206-97440A
Aug. 2011

Shimadzu UV-Visible Spectrophotometer

UV-2600/2700

INSTRUCTION MANUAL

Read the instruction manual thoroughly before you use the product.
Keep this instruction manual for future reference.

SHIMADZU CORPORATION
KYOTO JAPAN

ANALYTICAL & MEASURING INSTRUMENTS DIVISION

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Preface

Read this manual thoroughly before using the product.

Thank you for purchasing this product.

This manual describes installation, operation, hardware validation, cautions, and details about optional accessories related to this instrument.
Read the manual thoroughly before using the product. Use the product in accordance with the manual's instructions. Keep this manual for future reference.

■ IMPORTANT

- If the user or usage location changes, be sure this manual is always kept with the product.
- If the product's documentation, including this manual and the product's warning labels, become lost or damaged, contact your Shimadzu representative immediately.
- Safety Instructions are provided to ensure safe operation of the product.
  To ensure safe operation of the product, read these Safety Instructions carefully before use.
- To ensure safe operation, contact your Shimadzu representative for installation, adjustment, or re-installation after moving the product to a different site.

■ COPYRIGHT

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- Any errors or omissions which may have occurred in this manual despite the utmost care taken in its production will be corrected as soon as possible, but not necessarily immediately upon detection.
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Original version is approved in English.

Notations Used in This Manual

In this manual, warnings, cautions, and notes are indicated using the following conventions:

Notation	Description
WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or possibly death.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor to moderate injury or equipment damage.
NOTE	Emphasizes additional information that is provided to ensure the proper use of this product.

The following pictorial symbols and conventions are used in this manual with the following meanings.

Notation	Description
Reference	Indicates the location of related information in the instruction manuals.
Text in square brackets [ ]	Indicates text or expressions that appear in the window, such as buttons, menu items, setting options, window titles, and icons.
Text in quotation marks " "	Indicates entered numerical values, text, and keyboard key names.

Safety Instructions

To ensure safe operation of the product, read these Safety Instructions carefully before use.

Observe all of the WARNINGS and CAUTIONS described in this manual. They are extremely important for safety.

■Installation Site Precautions

⚠ WARNING

When using flammable and toxic samples, be sure to install ventilation equipment at the installation site.

⚠ CAUTION

- This product weighs 23 kg. To control the product, a separate personal computer (PC) is required. When selecting the installation location, consider the total weight of all equipment, including the PC, monitor, optional accessories and other devices.

  Use a flat and stable desk or a stand that can support the weight of all the equipment. The required approximate area size to install this product (W450 mm x D600 mm), a PC and a 17-inch liquid crystal display (LCD), and optional accessories is minimum W930 mm x D650 mm.
  If these requirements are not satisfied, the instrument may tip over or fall down, causing an accident.

- Position this product at least 100 mm away from the wall on its left-hand side and 50 mm from the wall on its right-hand side.

  This product is equipped with an exhaust fan on the left-hand side. If the clearance is not sufficient, the cooling capability of the fan may reduce, resulting in a risk of overheating and performance degradation.
  There is a power switch on the right-hand side of the product. Without adequate clearance, the power switch may not be able to be turned off quickly enough if an emergency occurs, which may lead to an accident.

NOTE

Avoid installation sites that are exposed to corrosive gases or excessive dust.

These adverse conditions may be detrimental to maintaining product performance and may shorten the product's service life.

Install the product in an indoor location under the following classifications: installation category II, pollution level 2, and altitude 2,000 meters max.

■Installation Precautions

To ensure safe operation, contact your Shimadzu representative for installation, adjustment, or re-installation after moving the product to a different site.

⚠ WARNING

- Take measures to prevent the product from falling in the event of an earthquake or other disaster.

  Strong vibrations could cause the product to fall over, resulting in injury.

- Ground the product.

  If the product is not properly grounded, malfunction or ground leakage may result, which may also result in electrical shock.
  Grounding the product is also important for providing reliable performance.

- The power specifications of the product are listed below.

  The specifications can also be found on the label on the side of the product. Be sure to connect the product to a power supply that meets the indicated specifications. Be sure to consider the power requirements of the PC and LCD that are used to control this product.
  Using a power supply that does not meet these specifications could cause fire and electric shock.
  Check that the power supply voltage is stable and that its current capacity is sufficient to operate all the components of the system. If not, the product will not operate properly.

Power Supply Voltage (Indication on product label)	Power Consumption	Frequency
AC 100 V to 240 V (100-240 V ~)	170 VA	50 Hz to 60 Hz

- Do not place heavy objects on the power cord, and keep any hot items away.

  The cord could be damaged, resulting in fire, electrical shock or malfunction.
  If the cord becomes damaged, contact your Shimadzu representative immediately.

- Do not modify the power cord in any way. Do not bend it excessively or pull on it.

  The cord could be damaged, resulting in fire, electrical shock or malfunction.
  If the cord becomes damaged, contact your Shimadzu representative immediately.

■Operation Precautions

⚠ WARNING

- Always wear protective gloves, glasses, etc. when handling any toxic or biologically infectious samples.
- Do not use flammable sprays (hair sprays, insecticide sprays, etc.) near the product.
  They could ignite and cause a fire.
- We recommend that you use a cell with a stopper when handling any toxic, biologically infectious, or combustible samples.

Reference
See "7.5 List of Cells".

⚠ CAUTION

If a sample is spilled, follow the handling and disposal instructions in the Material Safety Data Sheet (MSDS).

NOTE
Do not use mobile phones near the product. They may damage data.

■Precautions for Product Inspection, Maintenance, Adjustment, and Care

⚠ WARNING

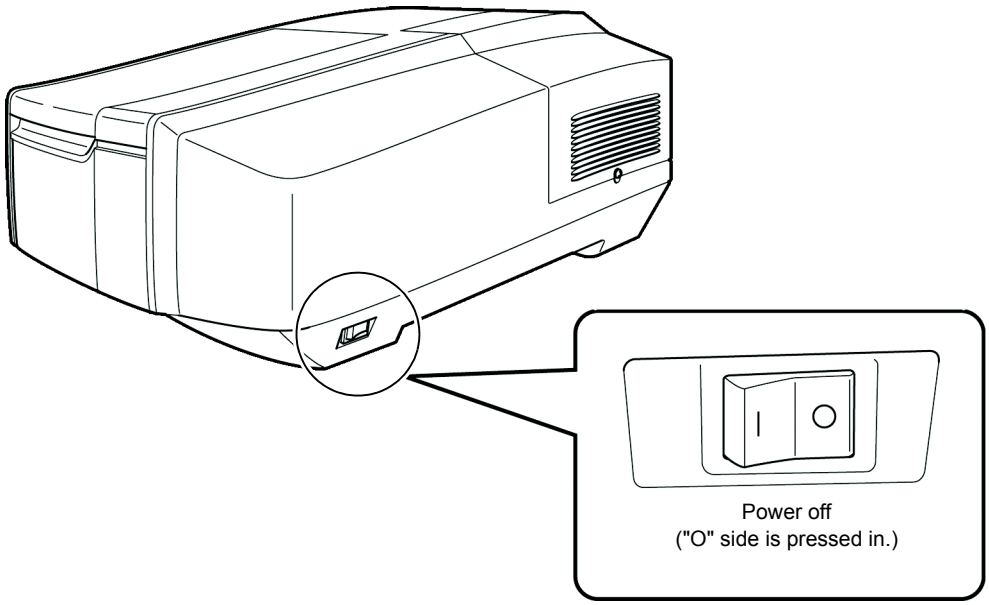
- Never remove the main cover.
  This may cause injury or product malfunction.
  The main cover does not need to be removed for routine maintenance inspection, or adjustment. Before attempting repairs that require removing the main cover, contact your Shimadzu representative.
- Unplug the product before inspection, maintenance, or parts replacement.
  Otherwise, electrical shock or short-circuit accidents could occur.
- If the power cord plug gets dusty, remove the plug from the power outlet and wipe away the dust with a dry cloth.
  Dust may cause fire.

NOTE

- When replacing parts, use the part listed in "1.1 UV-2600/2700 Configuration" and "7.2 Service Parts". Use of any other parts may result in product damage and malfunction.
- If any water gets onto the instrument, wipe it away immediately to prevent rust. Never use alcohol or thinner solvents for cleaning the product.
  They may cause rust or discoloring.
- Dispose of waste liquid properly and in accordance with the instructions of your administrative department.

■Emergency Procedure

In an emergency situation, press the "O" side of the power switch located on the bottom right side of the product to turn it off.



■Power Outage Procedure

In case of electrical failure, perform the following operations:

1. Press the "O" side of the power switch located on the bottom right side of the product to turn it off.
2. After the power comes back on, start up the product as normal, using the procedure described in "Operation Precautions".

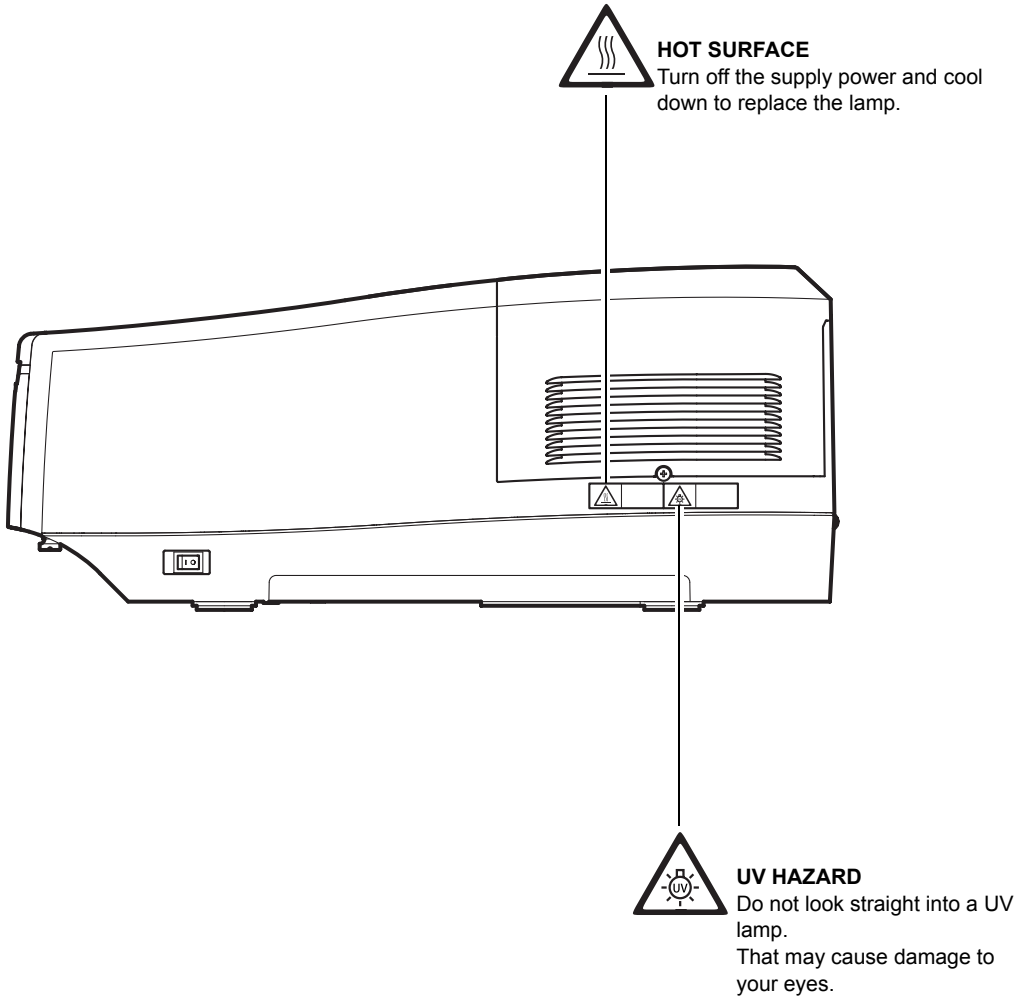
■Warning Labels

For safe operation, warning labels are affixed where special attention is required.

Should any of these labels peel off or become damaged, contact your Shimadzu representative to obtain replacement labels, and affix them to the product as shown below.

Warning Label (Part No. 206-27714)

Right side



Warranty

Shimadzu provides the following warranty for this product.

1. Period:

Please contact your Shimadzu representative for information about the period of this warranty.

2. Description:

If a product/part failure occurs for reasons attributable to Shimadzu during the warranty period, Shimadzu will repair or replace the product/part free of charge. However, in the case of products which are usually available on the market only for a short time, such as personal computers and their peripherals/parts, Shimadzu may not be able to provide identical replacement products.

3. Limitation of Liability:

1. In no event will Shimadzu be liable for any lost revenue, profit or data, or for special, indirect, consequential, incidental or punitive damages, however caused regardless of the theory of liability, arising out of or related to the use of or inability to use the product, even if Shimadzu has been advised of the possibility of such damage.
2. In no event will Shimadzu's liability to you, whether in contract, tort (including negligence), or otherwise, exceed the amount paid for the product.

4. Exceptions:

Failures caused by the following are excluded from the warranty, even if they occur during the warranty period.

1. Improper product handling
2. Repairs or modifications performed by parties other than Shimadzu or Shimadzu designated companies
3. Product use in combination with hardware or software other than that designated by Shimadzu
4. Computer viruses leading to device failures and damage to data and software, including the product's basic software
5. Power failures, including power outages and sudden voltage drops, leading to device failures and damage to data and software, including the product's basic software
6. Turning OFF the product without following the proper shutdown procedure leading to device failures and damage to data and software, including the product's basic software
7. Reasons unrelated to the product itself
8. Product use in harsh environments, such as those subject to high temperatures or humidity levels, corrosive gases, or strong vibrations
9. Fires, earthquakes, or any other act of nature, contamination by radioactive or hazardous substances, or any other force majeure event, including wars, riots, and crimes
10. Product movement or transportation after installation
11. Consumable items

    Note: Recording media such as floppy disks and CD-ROMs are considered consumable items.

* If there is a document such as a warranty provided with the product, or there is a separate contract agreed upon that includes warranty conditions, the provisions of those documents shall apply.

After-Sales Service and Replacement Parts Availability

After-Sales Service

If any problem occurs with the product, inspect it and take the corresponding action as described in the section "Chapter 6 Troubleshooting".

If the problem cannot be solved, or if symptoms not covered in the Troubleshooting section occur, contact your Shimadzu representative.

Replacement Parts Availability

Replacement parts for this product will be available for a period of seven (7) years after the product is discontinued. Thereafter, such parts may cease to be available.

Note, however, that the availability of units or parts not manufactured by Shimadzu shall be determined by the relevant manufacturers. If Shimadzu receives notice of the discontinuation of units or parts, the necessary quantity for the above period is immediately calculated and secured. However, such units or parts may cease to be available within seven years after the discontinuation of the product, depending on individual manufacturer conditions and on changes in the quantity required.

Disposal Precautions

When disposing of the product, contact your Shimadzu representative.

If you dispose of the product yourself, do so in accordance with the processing standards determined by law, separately from general industrial waste and household garbage.

Action for Environment (WEEE)

To all users of Shimadzu equipment in the European Union:

WEEE Mark

Equipment marked with this symbol indicates that it was sold on or after 13th August 2005, which means it should not be disposed of with general household waste. Note that our equipment is for industrial/professional use only.

Contact Shimadzu service representative when the equipment has reached the end of its life. They will advise you regarding the equipment take-back.

With your co-operation we are aiming to reduce contamination from waste electronic and electrical equipment and preserve natural resource through re-use and recycling.

Do not hesitate to ask Shimadzu service representative, if you require further information.

Regulatory Information

For Europe:
The product complies with the following requirements.

EMC Directive 2004/108/EC
Low Voltage Directive 2006/95/EC

Product Name	UV-Visible Spectrophotometer
Model Name	UV-2600/UV-2700
Manufacturer	SHIMADZU CORPORATION ANALYTICAL & MEASURING INSTRUMENTS DIVISION
Address	1 NISHINOKYO-KUWABARACHO NAKAGYO-KU KYOTO 604-8511 JAPAN
Authorized Representative in EU	Shimadzu Europa GmbH
Address	Albert-Hahn-Strasse 6-10, 47269 Duisburg, F.R. Germany

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4 Maintenance

5 Replace Sample Compartment

6 Troubleshooting

7 Reference Materials

1 Instrument Overview

This instrument is a UV-visible spectrophotometer for measuring the absorbance, transmittance, and reflectance of liquid and solid samples.
You can control this instrument using a special software UVProbe via a PC.

1.1 UV-2600/2700 Configuration

This instrument is shipped with the following items. Upon opening the shipping container, be sure that all of the listed parts are accounted for in your shipment.

