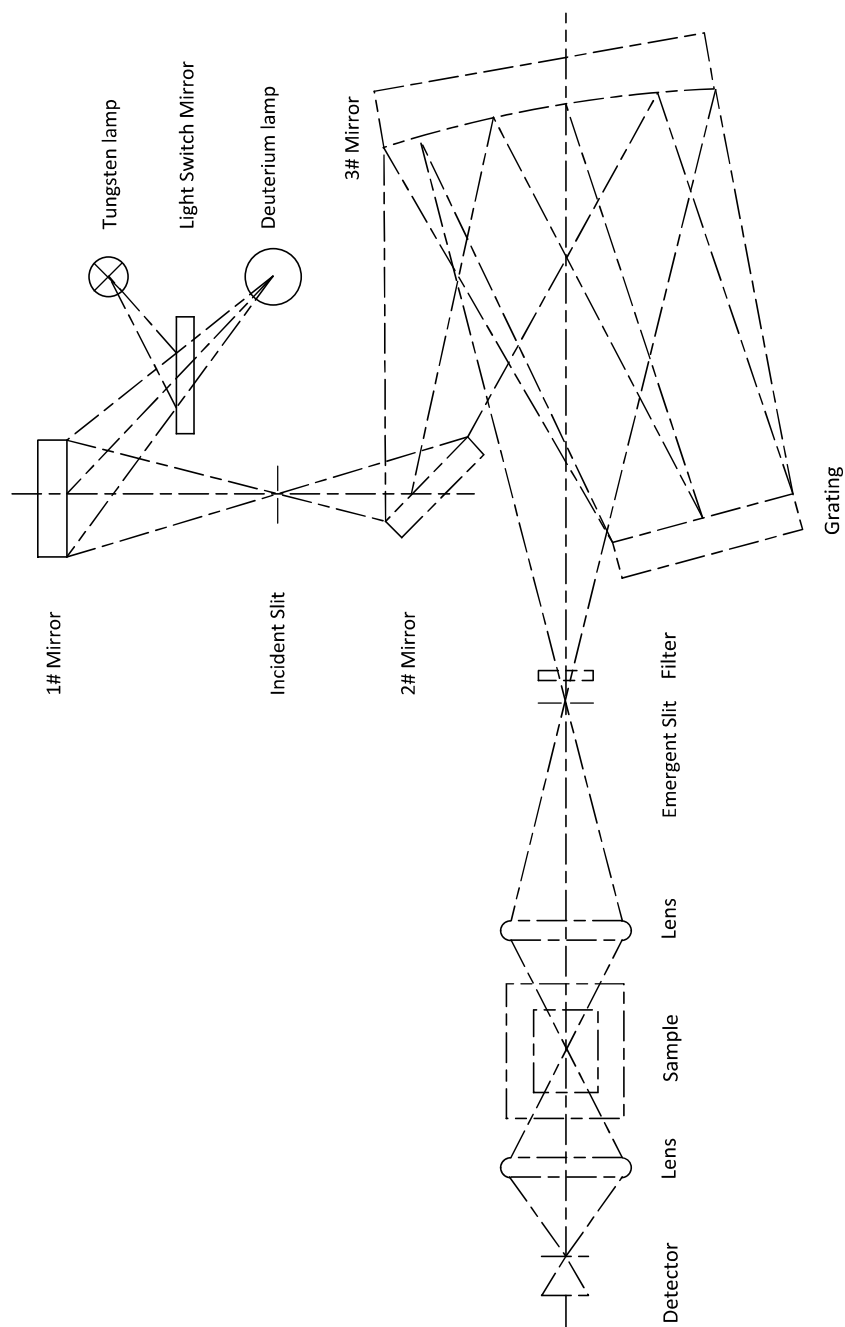
ID	Part Name	Part No.
1	Tungsten Lamp Power Transistor	916632
2	1# Reflector Mirror	916001
3	Power Supply Board	916661

4	2# Reflector Mirror	916002
5	Lens	916007
6	Signal Board	931619
7	Signal Board Block	916008
8	Filter Motor	916624
9	Filter Photoelectric Switch	931622
10	System Fan	916621
11	Tungsten Lamp	916634
12	Tungsten Lamp Holder	916639
13	Light Switch Components	916622
14	Light Switch Mirror	916005
15	Deuterium Lamp	916633
16	Wavelength Motor	931623
17	3# Reflector Mirror	916003
18	Grating	916004
19	Wavelength Filter Photoelectric Switch	916628
20	Wavelength Screw	916011
21	Filter Wheel	931006
22	EMI Filter	916603
23	Main Board	931621
24	Battery	916631
25	Power Socket	916601
26	Transformer	916604
27	Membrane Keyboard	931625
28	LCM Components	931011

5. Optical System

UV-3100 Spectrophotometer using grating Littrow system, its principle of optical system as shown in Fig. 5-1:

Fig. 5-1 Optical System



5.1 Incident Light

A continuous radiation emit from the light source (tungsten lamp or a deuterium lamp) reflected by the condenser mirror entered the monochromator, and then enter the entrance slit.

5.2 Dispersion

Entrance slit is just located on the focal plane of condenser mirror and collimating mirror in monochromator, so the composite light into the monochromator through the flat mirror and the collimating lens into the parallel light shooting at the dispersive element grating, then the grating will transform the composite light in to a certain continuously regular color spectrum according to the diffraction effect. This monochromatic spectrum will be back to collimator lens. Because the entrance slit is on the focal plane of collimating mirror, therefore, the monochromatic spectrum which dispersive from grating can be reflected to the exit slit after focus through collimating mirror.

