206-94376C

INSTRUCTION MANUAL

User's System Guide

SPECTROPHOTOMETER

UV-2401PC (P/N 206-82201/206-55670)

UV-2501PC (P/N 206-82251/206-55674)

Read the instruction manual thoroughly before you use the product. Keep this instruction manual with care so that you can use it any time you need it.

SHIMADZU CORPORATION
ANALYTICAL INSTRUMENTS DIVISION
KYOTO, JAPAN

本装置では、光源室内の重水素ランプの固定を補助するためのバンドは使用しておりません。したがいまして、取扱説明書に記載されております重水素ランプ交換時のバンドの開閉は必要ありません。

The lock band of D2 lamp in the light source compartment isn't used in this instrument. So it isn't necessary to release the spring of the lock band in light source replacement procedure .

Precautions for Safe Operation

UV-2401/2501 PC is a UV-Visible Spectrophotometer.

To operate the unit safety, strictly observe the following precautions.
It is dangerous not to comply with the following points.

1. Do not use the unit for any purpose other than the above-mentioned types of analysis.
2. Follow the procedures described in the user's manual.
3. Observe all warnings and cautions.
4. Do not disassemble or modify the unit without the express approval of authoried Shimadzu Representative. Failing to do so may lead dangerous situation or damage of the unit.
5. Do not use at the method not to indicate in the instruction manual. Failing to do so may lead dangerous situation or damage of the unit.
6. For internal repair of the product, contact your Shimadzu Representative.

MEANING OF CAUTION SIGNS

WARNING **indicates a potentially hazardous situation which, if not avoided, could result in death, serious injury or moderate injury.**

CAUTION **indicates a potentially hazardous situation which, if not avoided, may result in minor injury, or may result in machine damage.**

NOTE **is used to emphasize essential information.**

MEANING OF SAFETY SYMBOLS

Voltage is dangerously high.

HOT SURFACE

Warning labels indicated on the equipment

WARNING

HOT SURFACE

Risk of burn. Before replacing the lamp, set the power switch off and cool down the lamp.

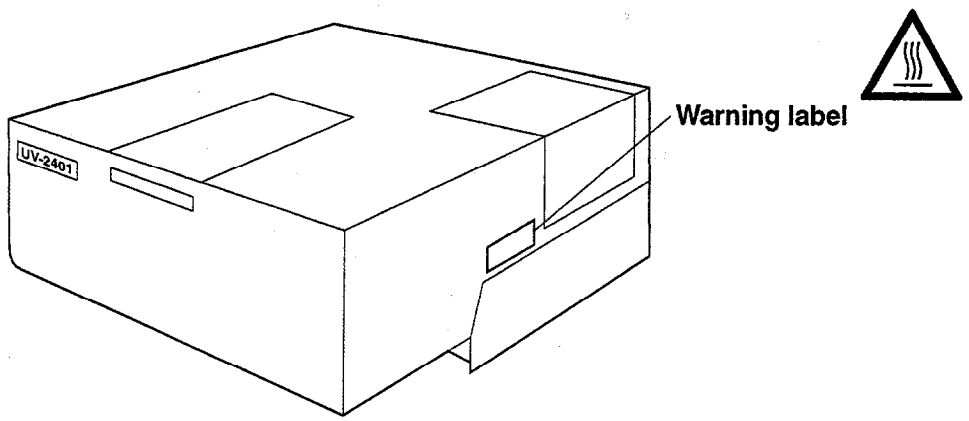

Fig. 1 UV-2401PC

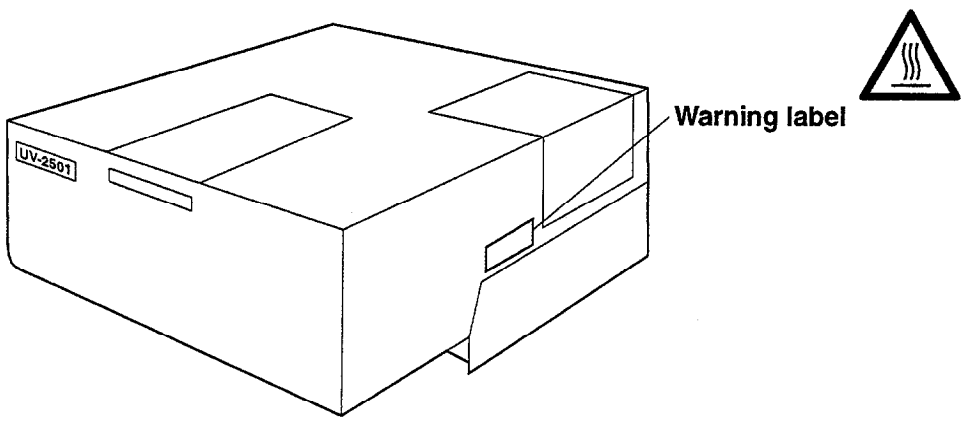

Fig. 2 UV-2501PC

WARNING

RISK OF ELECTRIC SHOCK

Before replacing the fuses or changing the power source voltage, read Instruction Manual.

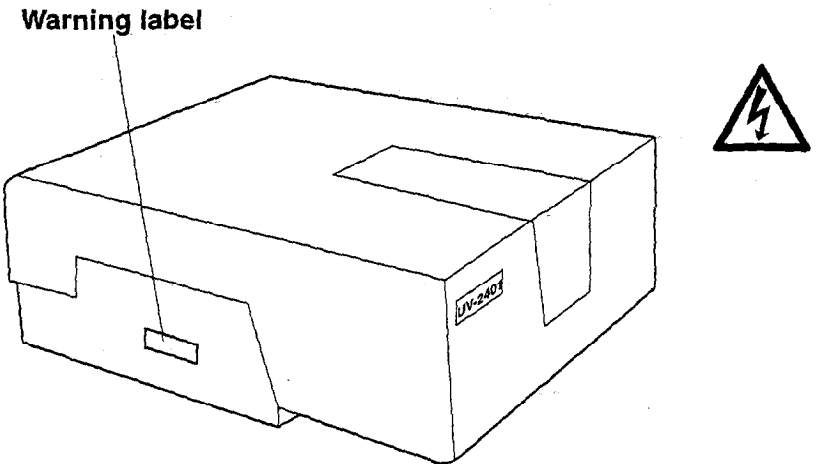

Fig. 3 UV-2401PC

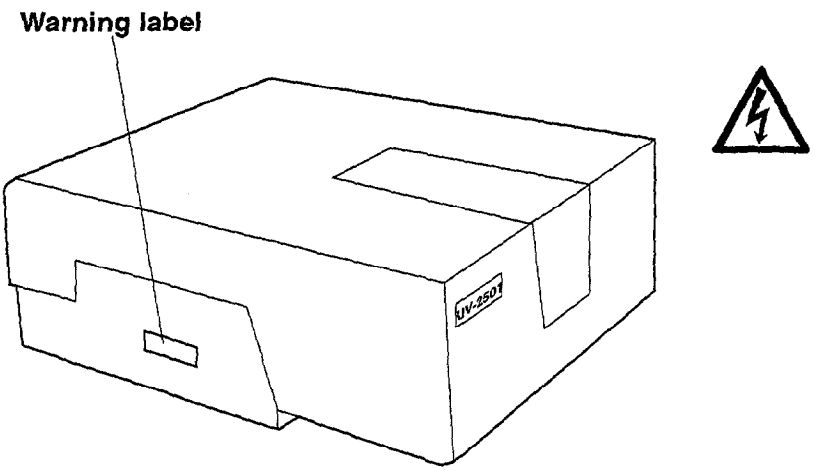

Fig. 4 UV-2501PC

Symbols indicated on the unit

Symbol	Contens
	Indicates current (a. c.).
	Indicates protective conductor terminal.
	Indicates power ON.
	Indicates power OFF.

Regulatory Information

For Europe :

The product complies with the requiremnts of the EMC Directive 89/336/EEC, and Low Voltage Directive 73/23/EEC.

Product name	: UV-Visible Spectrophotometer
Model name	: UV-2401PC UV-2501PC
Manufacturer	: SHIMADZU CORPORATION ANALYTICAL INSTRUMENTS DIVISION
Address	: 1, NISHINOKYO-KUWABARACHO, NAKAGYO-KU, KYOTO, 604-8511, JAPAN
Authorized Representative in EU	: SHIMADZU Deutschland GmbH
Address	: Albert-Hahn-Strasse 6-10, D-47269 Dusisburg, F, R, Germany

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Chapter 1 Inspection

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1.1 Inspection

The UVPC Spectrophotometer System consists of the photometer unit and its accessories, including separate computer and software. Upon unpacking, confirm that all parts and standard accessories listed below are included in your shipment.

Table 1.1 Shipment Inspection Items

No.	Description	Qty	Part Number	Remarks
1	Photometer (P/N)	1	UV-2401 206-86430-91 UV-2401 206-86430-92 UV-2501 206-86433-91 UV-2501 206-86433-92	for 100V, 120V, 220V, 240V for 230V for 100V, 120V, 220V, 240V for 230V
2	UVPC S/W	1	206-60570-08	
	S/W floppy disk 3.5"	1	204-59819	
	Communication cable	1	200-86408	
3	100-120V sets 220-240V sets	1	206-82202-91 206-82203-91	
	Fuses for Photometer	2	072-01652-23 or 072-01652-21	5A for 100-120V 3.15A for 220-240V
	AC Power cable	1	071-60814-01 or 071-60814-05	for 100-120V adaptable to UL and CSA regulation for 220-240V adaptable to VDE regulation
	Grounding adapter	1	071-60803-01	for 100-120V
4	Instruction Manual	1	206-94374	Operation Guide
5	Instruction Manual	1	206-94376	User's System Guide

Chapter 2 Installation

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2.1 Hardware installation

This chapter provides step-by-step instructions for setting up your UV-2401/2501 PC instrument and the software that comes with it.

2.1.1 Site requirements

An installation site measuring at least:

(Width) 1120 mm (44")
(Depth) 710 mm (28")
(Height) 520 mm (20.5")

should be made available for the UVPC Spectrophotometer system. This assumes a configuration comprising the photometer unit and host computer (IBM PC/A, PS/2 or 100% compatible). For individual component dimensions, refer to the appropriate specifications.

2.1.2 Environmental requirements

NOTE Any deterioration in function or mechanical damage that occurs as the result of use in a location that differs from these condications will not be covered by the warranty, even if they occur within the warranty period. Please take care in advance.