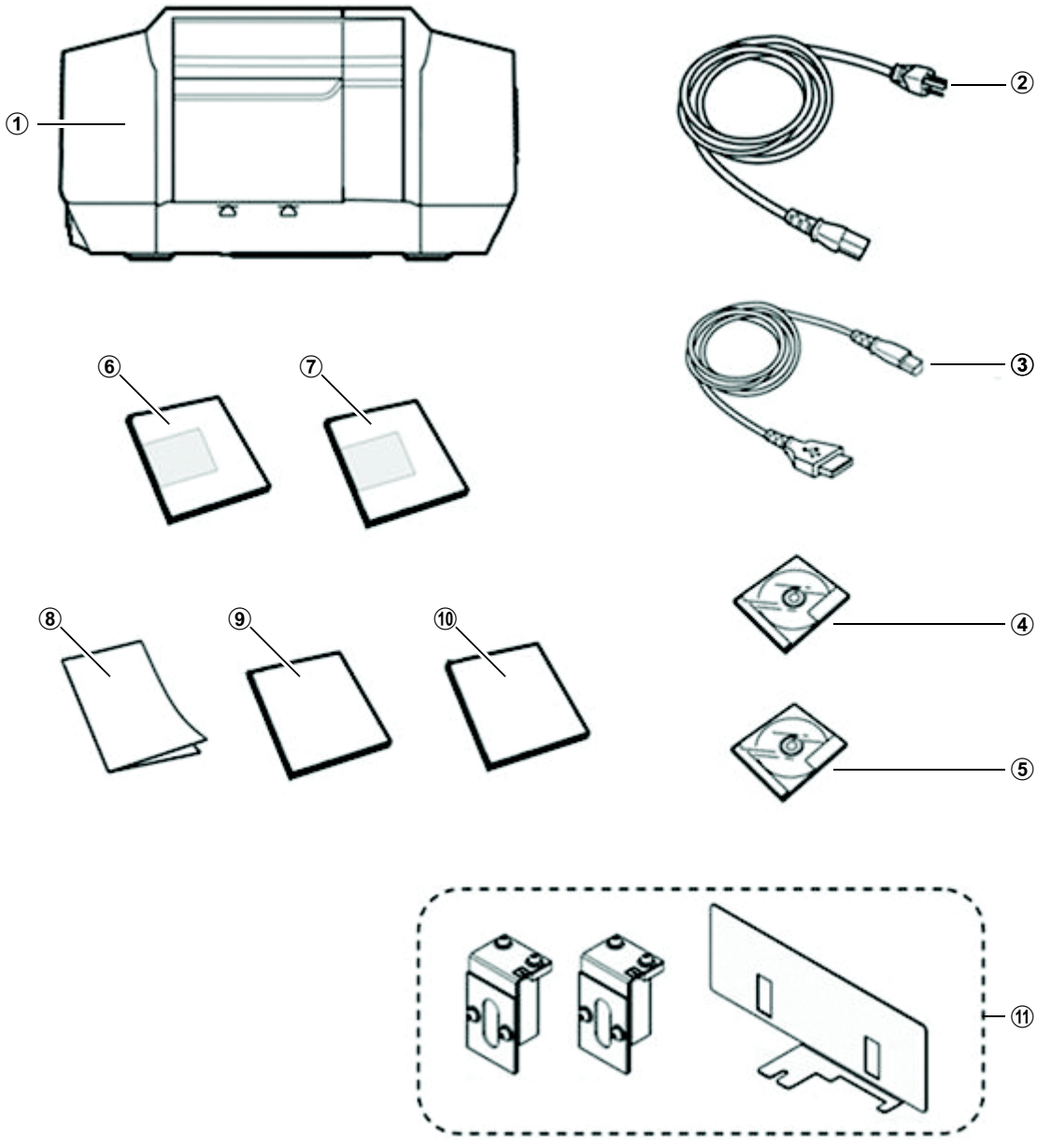


Fig.1-1 Standard Contents

Table 1-1

No.	Check	Part Name	Part No.	Q'ty
①		Spectrophotometer	206-27602-91 (UV-2600) 206-27602-92 (UV-2700)	1
②		AC Power Cable for 100 V area AC Power Cable for 200 V area	071-60816-12 071-60825-51	1
③		USB Cable	088-52848-32	1
④		UVProbe Software*1 (Install CD)	206-21439-91	1
⑤		UV Performance Validation Software*2 (Install CD)	206-21341-91	1
⑥		UV-2600/2700 Instruction Manual (this instruction manual)	206-97440	1
⑦		Instruction Manual UVProbe Tutorial	206-94459	1
⑧		Easy Operation Procedure for Photometric Module	206-94653	1
⑨		UV Performance Validation Software Instruction Manual	206-97445	1
⑩		The Shimadzu User Authentication Tool Instruction Manual*3	223-10410	1
⑪		High-absorbance measurement kit*4 (only UV-2700)	206-27692-41	1

*1 This software is used to control the spectrophotometer.
*2 This software is used to check the performance of the spectrophotometer.

Reference

See "4.6 Performance Check".

*3 This manual is the user management instruction manual for UVProbe.
*4 This kit is specially designed for high-absorbance measurement, including Abs. 3 and Abs. 4 dark filters as well as a partition plate to be set in the sample compartment.
The included parts are as follows:
Abs. 3 dark filter : Part No. 206-28562-91
Abs. 4 dark filter : Part No. 206-28562-92
Partition plate : Part No. 206-27693-02

1.2 Components

1.2.1 UV-2600/2700 Front View, Top View

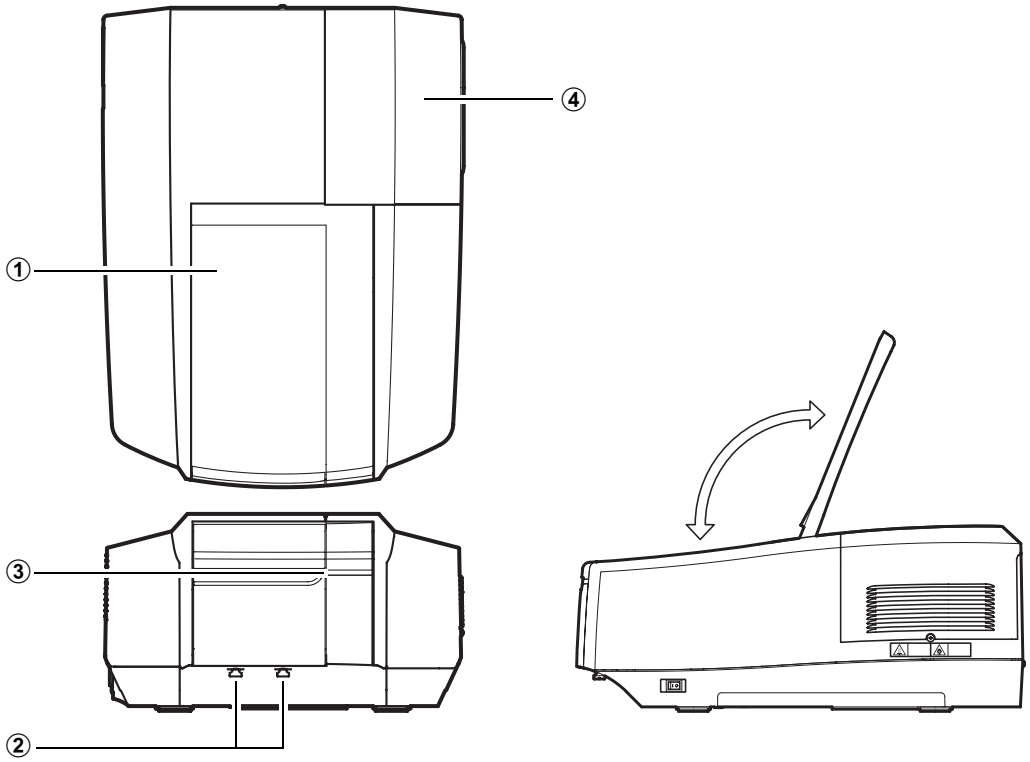


Fig.1-2 UV-2600/2700 Front and Top Views

Table 1-2

No.	Name	Description
①	Sample Compartment Cover	Open and close this cover when setting the measured sample. When changing samples, raise the cover of the sample compartment by an angle of at least 90 degrees to be sure that it is completely open. Carefully operate so that the cover does not close while samples are being changed. ☞ Reference See "1.2.4 Sample Compartment".
②	Sample Compartment Set Screws	These are screws for fastening the sample compartment unit. ☞ Reference See "5.2 Remove/Install the Sample Compartment Unit (Standard)".
③	LED	This lights when the power to the unit is on. • While measuring or during standby: Lights in green • During initialization: Flashes in green • During failure: Lights in red

No.	Name	Description
④	Light Source Compartment Cover	This is the cover of the light source compartment. When replacing the light source or Mercury Lamp Unit (optional accessory), open and close this cover. Reference See "1.2.5 Light Source Compartment" and "4.4 Replace the Light Source Lamp".

1.2.2 UV-2600/2700 Left Side View

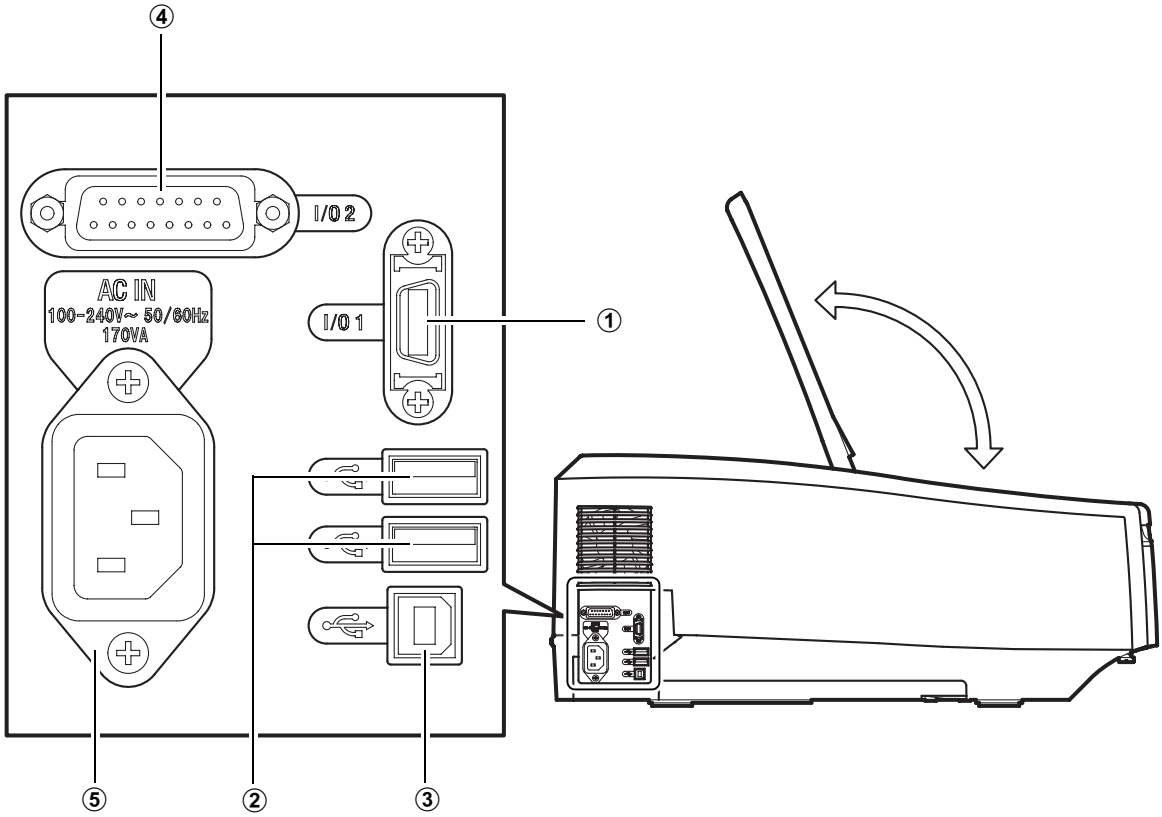


Fig.1-3 UV-2600/2700 Left Side View

Table 1-3

No.	Name	Description
①	I/O1	This is the connector to connect the optional accessory "ISR-2600/2600Plus" or "MPC-2600". Reference For installation and connection procedures, refer to the instruction manual of each optional accessory.

No.	Name	Description
②	USB Connector	The following optional accessories can be connected via the USB connector. Note, however, it is necessary to separately purchase the designated USB conversion adaptor required for the corresponding accessory and connect it. • For connecting 6-Cell Electronic Temperature Control Cell Positioner CPS-240A/B -> USB Adapter CPS (P/N: 206-25234-91) • For connecting Auto Sample Changer ASC-5 -> USB Adapter ASC (P/N: 206-25235-91) ☞ Reference For installation and connection procedures, refer to the instruction manual of each optional accessory.
③	USB Connector (for PC)	This is the connector used to connect the instrument to a PC. Do not connect the device to a PC until the USB driver is installed in the PC. ☞ Reference See "2.5.2 Connecting the USB Cable".
④	I/O2	This is the connector to connect the "Sipper 160", "Syringe sipper", or "Mercury Lamp Unit" (optional accessories). ☞ Reference For installation and connection procedures, refer to the instruction manual of each optional accessory.
⑤	Power Supply Connector	This connector is used to connect the AC power cable supplied as a standard accessory for power supply from the AC power outlet. ☞ Reference See "2.2 Connecting Power".

1.2.3 UV-2600/2700 Right Side View

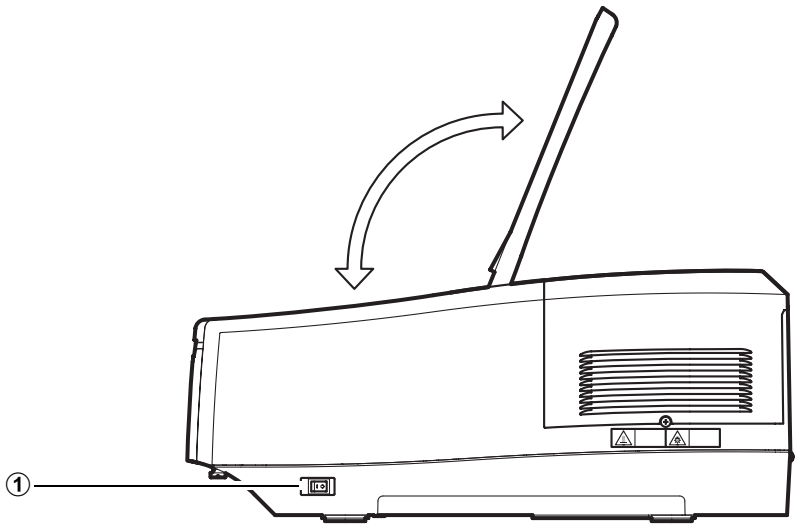


Fig.1-4 UV-2600/2700 Right Side View

Table 1-4

No.	Name	Description
①	Power switch	Use this switch to turn on/off the instrument. Press the "I" side on the switch to turn the instrument on, and press the "O" side to turn it off.

1.2.4 Sample Compartment

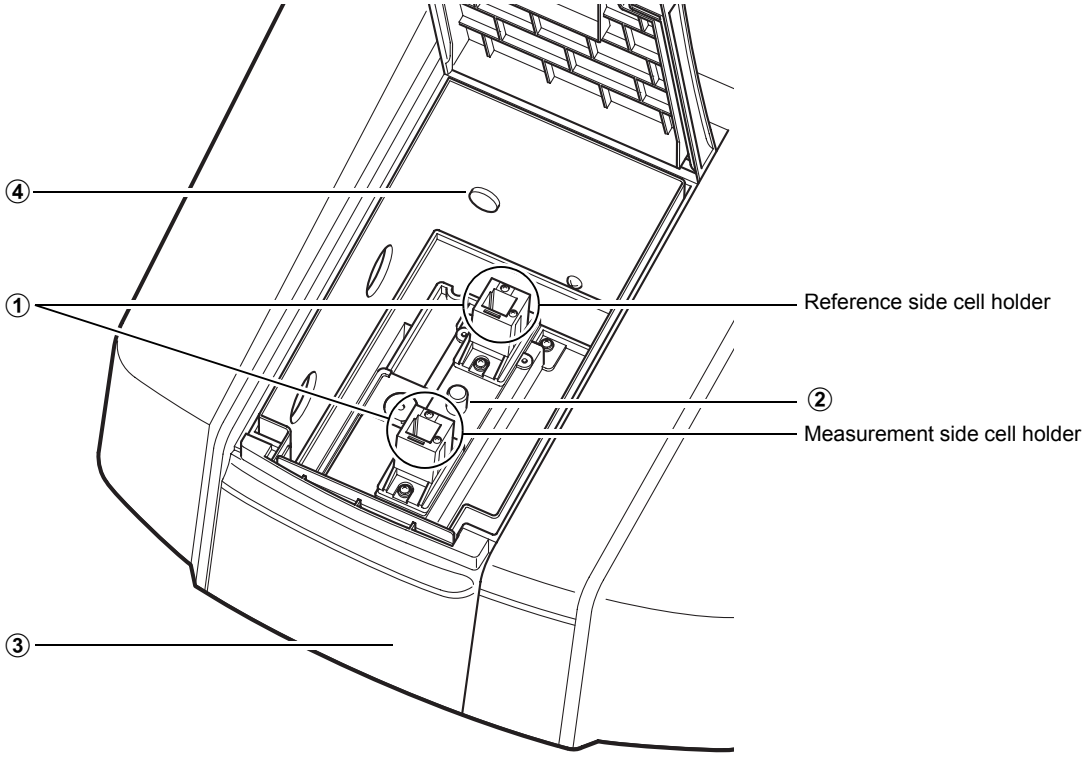


Fig.1-5 Sample Compartment

Table 1-5

No.	Name	Description
①	Cell holder	The cell holder for rectangular 10 mm light path cells has one sample cell holder and one reference cell holder. ☞ Reference See "7.5 List of Cells".
②	Cell Holder Set Screws	The cell holder can be easily removed by loosening and removing the cell holder set screws. ☞ Reference See "5.1 Removing/Installing the Cell Holder".
③	Sample Compartment Front Cover	When using a flow cell, etc., holes are needed to pass tubing, etc. through. To cope with such operation, the sample compartment has a removable cover that can be exchanged with a different type of front panel. ☞ Reference See "5.3 Remove/Install the Sample Compartment Front Cover".
④	Multi-Cell Holder Drive Connector	This is the connector for connecting the control cables for the 6-cell multi cell sample compartment and the 8/16-cell micro multi cell holder (MMC-1600) (optional accessories).

1.2.5 Light Source Compartment

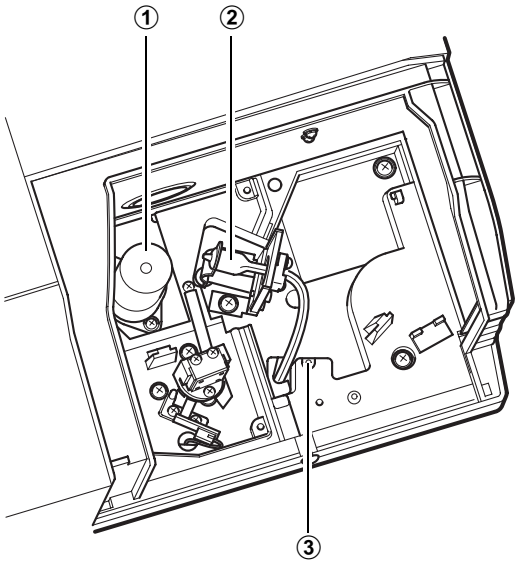


Fig.1-6 Light Source Compartment (UV-2600)

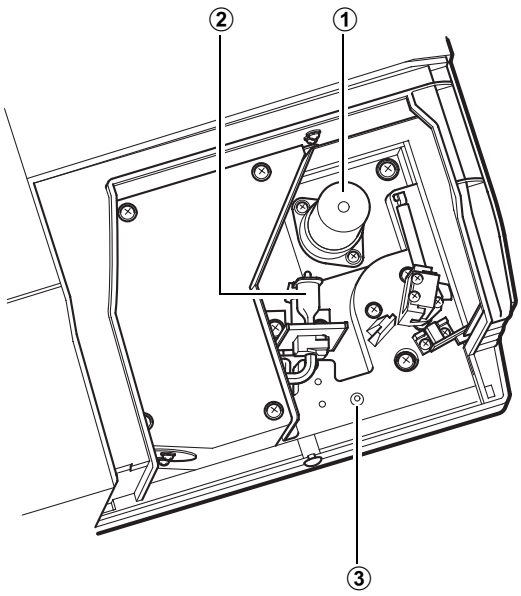


Fig.1-7 Light Source Compartment (UV-2700)

Table 1-6

No.	Name	Description
①	D2 (deuterium) Lamp	This is the light source for the ultraviolet spectrum (from 185 nm to the variable wavelength*1). Reference See "4.4 Replace the Light Source Lamp" to change the D2 lamp.
②	WI (halogen) Lamp	This is the light source for the visible/near-infrared spectrum (from variable wavelength*1 to 900 nm or 1400 nm*2). Reference See "4.4 Replace the Light Source Lamp" to change the WI lamp.
③	Third Light Source Installation Point	To a light source other than the standard D2 and WI lamps, a Mercury Lamp Unit (optional accessory) or a unit for introducing light from an externally installed light source.

