

UNICO 2100 SERIES
SPECTROPHOTOMETER
Model 2100 Spectrophotometer
Model UV 2100 Spectrophotometer



SERVICE MANUAL

UNITED PRODUCTS & INSTRUMENTS INC.
MANUFACTURER OF QUALITY OPTICAL SYSTEMS

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1. GENERAL

1.1 INTRODUCTION

The UNICO 2100 series spectrophotometers are single beam instruments. The instruments is available in two models, the model 2100, which covers the Visible wavelength region from 325nm to 1000nm and the model UV2100 which covers the Ultra Violet and Visible wavelength regions from 200nm to 1000nm.

The analytical grating system has 1200grooves/mm for high spectral dispersion. The nominal spectral slitwidth of 5nm is constant over the entire wavelength range.

The instruments have a large sample compartment which will accept cuvettes up to 100mm in length. The instruments have, as standard configuration a four cell manual positioner which will accept 4 standard 10mm cuvettes.

The instruments are microprocessed featuring: Automatic zeroing, Automatic blanking, Motor driven wavelength selection, Microprocessed T- A conversion, Microprocessed Halogen and Deuterium lamp selection, Digital wavelength display. The large LED display reads out in either %Transmittance, Absorbance or Direct Concentration. The built-in RS232C serial interface allows you to connect the instrument to you computer or printer.



UNICO 2100 Spectrophotometer



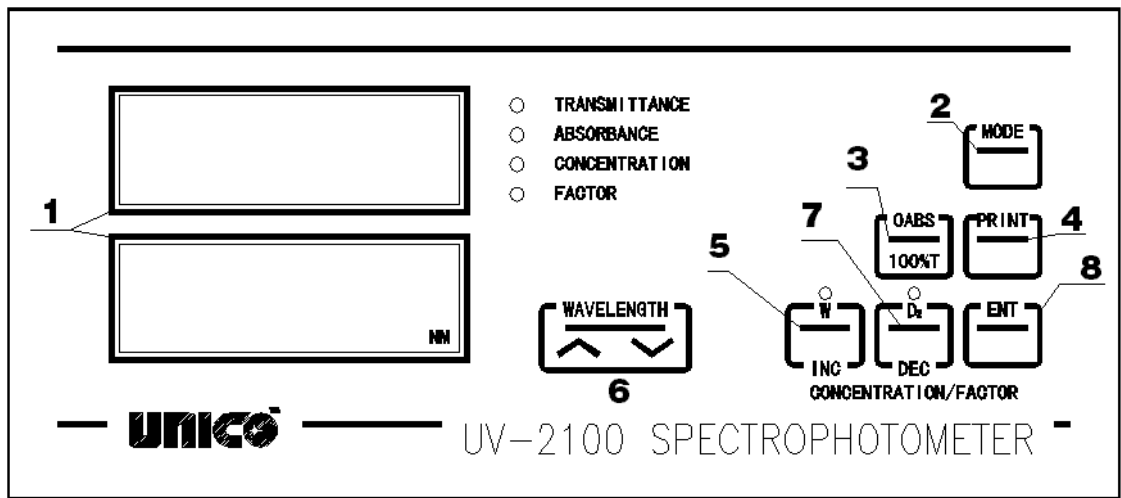
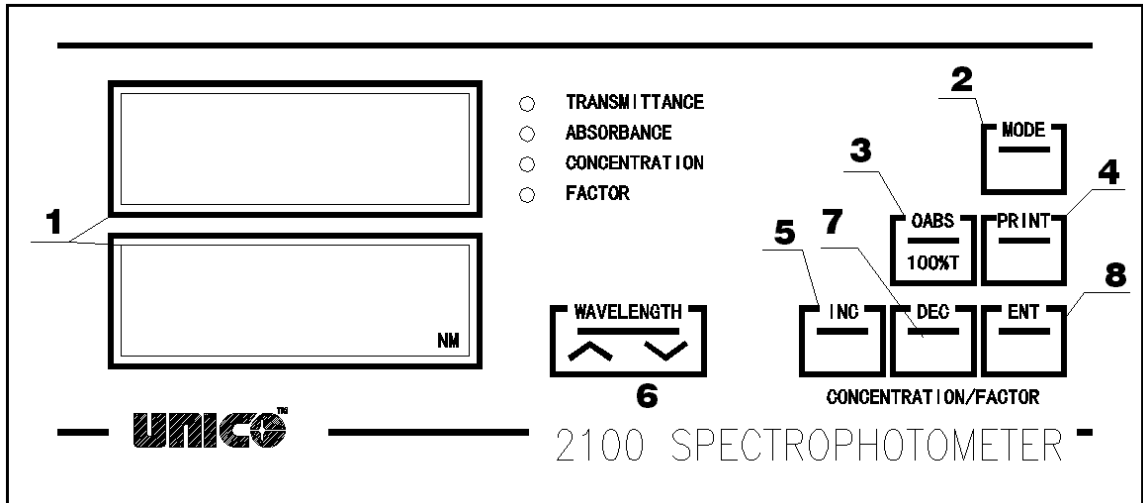
UNICO UV-2100 Spectrophotometer

1.2 SPECIFICATIONS:

Table 1

MODE	2100	UV-2100
<i>Spectral Slitwidth</i>	<i>5nm</i>	
<i>Optical System</i>	<i>Single Beam, Grating System 1200 lines/mm</i>	
<i>Wavelength Range</i>	<i>325-1000nm(VIS)</i>	<i>200-1000nm(UV/VIS)</i>
<i>Wavelength Accuracy</i>	<i>±2nm</i>	
<i>Repeatability</i>	<i>±1nm</i>	
<i>Readability</i>	<i>±1nm</i>	
<i>Stability</i>	<i>±0.002A/hr@500nm</i>	
<i>Stray Light</i>	<i>≤ 0.3%T at 340 and 400nm</i>	<i>≤ 0.3%T at 220 and 340nm</i>
<i>Photometric Range Accuracy</i>	<i>0-125%T, -0.1-2.5A, 0-1999C(0-1999F) ±0.004A@0.5A</i>	
<i>Standard Cell Holder</i>	<i>4-position</i>	
<i>Light Source</i>	<i>Tungsten Halogen Lamp</i>	<i>Tungsten Halogen/ Deuterium Lamp</i>
<i>Data Output</i>	<i>Two-line, 9-LED, display Trans., Abs., Conc., and wavelength RS232C, Analog Output</i>	
<i>Dimensions</i>	<i>470mm(18.5") W×400mm(15.7") D×140mm(5.5") H</i>	
<i>Weight</i>	<i>10Kg</i>	<i>12Kg</i>
<i>Power Requirement</i>	<i>115/230 volt. ±10%, 60/50Hz.Adjustable</i>	

1.3 NOMENCLATURE



Key Components of UNICO 2100 Series Spectrophotometer

① DIGITAL READOUT displays the data of Transmittance, Absorbance, Concentration, Factor and Wavelength. The red LED status indicators next to the labels Transmittance, Absorbance, Concentration and Factor indicate the currently active mode.

② MODE KEY selects the Transmittance, Absorbance, Concentration or Factor mode.

③ CONCENTRATION/FACTOR KEYS are used in the Concentration mode to set the

concentration and/or Factor value of a known standard on the digital display.

④ **PRINT BUTTON** to send displayed data to a printer or computer connected to the RS232C serial port.

⑤ **100%T/0A KEY** is used to set digital display to 100%T or 0Abs. It must be reset whenever the analytical wavelength has been changed.

NOTE: When operating at a fixed wavelength for an extended period of time, check the 0%T and 100%T readout and readjust if necessary.

⑥ **WAVELENGTH SELECTOR BUTTON** used to select the desired analytical wavelength of the instrument. The wavelength readout digital display is graduated in 1nm increments.

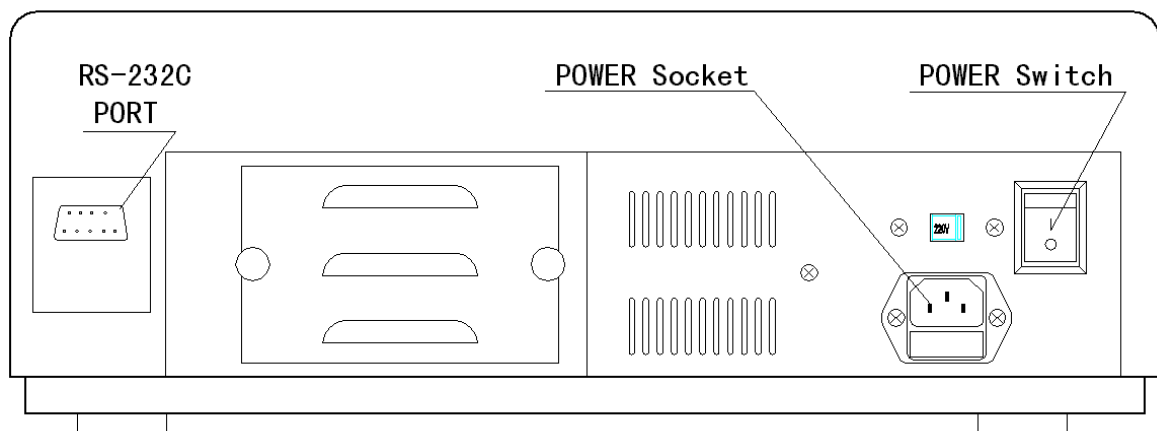
⑦ **RS-232C PORT** located on the back of the instrument. The pin functions for the connector are listed below:

- 1-Chassis ground
- 2-UNICO transmits data
- 3-UNICO receive data
- 7-Signal ground

⑧ **THE RS-232C** parameters are:

- Baud Rate -4800
- Date Bit -8
- Stop Bit -1
- Parity - None

⑨ **ANALOG OUTPUT** Connector is a double-banana socket located on the back of the instrument

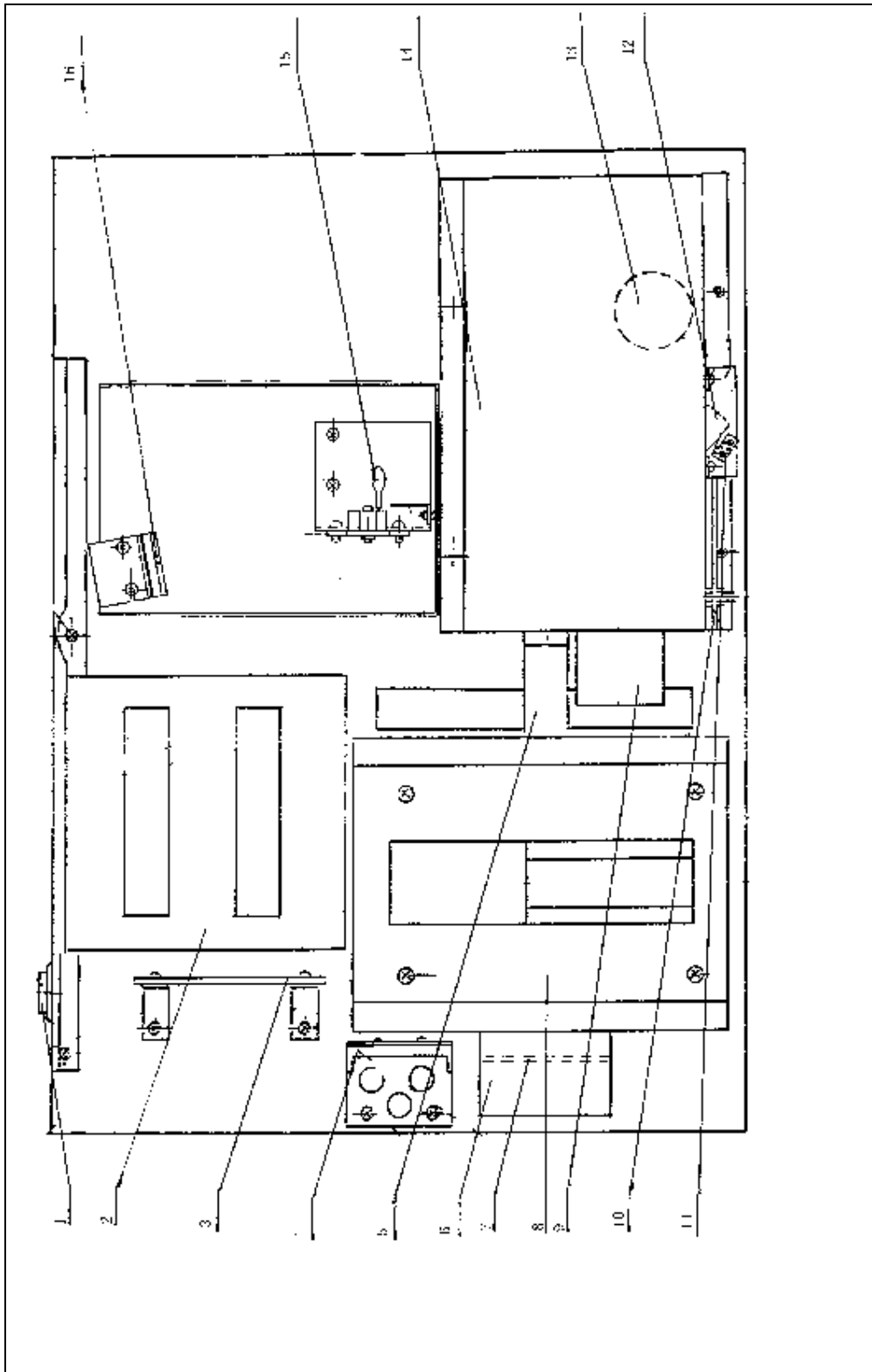


Operating Components of Back Side of UNICO 2100 (VIS Model Only)