- Room temperature within the range of 15°C to 35°C.
- A position not exposed to direct sunlight.
- A position not subject to strong vibration, or any continuous (even weak) vibration.
- A position free from strong magnetic or electromagnetic fields.
- Relative humidity within the range 45% to 80%. (If the room temperature is 30°C higher, the relative humidity must be no more than 70%.)
- A location free from exposure to corrosive gas, or any organic or inorganic gas that has an absorption band in the UV region.
- A location substantially free dirt or dust.

2.1.3 Instrument Voltage setting

NOTE Check the following points before connecting the power.

- Power supply voltage and power supply capacity

  100/120/220/230/240V AC±10% 190VA 50/60Hz

  If the power supply voltage is unstable or power supply capacity insufficient, the unit does not function properly. Also, it is necessary to check the power supply of entire unit before providing the power supply.

  Further, if fluctuation of the power supply voltage is more than ± 10%, use the constant voltage unit.

Power source voltage varies according to the geographic region. A voltage selector is provided at the left side of the instrument (in the fuse holder compartment) to allow setting the voltage (100, 120, 220, 230 or 240V) appropriate to the region.

To change the voltage, use a screwdriver to pry open the fuse holder cover. Remove the drum-shaped voltage selector. Re-insert the voltage selector, making sure that the appropriate voltage is displayed. Then re-mount the fuse holder cover.

WARNING **RISK OF ELECTRIC SHOCK**

Before changing a fuse or the inlet voltage, turn off the power switch and disconnect the power cable.

CAUTION Use a 5A fuse for 100-120V setting, and a 3.15A fuse for 220-240V power voltage settings.

2.1.4 Personal computer hardware and software requirements

In addition to the UVPC photometer unit, UVPC software, and standard accessories, the following hardware and software are either required (and therefore provided with the complete system), recommended or useful.

Minimum hardware requirements:

- IBM PC/AT (or 100% compatible) or IBM PS/2, Model 50 and higher
- 16M Random Access Memory (RAM)

- 1 floppy disk drive (3.5")
- 1 hard disk drive (200MB)
- Windows-compatible graphics adapter/ monitor with 640 × 480 resolution
- IBM compatible synchronous serial port

Minimum software requirements:

- MS or PC Disk Operating System (DOS), Version 5.0
- Windows3.1 or Windows95

Recommended optional accessories

- Mouse-type pointing device
- IBM compatible parallel port and Windows compatible graphics printer

2.1.5 Cable connections

The connections described in this section assume installation of the components supplied as standard with this system. For installation of components not standard with this system, refer to the appropriate instruction manuals.

Install the photometer unit and computer components and cables and set the switches as indicated in the illustration below. (refer to Section 3.1 "Fig. 3.1").

Confirm that Power switch is set to OFF. Then connect the attached AC power cord to the Power inlet of the UV-2401/2501 PC and the AC power source.

Be sure to use a grounded power source receptacle if possible.

If the employed power source receptacle is not equipped with a ground terminal, ground the instrument using the ground terminal.

CAUTION When performing grounding

- Be sure to unplug the power cord before connecting or disconnecting a gronud wire.
- If peripheral devices are being used, be sure to disconnect all power cords before connecting the ground.
- Do not connect the ground wire to a gas pipe under any circumstances.

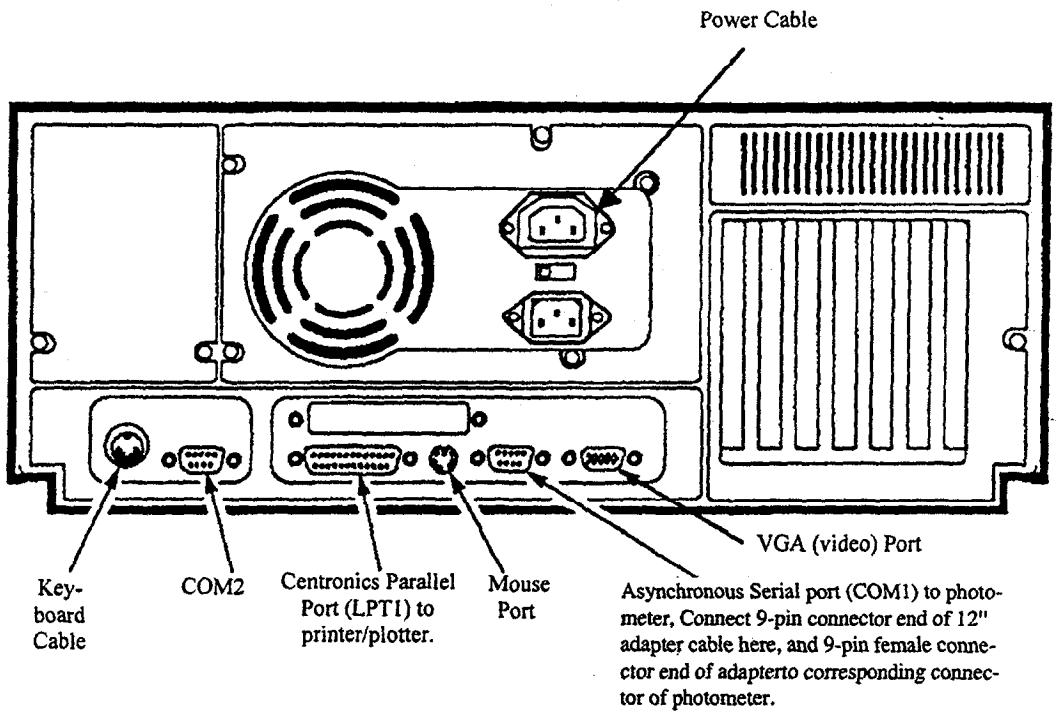

Fig. 2.1 Personal Computer (Rear view) (example)

2.2 Software installation

Before installing the UVPC software, it is necessary to first install Microsoft Windows Version 3.1 or Windows95. Please refer to the appropriate Microsoft Windows documentation for the installation procedure. The installation procedure for the UVPC software is performed as described below.

NOTE Before installing, please check that write-protect (installer floppy disk) is OFF. If it is ON, please start to install after you make it OFF. (Error occurs if you start to install on ON.)

Procedure

1. Insert the UVPC floppy disk into the A: drive and start "Install.exe".
2. At the prompt, type in the drive and directory where UVPC software is to be installed. The default directory can be accepted by simply pressing ENTER.
3. At the prompt, enter your company's name or the name of the licensee.
4. While the Install program is copying information from the disk, take the time to fill out the product registration card so that you can be notified when future upgrades and optional software are available.
5. When the installation is complete, you will be given the opportunity to view the README.TXT file. It is highly recommended that you read this file, since it contains important information that did not get into this manual.
6. This completes the software installation procedure. You will find that the installation program has created a "Shimadzu" group in Program Manager and has added the UVPC icon to it. Double click on the UVPC icon and proceed to the next section, "Communications and printer setup."

NOTE If the software was previously installed on the system, the previous installation will be over written and a second icon will appear in the shimadzu group. Choose one of the icons and select delete to remove it from the group.

2.3 Communications and printer setup

Before operation of the UVPC Spectrophotometer may begin, the communication and printer parameters must be set in the UVPC software.

Procedure

1. If the UVPC Personal Spectroscopy Software is already running proceed to step 3.
2. Start UVPC software.
3. When the main screen appears, select "PC Configuration" from the Configure menu. The dialog box will appear.
4. Select a printer to be used for Text output and one for Graphics output. The printers which appear in the list box are the same ones that were installed using Control Panel (see Microsoft Windows User's Guide), or when Windows was first installed.
5. Tab to the Photometer Serial Port item. Use the arrow keys to select the communication port (COM 1 ~ 4) which will be used for communication between the personal computer and the photometer unit. (This can also be selected by clicking on the radio button directly.)
6. To ensure that the communication port will be set whenever the program is executed, re-select the Configure menu from the menu bar, select "Save Parameters", press the ENTER key to indicate the default file name (UVPC.CFG), select "Save" and select "Yes" in response to the overwrite warning.
7. Power on the photometer if it is not already on.
8. Upon returning to the main screen after validating the above setting(s), select "Utilities" from the Configure menu, and set the Photometer to "ON". Select "OK", and the initialization procedure will be carried out as described in the following section. Pressing the Start/Read push button located at the bottom of the screen will also turn the Photometer "ON".

NOTE When the software is activated before turning ON the spectrophotometer, initialization can be started by selecting "ON" on the "Utilities" screen of the software. At this time, do not select "OK" on the "Utilities" screen until initialization for all items complete.

If the "Utilities" screen is closed on the way of initialization, improper photometric value may be displayed after initialization has completed. If this situation occurred, select "OK" on the "Spectrum Parameters" screen. Correct photometric value is displayed to return to the normal state.

2.4 System Initialization

To ensure that the system components are working correctly, a self check is carried out automatically whenever the software is executed after the photometer unit has been turned ON. The entire procedure takes about 4 minutes for UV2401PC and 5 minutes for UV2501PC. A window showing the progress of the initialization will appear on the screen. Next to each item listed in the window to be initialized is a status circle showing whether the item is being tested (yellow), whether it has passed (green) or failed (red). Remedial actions to be taken in case of initialization failure are outlined in Section 4.2.1~4.2.2 of this documentation. The initialization items are described in the following tables.

Table 2.1 Initialization Steps for UV-2401PC

Step	Item	Description
1	LSI Initialize	Initialization of parameters
2	ROM Memory Check	Checking photometer ROMs
3	RAM Memory Check	Checking Random Access Memory
4	Filter Motor Initialize	Detecting stray light cut-off filter position
5	Slit Motor Initialize	Detecting slit motor position
6	Light Motor Initialize	Detecting light motor position
7	Scan Motor Initialize	Detecting wavelength scanning motor position
8	WI Max. Position Search	Positioning halogen lamp for maximum energy
9	Wavelength Origin 1 Search	Detection of wavelength origin position
10	WI Lamp Energy Check	Checking halogen lamp energy
11	D2 Max Position Search	Positioning deuterium lamp for maximum energy
12	D2 Lamp Energy Check	Checking deuterium lamp energy
13	Wavelength Origin 2 Search	Detecting 0nm wavelength position
14	Stand By...	Initialization is completed

The entire procedure takes about four minutes.