*1 Variable Wavelength:
You can freely set the wavelength of the light source between 290 nm and 370 nm, which value is incremented by 0.1 nm.

Reference
See "3.4.1 Creating the Measurement Method (Parameter)" in "3.4 Measurement Procedure" for more information.

*2 Measurable Wavelengths:
When using the spectrophotometer by itself, the measurement wavelength range is from 185 nm to 900 nm.
When using the instrument in conjunction with an optional accessory ISR-2600Plus, it is extended to a range from 220 nm to 1,400 nm.

2 Installation

2.1 Installation Site

2.1.1 Installation Requirements and Preparation

To use the instrument properly and safely, install it in a location that meets the following requirements.

⚠ WARNING

When using flammable and toxic samples, be sure to install ventilation equipment at the installation site.

NOTE

- Do not install the instrument in an environment filled with dust or corrosive gas.
  These conditions will adversely affect the durability and performance of the instrument.
- Do not install the instrument near a device that produces strong magnetic fields.
  Magnetic fields may adversely affect the accuracy of the instrument.
  Filters may be added to the power supply lines to reduce any electrical noise.
- To ensure performance of the instrument, the installation site must meet the following requirements.
  - The ambient temperature must be between 15 °C and 35 °C with minimal temperature variations.
  - Air flow from air conditioners and heating systems must be avoided.
  - Exposure to direct sunlight must be avoided.
  - The site must be free from vibration.
  - Humidity must remain between 35 % and 80 % with no condensation.
    (Humidity must be maintained under 70 % at ambient temperatures over 30 °C.)
  - Install the instrument in an indoor location under the following classifications: installation category II, pollution level 2, and altitude 2,000 meters max.

2.1.2 Installation Space

⚠ CAUTION

- **This instrument weighs 23 kg. To control the instrument, a separate PC is required. When selecting the installation location, consider the total weight of all equipment, including the PC, monitor, optional accessories and other devices.**

  Use a flat and stable desk or a stand that can support the weight of all the equipment. The required approximate area size to install this instrument (W450 mm x D600 mm), a PC and a 17-inch liquid crystal display (LCD), and optional accessories is minimum W930 mm x D650 mm. If these requirements are not satisfied, the instrument may tip over or fall down, causing an accident.

- **Position this instrument at least 100 mm away from the wall on its left-hand side and 50 mm from the wall on its right-hand side.**

  This instrument is equipped with an exhaust fan on the left-hand side. If the clearance is not sufficient, cooling by the fan may not be effectively done, resulting in a risk of overheating and performance degradation.

  On the right-hand side of the instrument, a power switch is provided. Without adequate clearance, the power switch may not be able to be turned off quickly enough if an emergency occurs, which may lead to an accident.

The dimensions of the spectrophotometer are as given in the figure below.

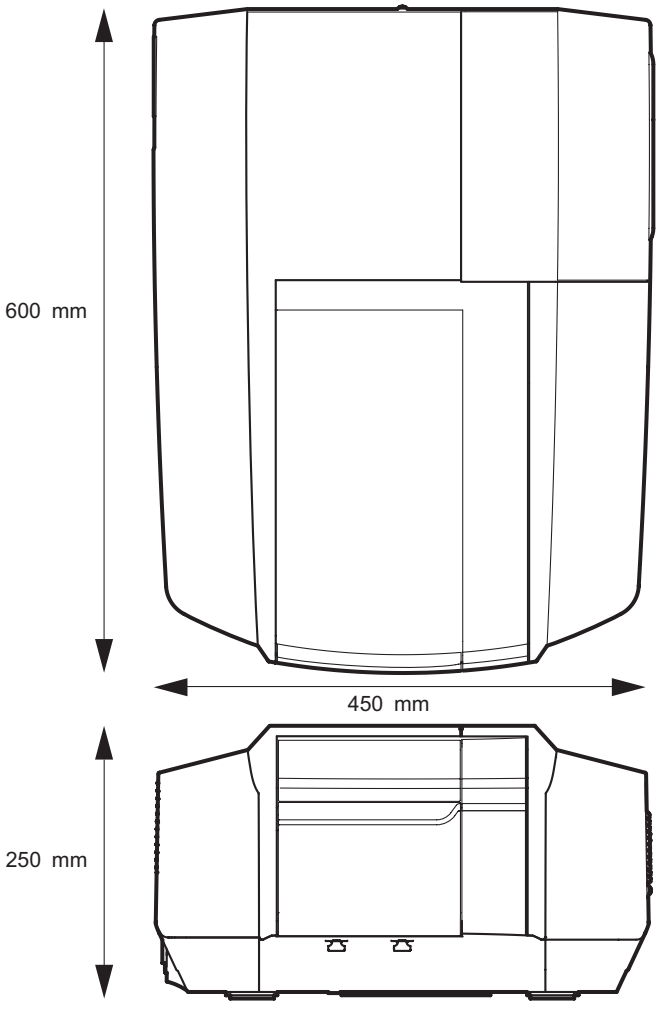


Fig.2-1 Dimensions of Spectrophotometer

2.2 Connecting Power

2.2.1 Verifying Power Supply Voltage Requirements

WARNING

The power supply voltage is indicated at the power supply connector on the left-hand side of the spectrophotometer. Be sure to connect the instrument to a power supply that meets the indicated specifications.

Using a power supply that doe not meet these specifications could cause fire and electric shock.

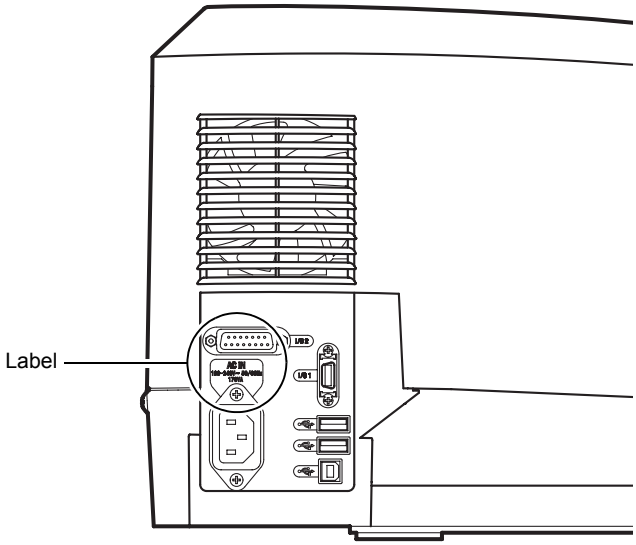


Fig.2-2 Location of the Power Supply Voltage Indication

The power specifications of the spectrophotometer are listed below.

Table 2-1

Power Supply Voltage (Indication on product label)	Power Consumption	Frequency
AC 100 V to 240 V (100-240 V ~)	170 VA	50 Hz to 60 Hz

Verify that the electrical outlet can provide sufficient power.

Insufficient power may cause blackouts and voltage drops, also affecting other devices that use the same power supply.

The range of the allowable voltage fluctuation is ± 10 %. If the fluctuation exceeds 10 %, be sure to use a voltage stabilizer.

2.2.2 Connecting to the Power Outlet

⚠ WARNING

Handle the AC power cord carefully.

The cord could become damaged, causing fire, electric shock, or instrument malfunction.

- Do not place heavy objects on the power cord.
- Keep hot appliances away from the power cord.
- Do not modify the power cord.
- Do not forcefully bend or stretch the power cord.
- Hold the plug (not the cord) when connecting or disconnecting the power cord.

Should the AC power cord become damaged, contact your Shimadzu representative.

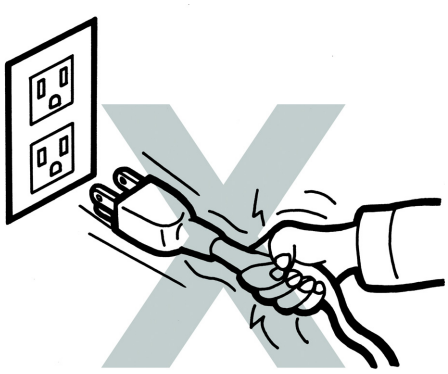


Fig.2-3

⚠ CAUTION

Verify that the power switch of the instrument is off (i.e., "O" is pressed in) before connecting the power cord to the outlet.

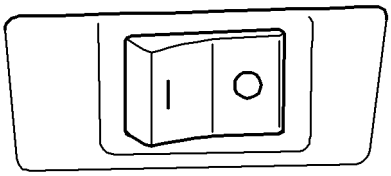


Fig.2-4

1 Connect the standard accessory AC power cord to the power supply connector (Fig.1-3) on the left-hand side of the spectrophotometer.

2 Connect the AC power cord to the power outlet.

2.2.3 Grounding

⚠ WARNING

Ground the instrument.

If the instrument is not properly grounded, malfunction or ground leakage may result, which may also result in electrical shock.

Grounding the instrument is also important for providing reliable performance.

The AC power cord shipped with the instrument consists of three pins including a ground pin. When installing the instrument, be sure to connect the cord to a three-pin outlet.

2.3 Checking the Light Source Lamp (D2)

⚠ CAUTION

- **Before opening the light source compartment cover, be sure to power off the instrument and remove the electric plug from the outlet.**
  Fire, electric shock, or instrument malfunction may result.
  Do not turn on the instrument while the light source compartment is visually exposed. The generated ultraviolet ray may damage the eyes.
- **When replacing the lamp immediately after operating the instrument, leave the instrument for at least 30 minutes with the power turned off to ensure that the lamp is totally cooled down.**
  Touching the lamp when it is still hot will burn you.
- **Be careful not to break the lamp.**
  The broken pieces of glass may cause injury.

NOTE

- When removing and installing the light source compartment cover, avoid hitting the protrusion (Fig.4-5) on the top of the D2 (deuterium) lamp against the back of the cover.
  The glass may break or crack, and air may leak into the vacuum.
- When handling the lamp, wear cloth gloves so as not to leave fingerprints on the glass.
  When the light source window gets hot, any fingerprints on the bulb will burn onto the bulb and light transmission will deteriorate.

Check that the light source D2 (deuterium) lamp was not dislodged from its correct mounting position during transportation.

Reference

For details about the components of the light source compartment and the procedure to remove the cover, see "4.4 Replace the Light Source Lamp".

1 Remove the light source compartment cover.

2 Check to be sure that the D2 lamp is seated well in the socket with no gap.
If the lamp is mounted at an angle or there is any gap, reinstall the lamp so that there is no gap.

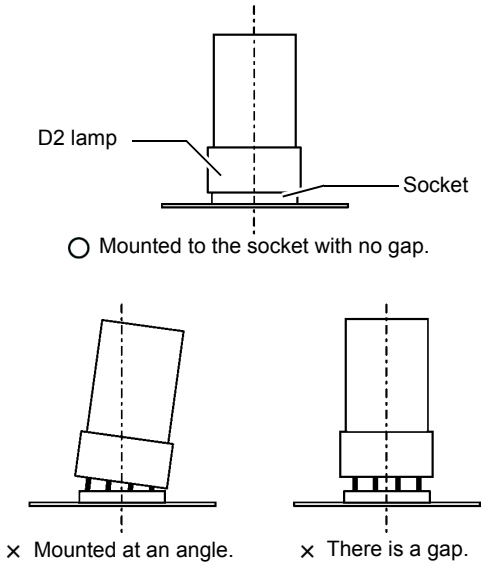


Fig.2-5 Checking D2 Lamp Installation

3 Reinstall the light source compartment cover.

2.4 Operation Precautions

■ Precautions Before Operation

NOTE

- Before turning on the power switch, check to be sure that nothing is placed in the sample compartment and cell holder.
  If the power is turned on while any cell containing a sample is set, the light may be obstructed and therefore the lamp energy check and/or wavelength origin check among the initialization items may return an "Error".
  When this occurs, turn off the power switch, remove the cell, and then turn on the power switch again.
- If "Sipper 160" (optional accessory) is installed, turn on the power switch with the flow cell filled with distilled water.
  If any sample other than water is left within the flow cell, the light that otherwise passes through the flow cell is refracted or scattered, which may cause the lamp energy check and/or wavelength origin check among the initialization items to return an "Error".
  When this occurs, first turn off the power switch, then turn on the power switch again while pressing down the sipper 160 suction lever. After the pump of the sipper 160 starts rotating, aspirate distilled water from the sample suction port. When the distilled water starts draining, release the lever and finish the suction.
- Keep the sample compartment cover closed during measurement or 100 %T (0 Abs) correction.
  Any outside light entering the device, if any, disables normal measurement and correction.
- 100 %T (0 Abs) correction is the function that corrects the no sample state or the mounted sample cell state to 100 %T for transmittance measurement, and 0 Abs for absorbance measurement.
  "Auto Zero" corrects only by the set wavelength. "Baseline" corrects by the section-specified wavelength range.

2.5 Connecting to UVProbe

Follow the UVProbe set-up procedure for controlling the spectrophotometer and configure other settings.

2.5.1 Installation UVProbe Software

NOTE

Do not connect the spectrophotometer and PC with a USB cable until USB driver installation is completed.

On the PC, install User Authentication, UVProbe, and Virtual COM Port Driver for USB (UV-2600/2700 Device Driver) for the spectrophotometer, sequentially.

Insert the UVProbe Installation disc into the CD-ROM drive to start Launcher.

Follow the on-screen instructions to install the software.

Fig.2-6

1 Press the [Step 1 Shimadzu user Authentication Tool] button to start the installation.

Reference

Refer to the "The Shimadzu User Authentication Tool Instruction Manual".

2 Press the [Step 2 UVProbe] button to start the installation.

Reference

Refer to the "Instruction Manual UVProbe Tutorial".

3 Press the [Step 3 Virtual COM Port Driver for USB] button to start the installation.
When the following window may appears during the installation, click [Install] to continue the installation.

Fig.2-7

2.5.2 Connecting the USB Cable

Use the USB cable to connect the spectrophotometer and the PC.

1 Complete "2.5.1 Installation UVProbe Software" and then verify that the PC is turned on.

2 Verify that the spectrophotometer is turned off.

3 Connect the USB cable to the USB connector for a PC on the left-hand side of the spectrophotometer.

Reference
See "1.2.2 UV-2600/2700 Left Side View".

4 Connect the USB cable to the PC.

5 Turn on the power switch on the right side of the spectrophotometer.
The PC detects the spectrophotometer, and then the USB Connection COM Port number appears on the bottom right of the window.

Reference
See "2.6.1 Turning the Power On and Off".

6 Take note of the USB Connection COM Port number.

The number is required for setting the COM Port for communications in UVProbe.
To check the number again, right-click the hardware eject icon located at the lower rightmost position of the window to display the COM Port number.

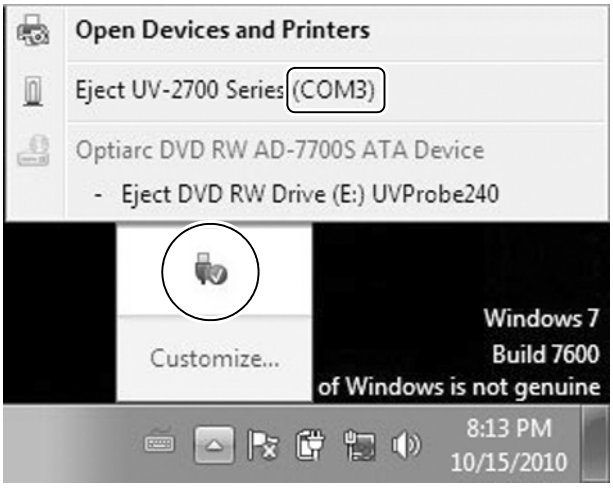


Fig.2-8

NOTE

When re-confirming the COM port number, take care not to take out the COM Port by mistake.

2.5.3 Registering the Instrument to UVProbe

This procedure registers your instrument in UVProbe.

The selected and input information (except the COM Port number) is saved as file information in the data file obtained using UVProbe.

1 Double-click the 

icon on your desktop to start UVProbe.

2 Go to the UVProbe [Instrument] menu and click [Add].

The [Add Instrument Wizard] appears.

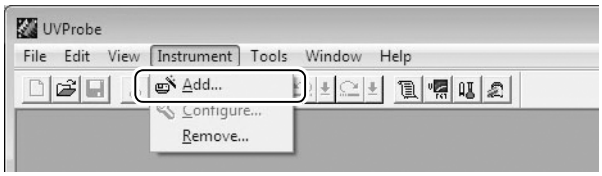


Fig.2-9

NOTE

If the software is installed in security mode or GLP mode, the [User Login] window appears. Before updating user information, log in by entering "admin" for the user ID and nothing for the password.