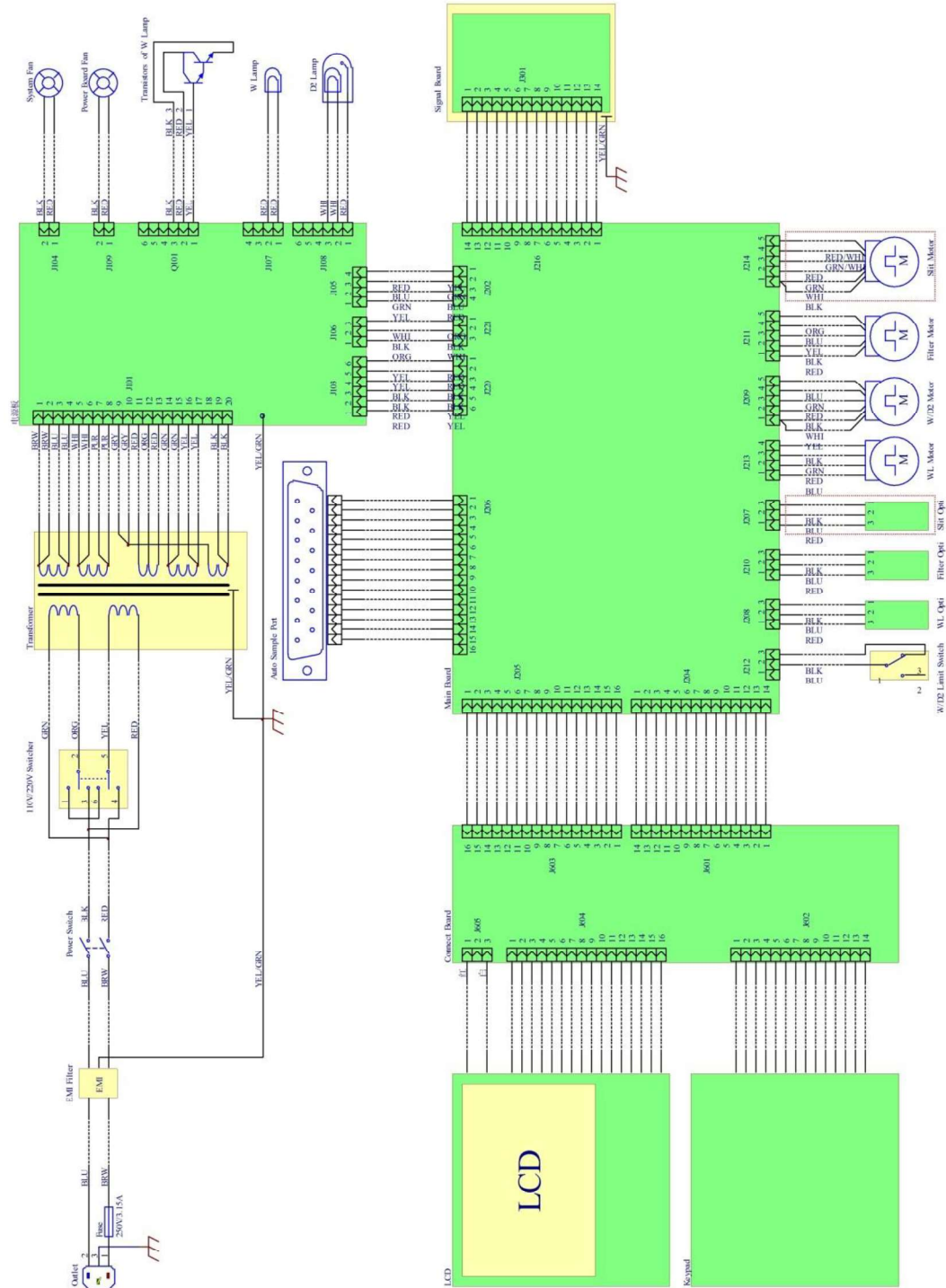
5.3 Emergent Light

Exit slit chooses the monochromatic light with appointed wavelength bandwidth, and collected by condenser lens, then it will focus on the center of testing sample in the sample room, after go through the testing sample, the monochromatic light illuminate to detector after focus by condenser lens.

6. Electronic Control System

The electronic control system of UV-3000 and UV-3100 spectrophotometer is composed of 3 modules. Those are power systems, control systems and signal processing systems.

Fig.6-1 Electrical Connection Diagram



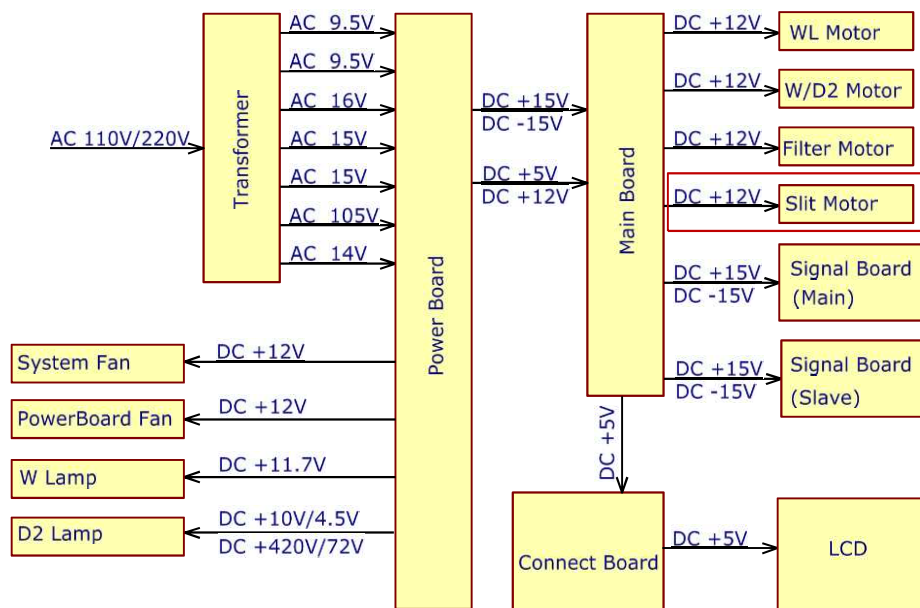
6.1 Power System

It uses a linear power supply in UV-3100 Spectrophotometer, can adapt to the input AC 220V/50Hz or 110V/60Hz. It is independent among light source, control part, pre-amplification and drive part, which effectively enhance the anti-jamming performance.

6.1.1 Principles of Power System

The principle of power system is as shown in Figure 6-2. Access 110V/220V alternating current, through the transformer into a corresponding voltage input to the power supply board. The different directly voltage will supply for light source, control part, signal processing part and motor and so forth.

Fig.6-2 Power System Block Diagram



6.1.2 Power Board

The connectors' location is shown in Fig.6-3. The pin details are as following:

J101 – Connect to power transformer secondary output

Pin [1,2], [3,4]:	AC 9.5V
Pin [5,6], [7,8]:	AC 9.5V
Pin [9,10], [19,20]:	AC 16V
Pin 11, 12:	AC 15V

Pin 12, 13: AC 15V
Pin 14, 15: AC 105V
Pin 16, 17: AC 14V
Pin 18: Free

J103 – Connect to main board

Pin 1, 2: DC +5V
Pin 3, 4: GND
Pin 5, 6: DC +12V

J104 – Connect to power board fan

Pin 1: DC +12V
Pin 2: GND

J105 – Connect to main board

Pin 1: DC +5V
Pin 2: DC +5V(on)/0V(off) (Tungsten Lamp)
Pin 3: DC +5V(warm-up)/0V(warmed) (Deuterium lamp)
Pin 4: DC +5V(on)/0V(off) (Deuterium lamp)