1.4 LAYOUT OF 2100 AND UV2100

1.4.1 LAYOUT OF 2100

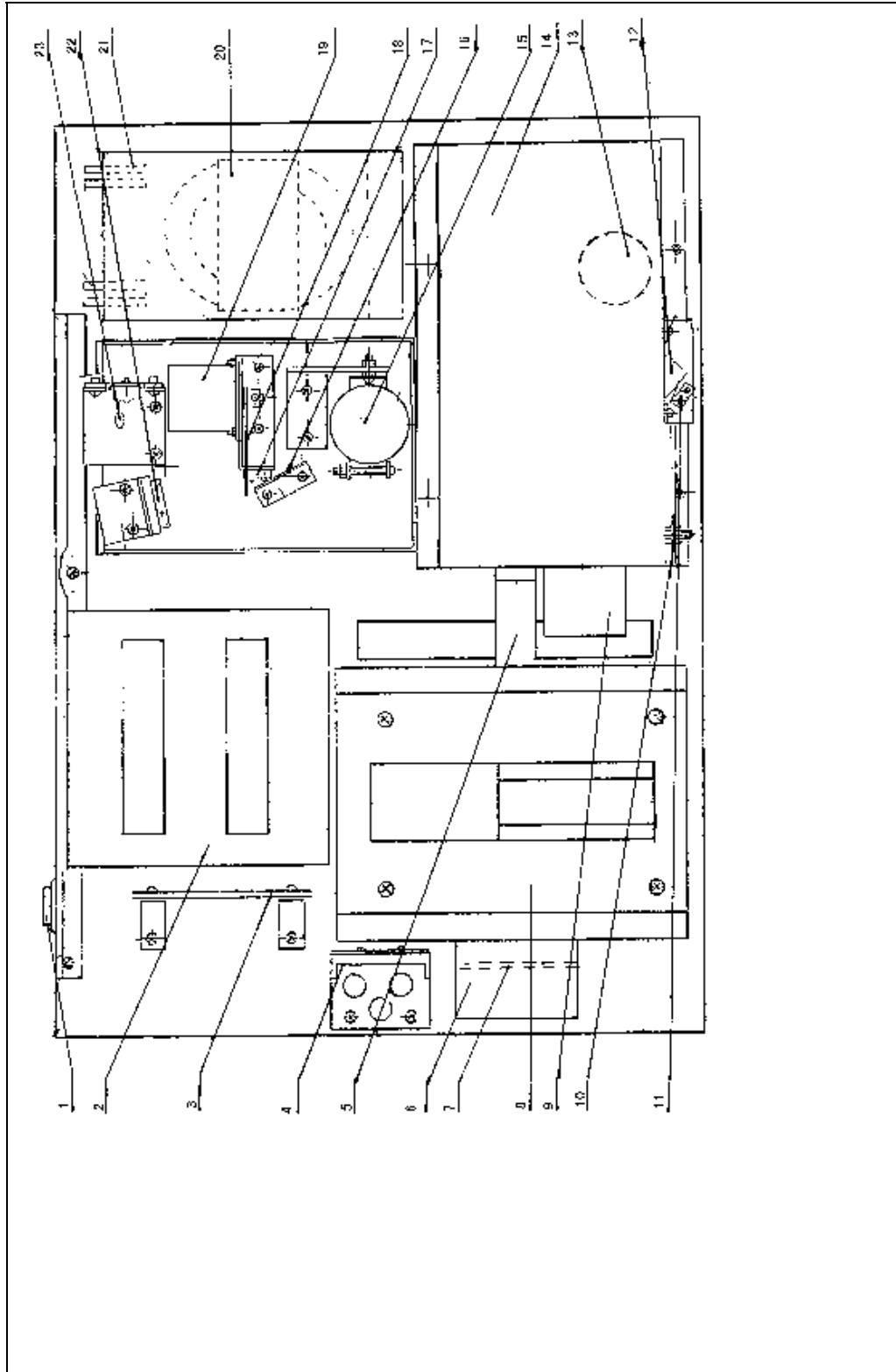
1. *Lamp Compartment*
2. *Tungsten Halogen Lamp*
3. *Mirror*
4. *Monochromator*
5. *Wavelength Position Switch*
6. *Motor(Wavelength Drive)*
7. *Condenser Lens*
8. *Sample Compartment*
9. *Detector*
10. *Amplifier*
11. *Power Supply Section*
12. *Power Switch*
13. *Fuse*
14. *Power Supply Board*
15. *Electric Fan*
16. *Transformer*
17. *Interface Board*
18. *Second Order Filters*
19. *Motor(Second order filter)*



Layout of UNICO 2100

1.4.2 LAYOUT OF UV2100

1. *Lamp Compartment*
2. *Tungsten Halogen Lamp*
3. *Mirror*
4. *Monochromator*
5. *Wavelength Positioning Switch*
6. *Motor (Wavelength Drive)*
7. *Condenser Lens*
8. *Sample Compartment*
9. *Detector*
10. *Amplifier*
11. *Power Supply*
12. *Power Switch*
13. *Fuse*
14. *Power Supply Board*
15. *Electric Fan*
16. *Transformer*
17. *Interface Board*
18. *Second Order Filters*
19. *Deuterium Lamp (D2)*
20. *Motor (Lamp changeover)*
21. *Halogen-Deuterium changeover lever*
22. *Plane mirror*
23. *Switch*
24. *Light blocking shelf*
25. *Power Supply Board (D2 lamp)*
26. *Transformer*
27. *Motor (Second order filters)*
28. *Power Transistor and heat sink*



Layout of UV 2100

1.5 THE SYSTEM

All of the electronic components except the power transistor are installed on four circuit boards.

1. *Main power supply board*
2. *CPU Board*
3. *Deuterium power supply and current regulator board*
4. *Amplifier Board*

1.5.1

The flow block diagrams are shown in Figure _____ and Figure _____.

When the instrument is turned on, the instrument will automatically go through a shelf test and self calibrating procedure as follows:

- A. *Locate instrument baseline, wavelength baseline, filter positioning baseline.*
- B. *Memorize dark current: the instrument is shut down and automatically after the instrument baseline is located and the dark current will be measured.*
- C. *The instrument is again automatically turned on, the wavelength of 546nm will pass through the sample compartment (air is used as a reference) and impinge on the detector. The photodetector will generate photo current. The photo current signal is then amplified and converted from an analog signal to a digital signal. The digital signal is sent to the CPU. The CPU compares the signal received to the memorized dark current. It then determines the proper lamp voltage and system gains so %Transmittance zeroing and 100%T Blanking are achieved. The instrument will display 100%T.*

Whenever you change or select another wavelength to measure you need to blank first with a reference solution, otherwise the instrument will not accept any commands.

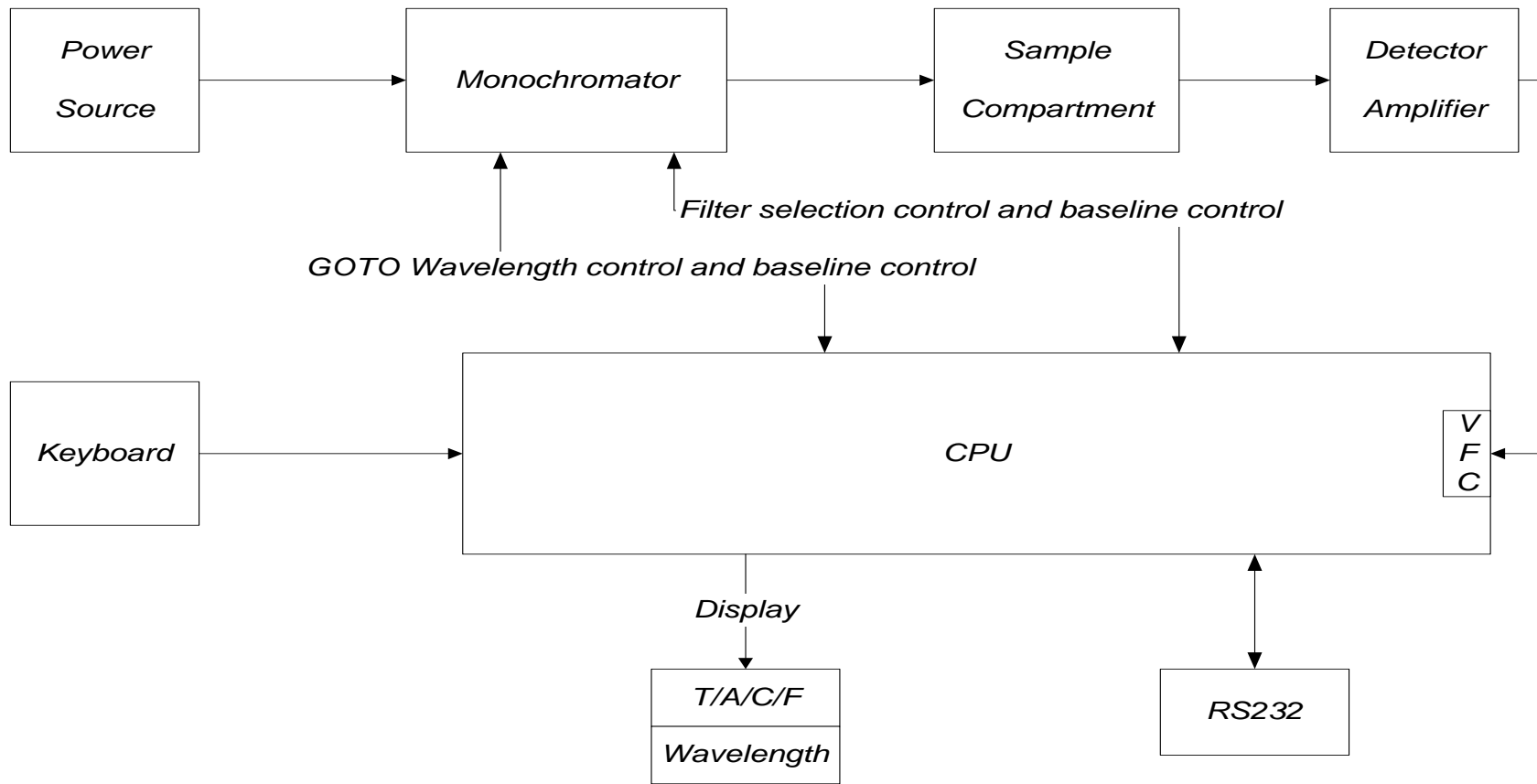


Fig.1.5.1.1 System Block Diagram(2100)

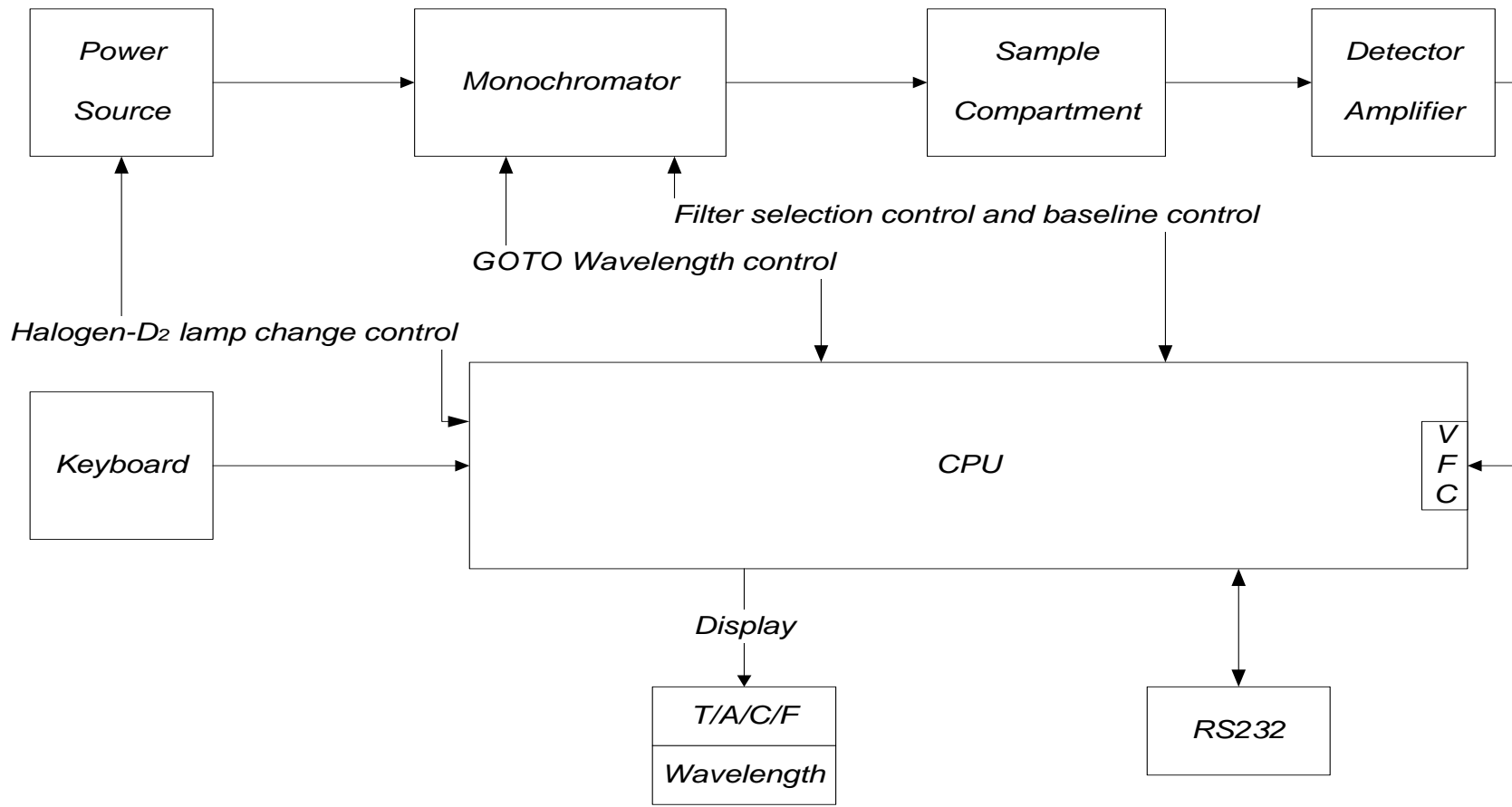


Fig. 1.5.1.2 System Block Diagram(UV2100)