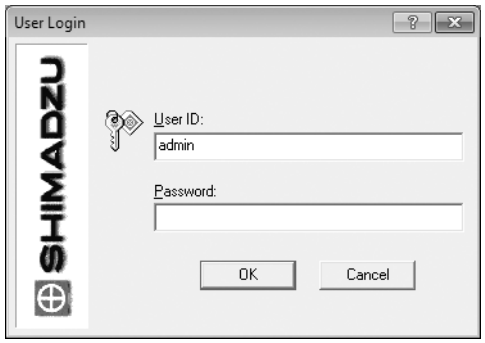


Fig.2-10

3 Select your instrument model and click [Next].

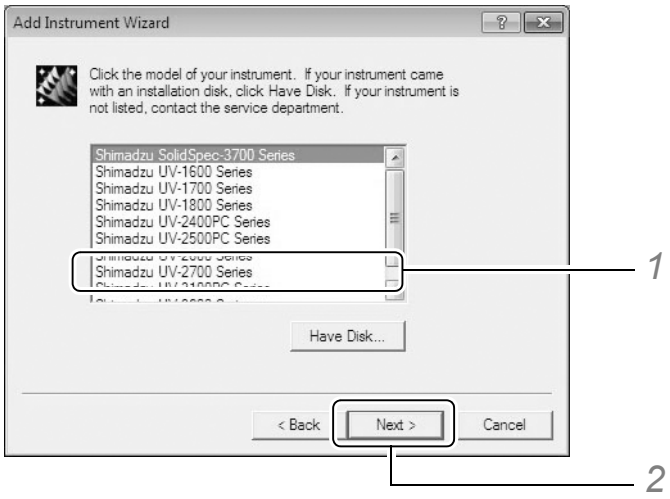


Fig.2-11

1 Select "Shimadzu UV-2600 Series" or "Shimadzu UV-2700 Series".
2 Click [Next].

4 Select your instrument model and Connection COM Port and click [Next].

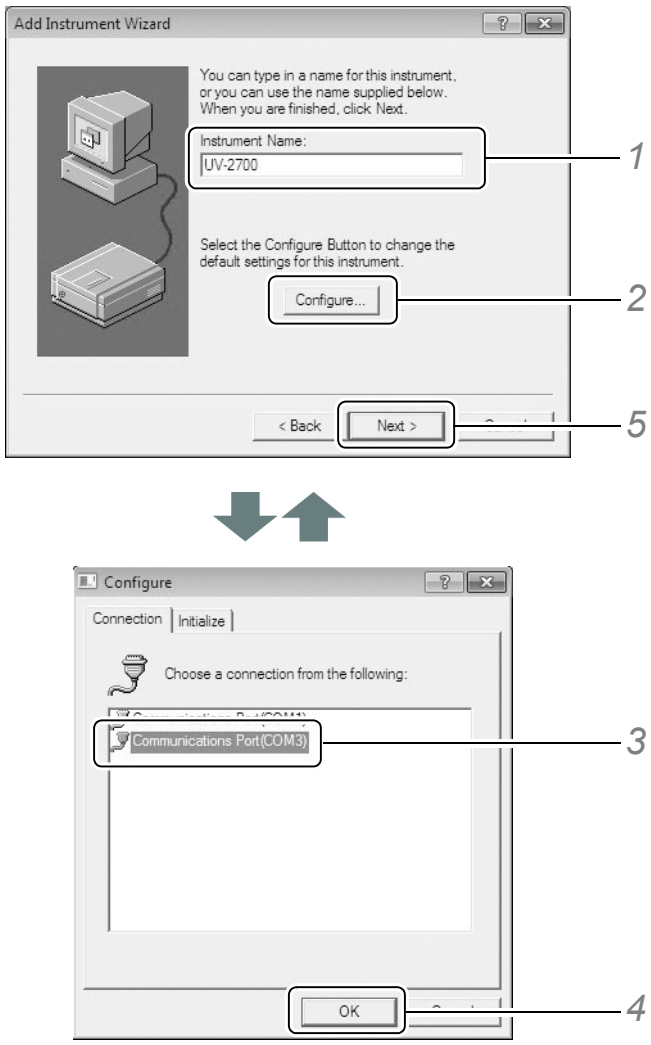


Fig.2-12

1 Enter "UV-2600", "UV-2700", or any instrument name here.

If you are managing several spectrophotometers on a single PC by using identification codes for the instrument names, such as "UV-1" and "UV-2", you can enter the relevant instrument name.

2 Click [Configure].

3 Select the COM Port number confirmed in "2.5.2 Connecting the USB Cable".

4 Click [OK].

5 Click [Next].

5 Enter the item name and serial number and click [Finish].

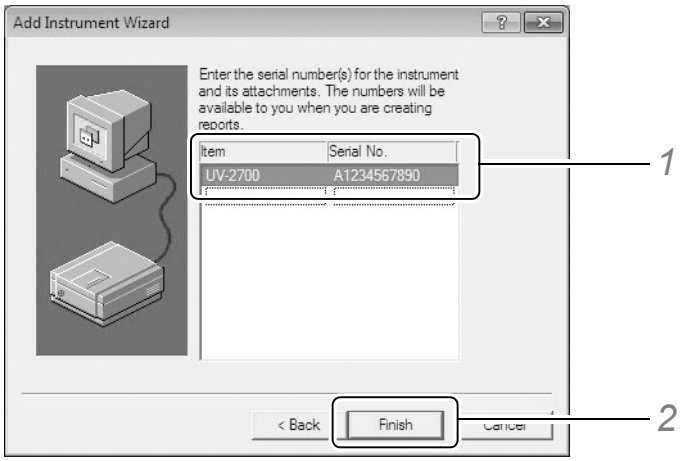


Fig.2-13

1 After left-clicking within the frame shown in Fig.2-13, enter the "model name" and "serial number" printed on the label affixed on the side of the instrument.

2 Click [Finish].

Now connection of the spectrophotometer to the PC is enabled.
Go to step 4 in "2.6.1 Turning the Power On and Off".

2.6 Turning On the Power and Initialization

2.6.1 Turning the Power On and Off

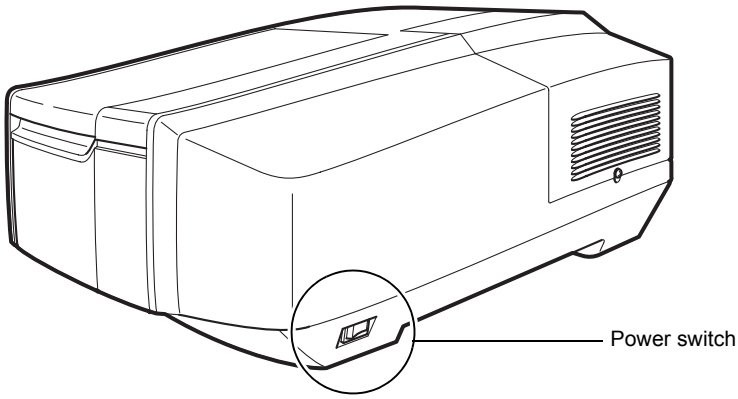


Fig.2-14 Power Switch for UV-2600/2700

■ Turning On the Power

1 Press "I" on the power switch (Fig.2-14) to turn on the power.
The LED on the front of the spectrophotometer lights in red, and then it flashes in green.
The LED flashes in green during initialization and lights in green after initialization.

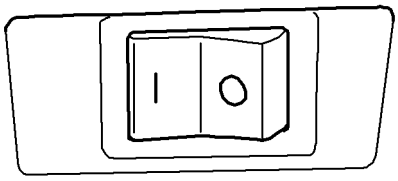


Fig.2-15

2 Double-click the 

icon on your desktop to start UVProbe.

The UVProbe (Measurement window) appears.

3 Click [Spectrum] from the [Window] menu.

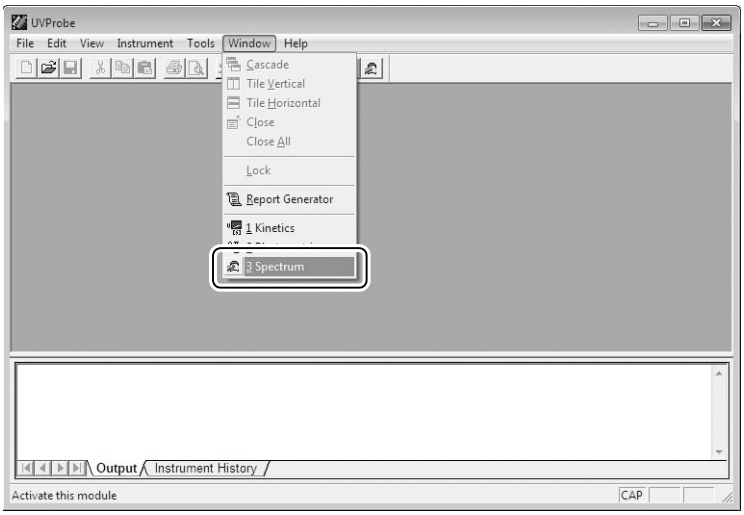


Fig.2-16

NOTE

If the software is installed in security mode or GLP mode, the [User Login] window appears. Before updating user information, log in by entering "admin" for the user ID and nothing for the password.

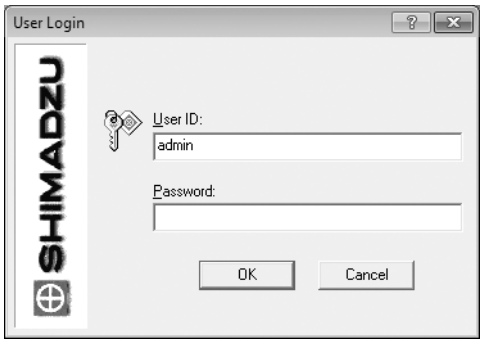


Fig.2-17

The Measurement window for the spectrum module appears.

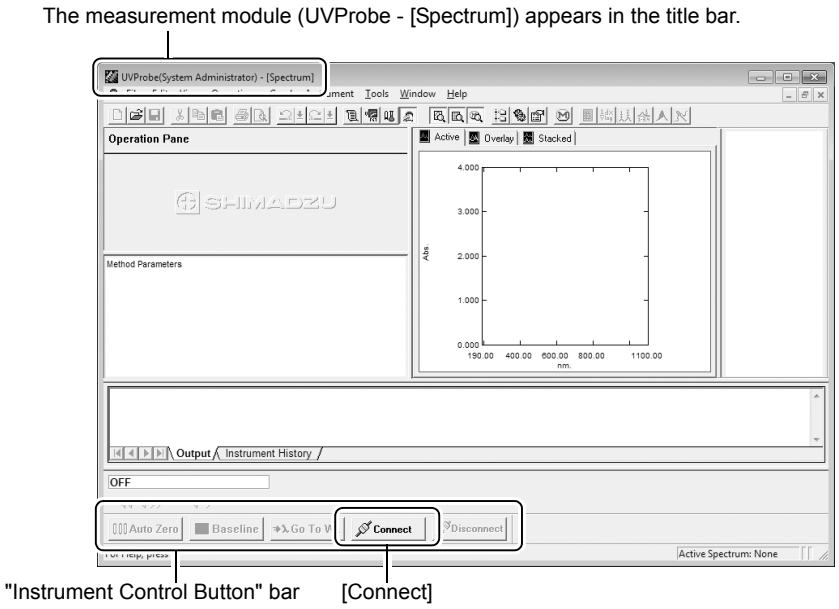


Fig.2-18 Measurement Window for Spectrum Module

4 Click [Connect] in the [Instrument Control Button] bar to connect the spectrophotometer to the PC.

NOTE

Wait until the green LED on the front side of the spectrophotometer flashes three or more times and then connect.

An error message may appear if connection is attempted immediately after the power is turned on. In that case, clear the error to enable connection.

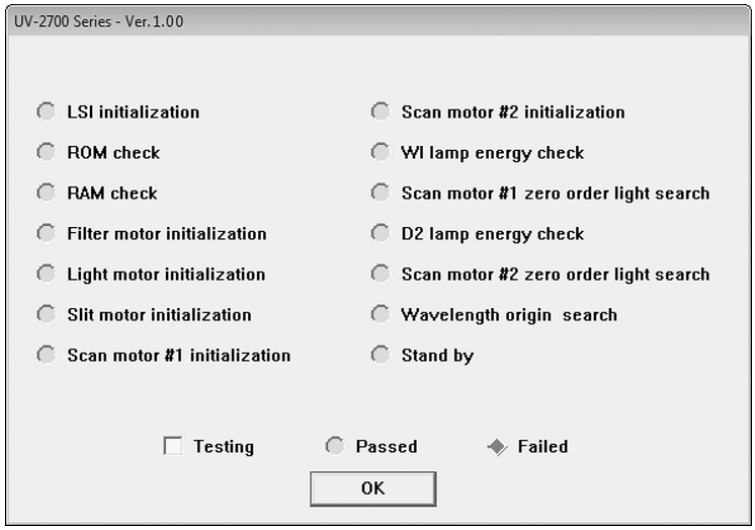


Fig.2-19 Initialization Window (for UV-2700)

Initializing items are set sequentially, displaying results either as Passed or Failed. The results for the items that have already been completed when [Connect] is clicked will be displayed immediately.

Reference

See "2.6.2 Initialization Procedure".

When all initialization items are displayed as "Passed", the [OK] button is available.

5 Click [OK] in the Initialization window.

This activates the measurement mode.
In the measurement mode, [Connect] changes to [Disconnect] and the current wave length and photometric value appear on the [Instrument Status] bar.
Click [Disconnect] to disconnect the communication.

Fig.2-20 Measurement Screen for Spectrum Module (communication connection is possible)

■ Turning Off the Power

1 If measuring, click [STOP] on UVProbe to terminate the measurement.

2 If UVProbe and the spectrophotometer are connected, click [Disconnect] to disconnect the linkage. Or click [Exit] from the [File] menu to exit UVProbe.

3 Press "O" on the power switch (Fig.2-14) to turn off the power.

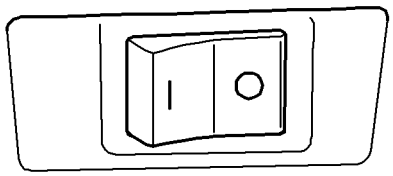


Fig.2-21

2.6.2 Initialization Procedure

When powered on, the spectrophotometer starts initialization and checking for items listed in Fig.2-22/2-23. Click [OK] as it is enabled after initialization is completed.

■ UV-2600

The initialization operation requires approximately 3 minutes.

Note, however, it may take about nine minutes maximum if an optional accessory is set up with the instrument (for identification of a detector when using an accessory device attached to the integrating sphere, and for initialization of the cell position when using a multi-cell holder).

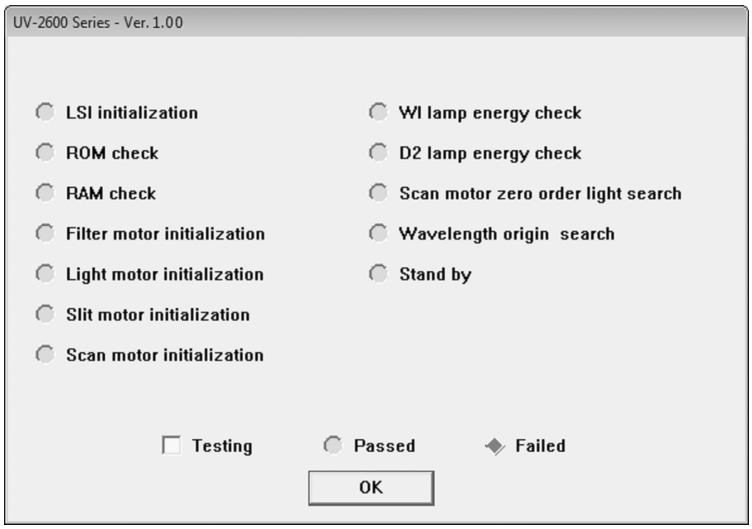


Fig.2-22 Initialization Window (UV-2600)

Table 2-2 List of Initialization Items

Initialization Items	Description
LSI initialization	Initializes each I/O device.
ROM check	Checks the program ROM.
RAM check	Checks the random-access memory (RAM).
Filter motor initialization	Detects the reference position of the stray light filter.
Light motor initialization	Detects the motor reference position that drives the light source switching mirror.
Slit motor initialization	Detects the motor reference position that drives the plate to switch the slit.
Scan motor initialization	Detects the mechanical wavelength origin position of the monochromator.
WI lamp energy check	Checks whether or not the WI (halogen) lamp light energy is at a sufficient level.
D2 lamp energy check	Checks whether or not the D2 (deuterium) lamp light energy is at a sufficient level.
Scan motor zero order light search	Checks the 0-order light which is the optical origin of the monochromator.
Wavelength origin search	Checks wavelength by detecting the emission line at 656.1 nm using the D2 (deuterium) lamp.
Stand by	Checks that the instrument initialization ends normally.

Each item is initialized in order, and if the item initialization is properly completed, the green lamp turns on.

However, if an error is found, its lamp turns red to stop the initialization.

In that case, check where an error is and turn off the power.

Reference

For the error checkpoint, see "6.1 Errors During Initialization".

■ UV-2700

Initialization requires approximately four minutes. Note, however, it may take about 12 minutes maximum if an optional accessory is set in conjunction (for gain adjustment when using an ultra-micro cell holder, and for initialization of the cell position when using a multi-cell holder).

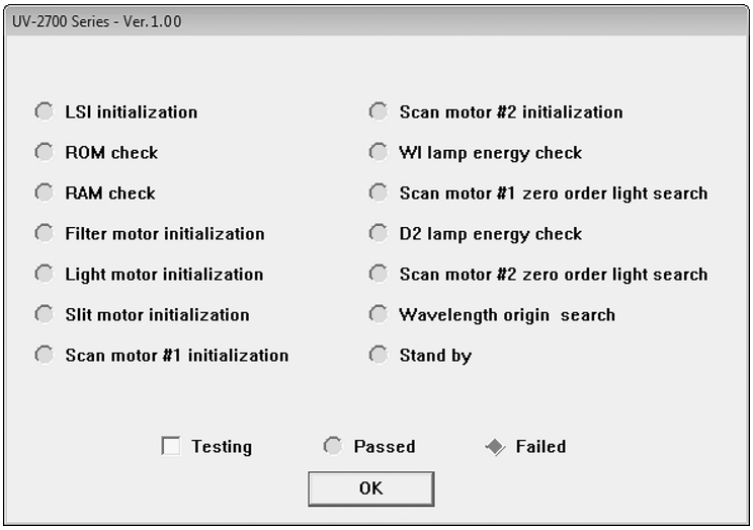


Fig.2-23 Initialization Window (UV-2700)

Table 2-3 List of Initialization Items

Initialization Items	Description
LSI initialization	Initializes each I/O device.
ROM check	Checks the program ROM.
RAM check	Checks the random-access memory (RAM).
Filter motor initialization	Detects the reference position of the stray light filter.
Light motor initialization	Detects the motor reference position that drives the light source switching mirror.
Slit motor initialization	Detects the motor reference position that drives the plate to switch the slit.
Scan motor #1 initialization	Detects the mechanical wavelength origin position of the pre-monochromator (only for UV-2700).
Scan motor #2 initialization	Detects the mechanical wavelength origin position of the main monochromator.
WI lamp energy check	Checks whether or not the WI (halogen) lamp light energy is a sufficient level.
Scan motor #1 zero order light search	Checks the 0-order light which is the optical origin of the pre-monochromator (only for UV-2700).
D2 lamp energy check	Checks whether or not the D2 (deuterium) lamp light energy is at a sufficient level.
Scan motor #2 zero order light search	Checks the 0-order light which is the optical origin of the main monochromator.
Wavelength origin search	Checks wavelength by detecting the emission line at 656.1 nm using the D2 (deuterium) lamp.
Stand by	Checks that the instrument initialization ends normally.

Each item is initialized in order, and if the item initialization is properly completed, the green lamp turns on.

However, if an error is found, its lamp turns red to stop the initialization.

In that case, check where an error is and turn off the power.

☞ Reference

For the error checkpoint, see "6.1 Errors During Initialization".

2.7 Performance Check After Installation

After installation, a Shimadzu representative checks the performance for the following items:

- Baseline flatness
- Wavelength accuracy
- Noise level

Use the UV validation software supplied as a standard accessory to check performance.