Table 2.2 Initialization Steps for UV-2501PC

Step	Item	Description
1	LSI Initialize	Initialization of parameters
2	ROM Memory Check	Checking photometer ROMs
3	RAM Memory Check	Checking the Random Access Memory
4	Filter Motor Initialize	Detecting stray light cut-off filter position

Step	Item	Description
5	Slit Motor Initialize	Detecting slit motor position
6	Light Motor Initialize	Detecting light source motor position
7	Scan Motor #2 Initialize	Detecting wavelength scanning motor 2 position (main monochromator)
8	Scan motor #1 Initialize	Detecting wavelength scanning motor 1 position (pre-monochromator)
9	WI Max. Position Search	Positioning halogen lamp for maximum energy
10	Wavelength Origin 1 Search	Optical detection of wavelength origin position (pre-monochromator)
11	WI Lamp Energy Check	Checking halogen lamp for maximum energy
12	D2 Max. Position Search	Positioning deuterium lamp for maximum energy
13	D2 Lamp Energy Check	Checking deuterium lamp energy
14	Wavelength origin 2 Search	Optically detecting Onm wavelength position (main monochromator)
15	Stand By...	Initialization is completed

The entire procedure takes about five minutes.

NOTE **Cautions when the power is turned ON again**

To perform system check at initialization normally, turn OFF the power, and turn it ON again after an interval of 10 minutes or more.

In "RAM Memory Check" to be performed at initialization just after turning ON the power, if the power is turned ON just after turning OFF the power, an error may not occur even if the battery that backs up the contents of RAM is abnormal.

2.5 Electro Magnetic Compatibility

NOTE Description of this section are only applied to the model for EU (European union) market : 206-55670-34, 206-55671-34, 206-55672-34, 206-55673-34 206-55674-34, 206-55675-34, 206-55676-34, 206-55677-34

This instrument complies with European standard EN61326-1 which is amended at 1998.

Emission : Non-industrial location

Immunity : Industrial location

1) Electro Magnetic Emission

This instrument can use in domestic environments.

The test specifications are stated below.

1. Radiated Emission (EN61326-1:1997+A.1:1998 Class B)
2. Conducted Emission (EN61326-1:1997+A..1:1998 Class B)
3. Harmonics AC Mains (EN61000-3-2:1995/A1:1998/A2:1998)
4. Voltage Fluctuations on AC Mains (EN61003-3:1995)

NOTE When a electro magnetic disturbance occur to those instrument being used close to this product, Take appropriate distance between instruments to eliminate the disturbance.

2) Immunity to Electro Magnetic Interference

This instrument can use in domestic environments.

The test specifications are stated below.

1. Radiated Susceptibility (EN61000-4-3:1996)
   Field strength:10V/m, Frequency range 80-1000MHz, Modulation:1kHz AM80%.
2. Power Magnetic Fields (EN61000-4-8:1993)
   Magnetic field strength : 30A/m
3. Electrostatic Discharge (EN61000-4-2:1995)
   Charge Voltage : 4kV (Contact), 8kV (Air Discharge)
4. Fast Transients on AC Power Lines (EN61000-4-4:1995)
   Test Voltage : 2kV
5. Surge Immunity of AC Power Lines (EN61000-4-5:1995)
   Test Voltage : 1kV line to line, 2kV line to earth
6. Conducted Radio Frequency Immunity of AC Power Lines (EN61000-4-6:1996)
   Applied Voltage:3V, Frequency Range 150k-80MHz, Modulation:1kHz, AM80%

7. Immunity Against Voltage Dips and Interruptions on AC Power Lines (EN61000-4-11)

NOTE Compliance to the standard does not ensure that the instrument can work with any level of Electro Magnetic interference stronger than the level tested.
Interference greater than the value specified in the condition above may cause malfunction of the instrument.
To avoid electro magnetic distrurbance, following notices are recommended to be followed.

1) Before touching the instrument, discharge the electro statics charged in operator's body to ground by touching metallic structure connected to ground.
2) Do not install this instrument in such enviroment where strong electro magnetic fields are generated near by.

Chapter 3 Construction

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3.3.3 Cell holder/Light Beam Relative Position ..... 3 - 9
3.3.4 Electrical system ..... 3 - 9

3.1 UV-2401/2501PC Photometer Unit

	Description	Comments
1	Power switch	Supplies power to the photometer unit.
2	Sample compartment	150mm width × 260mm depth × 120mm height
3	Cover for receptacle	Covers the receptacle to be connected to an external detector such as the integrating sphere attachment.
4	Light source compartment	The halogen lamp for VIS region and deuterium lamp for UV region are built in. The cover is removed by lifting straight up.
5	Communication connector	This is used for the signal communication between the data station and photometer unit.
6	Grounding terminal	To be used when the employed switch board has no grounding terminal. Use this terminal as a common ground for the UV-2401/2501 and other device(s).
7	AC power receptacle (inlet)	For supplying AC power to the photometer unit.
8	Voltage selector (also acts as fuse holder)	The position setting should correspond to the supplied voltage (100V, 120V, 220V, 230V, 240V). A5A fuse should be used for 100 - 120V and a 3.15A fuse for 220 - 240V.
9	Fixing Screw	The screw which fixes the sample compartment.