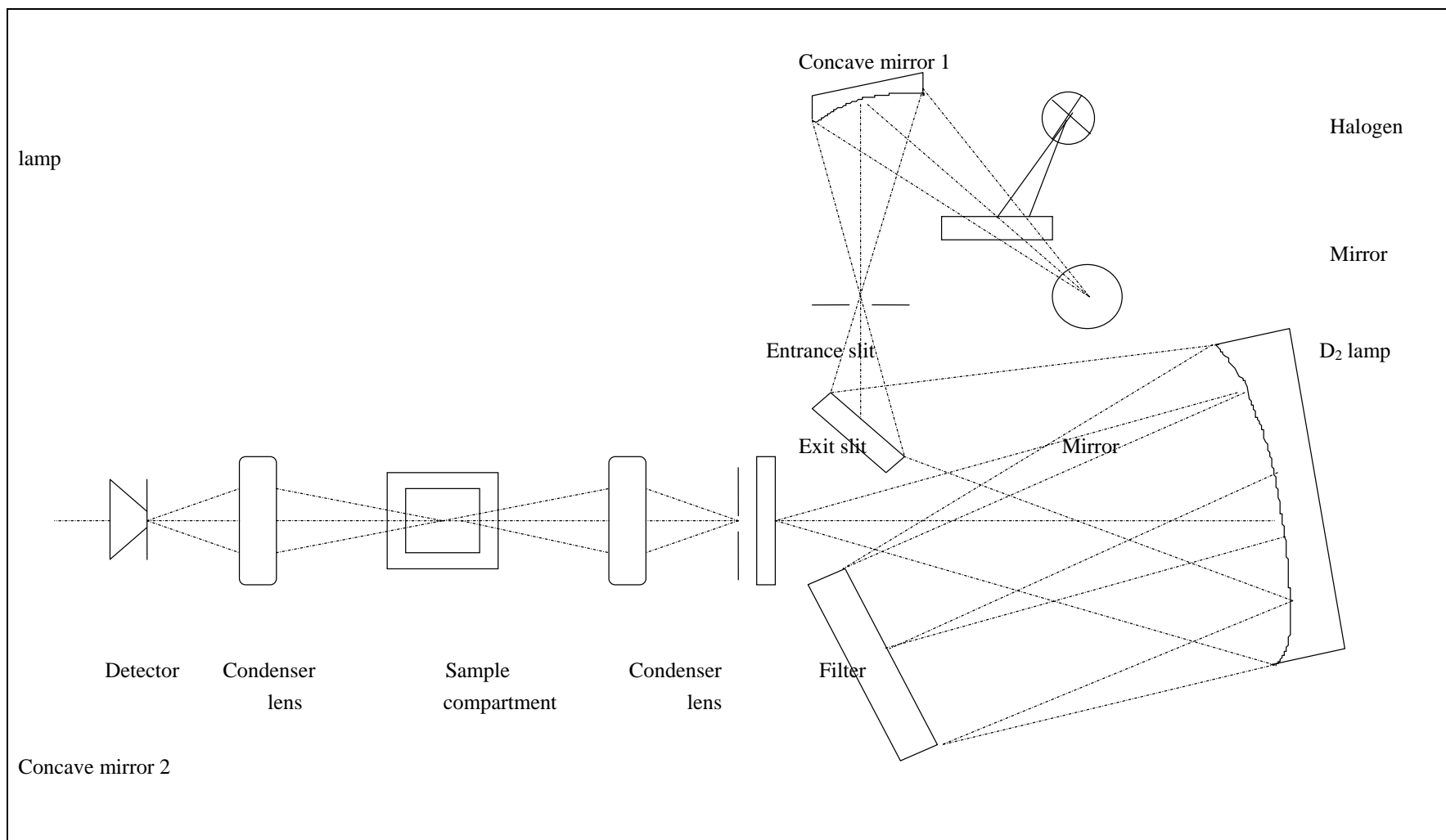
1.5.2 OPTICAL SYSTEM

The optical system schematic diagram for the UNICO 2100 and UV2100 instruments are shown in Figure _____ and Figure _____.

The neutral light coming from the Halogen lamp or the Deuterium lamp is focused by the concave mirror, passed through the entrance slit of the monochromator, reflected by the collimating mirror 2 to the analytical grating. The light is spectrally dispersed by the grating and reflected by the collimating mirror 2 to the exit slit, through a condenser lens continue on through the sample compartment and finally to the photodetector.

1.5.2

Optical System Schematic Diagram (UV2100)

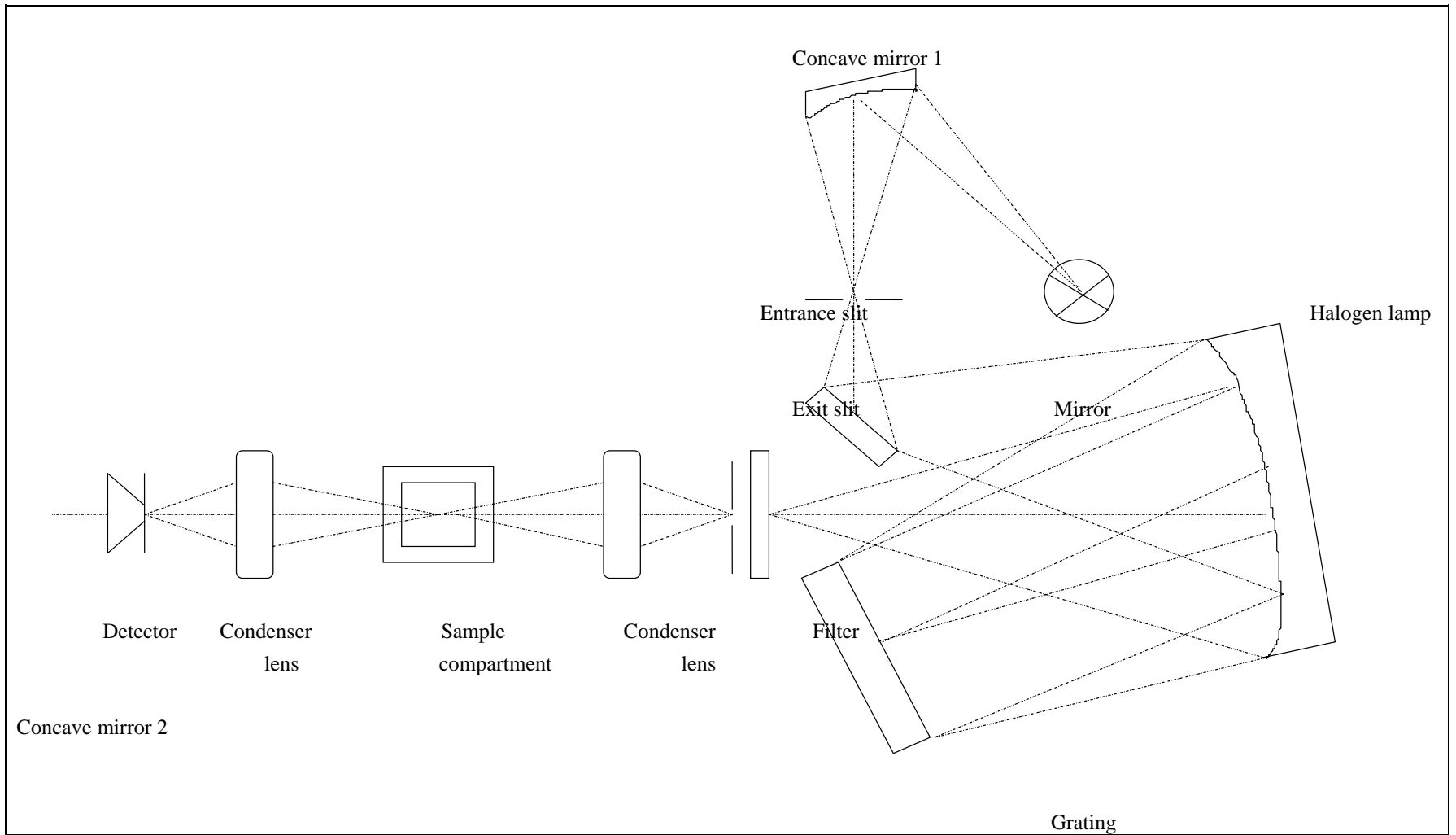




Grating

1.5.2

Optical System Schematic Diagram (2100)



1.5.3 Electronic system

- Fig.1.5.3.1 Power Supply and Control Circuit for Halogen Lamp
- Fig. 1.5.3.1.1 Layout of Power Supply and Control Board for Halogen Lamp Board
- Fig. 1.5.3.2 Power Supply Circuit for D2 Lamp (UV-2100)
- Fig. 1.5.3.2.1 Layout of Power Supply for D2 Board (UV-2100)
- Fig. 1.5.3.3 Amplifier Circuit
- Fig. 1.5.3.3.1 Layout of Amplifier Board
- Fig. 1.5.3.4 Motor Drive and Limit Switch Diagram
- Fig. 1.5.3.4.1 Layout of Motor Drive and Limit Switch Board
- Fig. 1.5.3.5 CPU Circuit
- Fig. 1.5.3.5.1 Layout of CPU Board

Fig.1.5.3.1 Power Supply and Control Circuit for Halogen Lamp

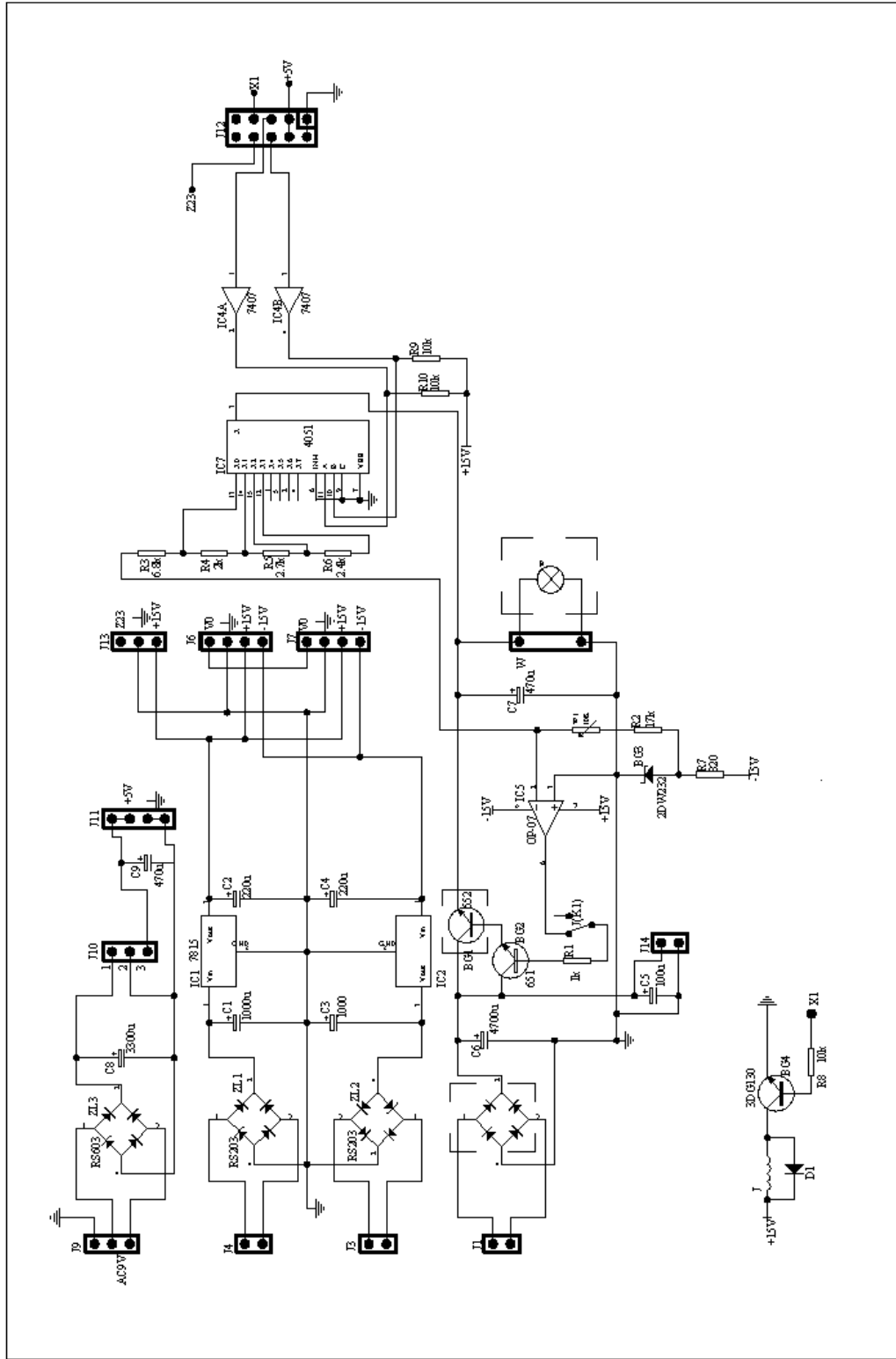


Fig. 1.5.3.1.1 Layout of Power Supply and Control Board for Halogen Lamp Board

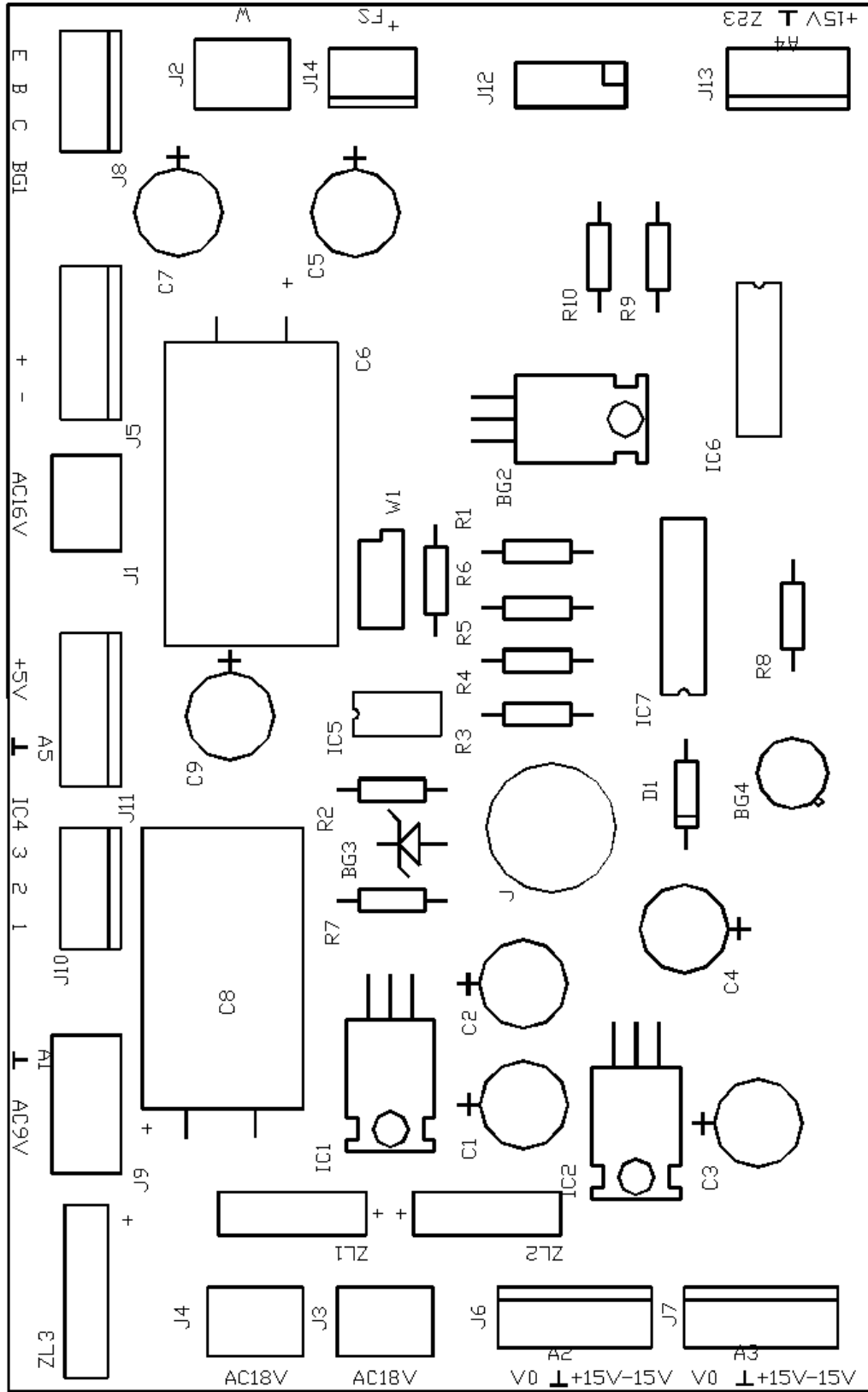


Fig. 1.5.3.2 Power Supply Circuit for D2 Lamp (UV-2100)