☞ Reference

For more details about UV Performance Validation Software, refer to "UV Performance Validation Software Instruction Manual".

3 UVProbe Basic Operation

The UVProbe software (hereafter "UVProbe") provided as a standard accessory is used to measure the UV-2600/2700 Series.

This chapter describes the basic operation using UVProbe.

Reference

For more details about UVProbe features and operating instructions, refer to the included "Instruction Manual UVProbe Tutorial" or see "3.1.4 Help Functions".

3.1 UVProbe Overview

3.1.1 Module Configuration

UVProbe consists of three measurement modules and one report generation module.

You can switch between these modules by selecting them from the [Window] menu.

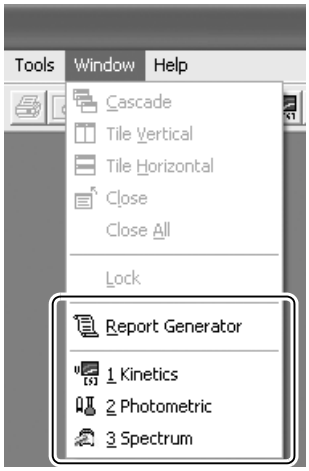


Fig.3-1

- Spectrum Module
  Scans within the specified wavelength range and records photometric values at each sampling pitch.

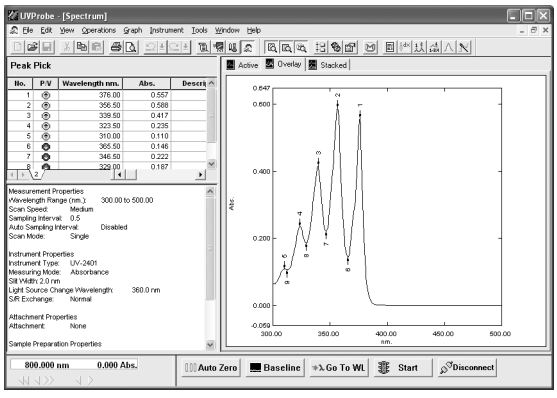


Fig.3-2

Reference

Refer to "Chapter 2 The Spectrum Module" in "Instruction Manual UVProbe Tutorial".

- Photometric Module
  Measures photometric values at single or multiple wavelengths (Photometric measurement). This module is also equipped with a quantitative function using various calibration curve methods (i.e., multi-point calibration curve method, one point calibration curve method, and K-factor method).

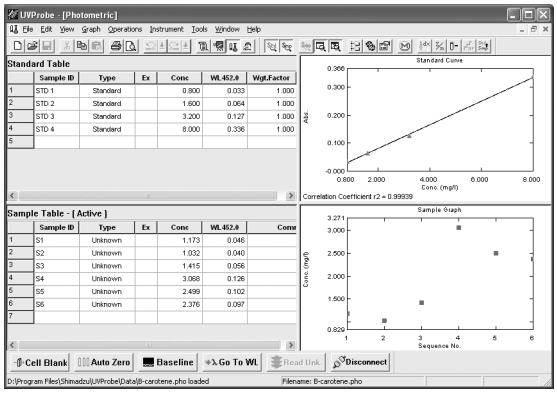


Fig.3-3

Reference

Refer to "Chapter 3 The Photometric Module" in "Instruction Manual UVProbe Tutorial".

- Kinetics Module
  Measures the time course change of photometric values at a fixed wavelength (Time course measurement). The activity value also can be calculated in this module.

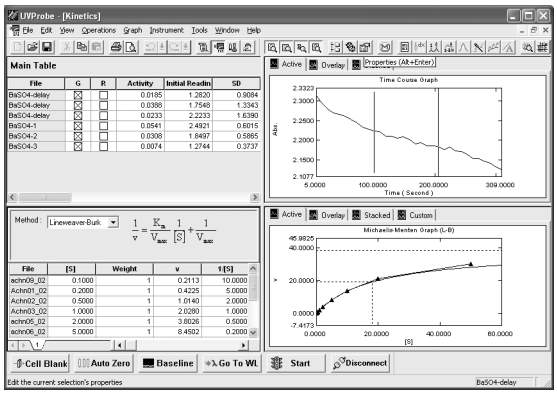


Fig.3-4

Reference

Refer to "Chapter 4 The Kinetics Module" in "Instruction Manual UVProbe Tutorial".

- Report Generator
  Creates and lays out a report of various objects such as measurement data, graphs, and others. You can register the created layout as a user template and print it.

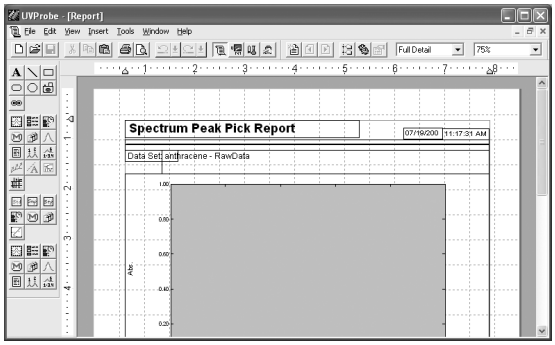
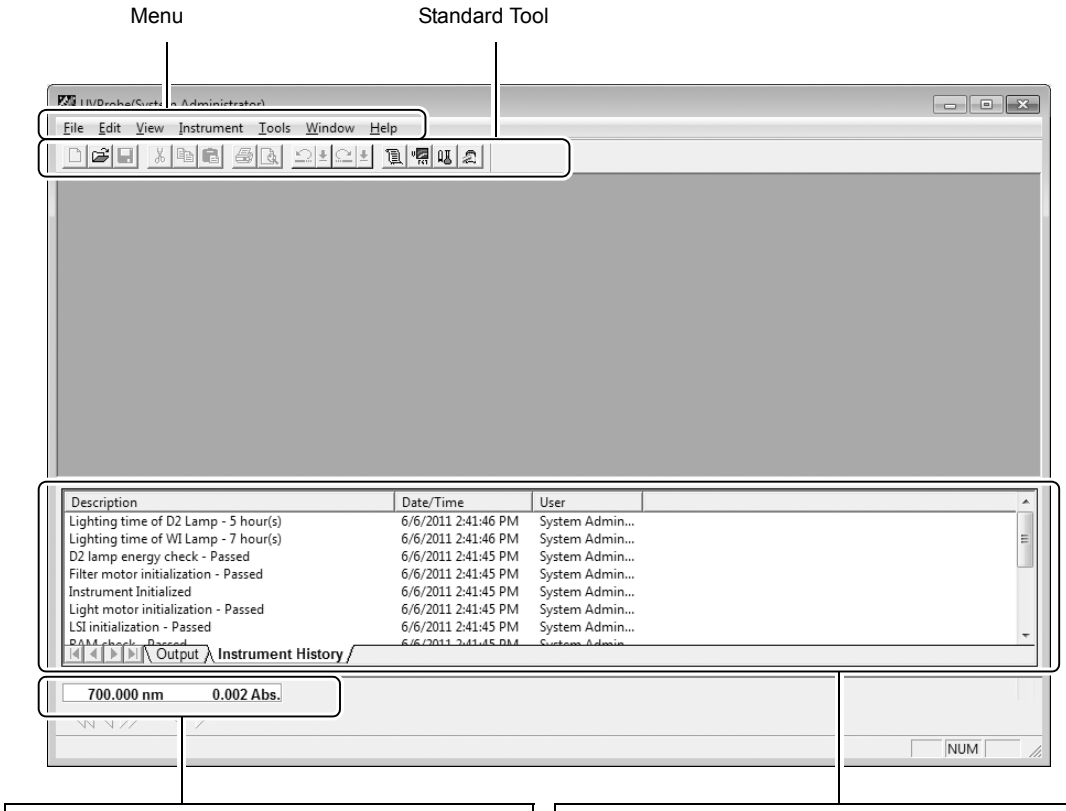


Fig.3-5

Reference

Refer to "Chapter 5 The Report Generator" in "Instruction Manual UVProbe Tutorial".

3.1.2 Common Window Frame



Instrument Status Window
Displays the current wavelength and photometric value in real time.
Also displays a calculated value of a simple operation using measured photometric values.

Reference
For more details, see "3.1.4 Help Functions". You need to use the keyword "Instrument Status".

Output Window
- [Output] displays various messages from the system (e.g. during print process).
- [Instrument History] displays the content and time of executed instrument initialization, time of baseline correction, etc.

Reference
For more details, see "3.1.4 Help Functions". You need to use the keyword "Output".

Fig.3-6

3.1.3 Data File Structure

The data files created in the spectrum module and kinetics module have a hierarchical structure (such as "File" - "Storage" - "Data set"). Only a single file is required to manage multiple data.

Reference

For more details, see "3.1.4 Help Functions". You need to use the keyword "File Structure".

For example, if you process (differentiation or others) spectrum data acquired from measurement, both the measured data (raw data) and its converted data are stored in the same file. This eases data management.

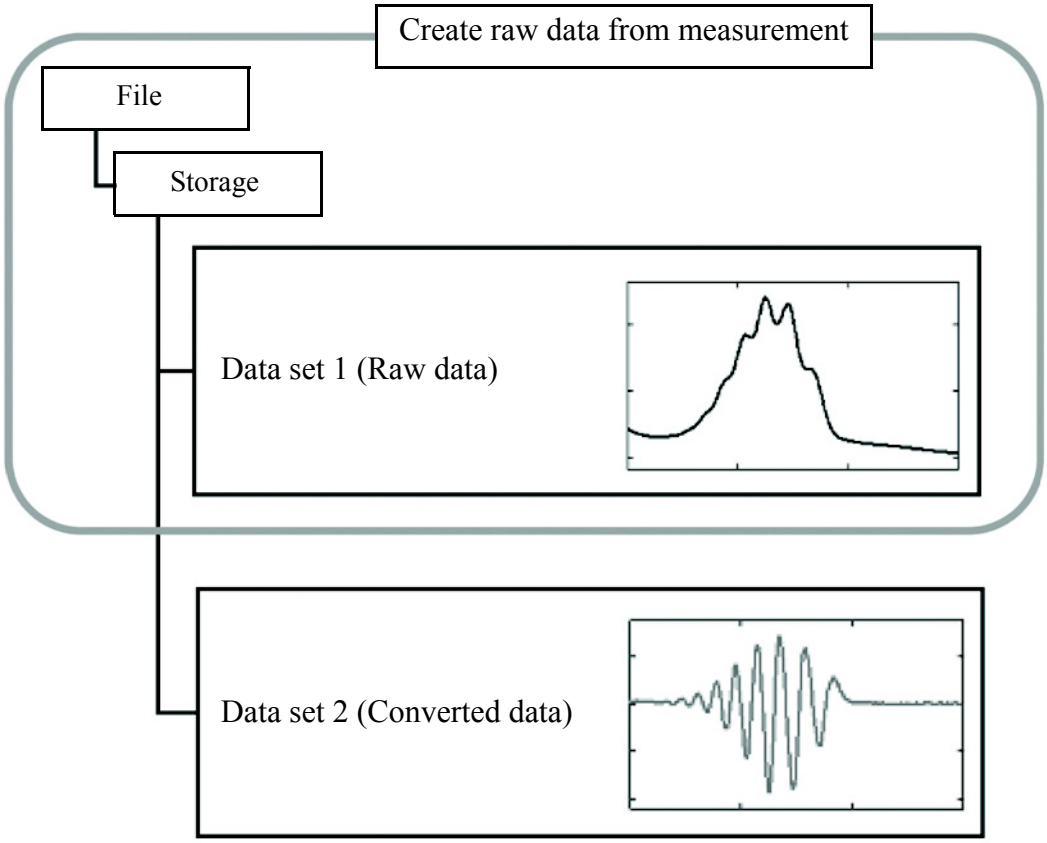


Fig.3-7

NOTE

For example, the following naming rule may be useful for managing measurement data.

- Use "sample name" for the file name (e.g. Glass_plate).
- Use "date" for the storage name (e.g. 20110501).
- Use "data status" for the data set name. (Default name is "RawData".)

3.1.4 Help Functions

UVProbe is equipped with various help functions enabling you to understand its features and operation procedures as you use the software.

■ Pop-Up Helps

The pop-up helps show the explanation for screen elements such as buttons and others. Right-click near the item you need information for to display pop-up help.

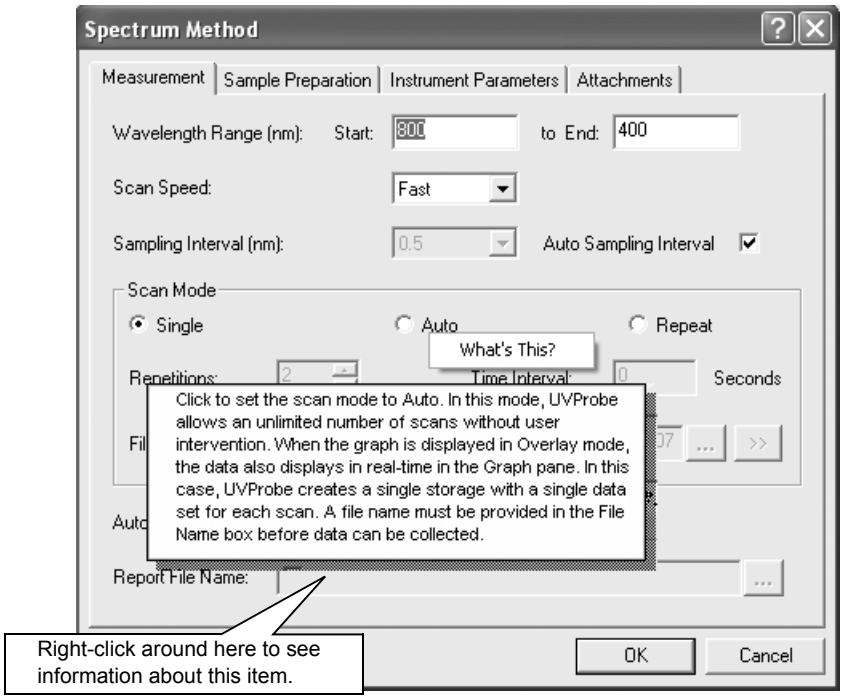


Fig.3-8

■ Help Topics

Select [Help Topics] from the [Help] menu to display the [UVProbe Help] window.

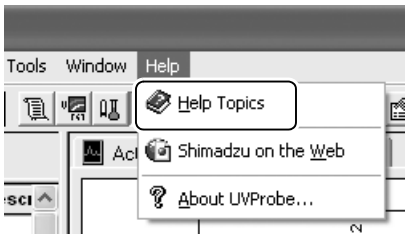


Fig.3-9

- Contents -

Search for the desired item using the [Contents] tab.

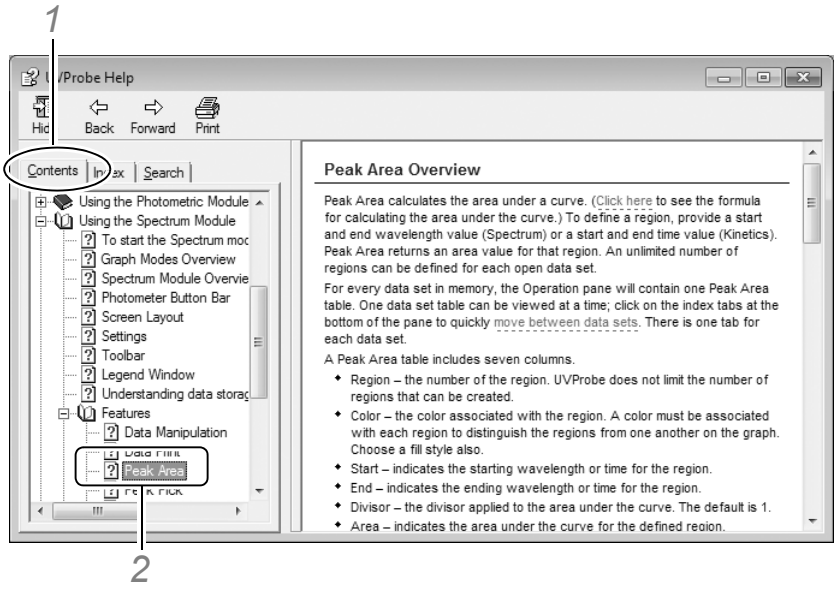


Fig.3-10

1 Click the [Contents] tab.
2 Click the desired item.
The explanation for the selected item is shown.

- Keyword -

Search for the desired item using the [Index] tab.

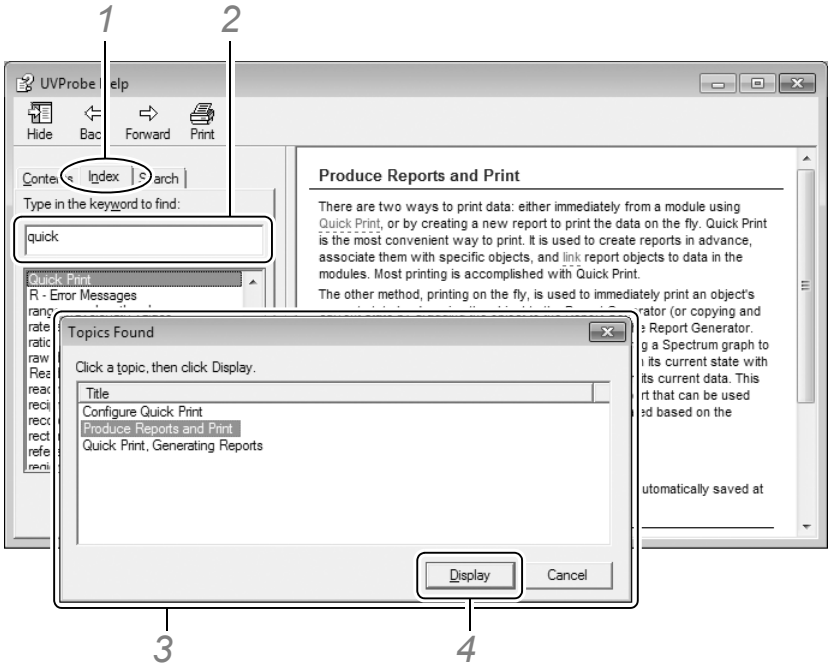


Fig.3-11

1 Click the [Index] tab.
2 Enter the keyword for the desired item.
3 Click [Display].
The item including the entered keyword is displayed under [Topics Found].
4 Click the desired item and then [Display].
The explanation for the selected item is shown.

- Search -

Search for the desired item using the [Search] tab.