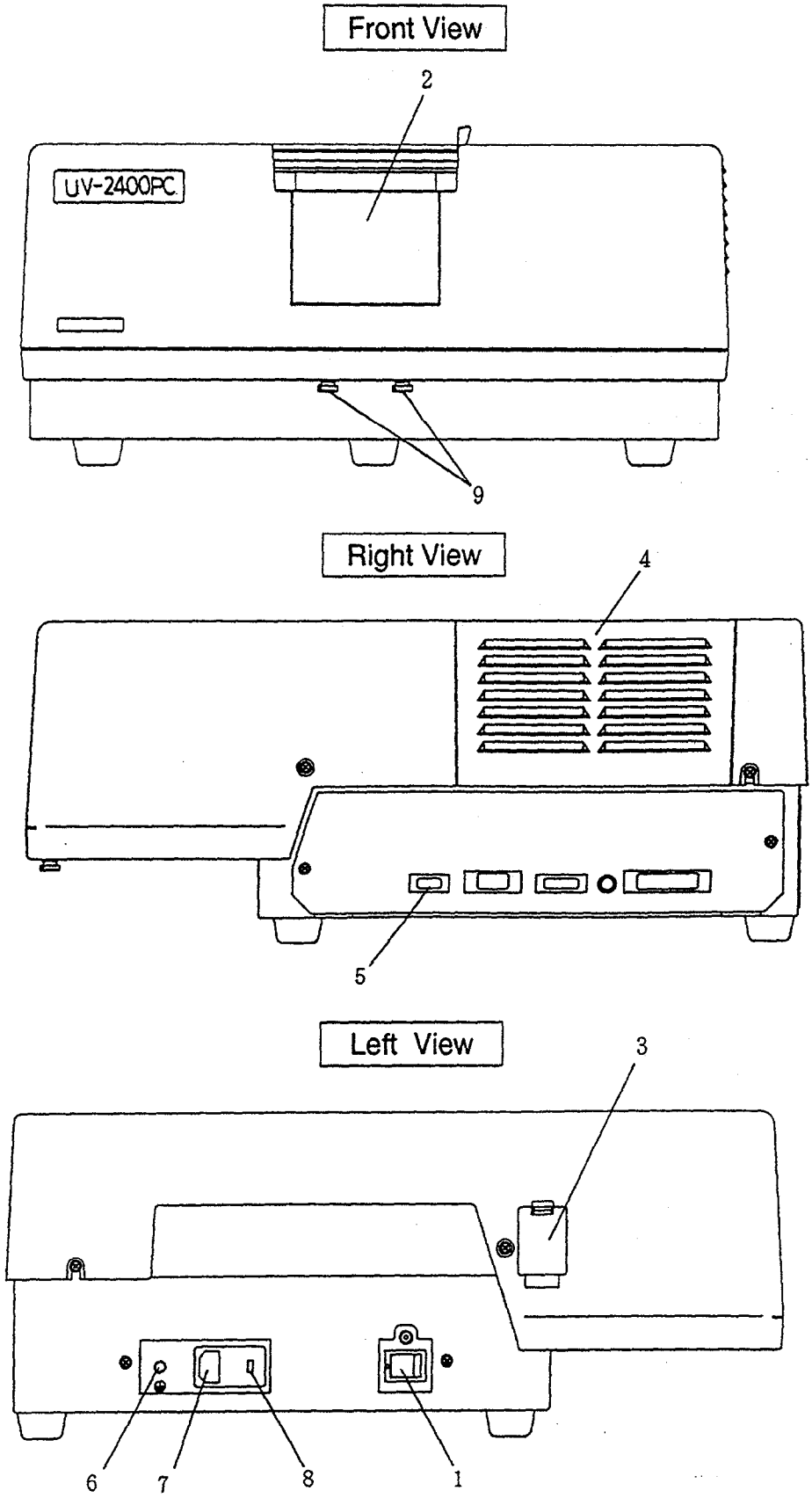


Fig. 3.1 Exterior Views of UV-2401/2501PC Photometer

3.2 Sample compartment of UV-2401/2501PC photometer unit

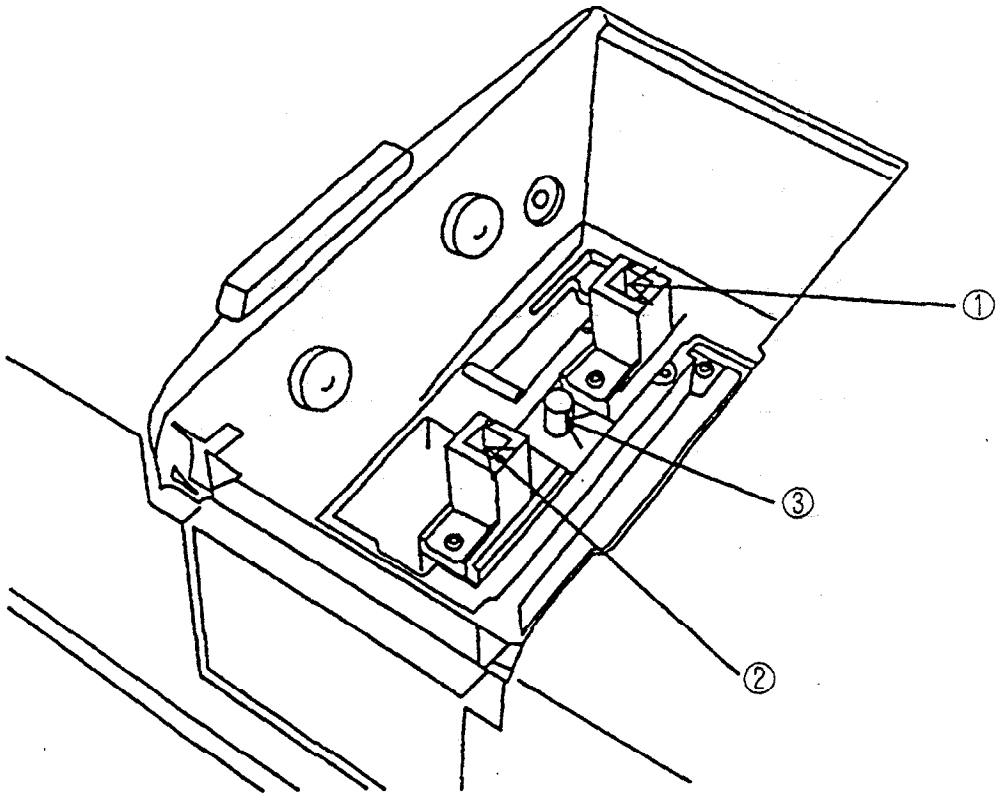
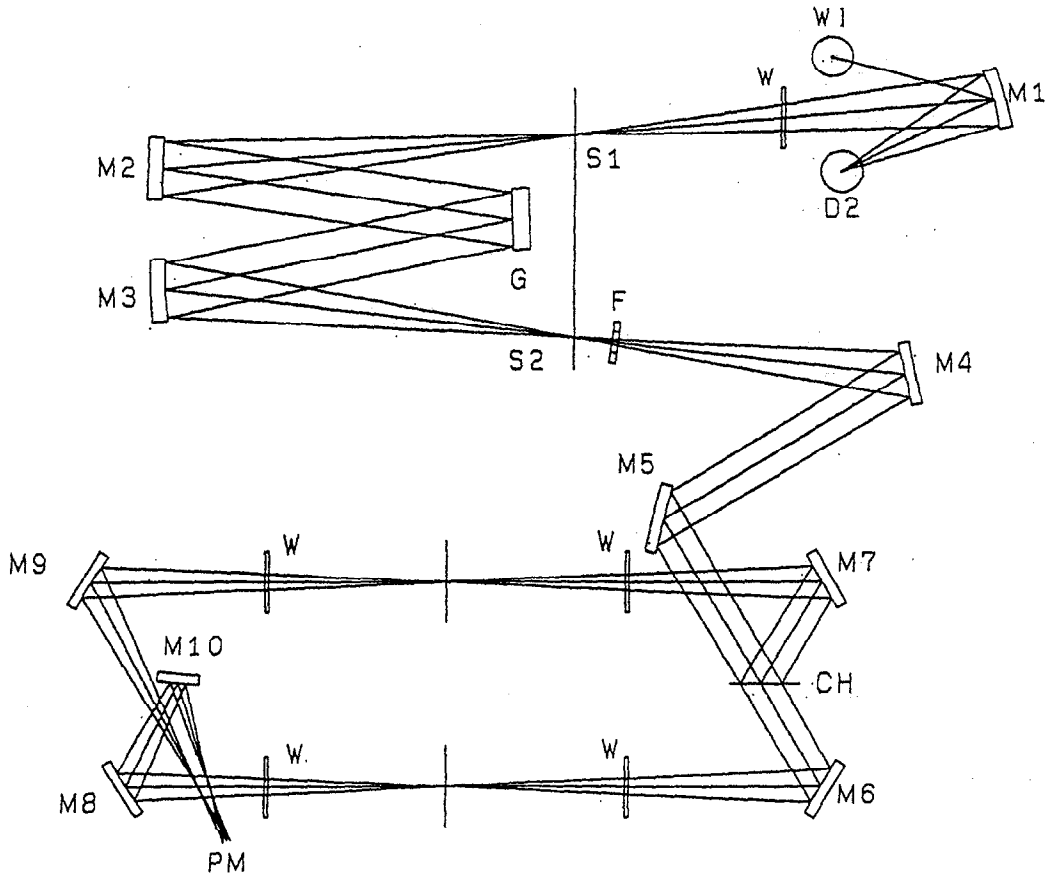


Fig. 3.2 UV2401/2501PC Sample Compartment

	Description
1	Cell holder for reference beam
2	Cell holder for sample beam
3	Set screws fixing the cell holder

3.3.1 Optical System (UV-2401PC)



D_2	: Deuterium Lamp	G	: Diffraction grating
WI	: Halogen lamp	S2	: Exit slit
S1	: Entrance slit	F	: Filters
W	: Quartz windows	CH	: Beam chopper
M1~ M10	: Mirrors	PM	: Photomultiplier

Fig. 3.3 Optical Schematics of UV-2401PC

The light emitted from the light source (deuterium lamp, D2 or halogen lamp, WI) is reflected by the mirrors M1 and M2 and projected onto the monochromator. The light source is switched automatically depending upon the wavelength as follows:

D2 : 190nm ~ light source switching wavelength

WI : light source switching wavelength ~ 900nm

(The light source switching wavelength is selectable from 282 ~ 393nm.)

The light source is turned on by the personal computer under specific conditions, as follows:

1) When both START and END wavelengths are within the range from 190nm to the switching wavelength, only the D2 lamp will be turned on.
2) When both the START and END wavelengths are within the range from the switching wavelength to 900nm, only the WI lamp will be turned on.
3) When one wavelength falls below the light source switching wavelength and one above, both D2 and WI lamps will be turned on.

In the UV-2401PC, the positions of the light sources are adjusted automatically, ensuring that maximum intensity is obtained from the detector every time the power switch is turned on.

All the optical elements except light source are sealed from the atmosphere by the windows W, to keep them dust-free. This is one of the features of the UV-2401PC. The slit width is selected in 6 steps; 0.1, 0.2, 0.5, 1, 2, 5.

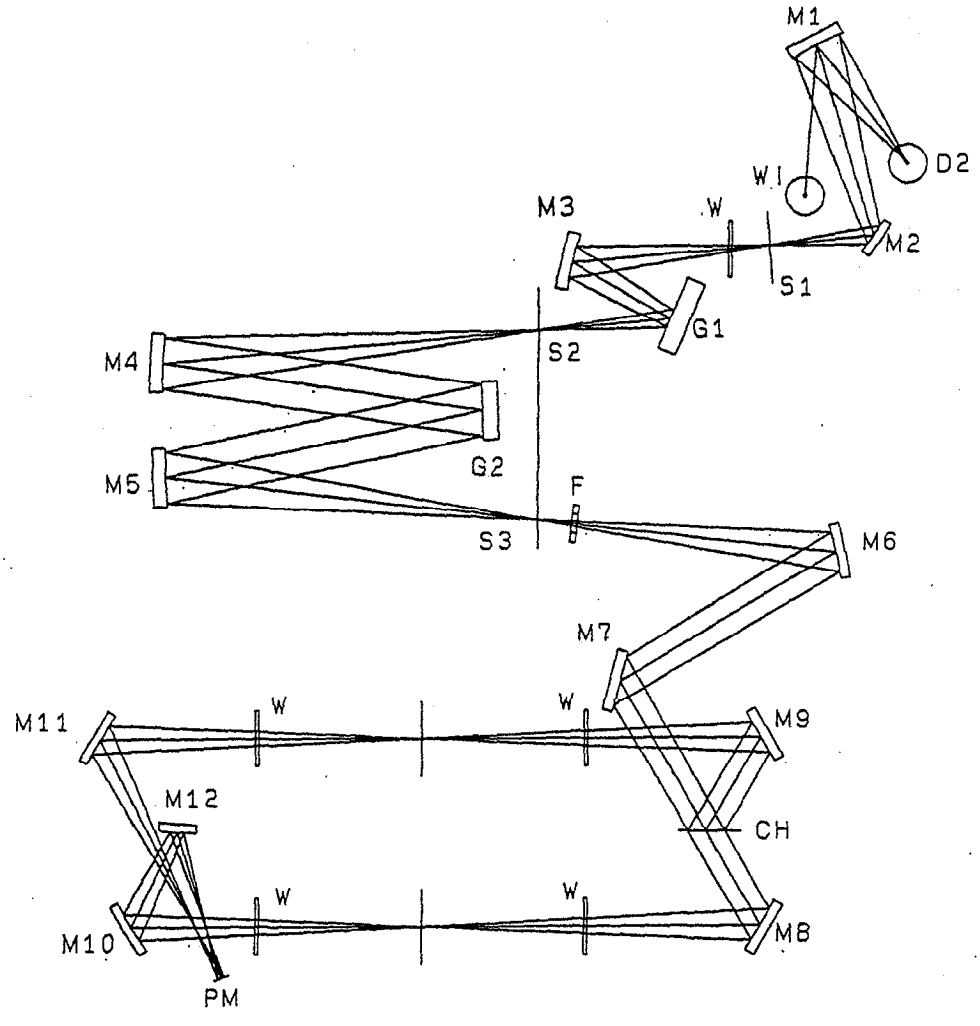
In normal measurement, a slit width of 2nm is considered appropriate.

The monochromator is composed of S1 (entrance slit), M2 (mirror), G (grating), M3 (mirror) and S2 (exit slit). The mounting is of the Czerny-Turner type, characteristically providing little aberration. The Shimadzu-designed blazed holographic grating with 1600 lines/mm provides high optical energy with minimal stray light.

The images of the exit slit S2 are focused at the cell position in the sample compartment. Figure 3-5 shows the relationship between the position of cell and light beam. The cross section of the light beam on the cell is about 1mm wide and 12mm high when the slit width is 2nm.

When a micro cell of narrow width below 2mm is used, it is recommended that the optional cell holder with mask (P/N 204-06896) or the optional super micro cell holder (P/N 206-14334) can be used. In addition, a black masked cell is preferable for decreasing the influence of the scattered radiation.

3.3.2 Optical System (UV-2501PC)



D_2	: Deuterium Lamp	M1~ M10	: Mirrors	S3	: Exit slit
WI	: Halogen lamp	G1	: Grating of first monochromator	F	: Filters
S1	: Entrance slit	S2	: Exit/Entrance slit	CH	: Beam chopper
W	: Quartz windows	G2	: Grating of second monochromator	PM	: Photomultiplier

Fig. 3.4 Optical Schematics of UV-2501PC

This monochromator is a double monochromator of grating-to-grating type which is composed of the first monochromator (pre-monochromator) and the second monochromator (main monochromator).

The light emitted from the light source (deuterium lamp D2, or halogen lamp WI) is reflected by the mirrors M1 and M2 and projected onto the pre-monochromator. The light source is switched automatically depending upon the wavelength as follows:

D2 : 190nm~light source switching wavelength

WI : light source switching wavelength ~ 900nm

(The light source switching wavelength is selectable from 282 ~ 393nm.)

The light source is turned on by the personal computer under specific conditions, as follows:

1) When both START and END wavelengths are within the range from 190nm to the switching wavelength, only the D2 lamp will be turned on.
2) When both START and END wavelengths are within the range from the switching wavelength to 900nm, only the WI lamp will be turned on.
3) When one wavelength falls below the light source switching wavelength and one above, both D2 and WI lamps will be turned on.