J106 – Connect to main board

Pin 1: DC +15V
Pin 2: GND
Pin 3: DC -15V

Q101 – Connect to tungsten lamp power transistor

Pin 1: DC +12.5V
Pin 2: DC +17V
Pin 3: DC 11.7V

J107 – Connect to tungsten lamp

Pin 1: DC +11.7V
Pin 2: GND

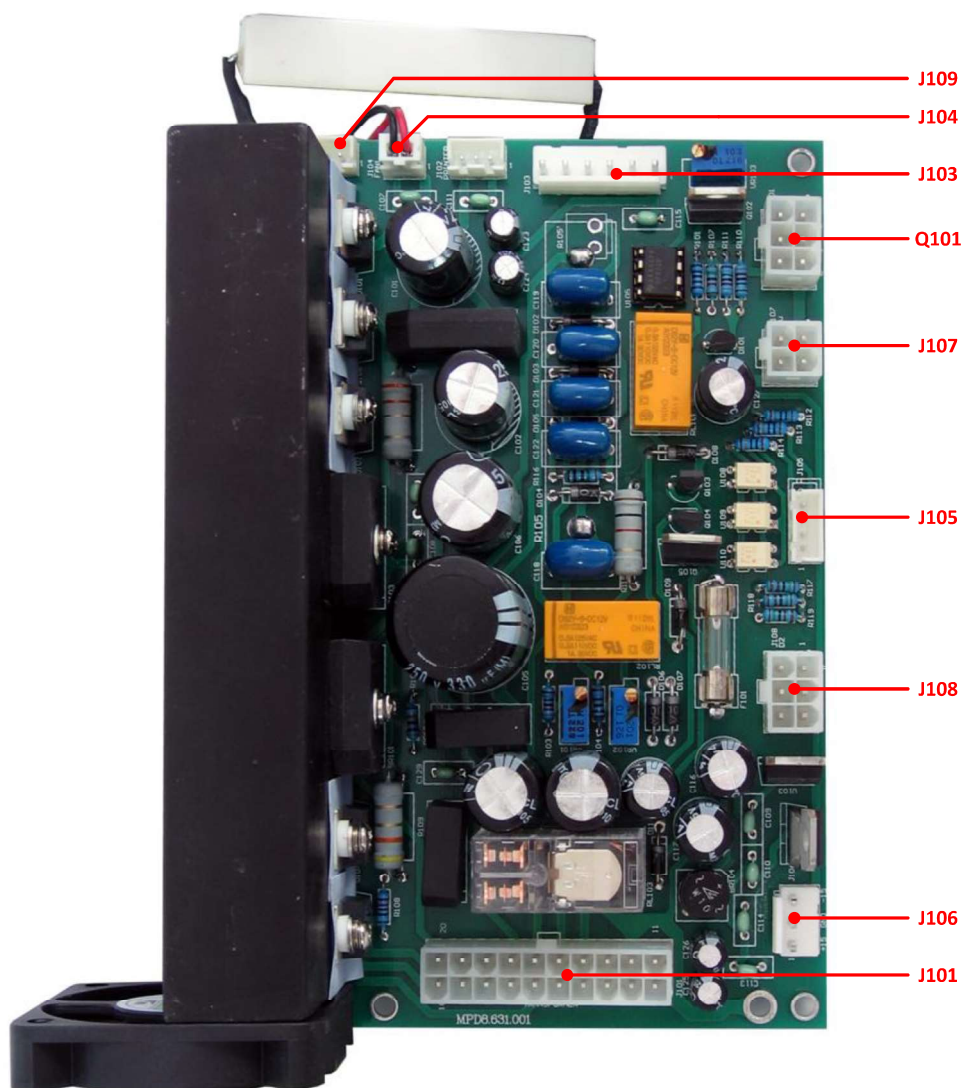
J108 – Connect to deuterium lamp

Pin 1: DC +420V(Warm-up)/+72V(On)
Pin 2: GND
Pin 3: DC +10V(Warm-up)/DC +4.5V(On)

J109 – Connect to system fan

Pin 1: DC +12V
Pin 2: GND

Fig.6-3 Power Board



6.2 Control System

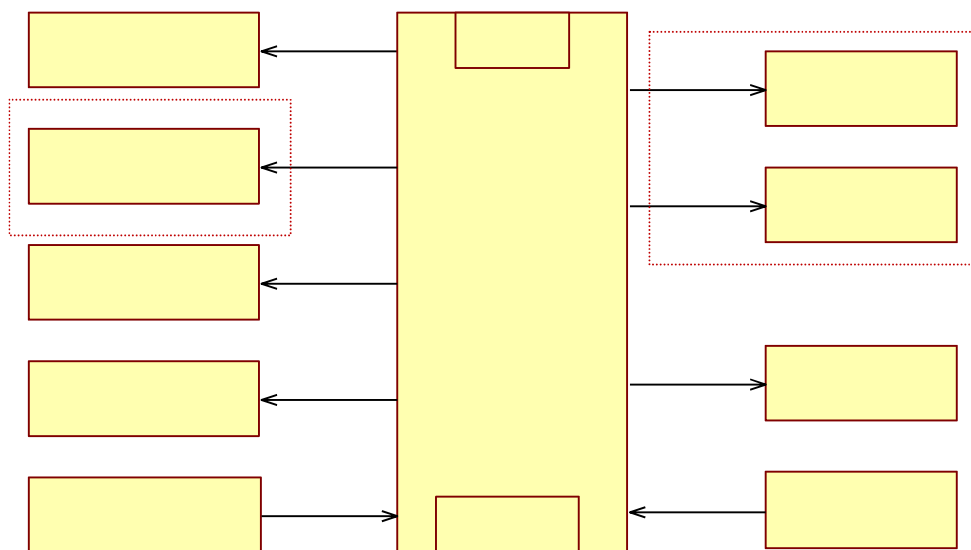
UV-3100 Spectrophotometer embedded real time operating system, which allows the system run stable with high efficiency; using high-resolution liquid crystal display and membrane keyboard, which makes it easy to machine interaction and convenient.

6.2.1 Description of Control System Principles

The principle of control system is shown in Fig.6-4. The main board receives control commands and setting parameters from keyboard or host computer. Drive the grating, light switch mirrors, filters, slit and 8-Position Auto Cell Changer. Open or close lights, adjust

the gain of preamp, display or print out the results.

Fig.6-4 Control System



6.2.2 Main Board

The connectors are shown on Fig.6-5. The details are as following:

J202 – Connect to Display Board (LCD & UDISK)

Pin 1,2:	GND
Pin 3,4:	+5V
Pin 5:	VLCD
Pin 6:	A0
Pin 7:	WR
Pin 8:	RD
Pin 9 - 16:	Data Bus
Pin 17:	LCD_CS
Pin 18:	RESET
Pin 19:	VEE
Pin 20:	UDIS_CS

J203 – Connect to Power Board

Pin 1:	DC +5V
Pin 2:	DC +5V(on)/0V(off) (Tungsten Lamp)
Pin 3:	DC +5V(warm-up)/0V(warmed) (Deuterium lamp)
Pin 4:	DC +5V(on)/0V(off) (Deuterium lamp)

J204 – Connect to Power Board

Pin 1, 2:	DC +5V
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Pin 3, 4: GND
Pin 5, 6: DC +12V

J205 – Connect to Power Board

Pin 1: DC +15V
Pin 2: GND
Pin 3: DC -15V

J206 – Printer Interface

Pin 1: /STB
Pin 2 - 9: D0 - D7
Pin 10: /ERR
Pin 11: BUSY
Pin 12: /RST
Pin 18 - 25: GND

J207 – Connect to Interposer (Button)

Pin 1, 2: Free
Pin 3 - 6: Button array output column
Pin 7 - 14: Key array input column

J209 – Connect to Signal Board

Pin 1 - 5: DC +5V/0V, Gain Control
Pin 6: /CS (A/D)
Pin 7: DCLK (A/D)
Pin 8: DOUT (A/D)
Pin 9, 10: DC +15V
Pin 11, 12: GND
Pin 13, 14: DC -15V

J212 – USB Interface

Pin 1: VBUS
Pin 2: D-
Pin 3: D+
Pin 4: GND

J213 – Interface for 8-Position Auto Cell Changer

Pin 1: DC +1.2V
Pin 2: DC +5V (Start Position)/0V
Pin 3, 4: GND
Pin 5, 6: DC +12V
Pin 7, 8: Phase A
Pin 9, 10: Phase B
Pin 11, 12: Phase C