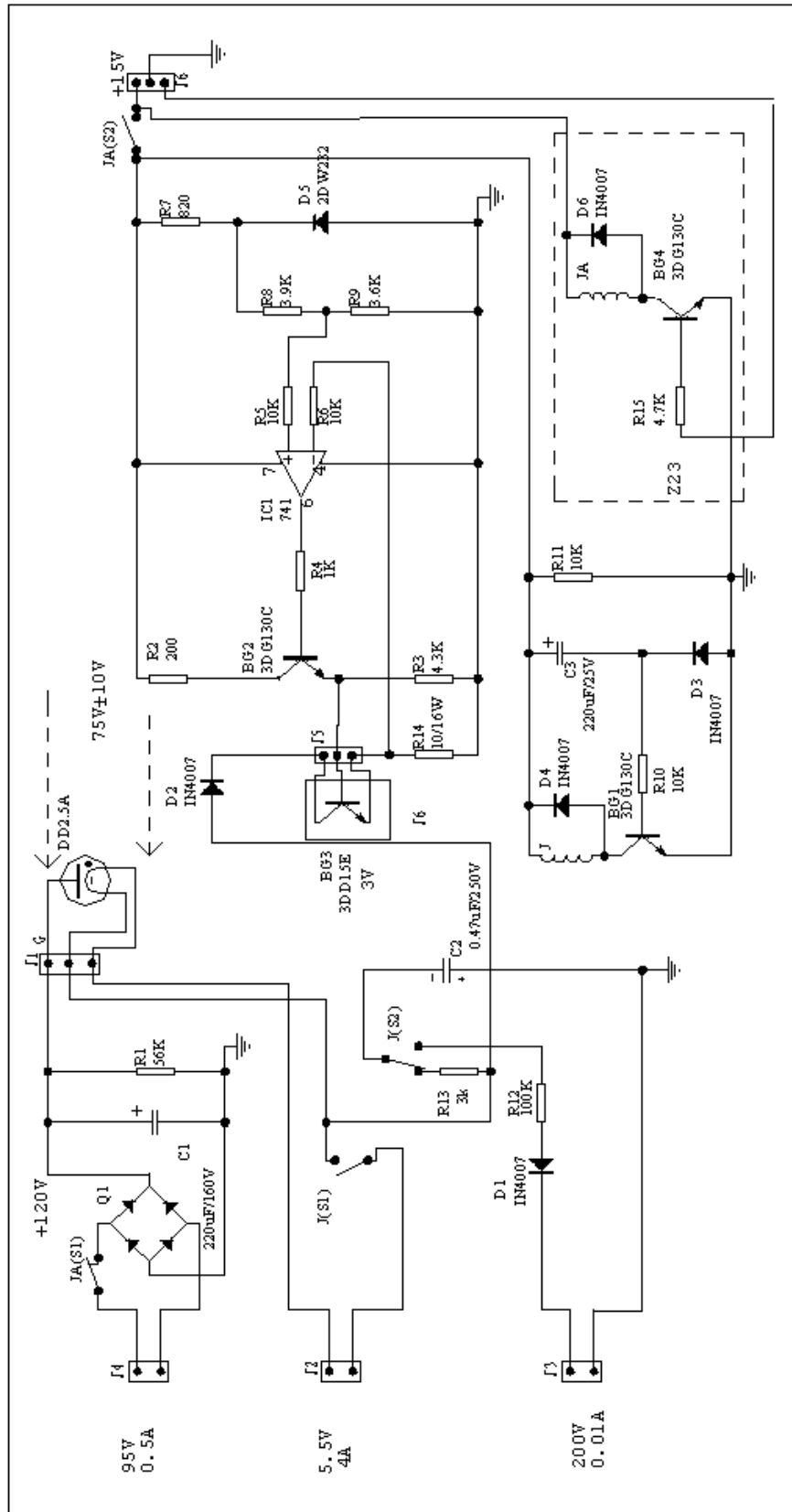


Fig. 1.5.3.2.1 Layout of Power Supply for D2 Board (UV-2100)