In the UV-2501PC, the positions of the light sources are adjusted automatically, ensuring that maximum intensity is obtaioned from the detector every time the power switch is turned on.

All the optical elements except the light source are sealed from the atmosphere by the windows W, to keep them dust-free. This is one of the features of the UV-2501PC. The slit width is selected in 6 steps: 0.1, 0.2, 0.5, 1, 2, and 5nm.

In normal measurement, a slit width of 2nm is considered appropriate.

The pre-monochromator is composed of S1 (entrance slit), M3 (mirror), G1 (Grating), and S2 (exit slit). The grating is Shimadzu double blazed holographic, which ensures ultra low stray light.

The main monochromator is composed of S3 (entrance slit), M4 (mirror), G2 (grating), M5 (mirror) and S3 (exit slit). The mounting is of the Czerny-Turner type, characteristically providing little abberation. The Shimadzu-designed blazed holographic grating with 1600lines/mm provides high optical energy with minimal stray light.

The images of the exit slit S3 are focused at the cell position in the sample compartment. Figure 3-5 shows the relatioship between the position of cell and light beam. The cross section of the light beam on the cell is about 1mm wide and 12mm high when the slit width is 2nm.

When a micro cell of narrow width below 2nm is used, it is recommended that the optional cell holder with mask (P/N 204-06896) or the optional super micro cell holder (P/N 206-14334) can be used. In addition, a black masked cell is preferable for decreasing the influence of the scattered radiation.

3.3.3 Cell holder / Light Beam Relative Position

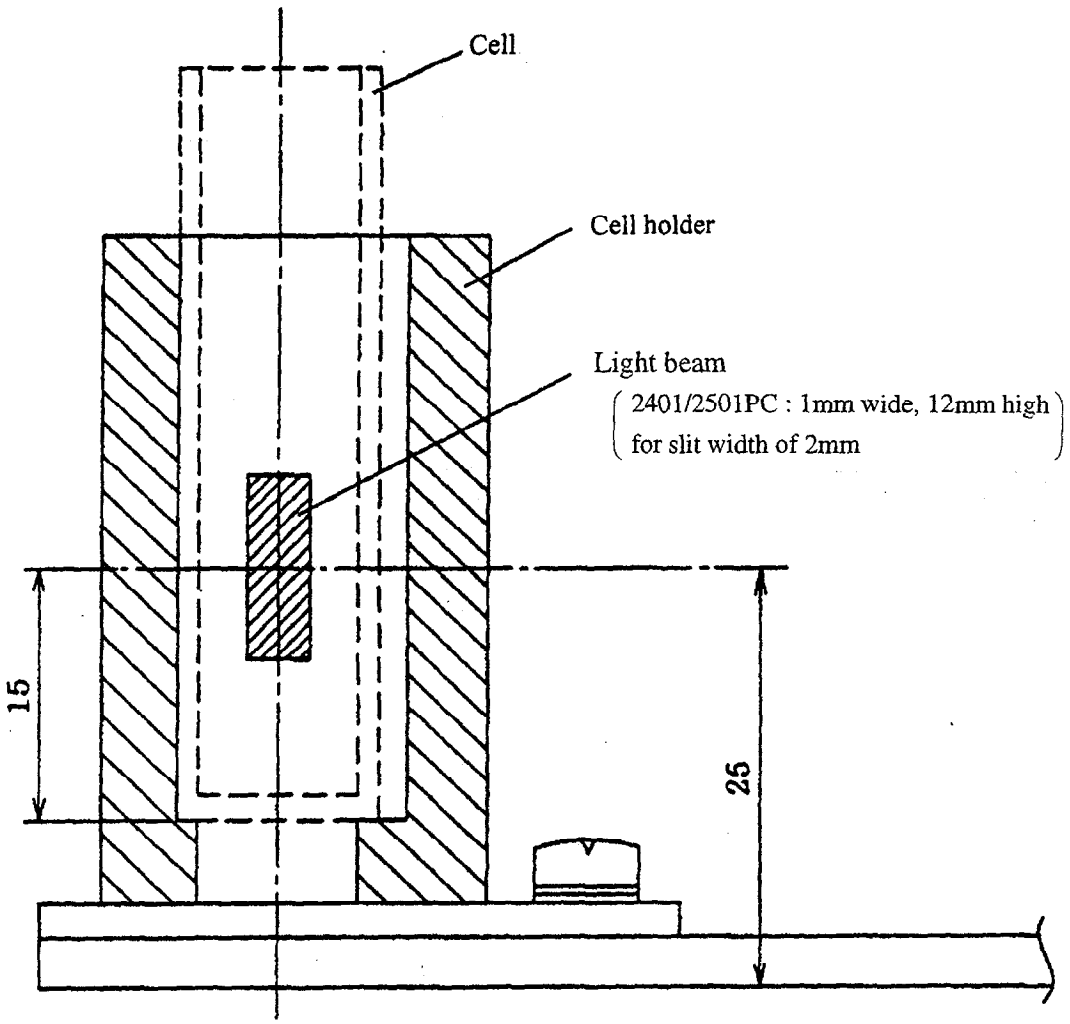


Fig. 3.5 Cell holder/Light Beam Relative Position

3.3.4 Electrical system

Fig. 3.6 and 3.7 show the electrical system for the UV2401PC and UV2501PC respectively.

The micro-computer CPU in the spectrophotometer works to control the light source lighting, light source switching, filter switching, slit width selection, grating switching (UV-2501PC only), and wavelength scanning pulse motor, according to the commands from the data station.

The light beams chopped into the sample beam and reference beam at 50/60Hz frequency are detected, and the output of the detector passes through the pre-amplifier to be separated into sample signal, reference and dark-level signals.

The sample and reference signals are individually A/D converted and enter the microprocessor.

There is a dark-level compensating circuit to compensate for the dark levels of the photomultiplier.

Thereafter, the photometer works to compute the ratio of sample signal to reference signal to obtain the transmittance (T%), to perform baseline correction, logarithmic conversion (into Abs.) and smoothing.