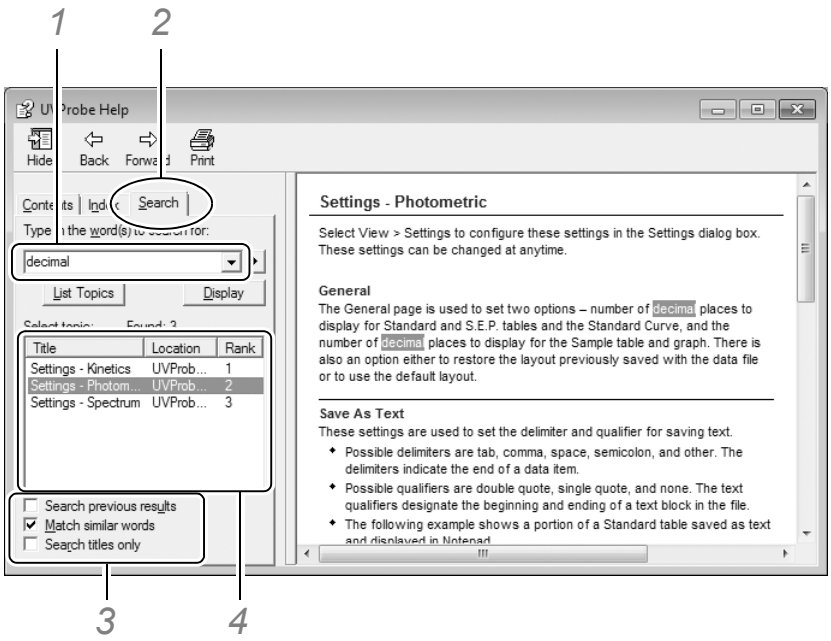


Fig.3-12

1 Click the [Search] tab.
2 Enter the word for the desired item.
3 Specify (check) the scope of the search.
4 Click the desired item.
The explanation for the selected item is shown.
The searched words are highlighted in the displayed text.

3.2 Basic Operation

3.2.1 Start/Exit UVProbe

■ Start UVProbe

1 Double-click the 

icon on your desktop to start UVProbe.

If the software is installed in security mode or GLP mode, the [User Login] window appears.

☞ Reference

For more details about application modes, refer to "Chapter1 Introduction" in "Instruction Manual UVProbe Tutorial".

2 Enter the registered user ID and password for UVProbe, and click the [OK] button.

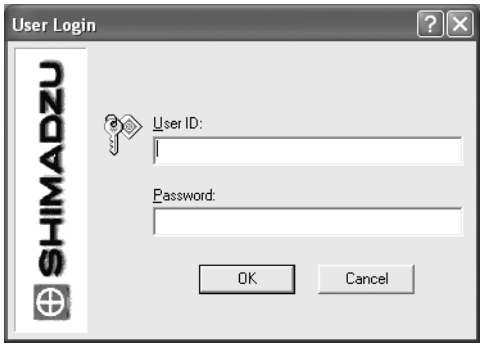


Fig.3-13

NOTE

Use UVProbe to configure user IDs and passwords.

☞ Reference

Refer to "System Administration" of "Chapter 1 Introduction" in "Instruction Manual UVProbe Tutorial".

UVProbe starts.

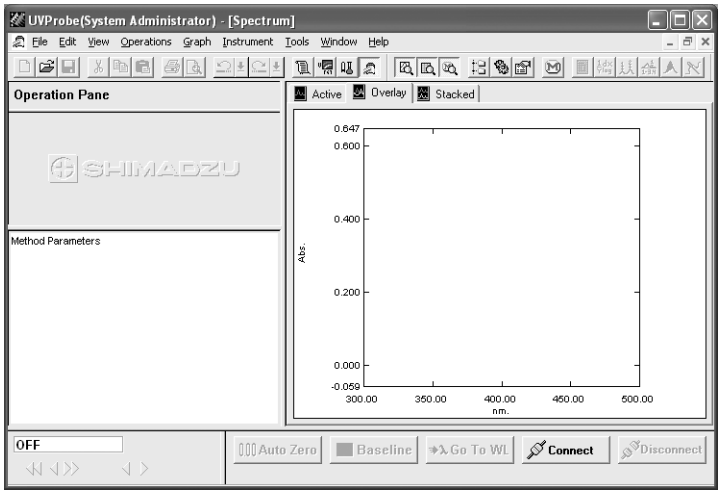


Fig.3-14

Reference

See "2.6.1 Turning the Power On and Off" for how to connect and communicate with the instrument.

■ Exit UVProbe

1 Click the [Disconnect] button to end the communication with the instrument.

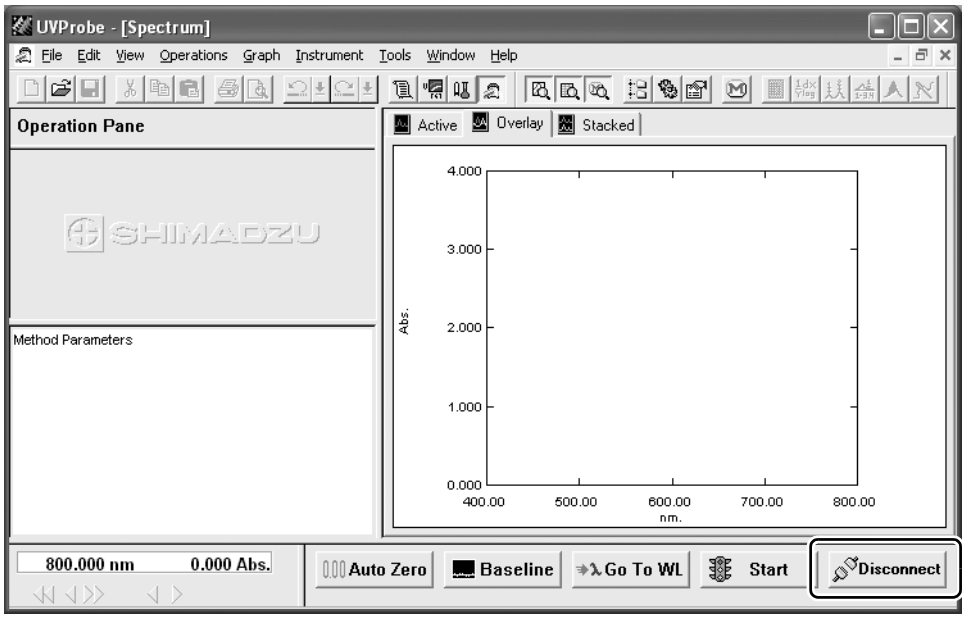


Fig.3-15

2 Click the  button on the upper right to close the UVProbe window.
Or click [Exit] from the [File] menu to exit UVProbe.

3.2.2 Open/Close Data Files

■ Open Data Files

1 Select [Open] from the [File] menu.

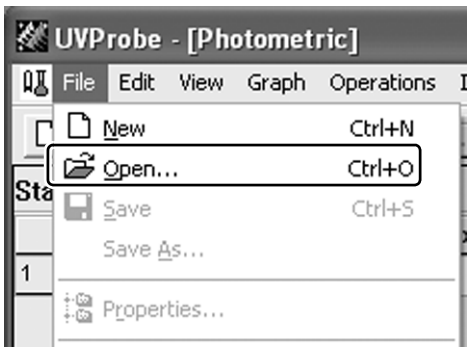


Fig.3-16

2 Select a data file.

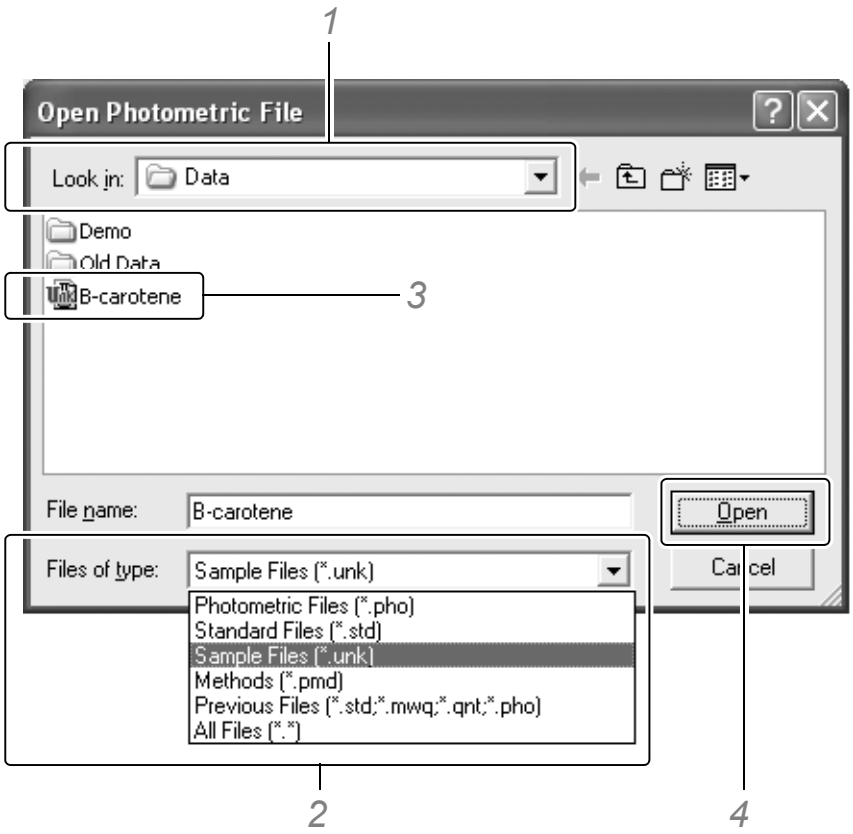


Fig.3-17

1 Select the folder where the desired file is saved.
2 Select the type of the file to be loaded.
3 Select the desired file.
4 Click [Open].

■ Close Data Files

Close data files currently active in UVProbe that may contain data loaded from the PC and measurement data.

For the Spectrum/Kinetics module

NOTE

The opened data exists in the PC's memory. When deleting data, UVProbe closes all data on the memory. In that operation, data stored in volatile memory (RAM) are not saved on the disk. That means they are cleared when the file is closed.
Save any unsaved data before erasing if you need them later.

Reference

See "3.4.6 Measurement Completion/Save Data".

1 Select [Properties] from the [File] menu.

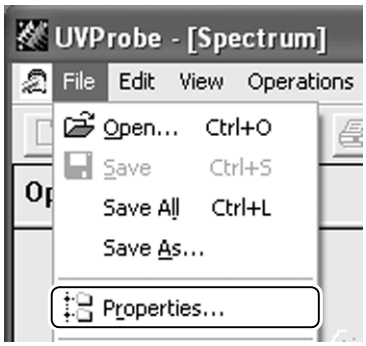


Fig.3-18

2 Select a data file.

The red asterisk (*) indicates that the data is not yet saved to the hard disk.

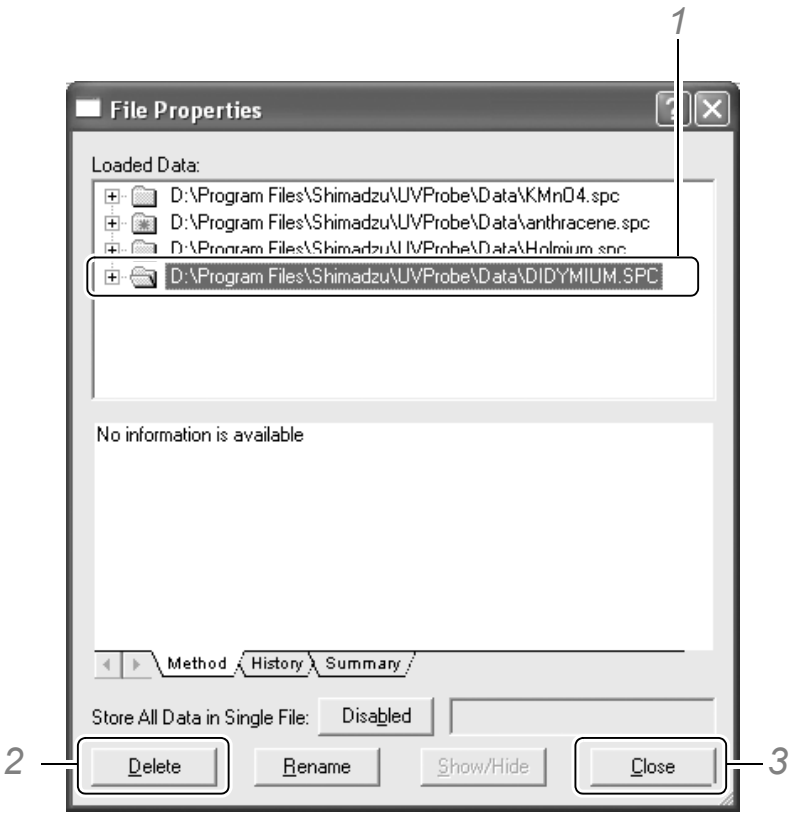


Fig.3-19

1 Select the data file to close.
2 Click [Delete].
3 Click [Close].

For the Photometric module

The photometric module does not have a function for closing data files.

Therefore, simply open another data file or create a new data file to discard data existing in PC memory. Save all measurement files beforehand.

Select [New] on the [File] menu to clear data in the open file.

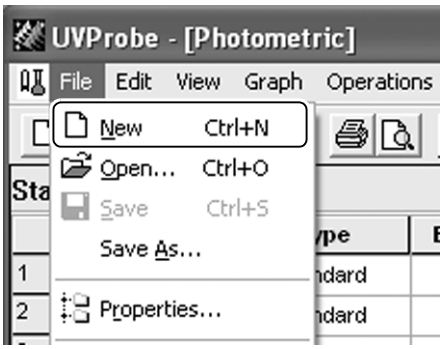


Fig.3-20

3.2.3 Change Graph Scales

In the UVProbe Software, you can change graph axis scales directly on the graph.

1 Click the upper (or lower) limit value of the axis scale.

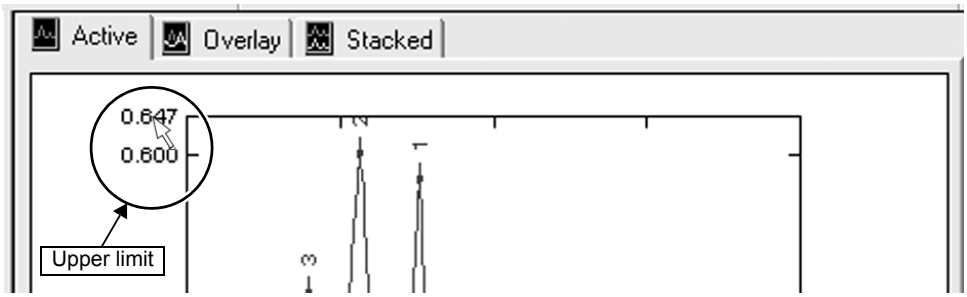


Fig.3-21

2 When the upper (or lower) limit value is highlighted, input the desired value and press the key.

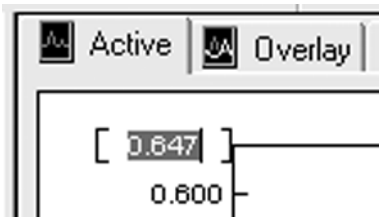


Fig.3-22

3 Using a similar procedure, change the upper (or lower) limit of the other axis scale.

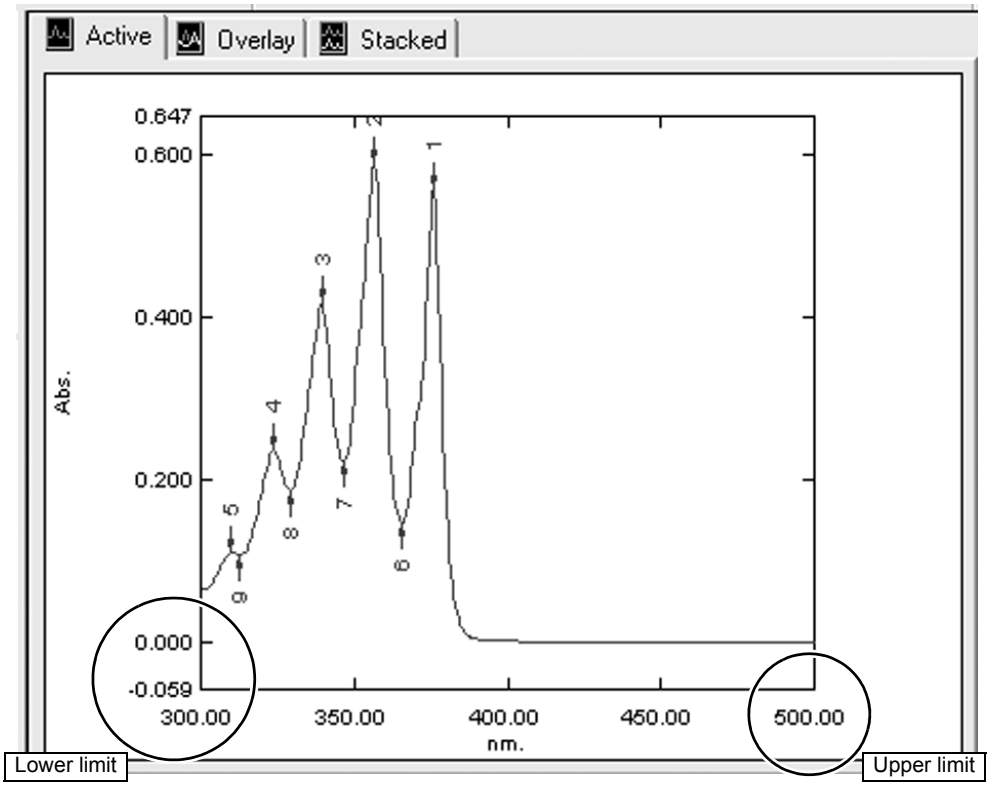


Fig.3-23

3.2.4 Change Graph Display Setting

From [Customize] on the graph shortcut menu, you can control the width and colors of graph lines as well as the format and size of label fonts.

Right-click in the graph area and click [Customize] from the shown menu. The [Customize Graph] window appears.