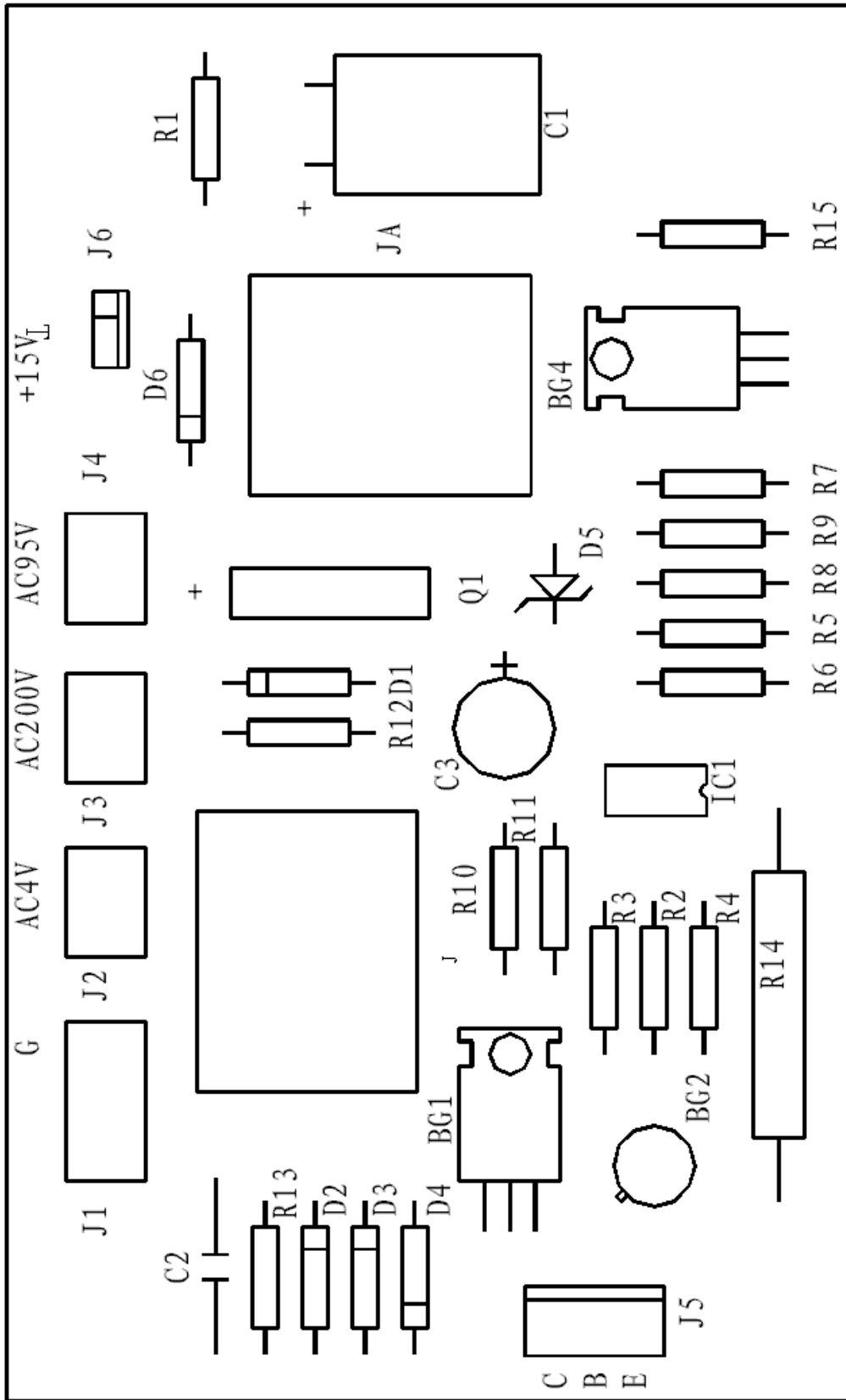


Fig. 1.5.3.3 Amplifier Circuit

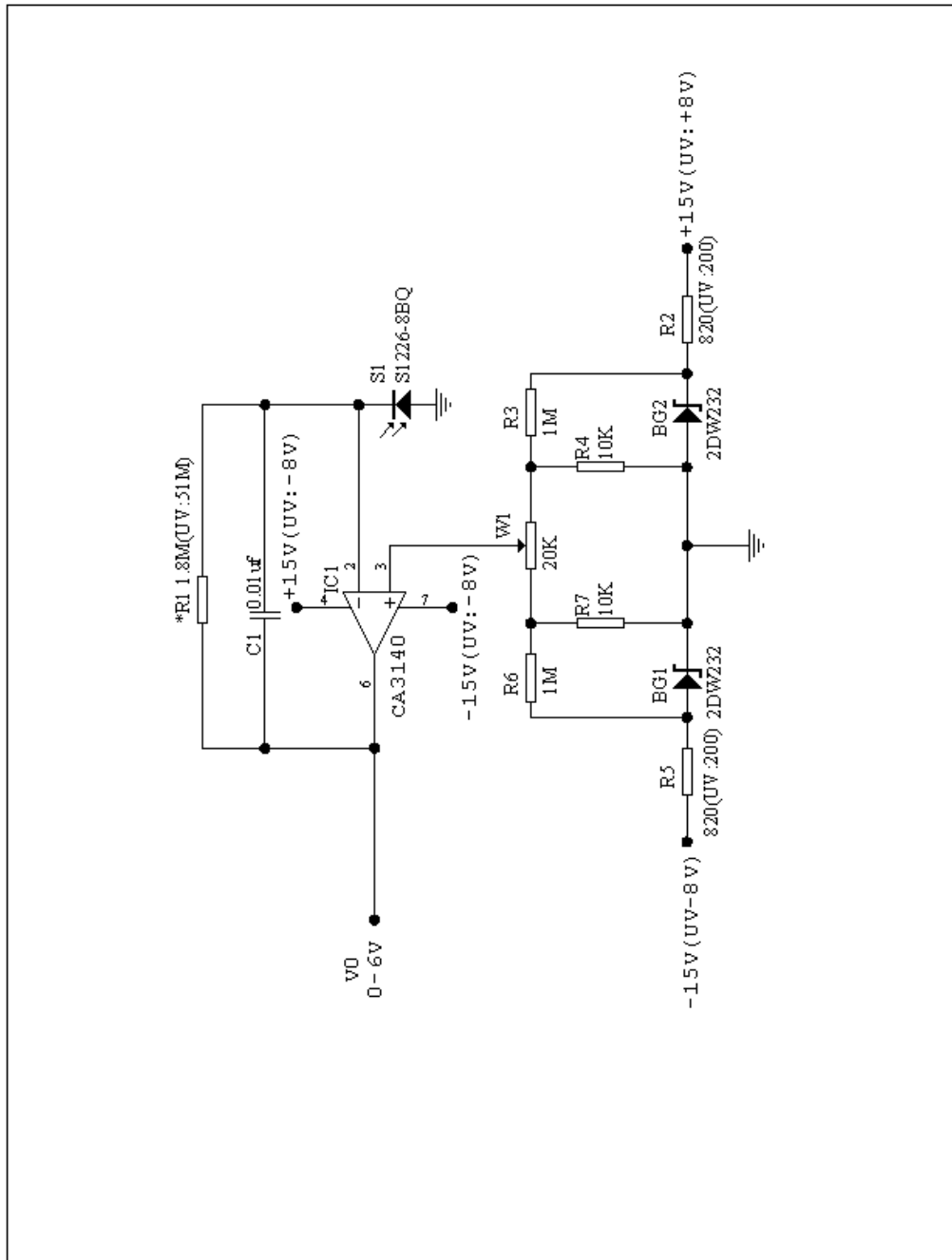


Fig. 1.5.3.3.1 Layout of Amplifier Board

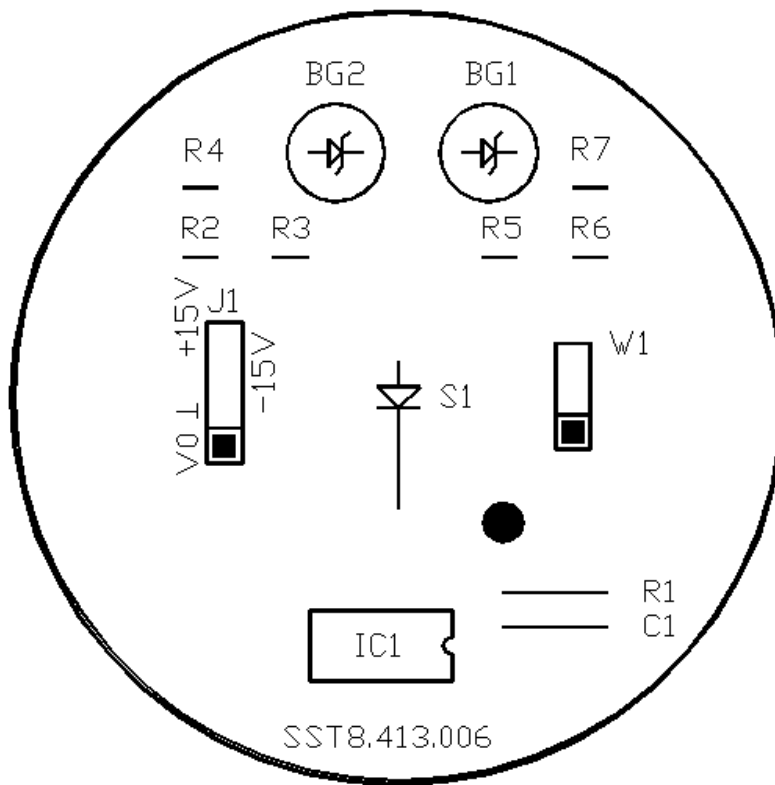


Fig. 1.5.3.4 Motor Drive and Limit Switch Diagram

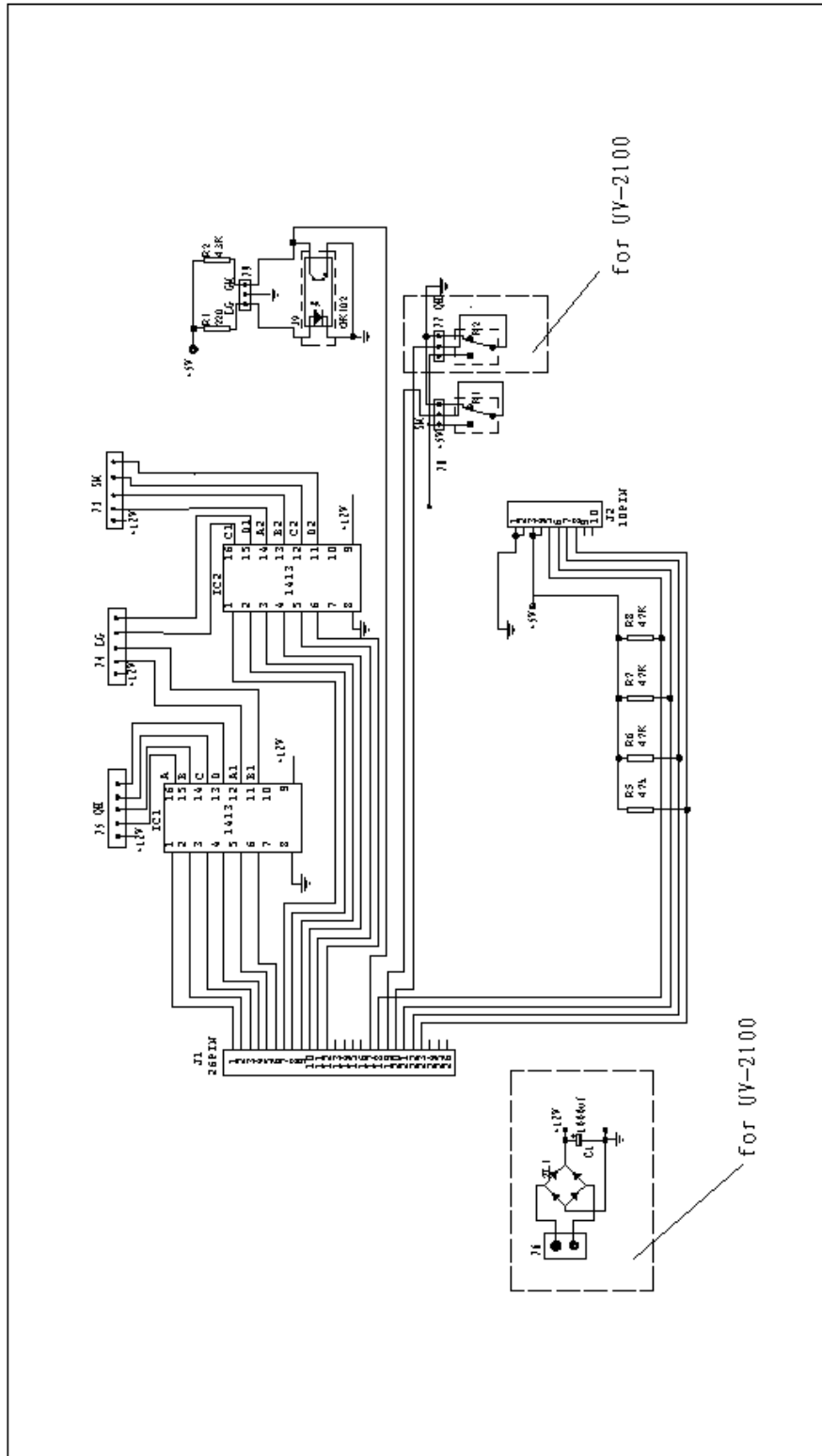


Fig. 1.5.3.4.1 Layout of Motor Drive and Limit Switch Board

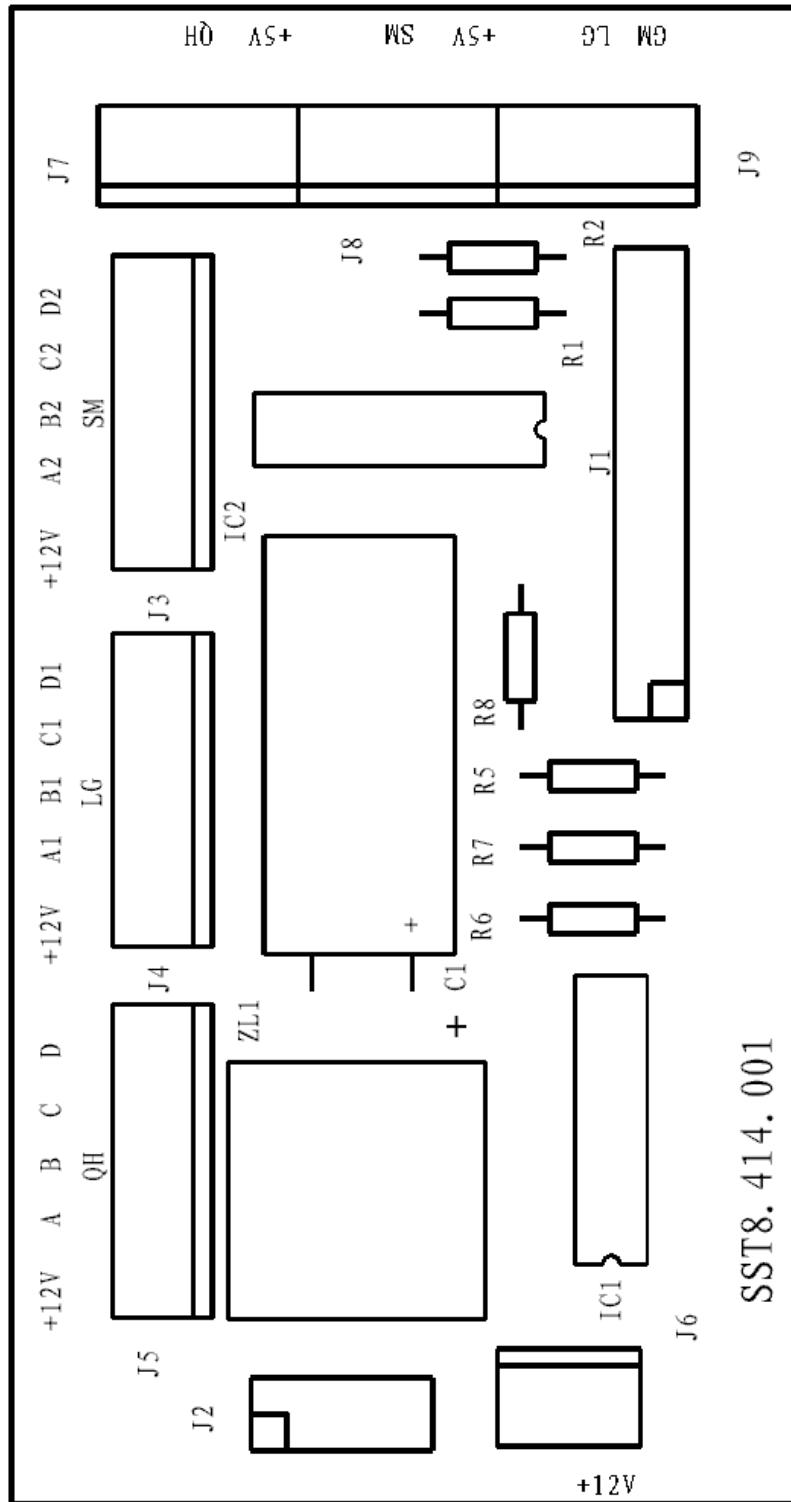


Fig. 1.5.3.5 CPU Circuit

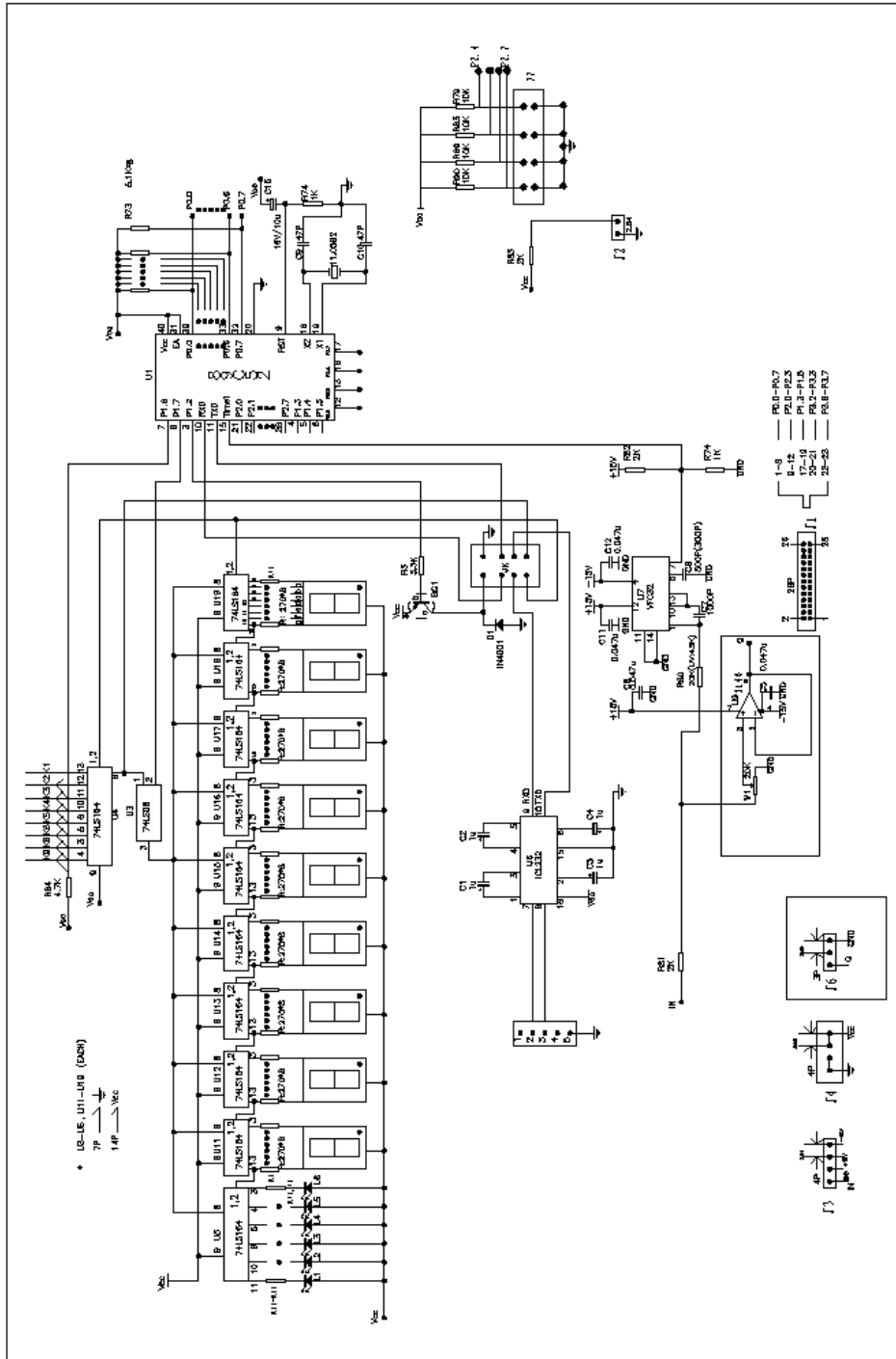
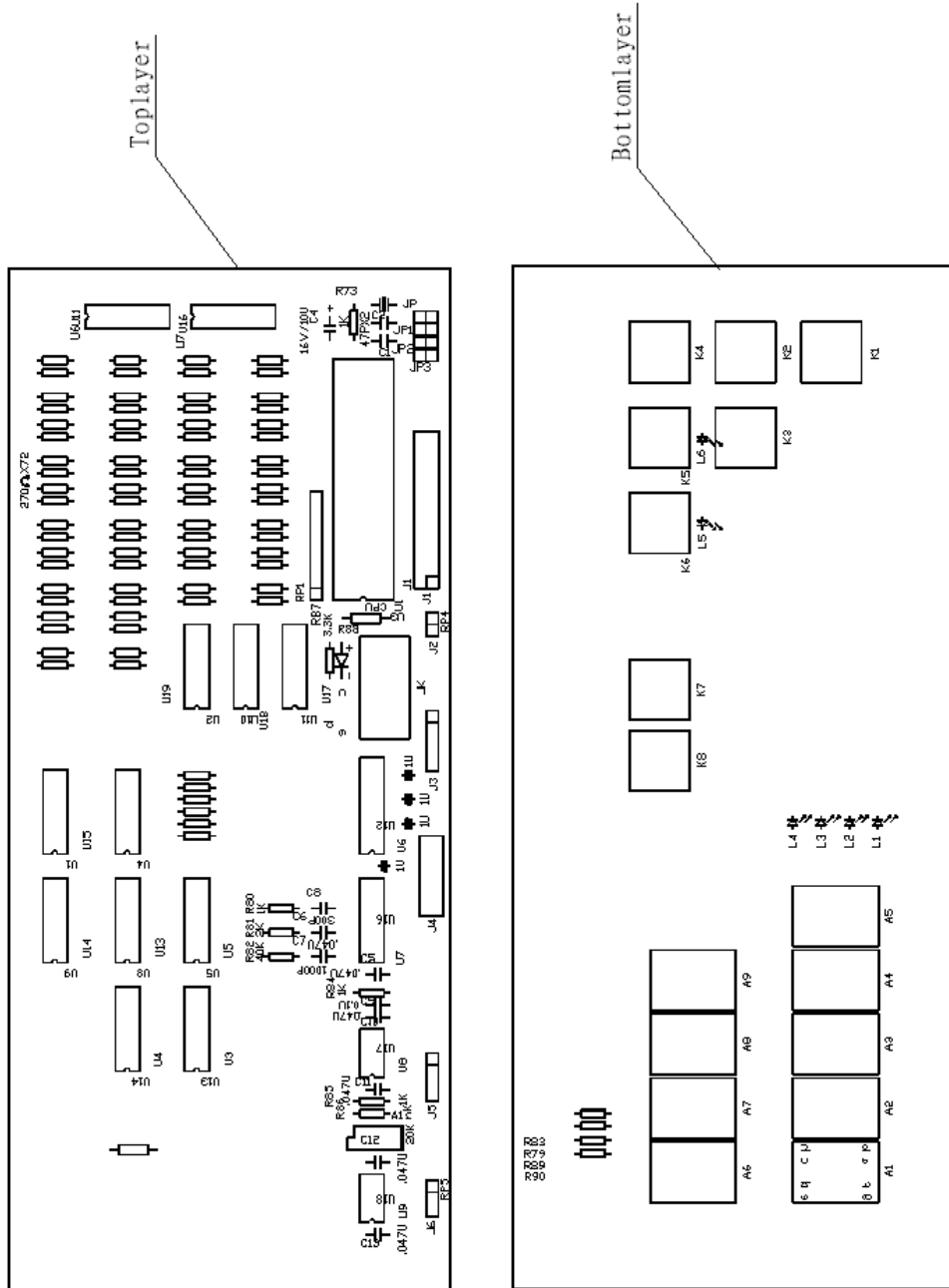


Fig. 1.5.3.5.1 Layout of CPU Board



2.MAINTENANCE

*** Working Environment**

The optimum environment for the instrument is as follows:

Temperature 5°to 35°C

Humidity <85%

Install the instrument in a clean non-vibrational area. Avoid direct strong light and air flow. The instrument will give better performance if the power supply stability is greater than $\pm 10\%$ and the line frequency is greater than $\pm 1\text{Hz}$. Always allow the instrument to warm up for 20 minutes prior to taking any readings.