Pin 13, 14: Phase D
Pin 15: DC +5V(Uninstalled)/0V(Installed)
Pin 16: Free

J215 – Wavelength Photoelectric Switch Board

Pin 1: DC +1.2V
Pin 2: DC +5V(Start Position)/0V
Pin 3: GND

J216 – Lamp Switch Motor

Pin 1: DC +12V
Pin 2: Phase A
Pin 3: Phase B
Pin 4: Phase C
Pin 5: Phase D

J217 – Filter Photoelectric Switch Board

Pin 1: DC +1.2V
Pin 2: DC +5V(Start Position)/0V
Pin 3: GND

J218 – Filter Motor

Pin 1: DC +12V
Pin 2: Phase A
Pin 3: Phase B
Pin 4: Phase C
Pin 5: Phase D

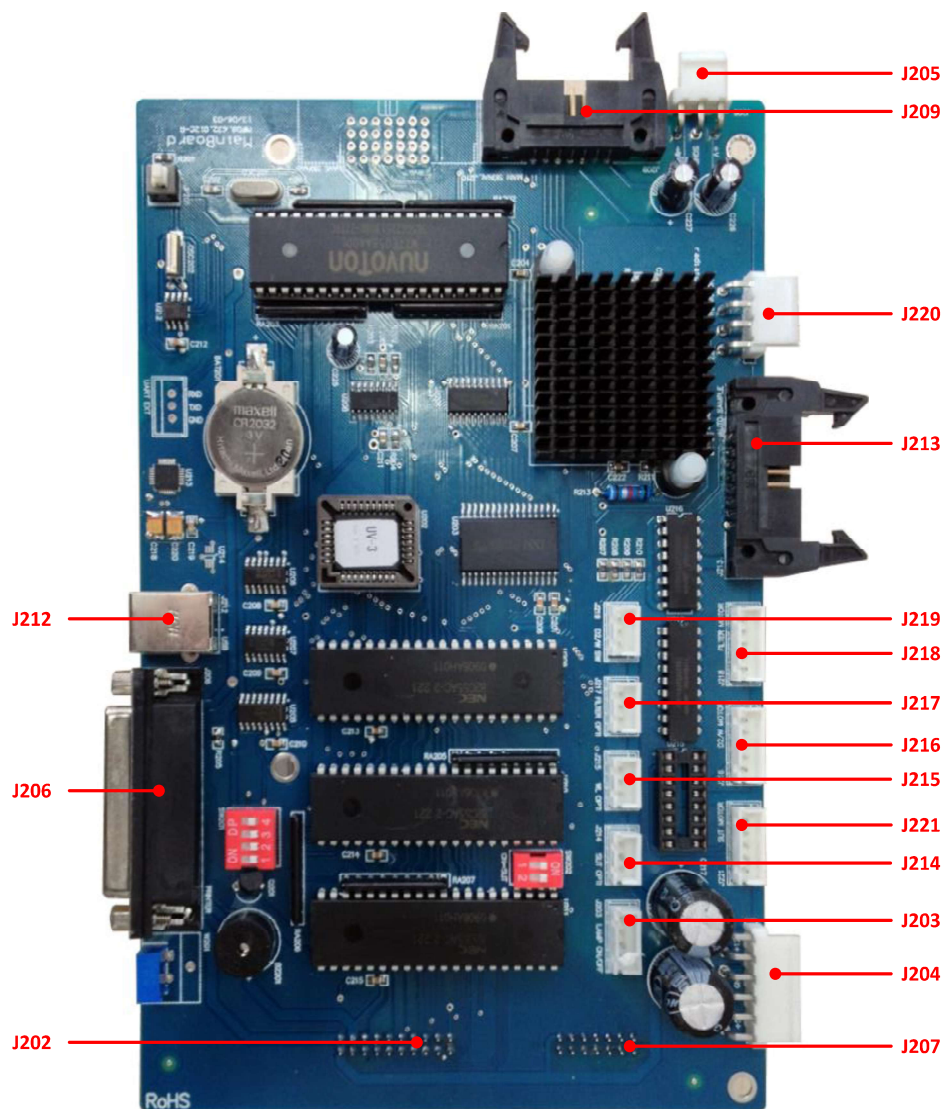
J219 – Lamp Switch Limit Switch

Pin 1: DC +1.2V
Pin 2: DC +5V(Start Position)/0V
Pin 3: GND

J220 – Wavelength Motor

Pin 1: Phase A
Pin 2: Phase B
Pin 3: Phase C
Pin 4: Phase D

Fig.6-5 Main Board



6.2.3 LCD Components

Connectors for LCD are shown in Fig.6-6. The details are as following:

J701 – Connect to Main Board(LCD & UDISK)

Pin 1,2:	GND
Pin 3,4:	+5V
Pin 5:	VLCD
Pin 6:	A0
Pin 7:	WR
Pin 8:	RD
Pin 9 - 16:	Data Bus
Pin 17:	LCD_CS

Pin 18: RESET
Pin 19: VEE
Pin 20: UDIS_CS

J702 – Connect to LCD

Pin 1,2: GND
Pin 3,4: +5V
Pin 5: VLCD
Pin 6: A0
Pin 7: WR
Pin 8: RD
Pin 9 - 16: Data Bus
Pin 17: LCD_CS
Pin 18,19,20: Free

J703 – Connect to USB DISK

Pin 1: +5V
Pin 2: D+
Pin 3: D-
Pin 4: GND

J704 – Connect to LCD (Backlight)