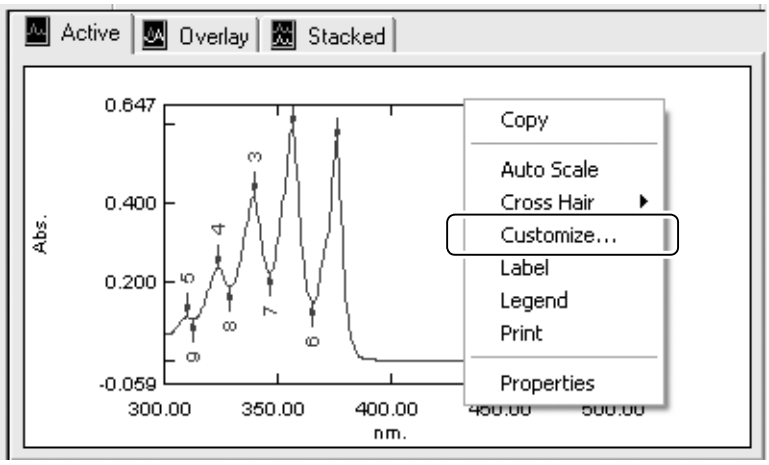


Fig.3-24

■ Changing Graph Line Colors

1 Set the line color.

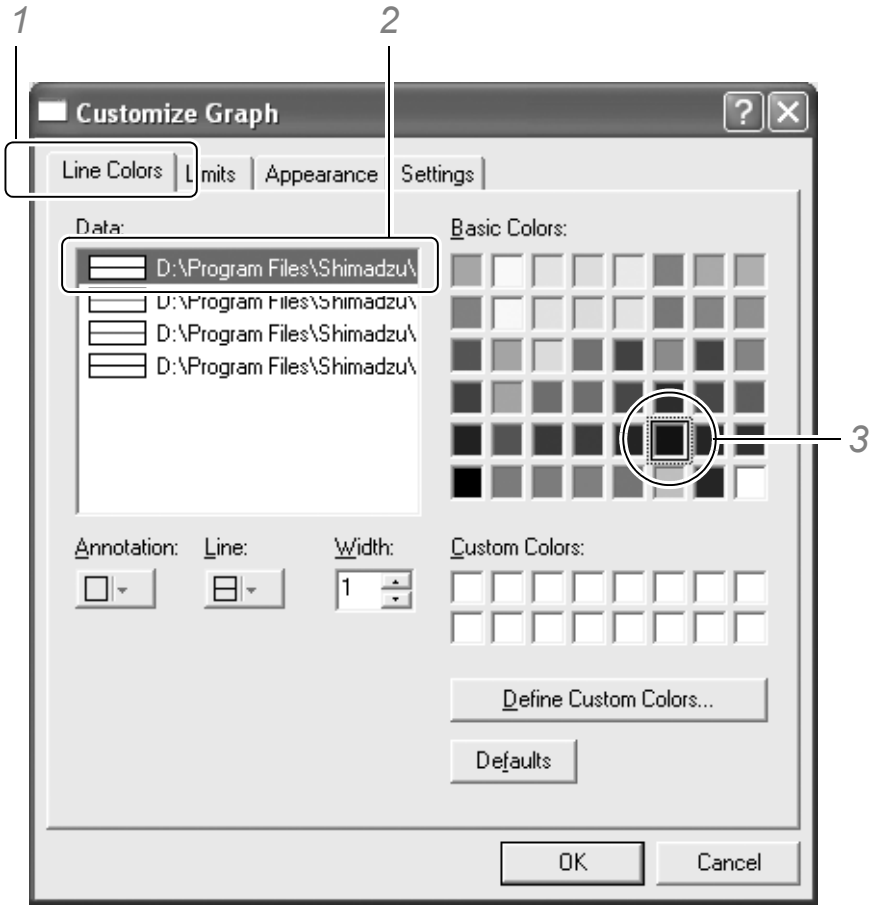


Fig.3-25

1 Click the [Line Colors] tab.
2 Select the desired data to change line color.
3 Click the desired color.

2 Click [OK].

■ Changing Graph Line Width

1 Set the line width.

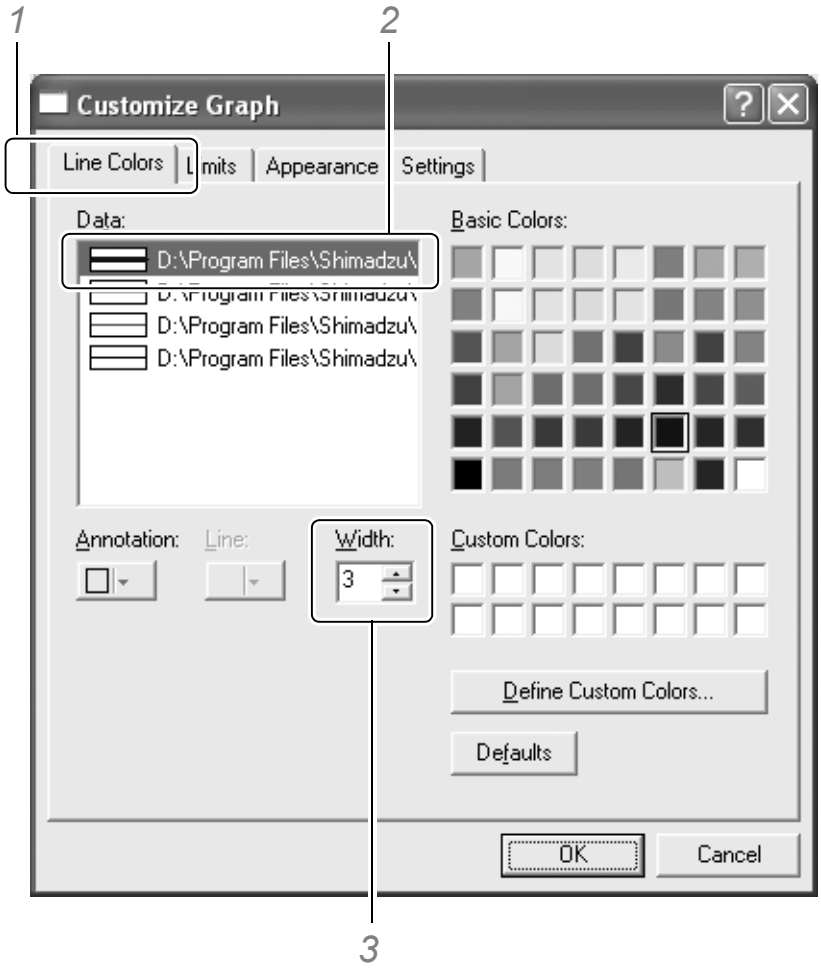


Fig.3-26

1 Click the [Line Colors] tab.
2 Select the desired data to change line color.
3 Click the [▲]/[▼] buttons to select the desired line width (from 1 to 5, default value is 1).
The greater the value, the thicker the graph line.

2 Click [OK].

■ Changing Axis Label Font

1 Set the axis label font.

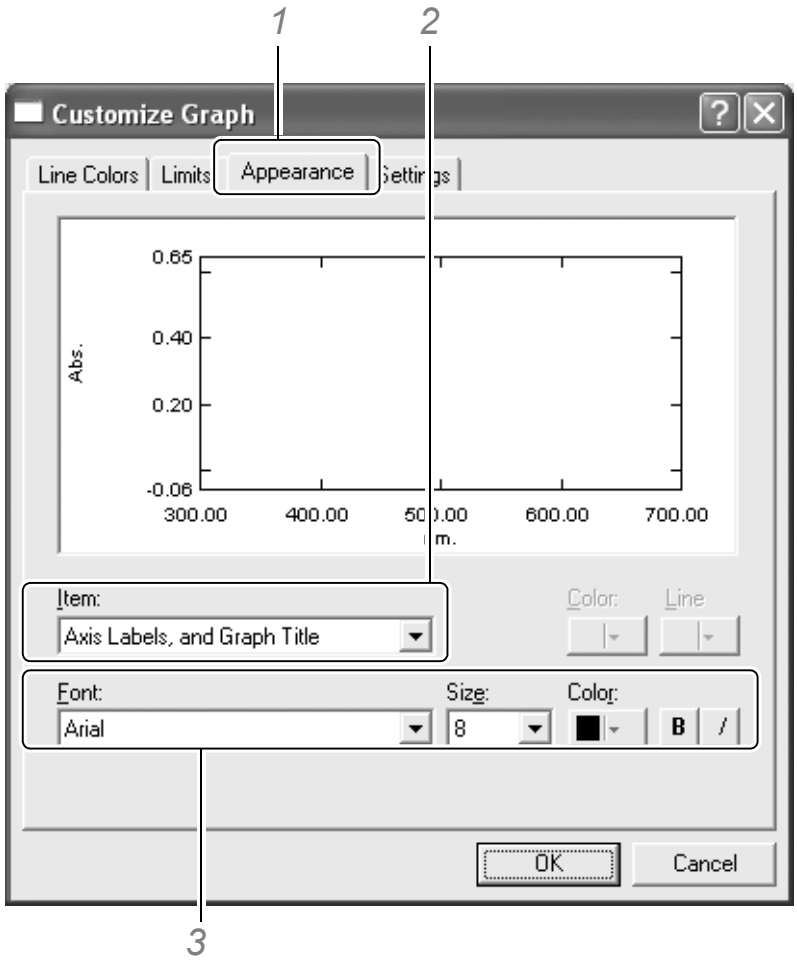


Fig.3-27

1 Click the [Appearance] tab.
2 Select [Axis Labels, and Graph Title].
3 Select the desired font type, size, color, etc.

2 Click [OK].

3.3 Other Settings

While UVProbe is used with other UV Series, however, this section describes the respective parameters in the Measurement Method window and various Maintenance windows that appear when the UV -2600/2700 Series is linked to it.

3.3.1 Advanced Options for Instrument Parameters

■ Instrument Parameters

The [Instrument Parameters] tab of the measurement method for each measurement module is described.

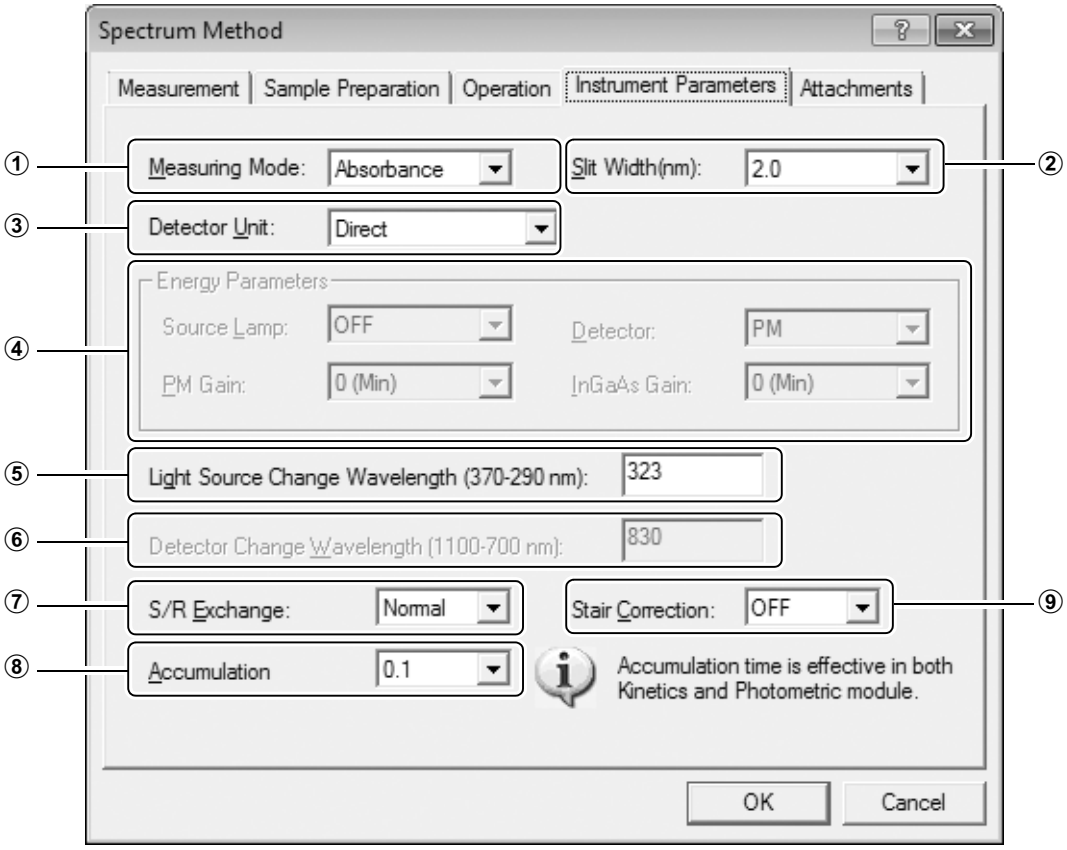


Fig.3-28 [Instrument Parameters] Tab

Table 3-1

No.	Name	Description
①	Measuring Mode	Select the photometric type for your measurement. Select one of the following: transmittance (T %), reflectance (R %), absorbance (Abs.), or energy (E).
②	Slit Width	Select the slit width for your measurement. Select one of the following widths: 0.1 nm, 0.2 nm, 0.5 nm, 1.0 nm, 2.0 nm, 5.0 nm, 2.0 nm L (low stray light), and 5.0 nm L (low stray light). Shimadzu recommends selecting 2.0 nm for typical measurements. The entrance slit of a low stray light is used to reduce the stray light effect. However, it also reduces the light intensity, so the noise increases.

No.	Name	Description
③	Detector Unit	Change the detector unit setting to use an optional detector such as an integrating sphere and others. • Direct: Use the attached detector. • External (1 Detector): integrating sphere attachment ISR/MPC-2600 (optional accessory) • External (2 Detectors): integrating sphere attachment ISR-2600Plus (optional accessory) • Variable Angle Mes.: Customized device for variable angle measurement
④	Energy Parameters	Turns each light on and off, and determines the detector and the gain level for the detector. These parameters are active when [Energy] is selected for [Measuring Mode]. Also, when [External (2 Detectors)] or [Variable Angle Mes.] is selected with the detector unit, the corresponding gain level is set according to the selected detector.
⑤	Light Source Change Wavelength	Sets the switching wavelength for the D2 (deuterium) and WI (halogen) lamps from 290 nm to 370 nm in 0.1 nm increments. The default setting is 323 nm.
⑥	Detector Change Wavelength	When [External (2 Detectors)] or [Variable Angle Mes.] is selected, set the corresponding detector switching wavelength from 700 nm to 1100 nm in 0.1 nm increments. The default setting is 830 nm.
⑦	S/R Exchange	This instrument has a double beam optical system to switch between sample light (S) and reference light (R) for data processing. This is used for an integrating sphere in a reflection measurement. When switching to [Reverse], set the test sample in the reference side (R). [Normal] is usually used.
⑧	Accumulation time	Sets the elapsed time for one measurement data in the photometric or time course measurement. The longer the elapsed time is, the more stable data are acquired.
⑨	Step Correction	When switching the detector or light source, a step may appear in the spectrum. Add a check mark to smoothen the transition from one step to another.

■ Measurement Parameters

This section describes the [Measurement] tab in the Spectrum Measurement Method window.

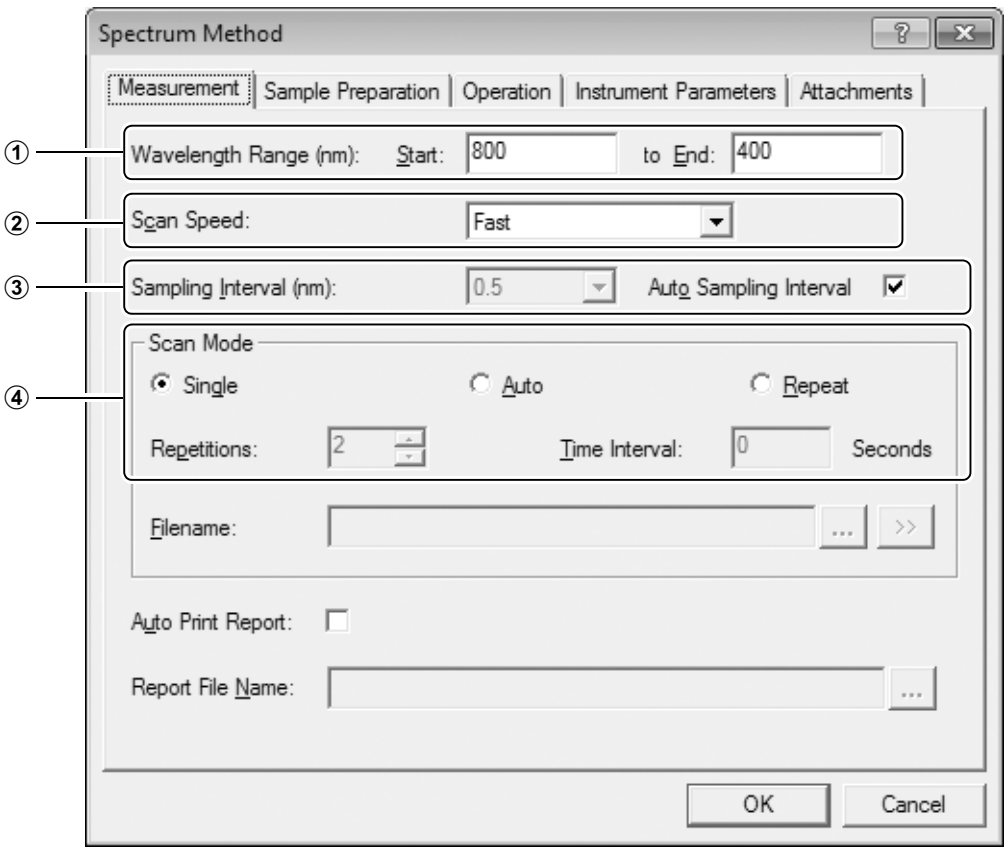


Fig.3-29 [Measurement] Tab

Table 3-2

No.	Name	Description
①	Wavelength Range	Sets up the wavelength range (nm).
②	Scan Speed	Sets up the wavelength scanning speed. Fast, Medium, Slow, Very slow, High absorbance (medium), or High absorbance (slow). The slower the speed, the more noise can be reduced. **Reference** For more information about high absorbance measurement, see "3.7.1 Measurement Overview and Precautions".
③	Sampling Interval	Sets up the interval between measurement data. You can set it to one of the following intervals: 0.01 nm, 0.05 nm, 0.1 nm, 0.2 nm, 0.5 nm, 1.0 nm, 2.0 nm, or 5.0 nm. Auto sampling interval: Automatically sets the interval to the maximum not exceeding 1,800 points within the specified wavelength range.
④	Scan Mode	Single: Enter a file name, etc., for each measurement. Auto: Measurement takes place using prescribed file names. Use this feature to omit file name input operation. Repeat: Measurement takes place repeatedly using prescribed file names. Repetitions: 2 to 100. Time Interval: 0 seconds to 9999 seconds.

■ Maintenance

This section describes the [Maintenance] tab on the [Instrument] parameter setting menu.
Click [Configure] from the [Instrument] menu, and the click the [Maintenance] tab.