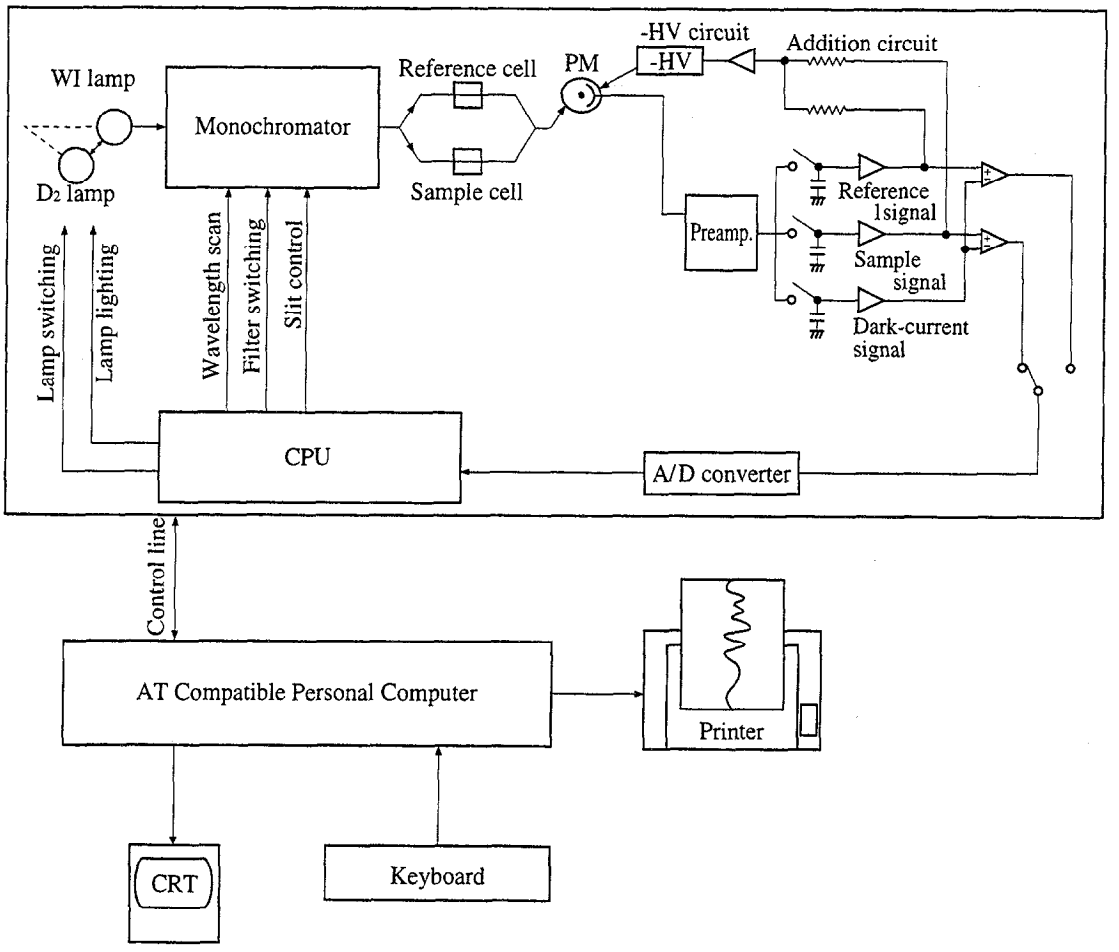


Fig. 3.6 Electrical System of UV-2401PC

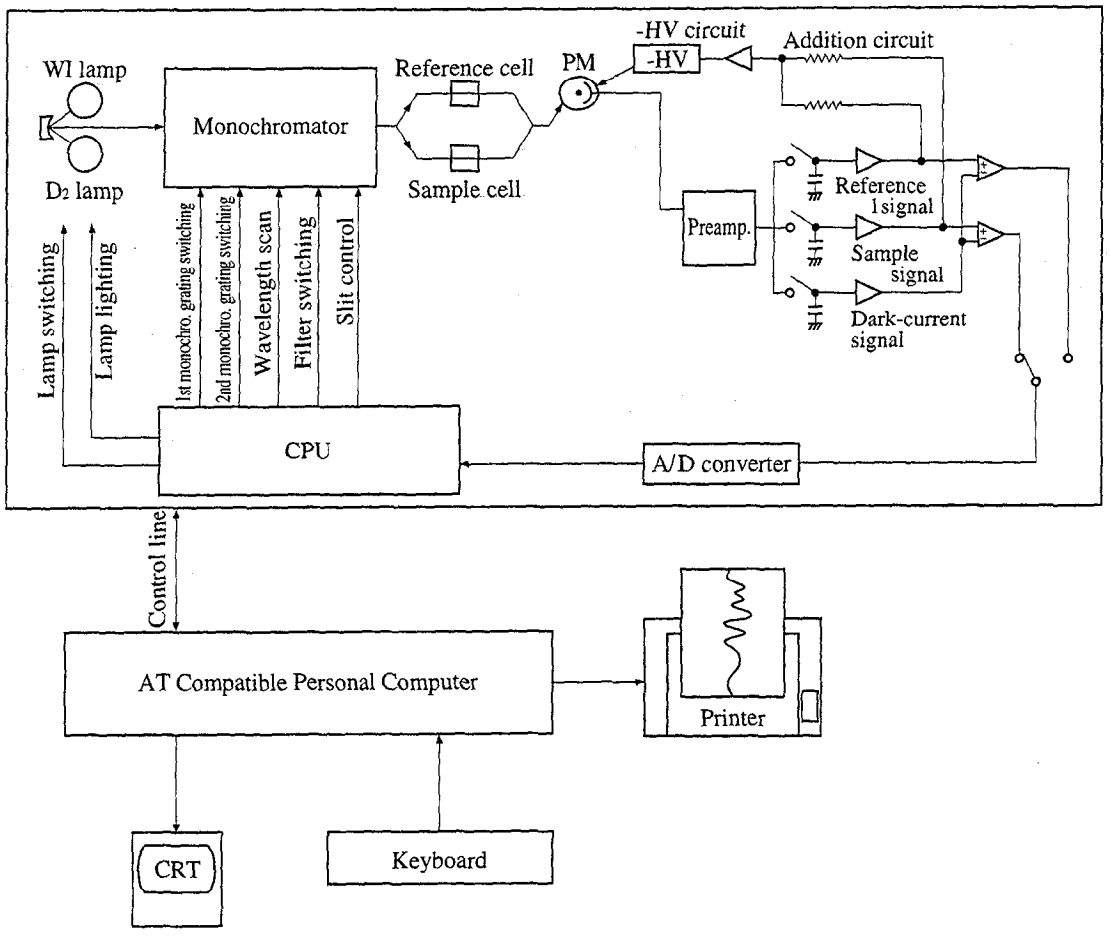


Fig. 3.7 Electrical System of UV-2501PC

Chapter 4 Maintenance and Checking

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4.1 Periodic Maintenance

1) Cleaning sample compartment (daily)

Wipe the sample compartment floor clean of any spilled liquid sample to prevent evaporation and possible corrosion of the compartment or erroneous results due to the corrosion.

2) Keeping quartz windows clean (weekly)

Remove the sample compartment (see Section 3.1) by grasping is sides and pulling up, and confirm the absence of stains (fingerprints, etc.) on the quartz windows at the entrance and exit of the sample compartment.

If stains are found on the quartz window(s), cleaning is required to prevent adverse effects on the measurement. The quartz window is removed by first removing the O-ring which holds it in place. After soaking the stained window in alcohol, gently wipe off the window with an alcohol-moistened cloth. Carefully remount it in the instrument using the O-ring.

3) Checking wavelength accuracy (semi-annually)

Wavelength accuracy is checked using the two characteristic wavelength peaks of deuterium light, at 486.0nm and 656.1nm. If the wavelengths of the characteristic peaks do not fall within the specified ranges, contact your service representative. The procedure is as follows:

1. Select "Spectrum" from the Acquire Mode menu.
2. Select "Parameters" from the Configure menu. Set the parameters as follows:

Measuring Mode	:	Energy
Recording Range	:	0 (Low)~100 (High)
Wavelength Range	:	660 (Start)~650 (End)
Scan Speed	:	Medium
Slit Width	:	0.2
Sampling Interval	:	Auto

Select the "Energy" push button at the bottom of the Spectrum Parameters dialog box to bring up the Energy Condition Parameters dialog box. Set the parameters as follows:

Lamp	:	D2 (Deuterium)
Detector	:	PM (photomultiplier)
PM Gain	:	2

Select the "OK" push button to return to the Spectrum Parameters dialog box, and select the "OK" push button to return to the main screen.

3. When the photometer setup waiting period ends, select the Start push button to plot the spectrum on the screen graph. When the spectrum has been plotted, a file name and comment may be entered in the File Name dialog box which will appear.
4. Select "Peak Pick" from the Manipulate menu. When the channel selection dialog box appears, select the channel corresponding to the wavelength check spectrum and select "OK". The graph will be redrawn with the characteristic peak indicated, and the Peak Pick scrollable window which appears will indicate the wavelength of the peak. The peak wavelength should fall in the range between 655.8nm and 656.4nm for UV-2401/2501PC.
5. Perform the same procedure again for the other characteristic peak of D2 light using:

   Recording Range : 0 (Low) ~ 10 (High)

   Wavelength Range : 490 (Start) ~ 480 (End)

   In this case, the peak wavelength should fall in the range between 485.7nm and 486.3nm for UV-2401/2501PC.

4.2 Troubleshooting

Initialization failures are often due to oversights in the instrument preparation or neglect of periodic maintenance. These are generally easily overcome and corrected. With conscientious maintenance and consumable part replacement, the photometer unit will provide many years of faithful service without significant degradation of performance.

4.2.1 Photometer Initialization failures

1) The photometer unit does not have power (check to see if the fan is running) and the software does not display the initialization screen. (The Photometer Status Window reports OFF.)

Items to be checked	Remedial Action
Power Cable	Plug into receptacle
Fuse	Replace it with a new one.

2) The photometer unit has power but the software initialization screen does not appear and communication cannot be established with the photometer unit (OFF is displayed in the Photometer Status Window).

Items to be checked	Remedial Action
RS-232C serial cable	Fasten the connectors securely on the terminal at the photometer unit and at the computer. Select "Utilities" under the "Acquire" menu. Establish communication with the photometer unit by selecting the "On" radio button. The inialization screen should appear.
Computer RS-232C port	Check the documentation for the computer to see that the port is being addressed properly (dip switch, jumpers, setup, etc.) In the software operation, select the port number that was set up using this documentation. Select "PC Configuration" under the "Configuration" menu. Designate the proper port number under: Optical Bench Serial Port." Establish communications with the optical photometer unit as outlined above. If successful, store these parameters by selecting "Save Parameters" under the "Configure" menu. Save these parameters as file name UVPC, which is the default configuration when the program is started.

3) Error appear at stages in the initialization (red marks appear)

Table 4.1 Initialization Errors and Remedial Actions

Step from Tables 2.1 or 2.2	Items to be checked	Remedial Action
1-7 (UV-2401PC) 1-8 (UV-2501PC)		Failure on these items will require service by Shimadzu or Shimadzu designated dealers for your location.
8-13 (UV-2401PC) 9-14 (UV-2501PC)	Light Source: Check to see that the light sources are lit by opening the light source housing cover. (Do not stare at the D2 source for more than a few seconds, as prolonged exposure to UV radiaton may cause damage to the eye).	Turn off the photometer unit and computer and begin the startup procedure again, watching to see if the lamps will light. If not, the lamps most likely should be replaced. The WI lamp should last 2000 hours and the deuterium lamp 500 hours of operation. Replace the failed lamp and begin the startup procedure again.
	Sample Compartment: Check to see if any material is blocking the light beams in the sample compartment.	Remove blockage and reinitialize.
	Sample compartment: Make sure the sample compartment door is tightly closed and the front panel cover in place.	Correctly set sample compartment door, and reinitialize.

4.2.2 Scanning Problems

1) The scan or data is very noisy (and not within specifications)

Items to be checked	Remedial Action
Slit width	The slit width setting may be too narrow. Set a wider slit and perform a new baseline. Perform the scan once again.
Reference sample	The absorbance in the reference beam may be too high. Check the absorbance of this sample beam. If it is above 2.0 Abs, the dynamic range limitations may cause a scan to appear noisy. A new baseline can be taken with the reference sample in the reference holder and another reference sample in the sample beam to balance the energy throughput.
Light source	The light sources may have failed. Check to see if the appropriate source is lit for the range of operation. Replace if necessary.

2) The baseline is not flat.

Items to be checked	Remedial Action
Sample of high absorbance	Remove sample and perform the baseline correction again.
"Fast" scan speed.	Perform baseline correction again using "Medium" or slower scan speed.
Wavelength range may be too narrow.	Perform baseline correction again using wider wavelength range.
An optional attachment for the sample compartment may be used.	Some optional attachment for the sample compartment may change the baseline. Execute the baseline correction after the attachment is equipped.

3) The photometric values are abnormal.

Items to be checked	Remedial Action
"Auto Zero" has been selected unintentionally in the measurement parameters. (The Abs 0 is set with the sample in the sample compartment)	Remove sample with blank and select "Auto Zero" again.
Wavelength setting is not appropriate.	Set the wavelength appropriately.
Faulty sample preparation	Correct sample preparation.
Improper cell being used.	The glass cell is opaque in the UV region. Use a silica cell.

4.3 Replacement of the light source

4.3.1 Light Source Specifications

Table 4.2 Light Source Specificatins

	WI lamp	D2 lamp
Part Number	062-65004-06	062-65055-05
Model Name	RJ5012	L-6380
Mean Service Life	2000 hrs.	500 hrs.

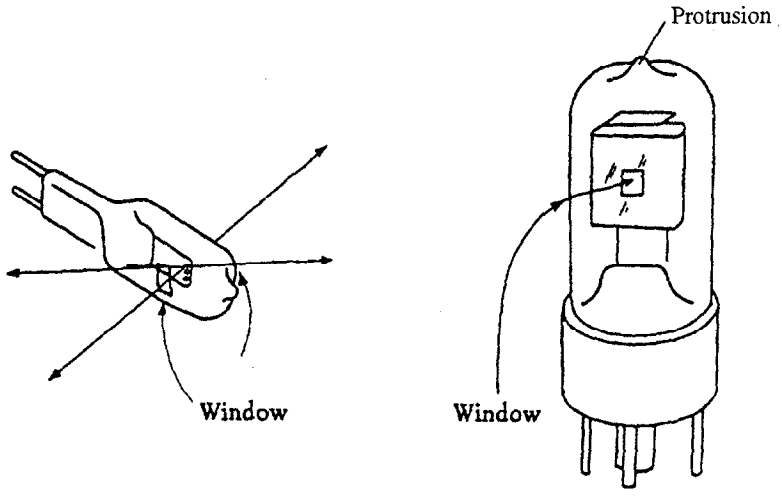

Fig. 4.1 Exterior View of Light Sources

4.3.2 Light Source Replacement Procedure

WARNING **HOT SURFACE**

The light source and light source compartment both get very hot.
To change a light source, turn off the power and then change the light source only after checking to see that it has cooled sufficiently.