Pin 1: DC +5V
Pin 2: Free
Pin 3: GND

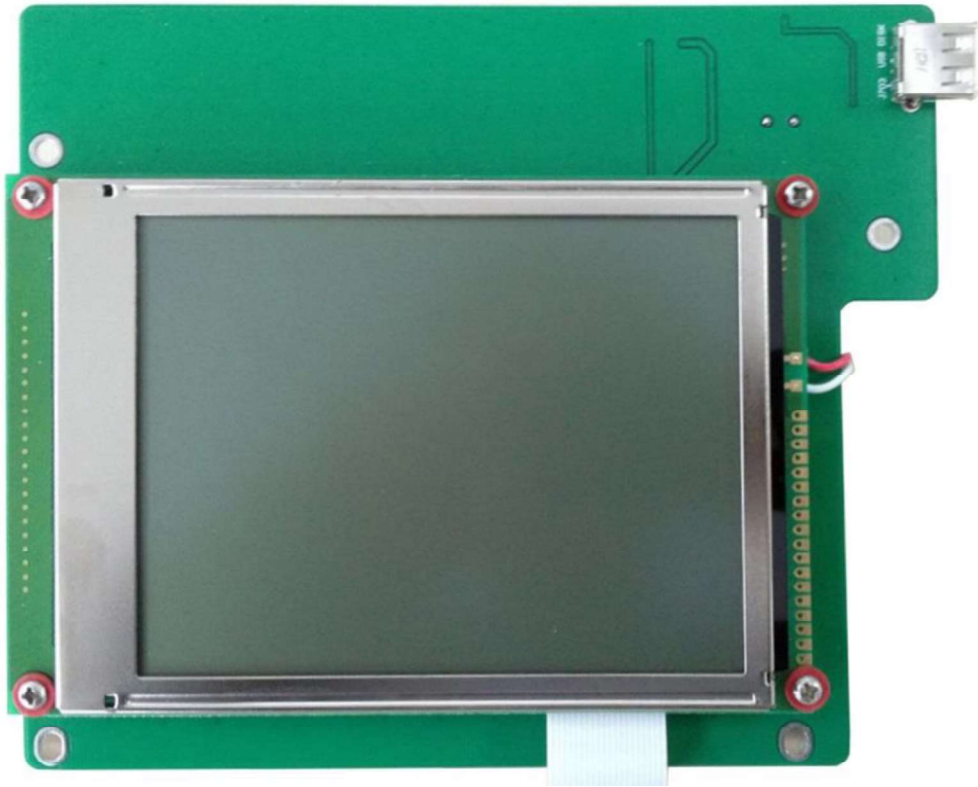
J705 – Connect to Main Board

Pin 1, 2: Free
Pin 3 - 6: Key Out
Pin 7 - 14: Key In

J707 – Connect to Membrane Keypad

Pin 1 - 4: Key Out
Pin 5 - 12: Key In

Fig.6-6 LCD Components



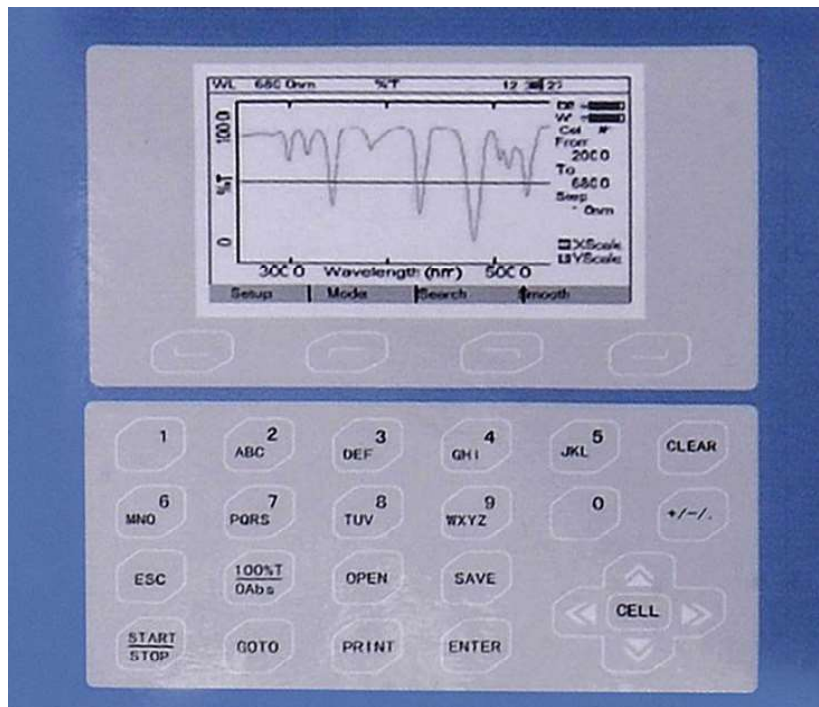
6.2.4 Keypad

Membrane Keypad is shown in Fig.6-7. The details are as following:

Connect to LCD Module

Pin 1 - 4:	Key Out
Pin 5 - 12:	Key In

Fig.6-7 Membrane Keypad



6.3 Signal Processing System

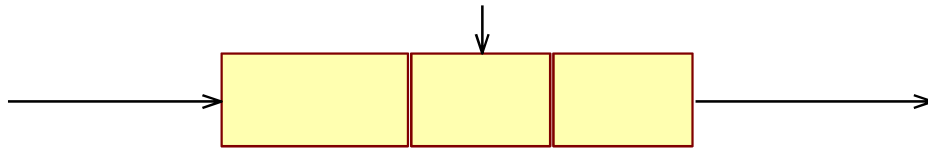
Using carefully optimized preamplifier circuit and 16-bit high speed A/D converter, which ensure the signal with stability and high accuracy. Besides, zooming in and A/D converter located at the same circuit board and transmitting the digital signals to CPU directly which can effectively avoid the simulated small-signal interference problems while long-distance transmission.

6.3.1 Descriptions of Signal Processing System

As the fig. 6-8, the detector gets the light signal, then converted into weak electrical signal. After two amplified, sent to the A /

D converter to convert into a digital signal.

Fig.6-8 Signal Processing System



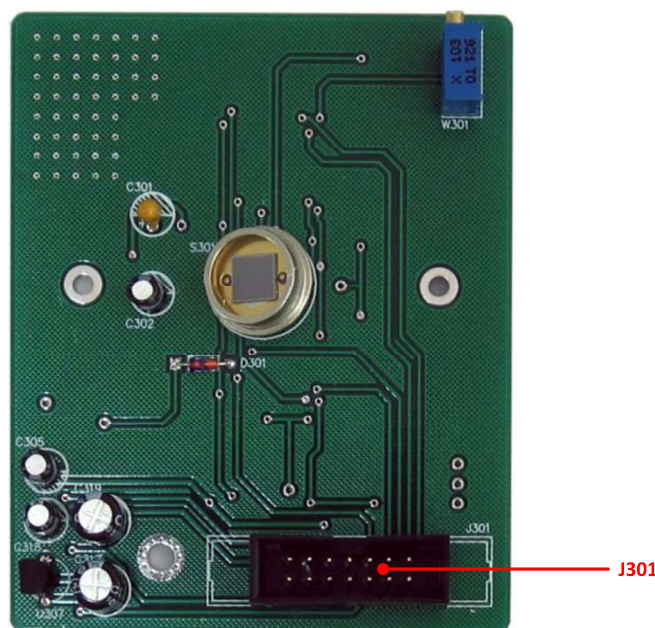
6.3.2 Signal Board

The signal connectors are shown in Fig.6-8. The details of Pin are as following:

J301 – Connect to Main Board

Pin 1 - 5:	DC +5V/0V, Gain Control
Pin 6:	/CS (A/D)
Pin 7:	DCLK (A/D)
Pin 8:	DOUT (A/D)
Pin 9, 10:	DC +15V
Pin 11, 12:	GND
Pin 13, 14:	DC -15V

Fig.6-9 Signal Board



The gain of preamp is determined by the energy when blanking. Fixed

slit is different from the variable slit. Refer the table 6-1 and 6-2:

- ※ L: Low(0V)
 H: High(+5V)
 ×: Uncertain

Tab.6-1

Bandwidth	Gain	Pin 5	Pin 4	Pin 3	Pin 2	Pin 1
×	0	L	L	L	×	×
	1	L	L	H	×	×
	2	L	H	L	×	×
	3	L	H	H	×	×
	4	H	L	L	×	×
	5	H	L	H	×	×
	6	H	H	L	×	×
	7	H	H	H	×	×

7. Troubleshooting

7.1 Instrument inoperative after switch power on

Possibility	Solution
Power cord not connected to outlet	Plug instrument in
Dead Power outlet	Change outlet
Poor contact between power cord to Main Board.	Improve the contact
Poor contact for the outlet	Change new outlet
Power line filter breakdown	Change a new filter
Poor contact for power switch	Change a new power switch
Poor contact for 110V/220V communication switch	Change a new communication switch
Power transformer breakdown	Change a new power transformer
Problem power board	Change a new power board

7.2 Tungsten lamp not light

Possibility	Solution
Tungsten glower breakdown	Change to another lamp
Poor contact for tungsten lamp holder	Improve the contact or change lamp
Poor contact between tungsten lamp connector and power board J107	Improve the contact
Poor contact between tungsten lamp power tube connector and power board Q101.	Improve the contact
Tungsten lamp power tube breakdown	Change power tube
Poor contactor between power board socket J105 and main board J203 connect line	Improve the contact

Problem power board	Change a new power board
Problem main board	Change a new power board

7.3 Deuterium lamp not light

Possibility	Solution
Power board fuse breakdown	Change fuse
Poor contact between Deuterium lamp line connector and power board J108	Improve the contact
Poor contactor between power board socket J105 and main board J203 connect line	Improve the contact
Deuterium lamp breakdown	Change lamp
Problem power board	Change power board
Problem power board	Change main board