*** Replacing Tungsten-Halogen lamp and Adjustment**

Replacing Lamp: Refer to the "Operators Manual"

Adjustment: Turn the instrument on and make sure the wavelength is in the visible range (for the UV2100). The light image (rectangular shape) should be focused on the entrance slit of the monochromator as shown in Figure _____. If not, loosen the locking screws and move the lamp in the desired direction until the image is centered on the entrance slit. Then tighten the locking screws firmly.

*** Replacing the Deuterium lamp.**

Replacing the D2 Lamp--refer to the "Operators Manual"

Adjustment--adjustment is not necessary--the lamp is prealigned.

The light spot of the Deuterium lamp should be focused on the entrance slit of the monochromator as shown in Figure _____. If the spot is not on the slit, loosen and adjust the screws of the D2 lamp bracket to bring the spot to the center of the entrance slit. Tighten the screws firmly.

MAINTENANCE

*Follow these instructions carefully to avoid injury to yourself or damage to the UNICO 2100 series spectrophotometer! **IT IS RECOMMENDED YOU CONTACT AN AUTHORIZED SERVICE REPRESENTATIVE TO PERFORM ANY MAINTENANCE OR REPAIRS ON THE UNICO SPECTROPHOTOMETERS.***

TO REPLACE HALOGEN LAMP

1. *TURN OFF AND UNPLUG THE INSTRUMENT.*
2. *Remove the four screws on the sides of the spectrophotometer.*
3. *Remove the cuvette holder rod by unscrewing the rod counterclockwise.*
4. *Very carefully remove the cover of the instrument and place in front of the instrument, taking care not to unplug any of the connections inside the instrument.*
5. *Loosen but do not remove the two top screws on the lamp base.*
6. *Remove the lamp from the ceramic base.*
7. *Carefully replace the new lamp.*
8. *Retighten the two screws on the lamp base.*

CAUTION: *Do not handle Halogen lamp with bare fingers. Use a piece of tissue or cloth when handling the lamp. The oil from your fingers can cause the lamp to burn out prematurely!!!*

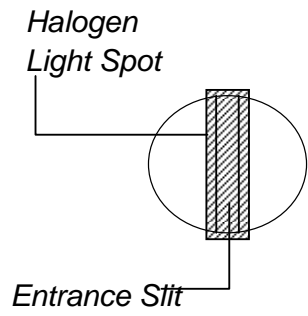
9. *Carefully replace instrument cover and replace screws.*

TO REPLACE DEUTERIUM LAMP

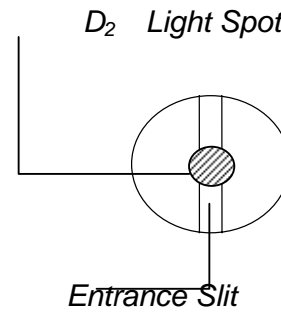
1. *TURN OFF AND UNPLUG THE INSTRUMENT.*
2. *Remove the four screws on the sides of the spectrophotometer.*
3. *Remove the cuvette holder rod by unscrewing the rod counterclockwise.*
4. *Very carefully remove the cover of the instrument and place in front of the instrument, taking care not to unplug any of the connections inside the instrument.*
5. *Remove the metal plate covering the Deuterium Lamp by removing the two screws from the rear of the plate.*
6. *Remove the lamp from the instrument and replace with a new lamp.*
7. *Reverse the order from lines 5 through line 2.*

CAUTION: THE LAMP MAY BE HOT—TAKE PRECAUTIONS TO PREVENT BURNS FROM THE LAMP.

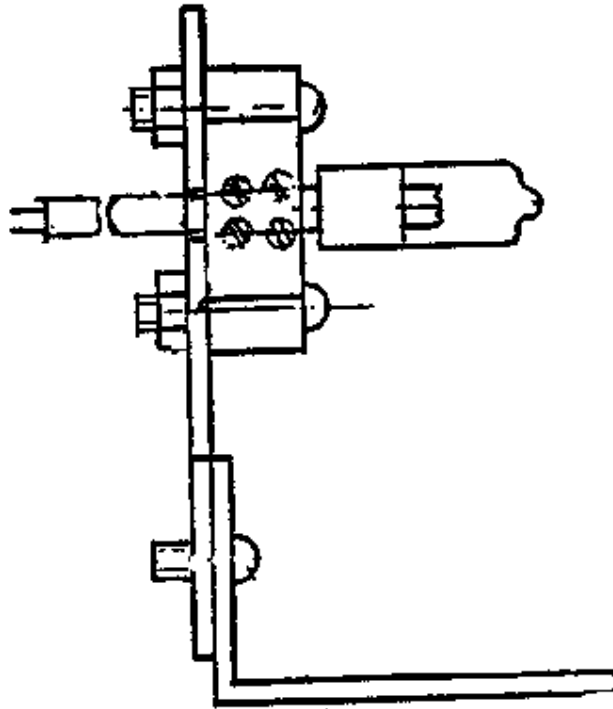
The Correct Position of Light Spot on Entrance Slit

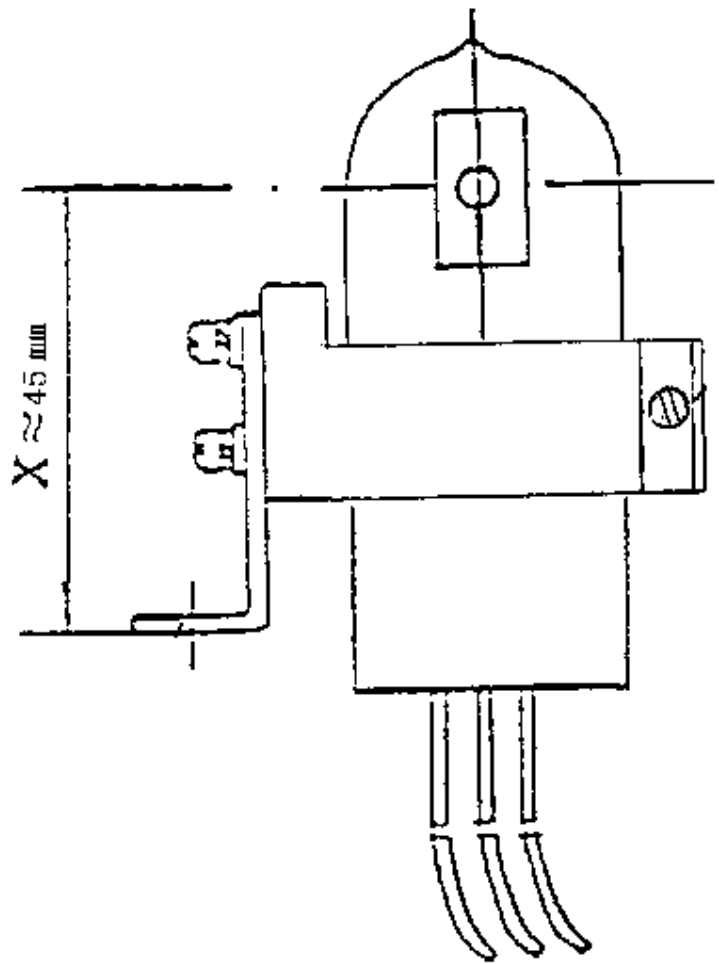


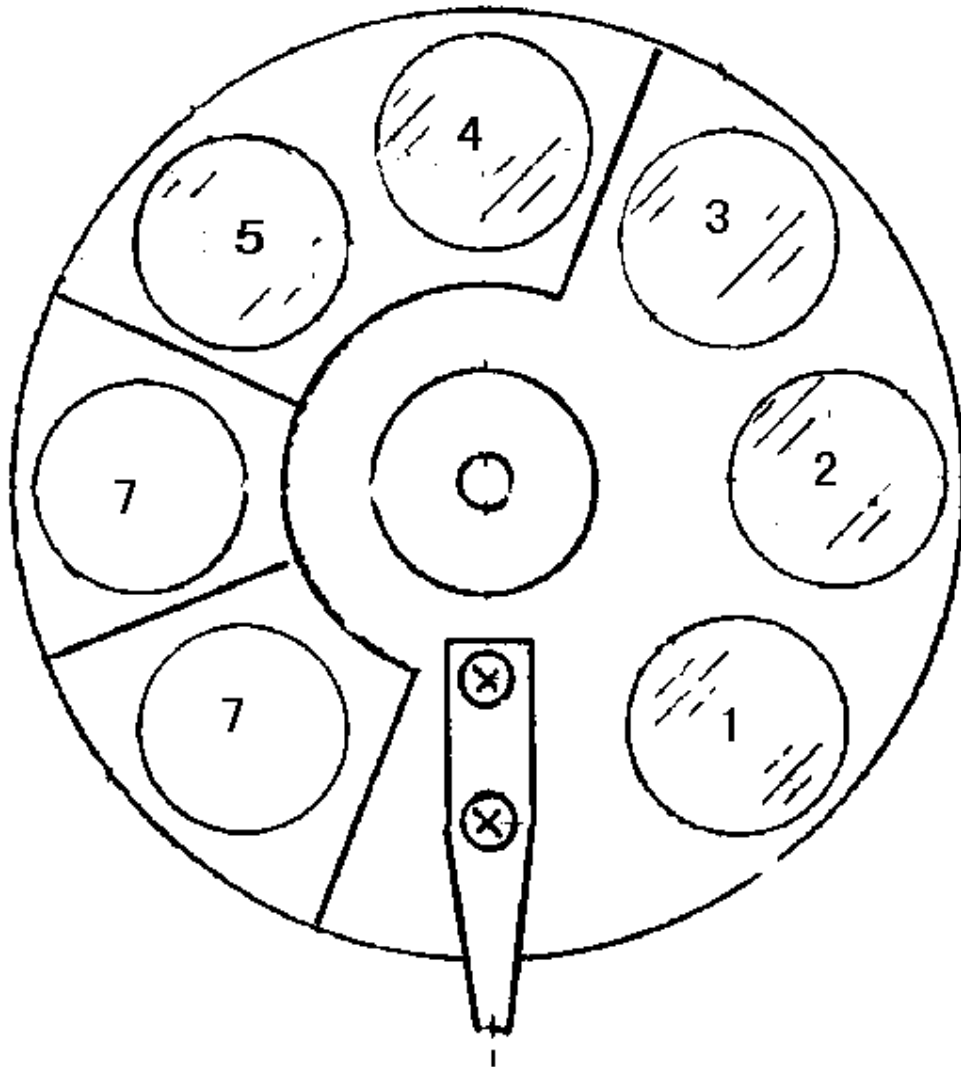
Halogen Lamp



Deuterium Lamp







	Filter	Wavelength
1	BLACK	335~370nm
2	VIOLET	380~450nm
3	NAUTRAL	450~550nm
4	ORANG	550~750nm
5	DEEP RED	750~1000nm
6	Vacant	
7	Vacant	

MAINTENANCE

* WAVELENGTH CALIBRATION

* Wavelength calibration check

Refer to the "Operator's Manual"

* Wavelength Calibration:

The Wavelength accuracy is $\pm 2\text{nm}$. If the wavelength is off, it can be adjusted. A JMP calibration terminal can be found on the bottom right corner of the CPU board. There are 8 pins in four rows (2 pins in each row). The following definitions are made in the system.

For Row B, C, D

If 2 pins in a row are connected, the result is defined as "1".

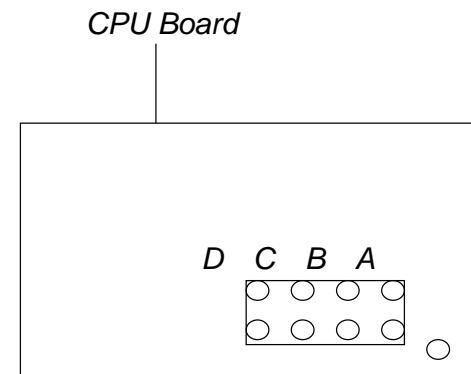
If 2 pins in a row are not connected the result is defined as "0".

For Row A (Very right row)

If the 2 pins are connected the result is defined as "-".

If the 2 pins are not connected the result is defined as "+".

D	C	B	A	Results
0	0	0	-	0nm
0	0	1	-	-1nm
0	1	0	-	-2nm
0	1	1	-	-3nm
1	0	0	-	-4nm
1	0	1	-	-5nm
1	1	0	-	-6nm
1	1	1	-	-7nm
0	0	0	+	0nm
0	0	1	+	+1nm
0	1	0	+	+2nm
0	1	1	+	+3nm
1	0	0	+	+4nm
1	0	1	+	+5nm
1	1	0	+	+6nm
1	1	1	+	+7nm

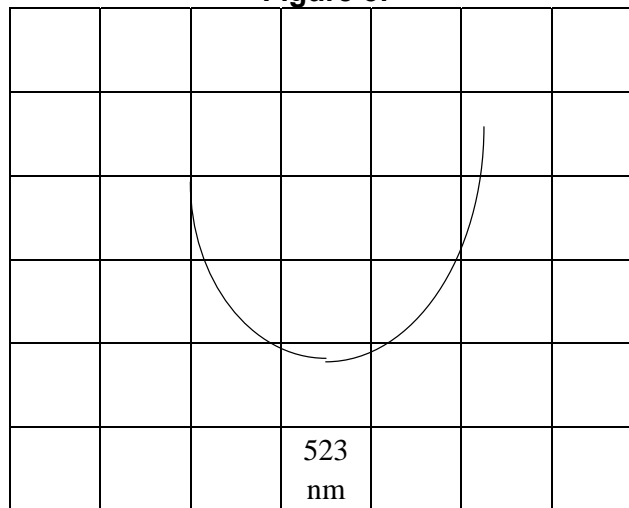


WAVELENGTH CALIBRATION CHECK

As usual the UNICO 2100 series spectrophotometer retains its wavelength calibration indefinitely. However if the instrument receives a severe shock or is abused, use the following methods to check wavelength calibration.