NOTE

1. Please wear gloves when handling the light source so as not to leave fingerprints on the beam port of the new light source. A fingerprint will burn onto the bulb, and when the light source gets hot, light transmission will deteriorate.
2. Be especially careful when removing and mounting the light source compartment cover so that the back of the cover does not strike the protrusion on the top of the D2 lamp (deuterium lamp). Such a hit could cause a leak in the

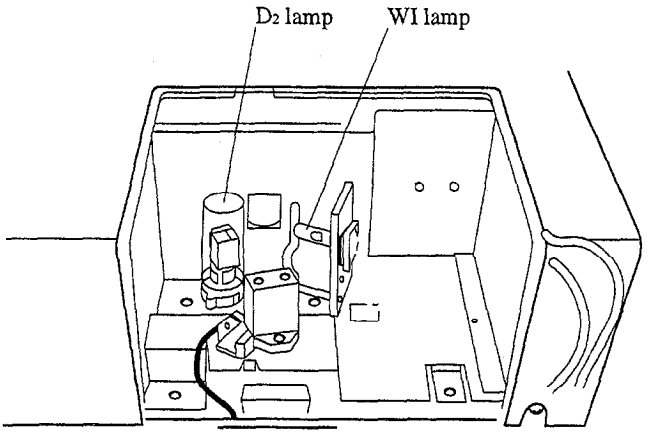

Fig. 4.2 Interior of light source compartment (UV-2401PC)

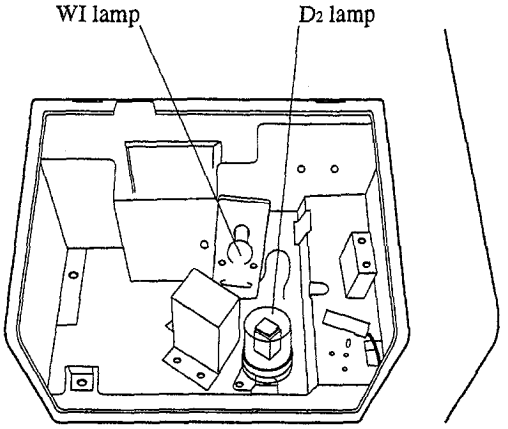

Fig. 4.3 Interior of light source compartment (UV-2501PC)

- Procedure for WI Lamp replacement

1. After allowing the light source cover to cool sufficiently, remove the light source cover (see Fig. 3.1).

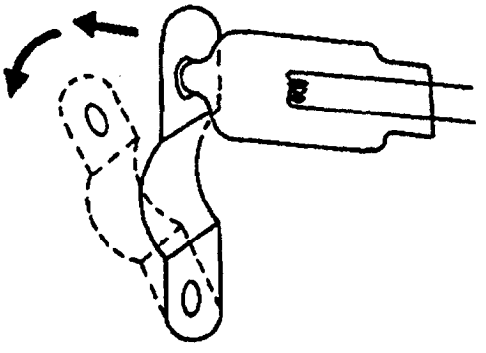

Fig. 4.4 WI Spring Holder

2. Push the WI spring holder back from the WI lamp and shift it to the side.
3. Pull the WI lamp from the socket.
4. Insert a new WI lamp fully into the socket. (Wear a glove to prevent staining of the glass).
5. Shift the WI spring holder back onto the WI lamp so that the lamp protrusion fits properly into the hole at the top of the spring holder.

- Procedure for D2 lamp replacement

1. Insert the tip of a flat screwdriver into the opening of the fixing clamp and turn it counter-clockwise slowly to release the clamp and remove the old lamp.

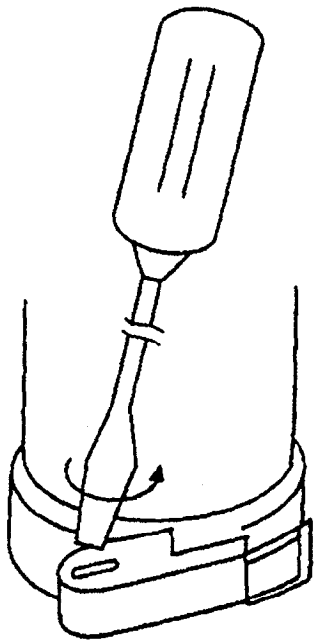

Fig. 4.5 D2 Fixing Clamp

2. Insert a new D2 lamp fully into the socket. (Wear a glove to prevent staining of the glass).
3. Turn the screwdriver clockwise in the clamp until the clamp snaps closed. Then remount the light source cover.

4.4 Replacement of the fuses

WARNING **RISK OF ELECTRIC SHOCK**

Before changing a fuse, turn off the power switch and disconnect the power cable.

CAUTION **REPLACEMENT OF FUSES**

This unit uses the following fuse.

Be sure to replace the fuse of same type and capacity.

Rated voltage 100-120V : Part No. 072-01652-23
250V 5A T(5 × 20)

Rated voltage 220-240V : Part No. 072-01652-21
250V 3.15A T(5 × 20)

When the fuse burns out, replace it by the following procedure. Use only the specified fuse.

(1) Turn OFF the power.

(2) Remove the power cord from the power connector.

(3) Use a standard screwdriver to open the cover on the fuse holder, as shown in Figure 4.6.

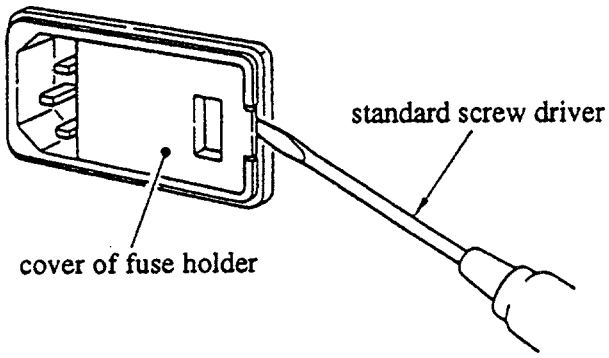

Fig. 4.6 Opening the fuse holder cover

(4) Pull out the fuse holder, as shown in Figure 4.7.

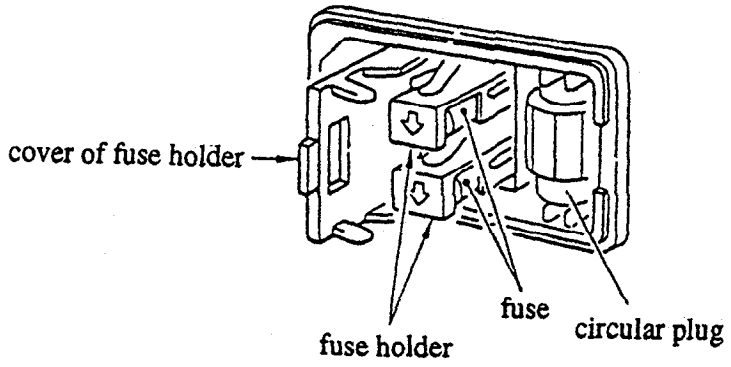

Fig. 4.7 Interior of fuse holder

(5) Remove the old fuse from the fuse holder and replace it with the new fuse. Of the two fuses, you need only replace the burned out fuse. (If both fuses are burned out, replace both fuses.)

(6) After replacing the fuse, push the fuse holder in so that the arrow on the fuse holder points down.

(7) Close the fuse holder cover until you hear its snap shut.

NOTE After replacing the fuse, turn ON the power switch and check to see that the until initializes properly.

4.5 Cleaning the unit

The spectrophotometer case and sample compartment should be kept clean. Cleaning should be done with a soft cloth slightly dampened with water or a solution of water and a mild detergent. Do not use an excessively damp cloth that liquid can drip into the spectrophotometer.

CAUTION Be very careful not to spill water, organic solvent, etc. on the instrument. Spilling liquid on the instrument can cause electric shock, fire, damage or malfunction of the instrument.

Table 4.3 Consumable Parts for UV-2401/2501PC

Classification	Description	Model	Part No.	Remark
Consumable	Halogen lamp	RJ-5012	062-65004-06	
	Deuterium lamp	L-6380	062-65055-05	
Maintenance	Fuse 5A (100 - 120V)		072-01652-23	
	Fuse 3.15A (220 - 240V)		072-01652-21	
	Sample compartment slide plate		204-07348-00	
	Cell holder assembly		206-82009-91	
	Grounding adapter		071-60803-01	
	Communication cable		200-86408	Photometer to personal computer

4.7 Precaution During Transportation of the Unit

CAUTION This unit weights about 35kg. When moving this unit, it must be lifted by two persons firmly holding the positions shown in the diagram.

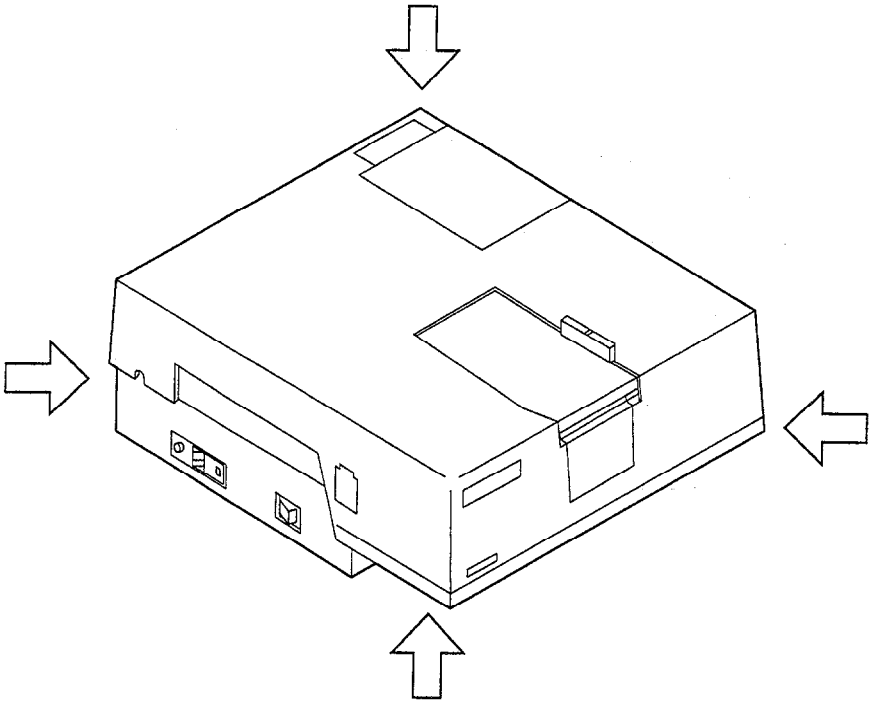

Fig. 4.8

Chapter 5 Specifications

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Table 5.1 Specifications for UV-2401/2501PC