7.4 Self-checking, filter positioning failure

Possibility	Solution
Poor contact between filter motor plug in and main board J218	Improve the contact
Damage of filter motor	Change the filter motor
Poor contact between Filter optocoupler plugin and main board J217	Improve the contact
Damage of filter optocoupler	Change filter optocoupler
Main board failure	Change main board
Filter doesn't move	Adjusting the position of filter

7.5 Self-checking, light source positioning failure

Possibility	Solution
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Poor contact between lamp switching motor plugin and main board J216	Improve the contact
Damage of lamp switching motor	Changing lamp switching motor
Poor contact between limit switch plug in for lamp switching and Main board J219	Improve the contact
Damage of limit switch for lamp switching	Changing limit switch for lamp switching
Main board failure	Changing main board

7.6 Self-checking, failure of calibrating system

Possibility	Solution
Restraining mass in light path	Removing the restraining mass
Failure of deuterium lamp opening	Check 7.3 Checking 7.3
Inaccurate positioning of filter	Check 7.4 checking 7.4
Error of light positioning	Check 7.5 checking 7.5
Poor contact between wavelength motor plug in and Main board J220	Improve the contact
Damage of wavelength motor	Change wavelength motor
Poor contact between wavelength optocoupler plug in and main board J215	Improve the contact
Damage of wavelength optocoupler	Change the wavelength optocoupler
Failure of Main board	Change main board

7.7 Self-checking, 8-auto cell changer location failure

Possibility	Solution
Poor contact between 8-auto cell changer plug in and Main board J213	Improve the contact

Damage of motor 8-auto cell changer	Change motor or 8-auto cell changer
Poor contact between plug in of 8-auto cell changer and plug in of sample room socket	Improve the contact
Failure of 8-auto cell changer interface	Change 8-auto cell changer interface
Poor contact between 8-auto cell changer plug in and interface socket	Improve the contact
8-auto cell changer blocked	Adjust the location
Damage of Main board	Change Main board

7.8 Self-checking, dark current error

Possibility	Solution
Inaccurate positioning of filter	Checking 7.4
Poor contact between Main board plug in J209 and plug in of Signal board J301	Improve the contact
Sample room lid opening or there are light in it.	Keep the sample room closing
Wrong value for Signal board dark current	Reset dark current value
Damage of Mainboard	Change Main board
Damage of Signal board	Change Signal board

7.9 LCD no display, others are working properly

Possibility	Solution
Unsuitable contract of LCD	Adjust contrast of potentiometer
Poor contact of Main board J202 and J701	Improve the contact
Poor contact between J702 and LCD mode	Improve the contact
Damage of LCD module	Change LCD

Damage of Main board	Change Main board
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7.10 LCD has no backlight, others are OK

Possibility	Solution
Poor contact of Main board J202 and Connect board J701	Improve the contact
Poor contact of J704 and LCD backlight connector	Improve the contact
LCD trouble	Replace LCD
Main board trouble	Replace Main board

7.11 Calibrating 100%T/0Abs, not steady value on screen

Possibility	Solution
Light path blocked	Remove the blocker
Using Glass cuvette in UV range	Substitute Glass cuvette to Quartz cuvette
High concentration solution	Dilute the solution
Wrong filter location	Refer 7.4
Wrong light source location	Refer 7.5
Damaged light source or exhausted	Refer 7.2,7.3

8. Checking and Calibrating

Prepare before calibrating.

1. Turning on and pre-heating the machine for 20 minutes.
2. Calibrate system.

8.1 Photometric Accuracy Checking

Sample: 0.5A,1A,2A neutral filter
 Testing mode: Photometric mode
 Testing wavelength: 546nm
 Display mode: Absorbance
 Steps: 1. go to 546nm;
 2. take air as blank reference, calibrate 100%T/0Abs;
 3. Test and record the Abs. Value for the 3 neutral filter;
 4. Check the value with the standard.

Standard value	Accept value
0.500A	0.500±0.005A
1.000A	1.000±0.010A
2.000A	2.000±0.020A

8.2 Wavelength Accuracy Checking

Sample: Holmium filter, Pr+Nd filter
 Testing mode: Wavelength Scan
 Wavelength range: 400-300nm(Holmium filter);
 850 – 750nm (Pr+Nd filter)
 Interval: 0.1nm
 Scan speed: Mid
 Display mode: Absorbance
 Steps: 1. Take air as blank reference, scanning baseline(400 – 300nm);
 2. Scanning Holmium Oxide filter, record the value of peak;
 3. Take air as reference, scanning

- baseline (850 – 750nm);
4. Scan Pr+Nd filter, record results;
 5. Check the value with the standard.

Standard Value	Accept Value
360.9nm(Holmium Oxide filter)	360.9±0.5nm
807.1nm(Pr+Nd filter)	807.1±0.5nm

8.3 Stray Light Checking

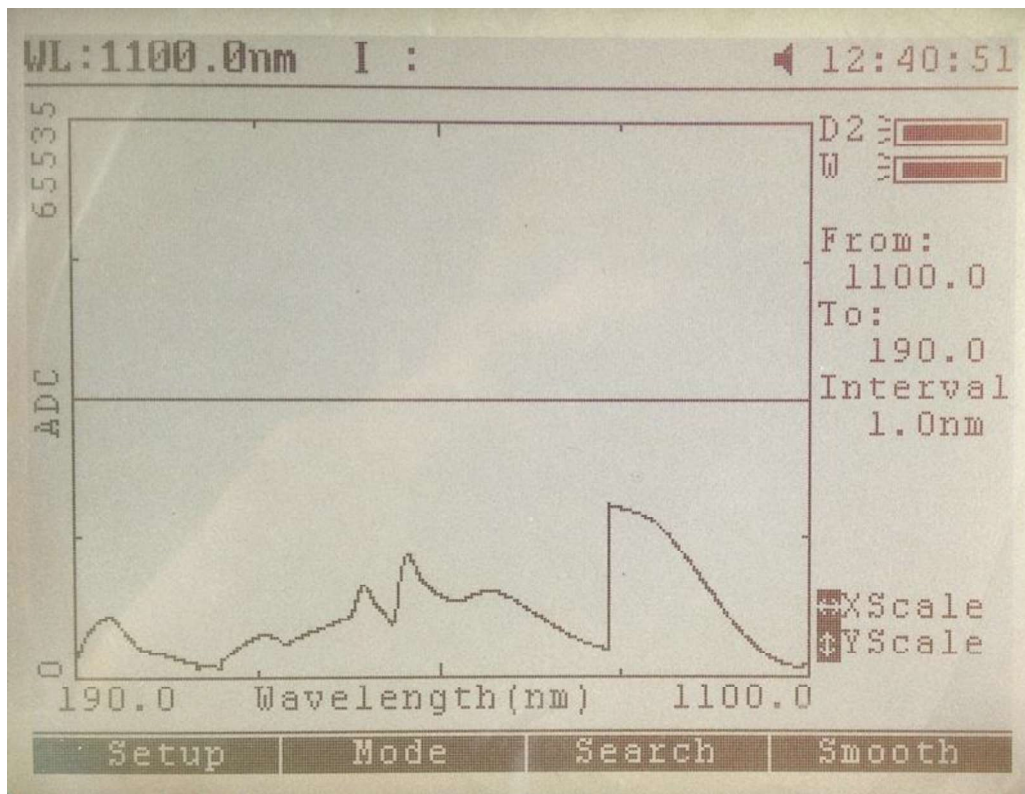
Sample: GG295 filter(220nm),GG375 filter(360nm)
 Testing mode: Photometric mode
 Testing wavelength: 220nm,360nm
 Display mode: %T
 Steps:

1. Go to 220nm;
2. Take air as blank reference, calibrate 100%T/0Abs;
3. Test and record the value for the GG295 filter;
4. Go to 360nm;
5. Take air as blank reference, calibrate 100%T/0Abs;
6. Test and record the value for the GG375 filter;
7. Check the value, If they are less than 0.05%T are OK.