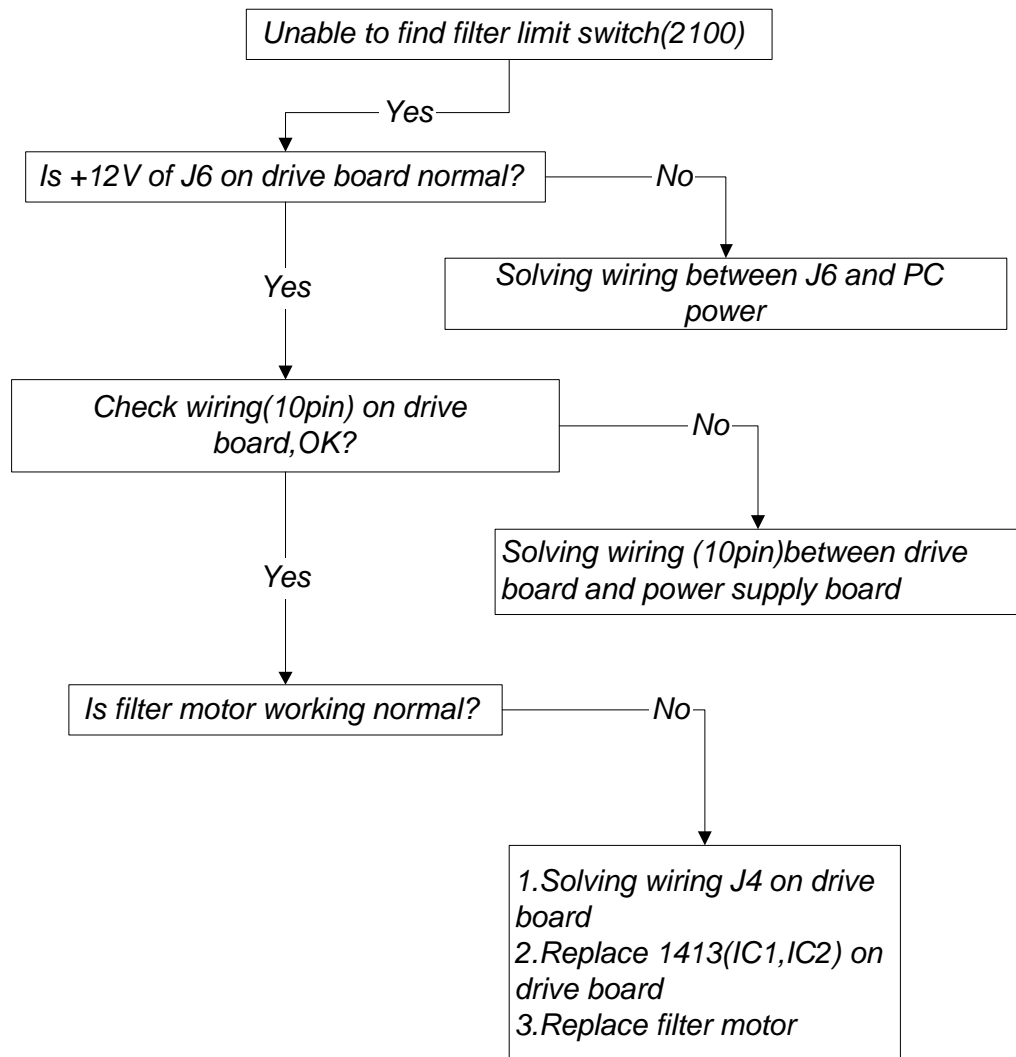
In the Didymium filter method, the filter has two special absorbance peaks at 529nm and 808nm. When the instrument is calibrated properly you will find minimum Transmittance (maximum absorbance) at the range of 529nm (or 808nm) ± 2 nm. Note that the specific transmittance values are not important as you are only looking for the wavelength where minimum transmittance (maximum absorbance) occurs.

1. Turn instrument on and allow it to warm up for 15 minutes.
2. Select the %Transmittance operating mode.
3. Set the wavelength to 519nm.
4. Insert the cuvette filled with distilled water in position 1 in the cuvette holder.
5. Insert the didymium filter in position 2 in the cuvette holder.
6. Place the cuvette holder into the sample compartment, put the distilled water cuvette into the light path and set 100%T.
7. Place the didymium filter in the light path and record the %T reading on the digital display.
8. Repeat steps 3 through 7 to measure separately the wavelength of the points between 519nm and 539nm.
9. Looking for the minimum Transmittance along this record, the minimum %Transmittance should be obtained between 526nm and 532nm. The wavelength accuracy of the 2100 spectrophotometer is ± 2 nm.

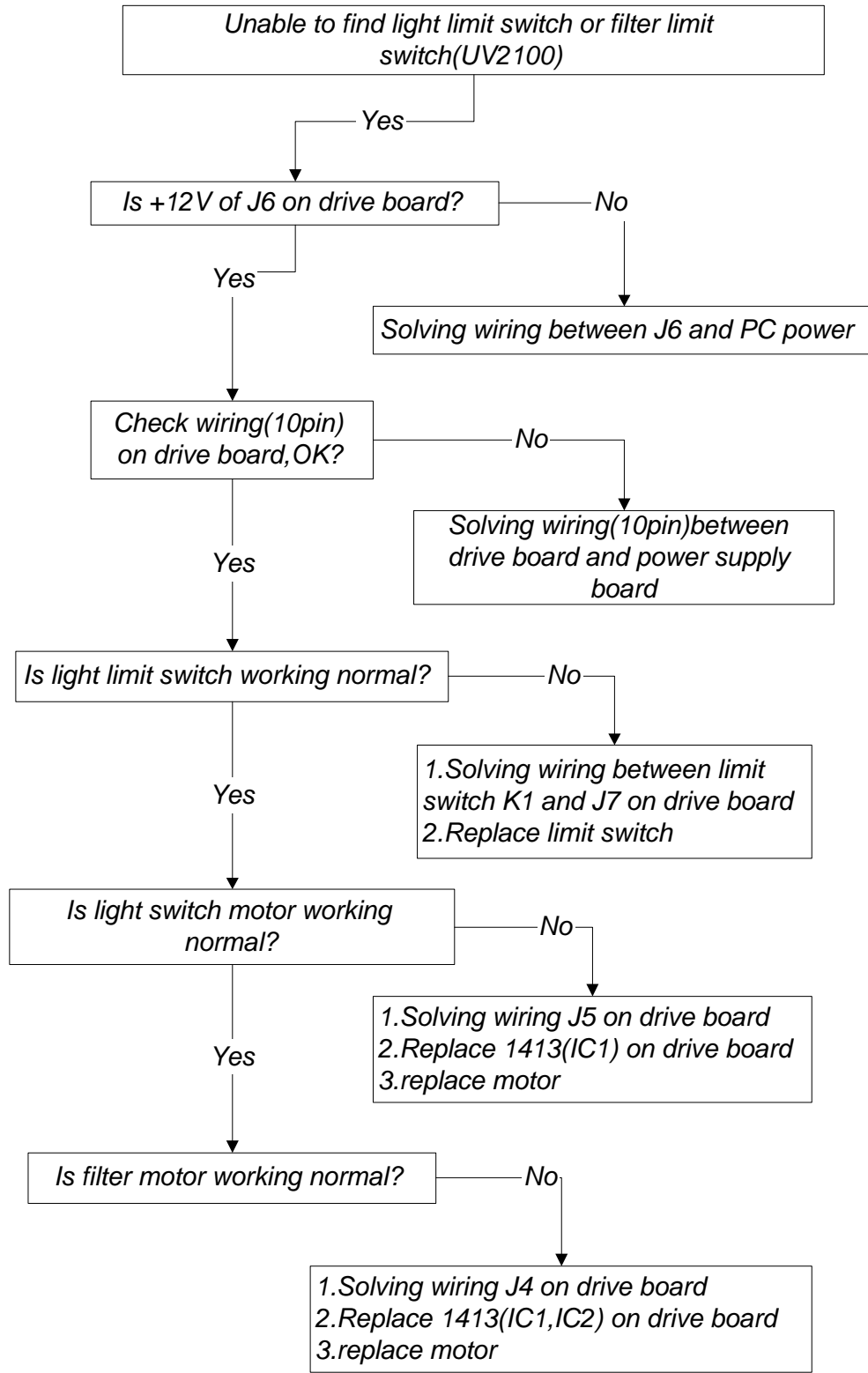
Figure 5:**Check The Wavelength Calibration with Didymium Filter**