Wavelength range	190nm ~ 1100nm (Effective measuring range is 190~900nm)
Spectral band width (slit width)	6steps in 0.1, 0.2, 0.5, 1, 2, 5
Resolution	0.1nm
Display of wavelength	0.1nm increments
Setting of wavelength	The start wavelength and end wavelength in scanning can be set in increments of 1 nm. With the Goto WL command, wavelength can be set in increments of 0.1nm
Wavelength accuracy	± 0.3nm (at slit width of 0.2nm) Automatic wavelength calibration is possible.
Wavelength repeatability	± 0.1nm
Wavelength scanning speed	In the case of wavelength setting by: Goto WL command: approx. 3200nm/min [UV-2401PC] 2400nm/min [UV-2501PC] Pop Up Scan approx.1400nm/min (with 2nm sampling interval) FAST approx.550nm/min MIDDLE approx.210nm/min These are the speed when scanning SLOW approx.140nm/min with 0.5nm sampling interval VERY SLOW approx.85nm/min
Switching of the light sources	The light sources are switched automatically in conjunction with wavelength scanning. The wavelength at which the light sources are switched is selectable in the range of 282nm to 393nm in 0.1nm increments.
Stray light	[UV-2401PC] Less than 0.015% (220nm, NaI 10g/1.H_2O) Less than 0.015% (340nm, UV-39 Filter) [UV-2501PC] Less than 0.0003% (220nm, NaI 10g/1.H_2O) Less than 0.0003% (340nm, UV-39 Filter)
Photometric system	Double beam , direct-ratio measuring system by dynode feed-back method. With summing feed-back system, negative absorbances or more than 100% transmittances/reflectances can be accurately measured.
Photometric range	Absorbance: - 4 ~ 5 Abs Transmittance: 0 ~ 999.9%T
Recording range	Absorbance: - 9.999 ~ 9.999 Abs (0.001 Abs of the full scale in maximum expansion) Transmittance: - 999.9 ~ 999.9%T (0.1% of the full scale in maximum expansion)

Table 5.1 Specifications for UV-2401/2501PC (continued)

Photometric accuracy	± 0.002 Abs in the range 0 ~ 0.5Abs. These are determined ± 0.004 Abs in the range 0.5 ~ 1.0 Abs. using the NIST standard ± 0.3% T in transmittance reference filter NIST930D.
Photometric repeatability	± 0.001 Abs (0 ~ 0.5 Abs) ± 0.002 Abs (0.5 ~ 1.0 Abs) ± 0.1% T in transmittance
Response	Most appropriate response is set automatically according to the spectral slit width and scanning speed. The fastest response is 0.1 sec.
Automatic zero setting function	One-touch setting is available with AUTO ZERO command.
Drift	Less than 0.0004 Abs/H (after 2-hour warm-up)
Baseline flatness	Within ± 0.001 Abs (slit width of 2nm) (SLOW scan , baseline correction is made, without spike noise.)
Light source	50W halogen lamp (long life type 2000H), Deuterium lamp (socket type). Automatic position alignment for maximum sensitivity.
Monochromator	Aberration corrected Czerny-Turner mounting. High performance blazed holographic grating is used (UV-2401PC). High performance double blazed holographic grating is used (UV-2501PC)
Detector	Photomultiplier R-928
Sample compartment	Inside dimensions: 150W × 260D × 120H (mm) Beam separation: 100mm Maximum allowable path length for cell: 100mm
Ambient temperature	15°~ 35°C
Ambient humidity	45% ~ 80% (less than 70% at temperature higher than 30°C)
Power requirements	AC 100V, 120V, 220V, 230, 240V 50/60 Hz. (Optical Bench)
Power consumption	190VA (Optical Bench);
Dimensions	Photometer unit: 570W × 660D × 275H (mm)
Weight	Photometer unit: 35kg
Basic measurement modes	Spectrum measurement Time course measurement Quantitative measurement Kinetics (Optional Software), Photometric (Optional Software), Film Thickness (Optional Software), Color Analysis (Optional Software).
File functions	Open/Save/Delete Rename/Erase ASCII Export DIF Export

Table 5.1 Specifications for UV-2401/2501PC (continued)

Data processing	Arithmetic calculation of spectrum and constant value Arithmetic calculation between two spectrums Smoothing Differentiation (1st~4th order) 1/Y Calculation Log Calculation A ↔ T% Energy → T% Kubelka-Munk Blank Subtract Data Print Peak Pick Point Pick (15 points maximum) Peak Area Crop Scan Average Working Curve Activity Calculation (Time Course)
Display	Data output to printer (free formatting) Direct reading of wavelength and photometric values using cursor Expansion and expression of scale by numeric value setting or mouse Radar function (displays all graphed spectra completely with single operation)
Others	Auto File function, Repeat scan, PopUp ScanTM, SpeedBox(R), DDE

Chapter 6 Optional Accessories

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6.1 Optional Cells

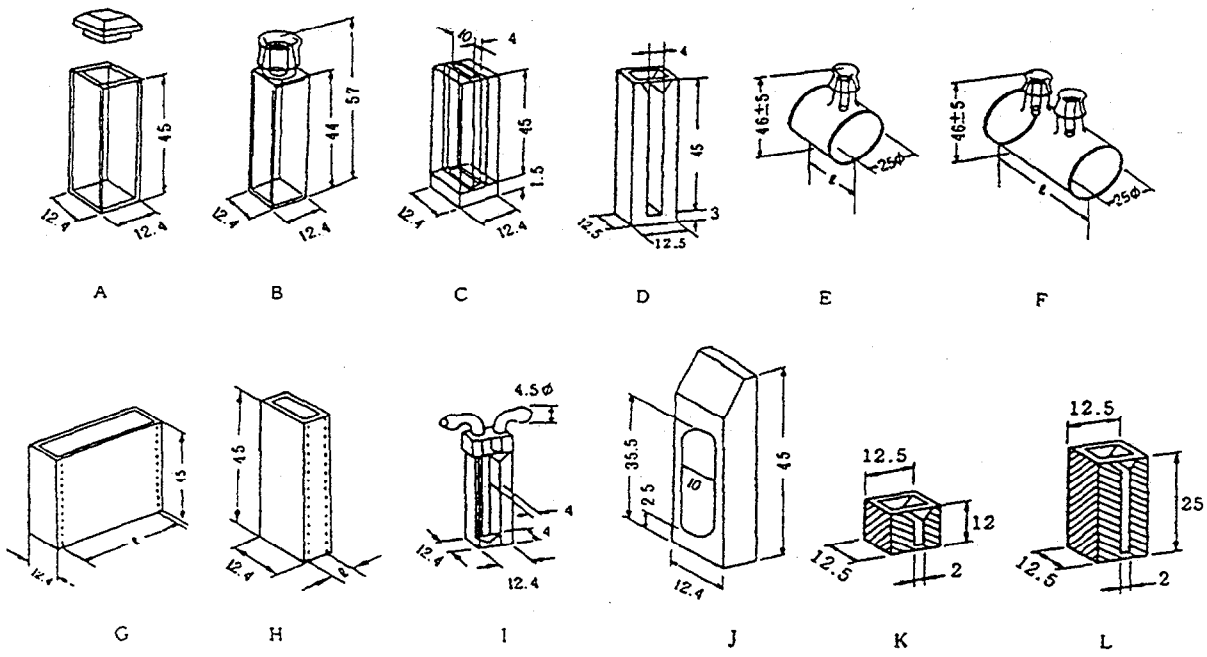

Fig. 6.1 Optional Cell Shapes

Table 6.1 List of Optional Cells

Name	Shape	Quartz (S cell)	Glass (G cell)	Qty	Special holder
Square cell, optical length 10mm	A	200-34442-00	200-34565-00	1	Not required
Square cell, matching type	A	201-98716-00	201-98746-00	2/set	Not required
Sealed-type square cell, optical length 10mm	B	200-34444-00	200-34444-01	1	Not required
Semi-microcell, optical length 10mm required sample volume 1.0ml or more	C	200-66501-00	200-66501-01	1	Cell holder with mask (P/N 204-06896 req'd)
Semi-microcell, optical length 10mm, required sample volume 1.0ml or more	D	200-66551-00		1	Cell holder with mask (P/N 204-06896 req'd)
Super-micro black cell, with 10mm optical path and required sample volume of 50μl or more	K	200-66578-11		1	Super-micro cell hoder (206-14334) req'd)
Micro-black cell, with 10mm optical path and required sample volume of 50μl or more	L	220-97043-00		1	Super-micro cell holder (206-14334) req'd

Table 6.1 List of Optional Cells (Continued)

Name		Shape	Quartz (S cell)	Glass (G cell)	Qty	Special holder
Cylindrical cell (OD 250) (ID 220)	L (Optical length)= 10mm	E	200-34448-00 (quartz window)	200-34448-01 (glass window)	1	Cylindrical cell holder (204-06216) req'd
	L = 20mm		200-34472-00 (quartz window)	200-34472-01 (glass window)	1	
	L = 50mm	F	200-34473-01 (quartz window)	200-34473-03 (glass window)	1	
	L = 100mm		200-34473-02 (quartz window)	200-34473-04 (glass window)	1	
Square long absorption cell	L = 20mm	G	200-34446-00	200-34446-01	1	Long-path rectangular cell holder (204-23118-01) req'd
	L = 50mm		200-34944-00	200-34944-01	1	
	L=100mm		200-34676	200-34676-01	1	
Short optical length cell	L = 1mm	H	200-34660-01	200-34662-01	1	Short optical length cell spacer req'd
	L = 2mm		200-34655	200-34662-11	1	
	L = 5mm		200-34449-00	200-34449-01	1	
Spacer for short optical length cel	for 1mm	J		204-21473-03	1	Not required
	for 2mm			204-21473-01	1	
	for 5mm			204-21473-02	1	

Table 6.1 List of Optional Cells (continued)

Nomenclature	Optical length	Shape	Quartz cell (S Cell)	Capacity	Optical width of cell	Special holder	Remarks
Flow cell	L = 10mm	1	200-34670-00	1.5ml	4 × 36	Not req'd, but front plate with hole req'd	For general use, without tubes

Table 6.2 Available Cell Wavelength Ranges

Quartz (S cell)	190 - 2500nm
Glass (G cell)	320 - 2500nm

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7.1 Index

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