8.4 Energy Checking



Sample: Air
 Testing mode: Wavelength Scan
 Wavelength range: 1100-190nm
 Interval: 1nm
 Display mode: Energy
 Steps: Remove anything in the light path, select "Wavelength Scan", press key "6",input gain "0", start scan. The energy<1000 @ 200nm, replace the deuterium lamp. The energy<5000 @ 500nm, replace the tungsten lamp.

Fig. 8-1 Energy



8.5 Adjust Dark Current

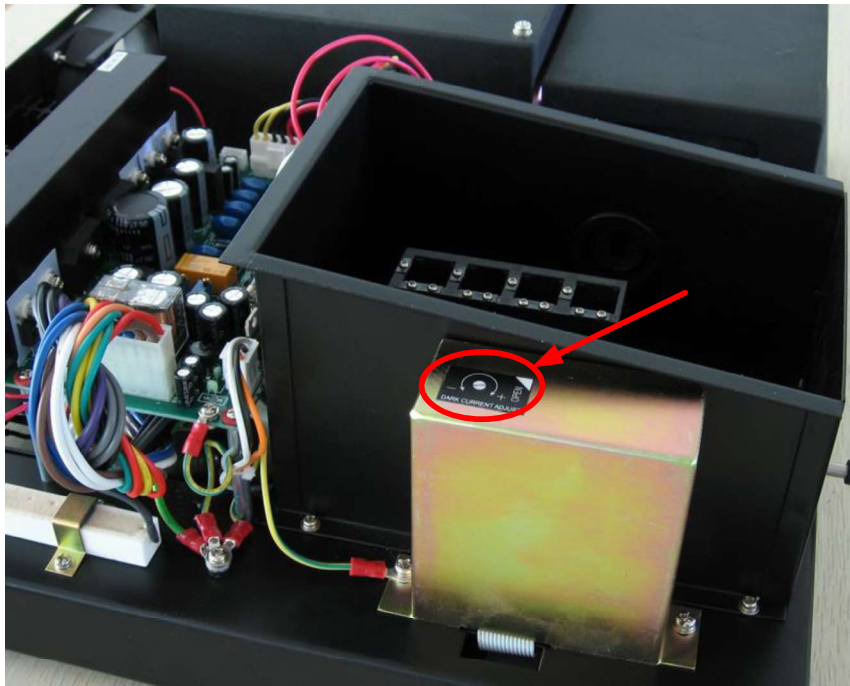
Check:

Enter into "System Utility", press ,
, select "Check Dark Current". It will show the Dark Current value of the gain 0 to 7. Typical value is about 5-10 of the gain 0, and the values showed increasing magnification.

Adjust:

1. Open the casing, move it to right side;
2. Reveal sticky trap of dark current regulation holes (Fig. 8-2);
3. Adjust and check the dark current, until the value is between 5 - 10 of the gain 0;
4. Re-paste sticky trap of dark current regulation hole.

Fig. 8-2 Adjust Dark Current



9. Replacement of Wearing Parts

9.1 Replace Fuse



Power supply accessed to the instrument may cause harm to humans. Make sure that the power had been pulled out before replacing fuses!

Step 1: Tools

3×75 Straight Screwdriver: 1 pcs.

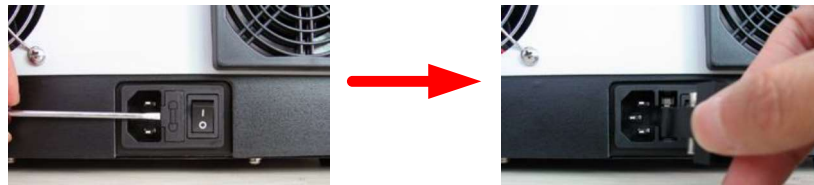
Step 2: Power off

Power off, unplug the Power Cord;

Step 3: Remove the fuse block

Remove the fuse with a screwdriver Holder (Fig.9-1);

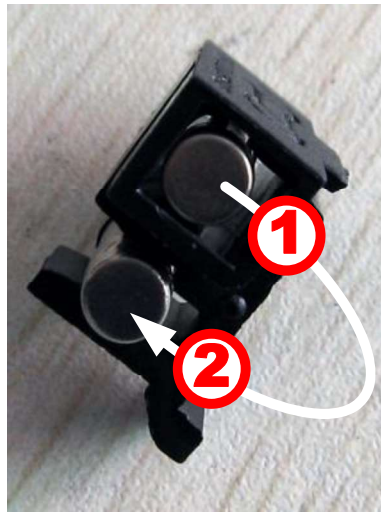
Fig.9-1



Step 4: Replace fuse

As the Fig.9-2, to replace fuses No.1 with fuses No.2;

Fig.9-2



Step 5: Install Fuse Block

Install Fuse Block back to the outlet;

Step 6: Power on

Connect to the power, power on.

9.2 Replace Lamp



Deuterium lamp and Tungsten lamp are big heat. Cool more than 20 minutes before open the lamp room. Avoid high-temperature burns!

Step 1: Tools

6×150 Phillips screwdriver: 1 pcs. Cotton glove: 1 pair;

Step 2: Power off

Power off, unplug the Power Cord;

Step 3: Open the instrument casing

Remove 4 screws and pull rod(Fig.9-3).Take away the casing.

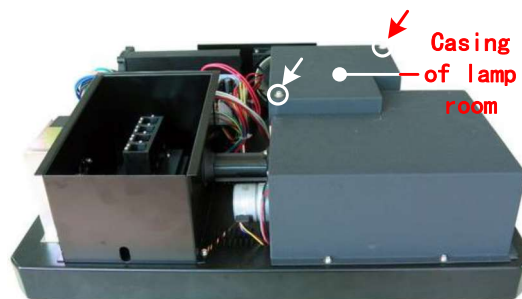
Unplug the connectors on the Main Board;

Fig.9-3

**Step 4: Open the casing of lamp room**

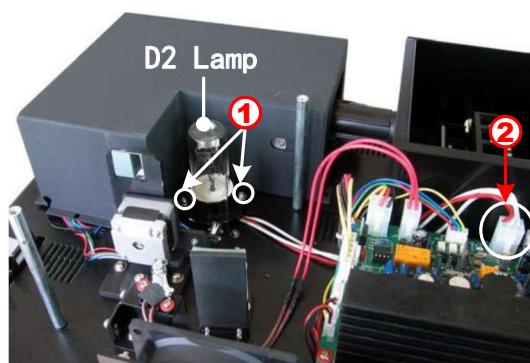
Remove 2 screws(Fig.9-4).Take away the casing of lamp room;

Fig.9-4

**Step 5: Replace Deuterium lamp**

Remove 2 screws (Fig.9-5) which fixed the Deuterium lamp, Deuterium lamp, unplug the connector of Deuterium lamp on the Power Board. Wear cotton gloves, install the new Deuterium lamp and fix it. Plug the connector of Deuterium lamp;