TROUBLESHOOTING

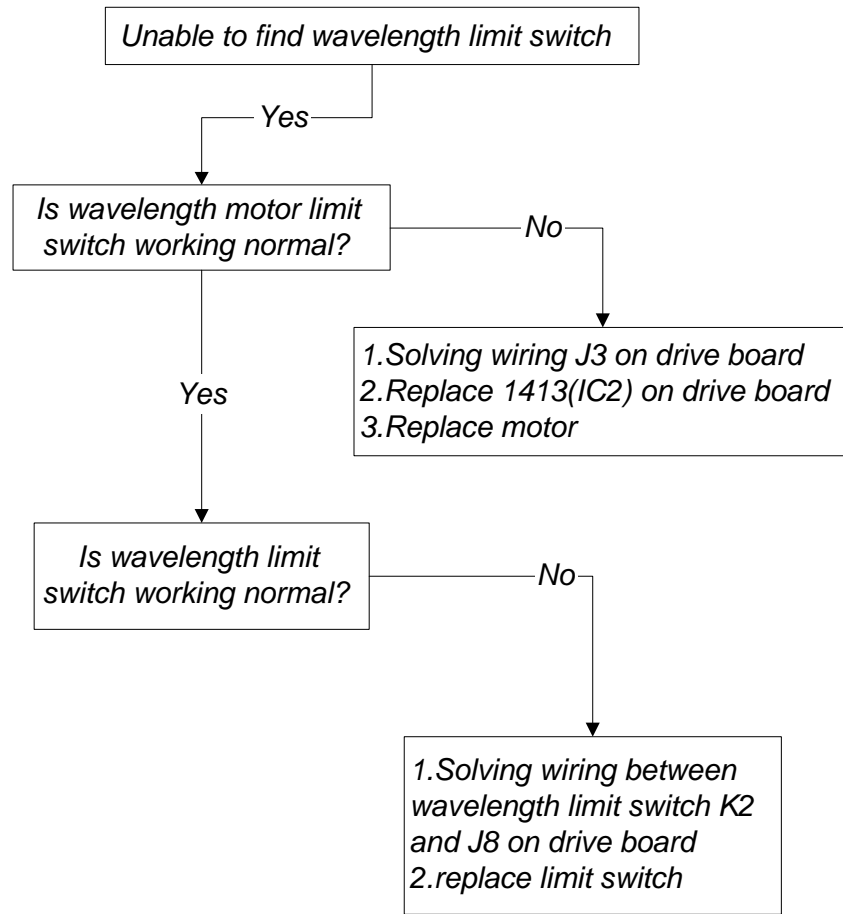
TROUBLESHOOTING #1



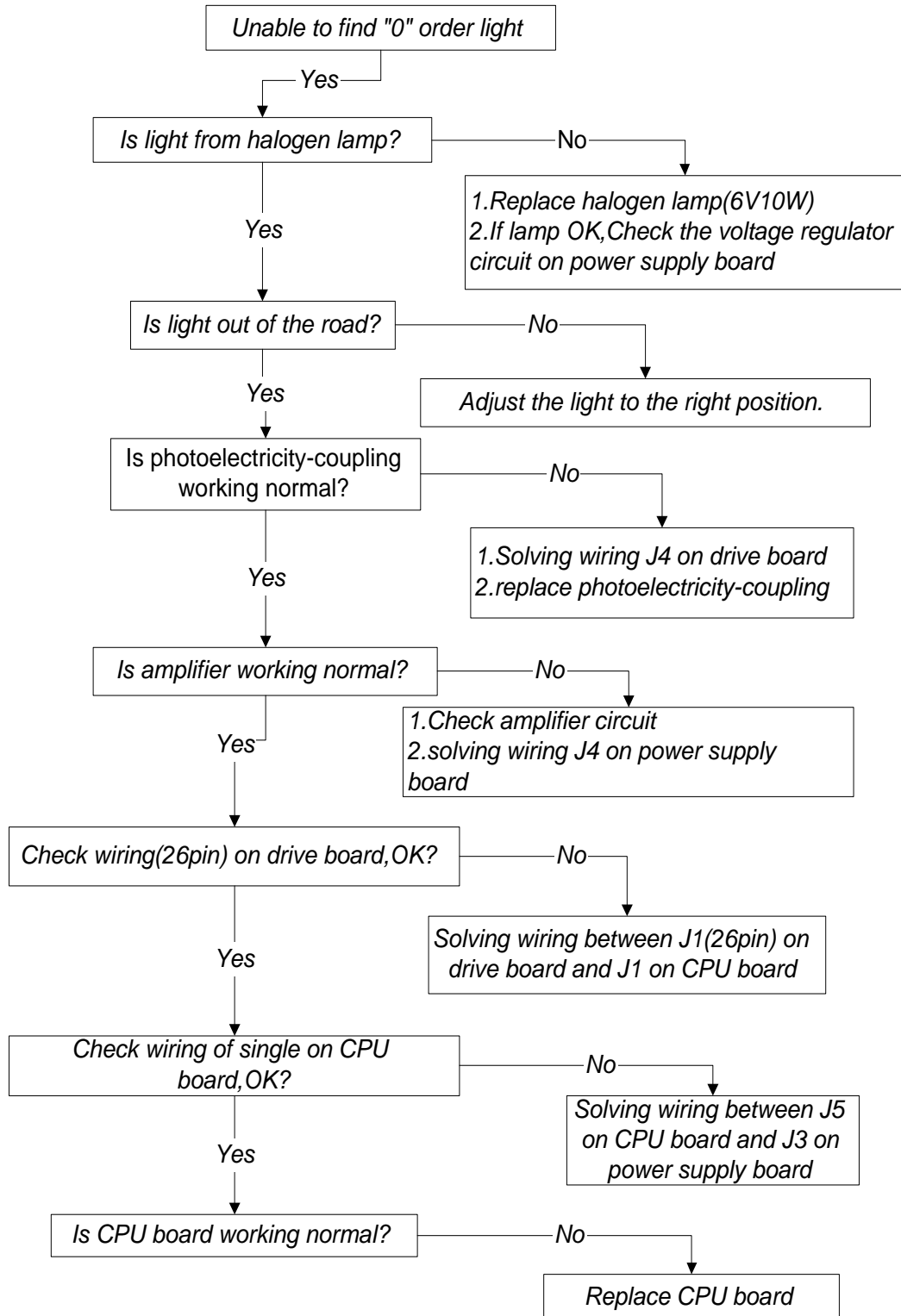
TROUBLESHOOTING #2



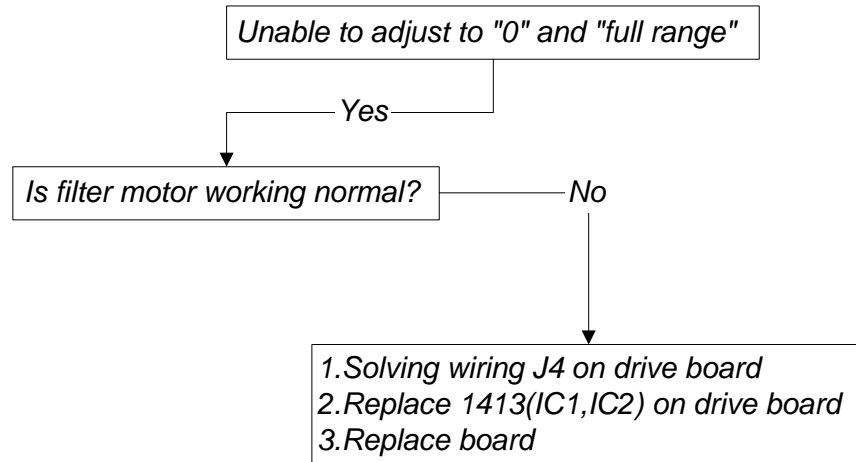
TROUBLESHOOTING #3



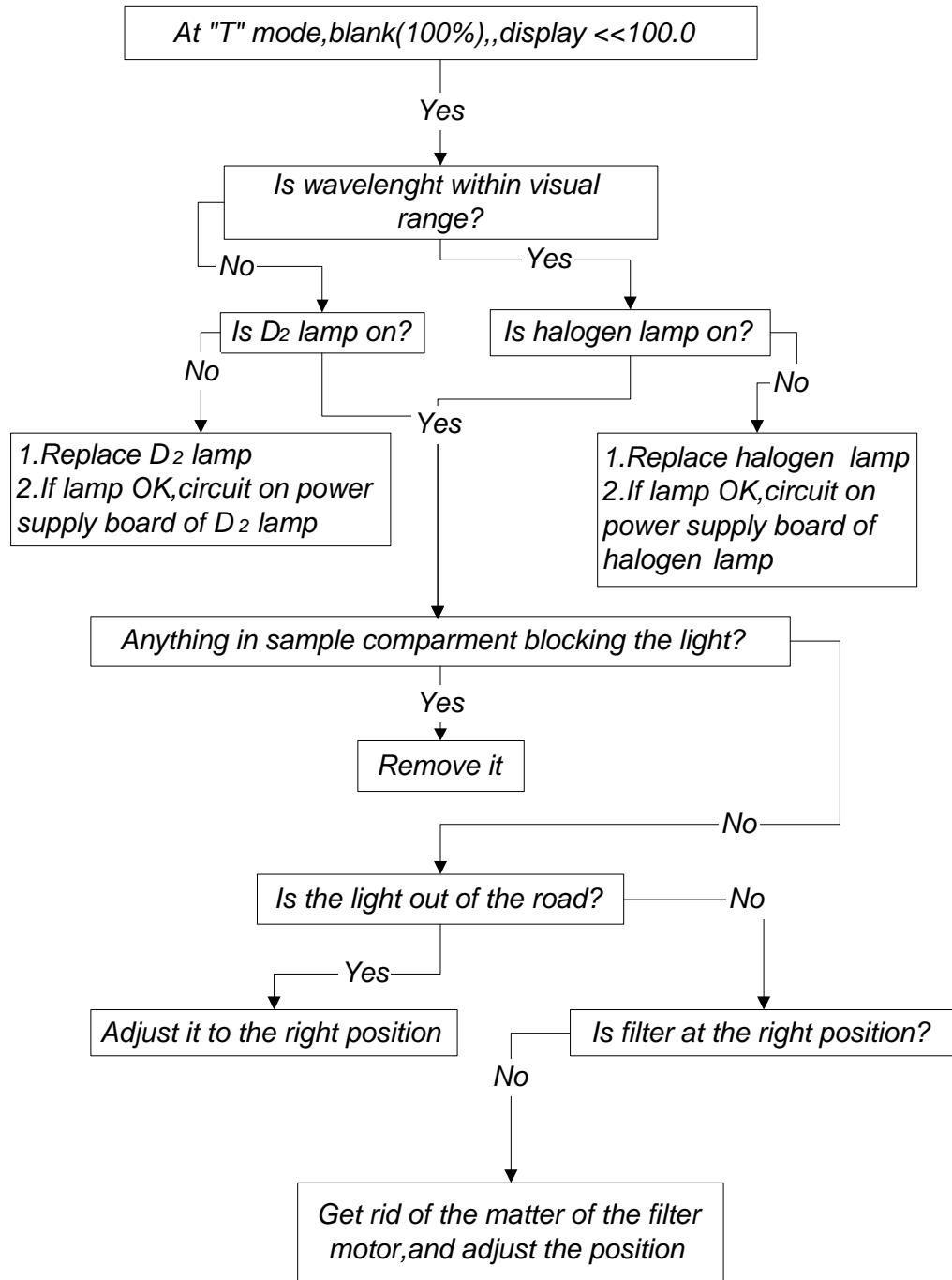
TROUBLESHOOTING #4



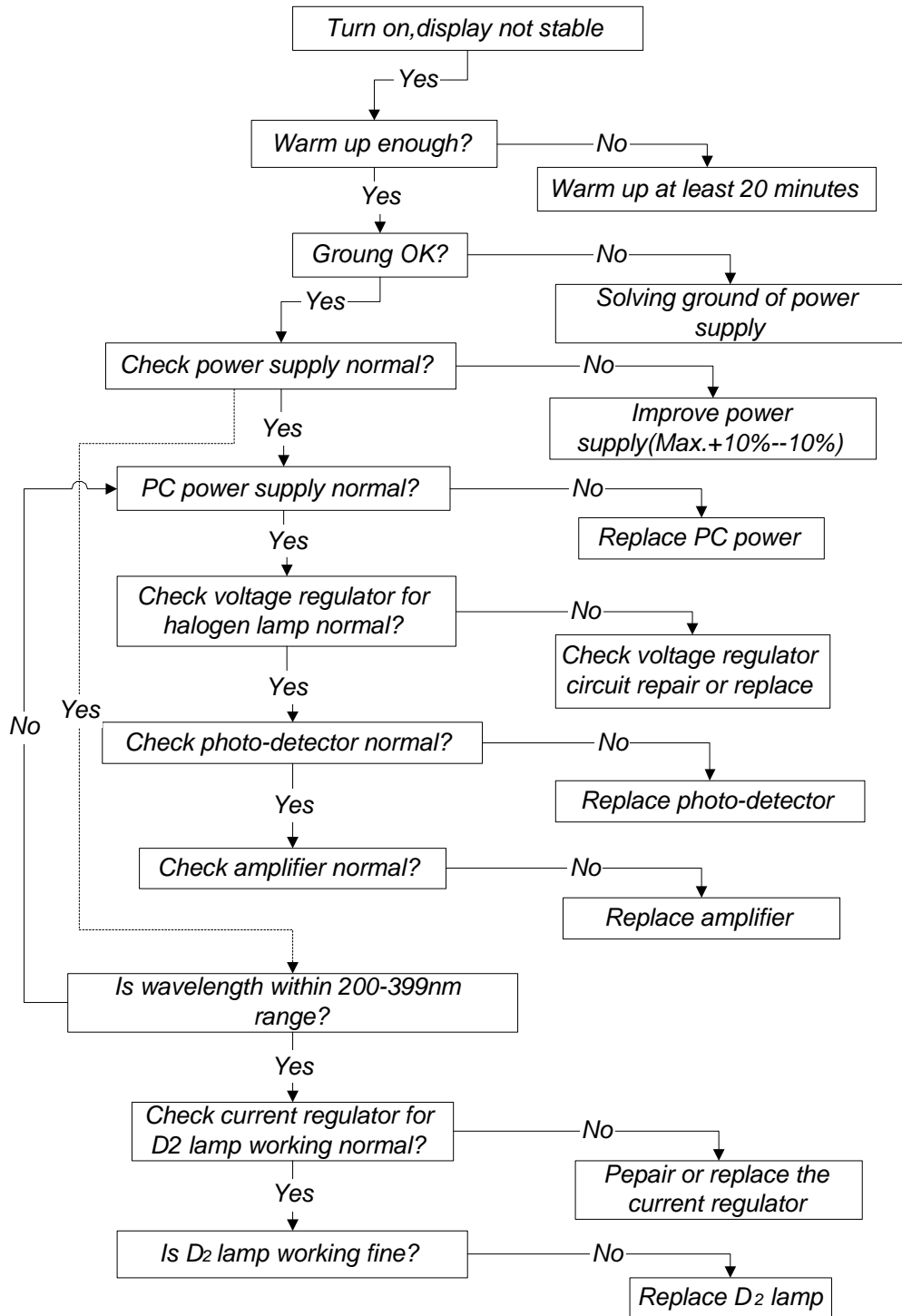
TROUBLESHOOTING #5



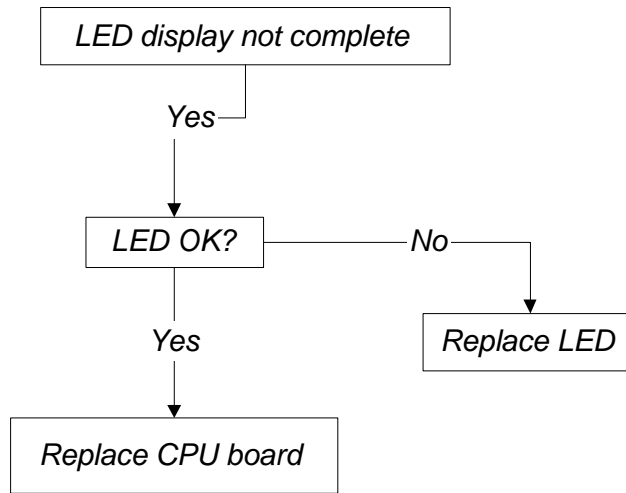
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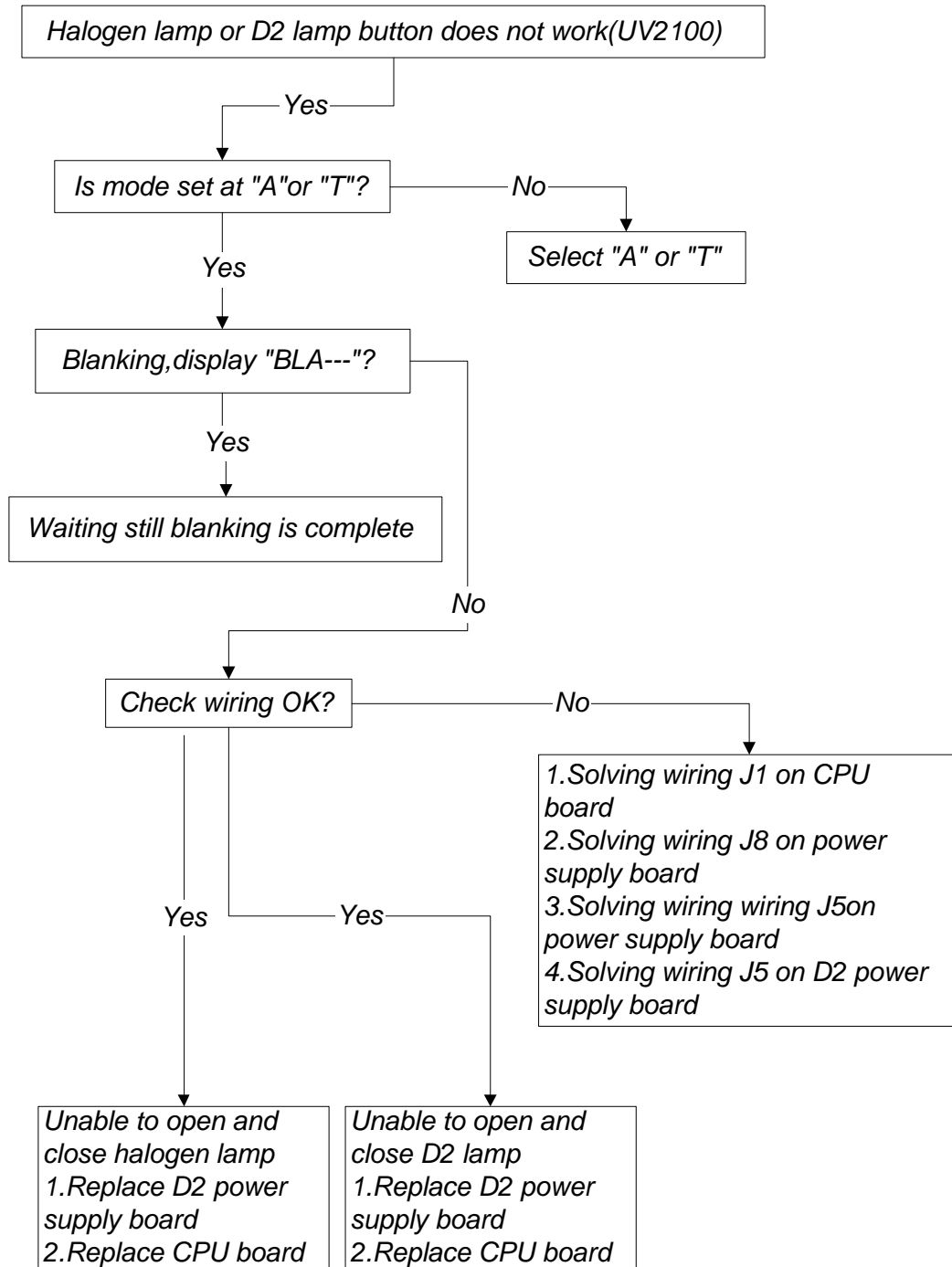
TROUBLESHOOTING #7



TROUBLESHOOTING #8



TROUBLESHOOTING #9



TROUBLESHOOTING #10