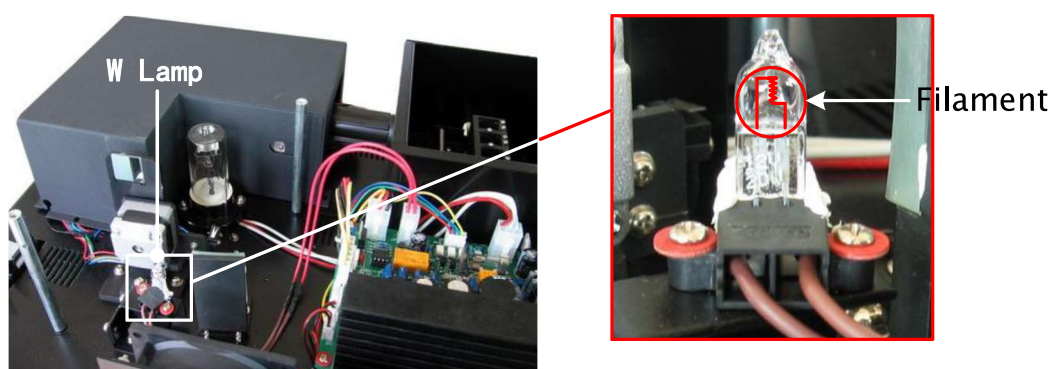
Fig.9-5



Step 6: Replace Tungsten lamp

Please make sure the direction of the filament before unplug the Tungsten lamp. Wear cotton gloves. Plug in the new Tungsten lamp according to the original direction of filament (Fig.9-6);

Fig.9-6

**Step 7: Finished**

Power on, confirm the light spot is on the center of the incident slit. Reinstall the instrument.

9.3 Replace Battery



**First confirmed that the power had been cut off
Instruments before open the bottom cover!**

Step 1: Tools

6×150 Phillips screwdriver: 1 pcs. Cotton glove: 1 pair;

Step 2: Power off

Power off, unplug the Power Cord;

Step 3: Open the bottom cover

Remove all the screws (Fig. 9-7).Take away the cover;

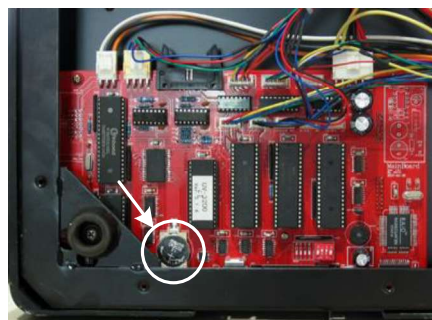
Fig. 9-7



Step 4: Replace

Take down the old battery and install new one on the Main board(Fig.9-8);

Fig. 9-8



Step 5: Finished

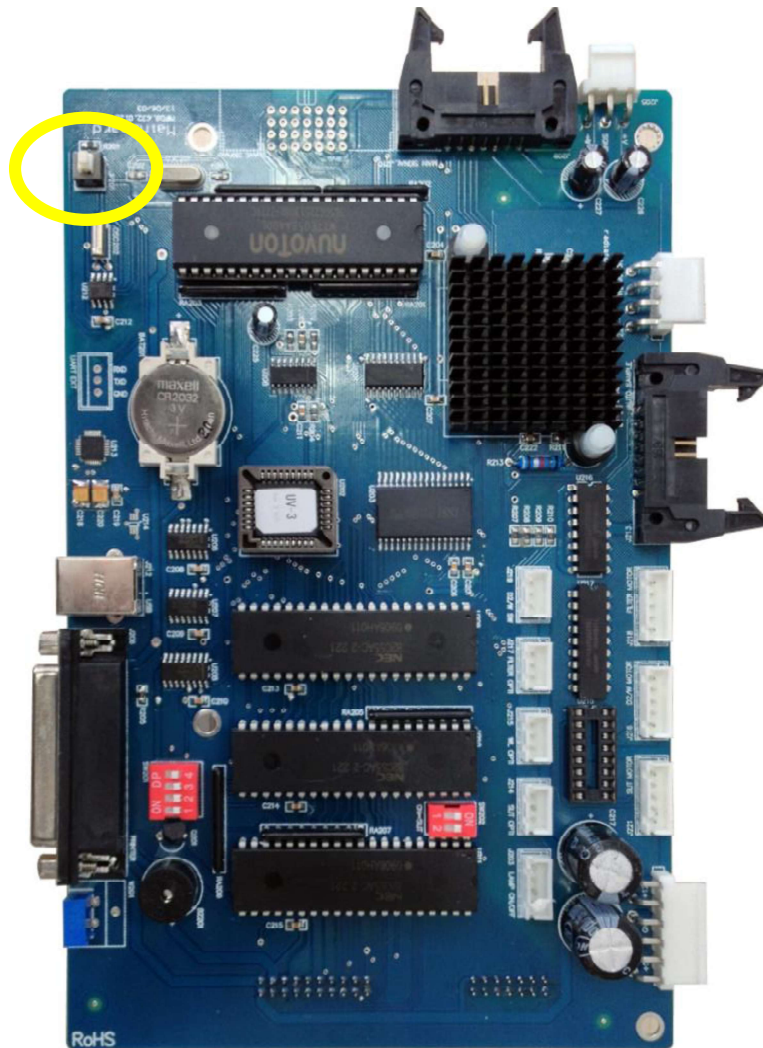
Install the bottom cover. Finished replace.

10. Update Firmware

Step 1: Switch to "Update Mode".

Presses down the **PRG** Button (JP201 on Mainboard), turn on, and the instrument go into "Update Mode".

Fig. 9-9



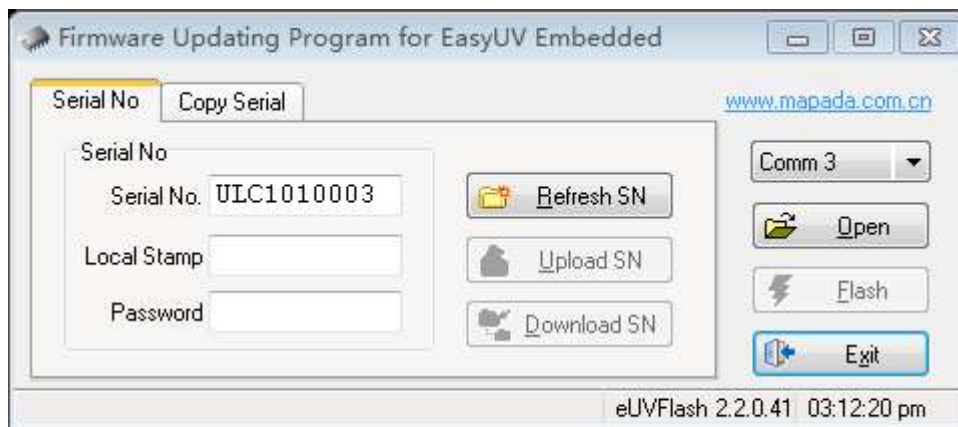
Step 2: Connect USB Cable.

Connect the USB Cable with the instrument and PC.

Step 3: Update

Run the **eUVFlash** software, select the Comm. Port, Click **Open** the Firmware file (***.H00), click **Flash** to start update.

Fig. 9-10

**Step 4: Finish**

After the instrument beeps three times, update finished. Turn off the instrument, press the **PRG** Button again. Turn it on, and the instrument starts self-checking.