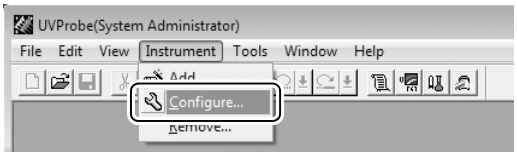


Fig.3-30

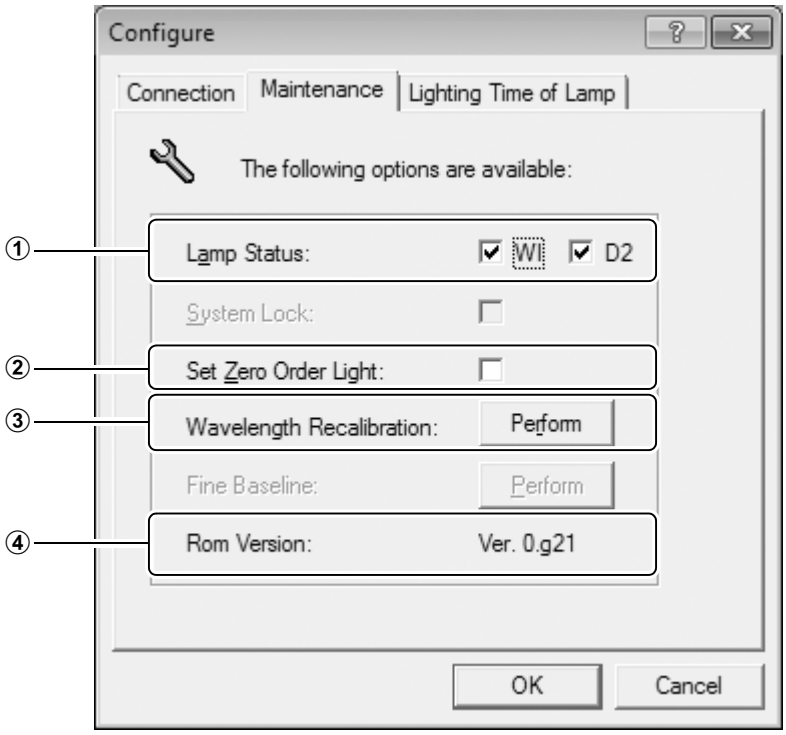


Fig.3-31 [Maintenance] Tab Window

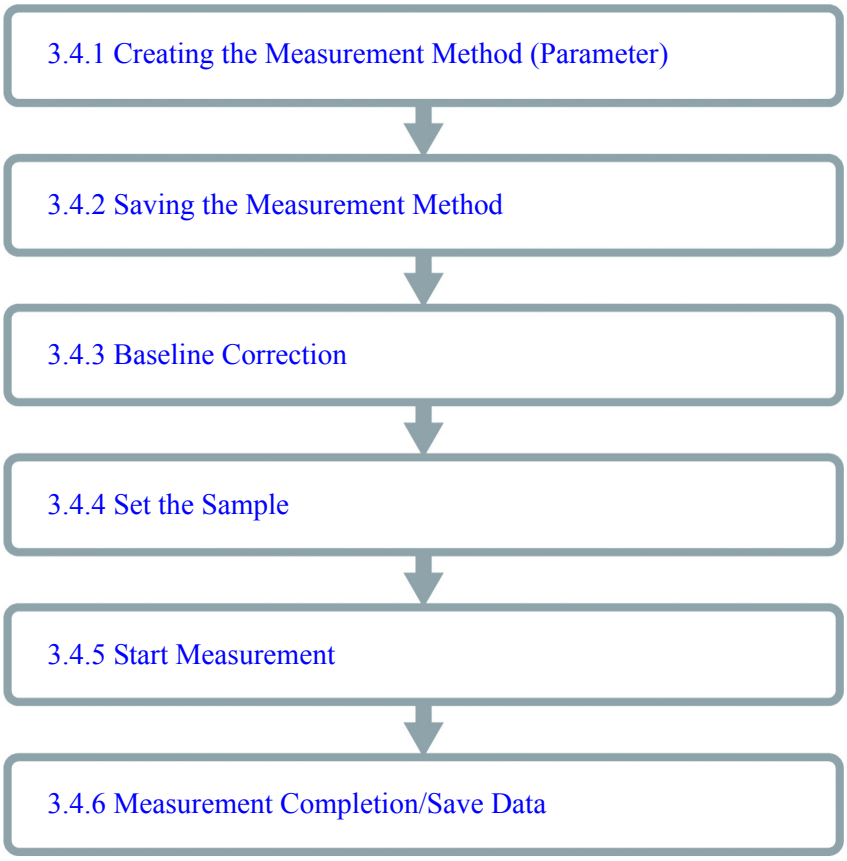
Table 3-3

No.	Name	Description
①	Lamp Status	This shows the on/off status for the WI and D2 light source lamps. It also enables you to turn on or off the light source lamps by checking or unchecking the boxes for light source lamps.
②	Set Zero Order Light	Sets the wavelength the spectrophotometer to that of 0-order light. This setting leads white light into the sample compartment. When performing optical axis adjustment, check this item. **NOTE** When applying 0-order light, use the light shield so as not to irradiate a direct light into the detector. The detector may be damaged if no light shield is used.
③	Wavelength Recalibration	Measure the D2 emission line at 656.1 nm and calibrate the monochromator wavelength again.
④	Rom Version	This shows the ROM version of the connected spectrophotometer.

3.4 Measurement Procedure

This chapter briefly describes the UVProbe measurement flow and operation procedure using the spectrum module as an example.

When measuring samples in the spectrum module, basically follow the flow of steps below to proceed with the measurement.



The following pages details the measuring procedure along the flow of measurement tasks above.

☞ **Reference**

For information about operating other measurement modules not covered by this manual, and for more detailed information about the operational procedure, refer to "Instruction Manual UVProbe Tutorial".

- Spectrum Module -> "Chapter 2 Spectrum Module"
- Photometric Module -> "Chapter 3 Photometric Module"
- Kinetics Module -> "Chapter 4 Kinetics Module"

3.4.1 Creating the Measurement Method (Parameter)

1 Click [Method] in the [Edit] menu.
The [Spectrum Method] window appears.

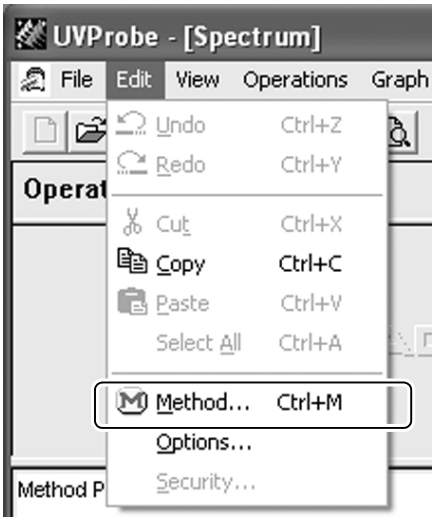


Fig.3-32

2 Set the [Measurement] tab.

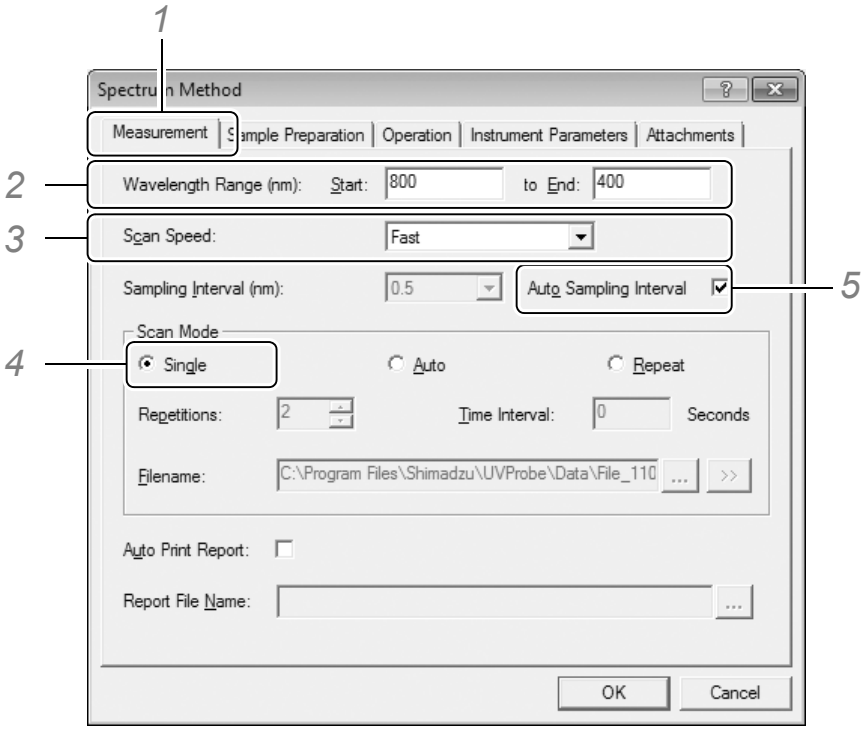


Fig.3-33

1 Click the [Measurement] tab.
2 Enter the wavelength range (nm).
3 Use the [▼] key to select [Scan Speed].

4 Select [Single].

NOTE
If [Single] is selected, the spectrum measurement is performed only once.

5 Check the [Auto Sampling Interval] box.

NOTE
When the [Auto Sampling Interval] box is checked, the number of data points is automatically set within the measurement wavelength range already set to the maximum within a scope not exceeding 1,800.

3 Set the [Instrument Parameters] tab.

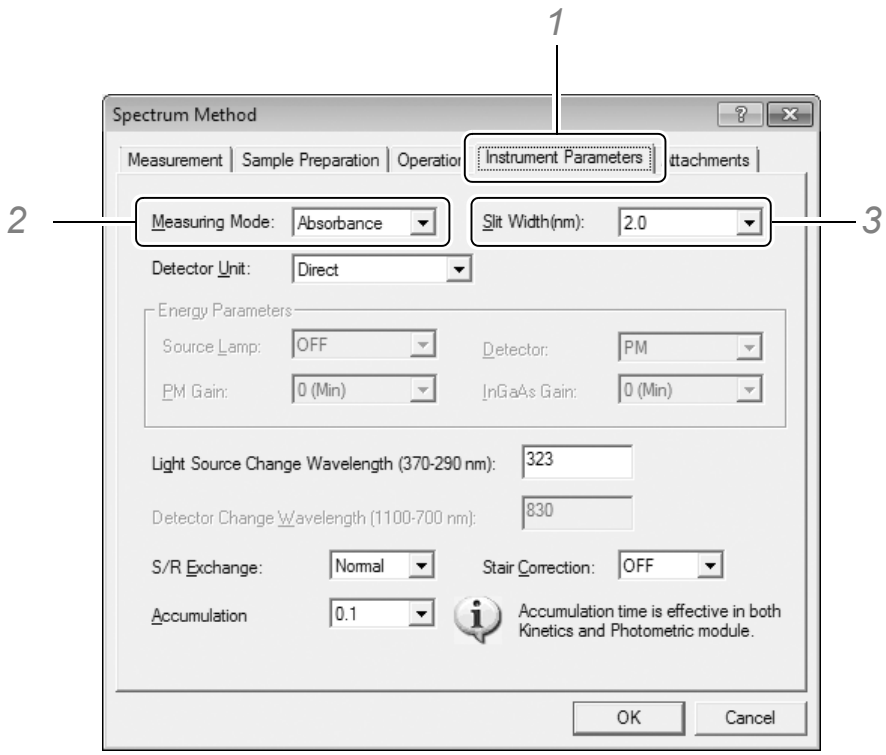


Fig.3-34

1 Click the [Instrument Parameters] tab.
2 Use the [▼] key to select the appropriate measuring mode.
3 Use the [▼] key to select the appropriate slit width.

4 Click [OK].

3.4.2 Saving the Measurement Method

Respective measurement parameters set in the Measurement Method window can be saved as a file.

1 Click [Save As] from the [File] menu.
The [Save Spectrum File] window appears.

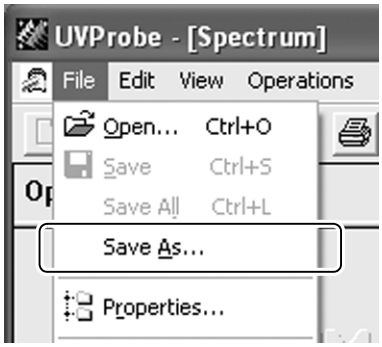


Fig.3-35

2 Save the respective parameters you have set in the Measurement Method window as a measurement method file.

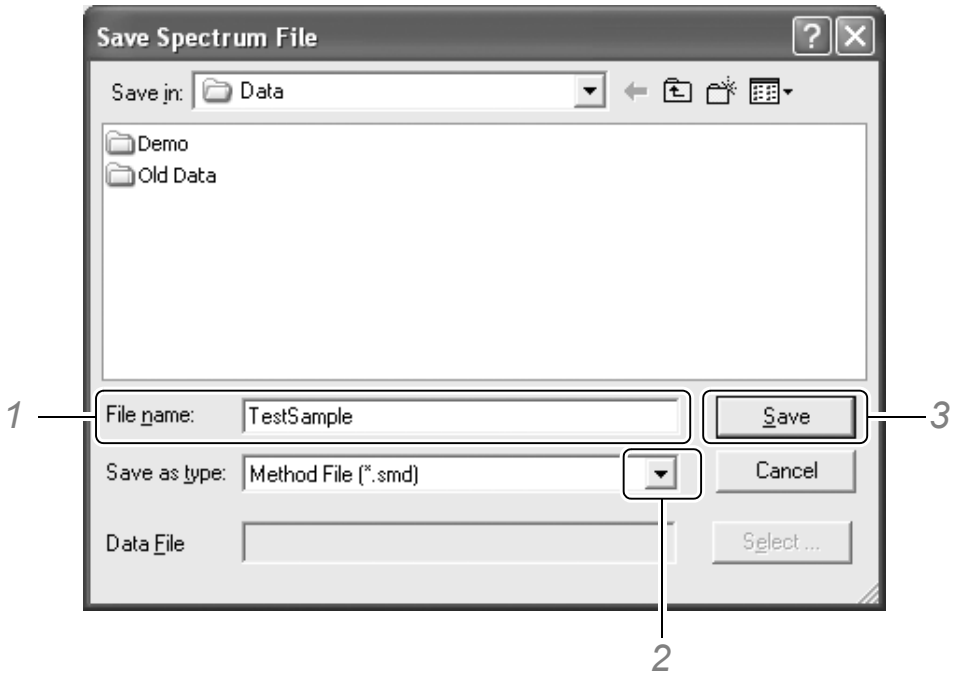


Fig.3-36

1 Enter the file name.
2 Click [▼] to select [Method File (*.smd)] for the file type.
3 Click [Save].

NOTE

The file for saving data is located in the Data folder by default, which is under the directory where UVProbe was installed. If the folder is not renamed upon installation, the default path is as follows.

C:\Program Files\Shimadzu\UVProbe\Data

3.4.3 Baseline Correction

The system corrects the baseline so that the 0 (zero) Abs line (100 % line for transmittance or reflectance) is leveled in the specified wavelength range under the current conditions of the sample compartment.

NOTE

- When correcting the baseline after the instrument has not been used for a long period of time, turn on the power and wait for about one hour until the spectrophotometer enters a stable status.
- When measurement conditions are changed, be sure to perform the baseline correction.
- The default correction wavelength range that appears for baseline correction depends on the selected measurement module. For the spectrum module, the measurement wavelength range set in the Measurement Method window is shown as the default.

Reference

Refer to the included "Instruction Manual UVProbe Tutorial".

1 Verify that no sample is placed in the sample compartment.

2 Specify a baseline correction range.

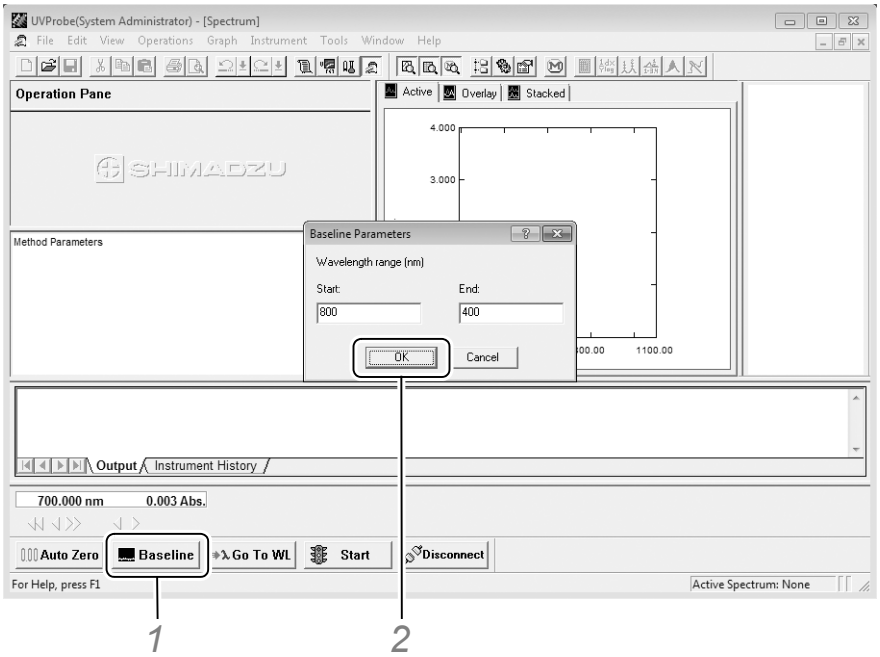


Fig.3-37

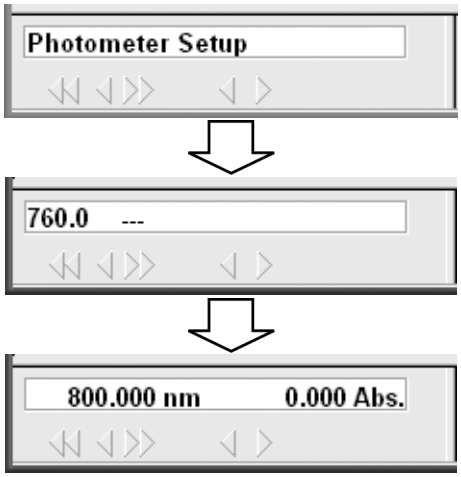
1 Click [Baseline] on the [Instrument Control Button] bar.

The [Baseline Parameters] window appears.

2 Verify that the displayed correction range is the same as the wavelength range specified in the [Spectrum Method], and click the [OK] button.

Baseline correction starts.
Do not open the sample compartment cover before baseline correction is completed.
The spectrophotometer's status is displayed in the Instrument Status window.

After the baseline correction process is finished, it returns to the baseline start wavelength and is ready to measure.



The spectrophotometer is being set up.

Baseline correction is in progress.

Baseline correction is completed.
(The instrument is ready to measure.)

Fig.3-38

3.4.4 Set the Sample

1 Open the sample compartment cover of the spectrophotometer and insert the cell containing the sample into the cell holder on the sample side.

2 Close the sample compartment cover.

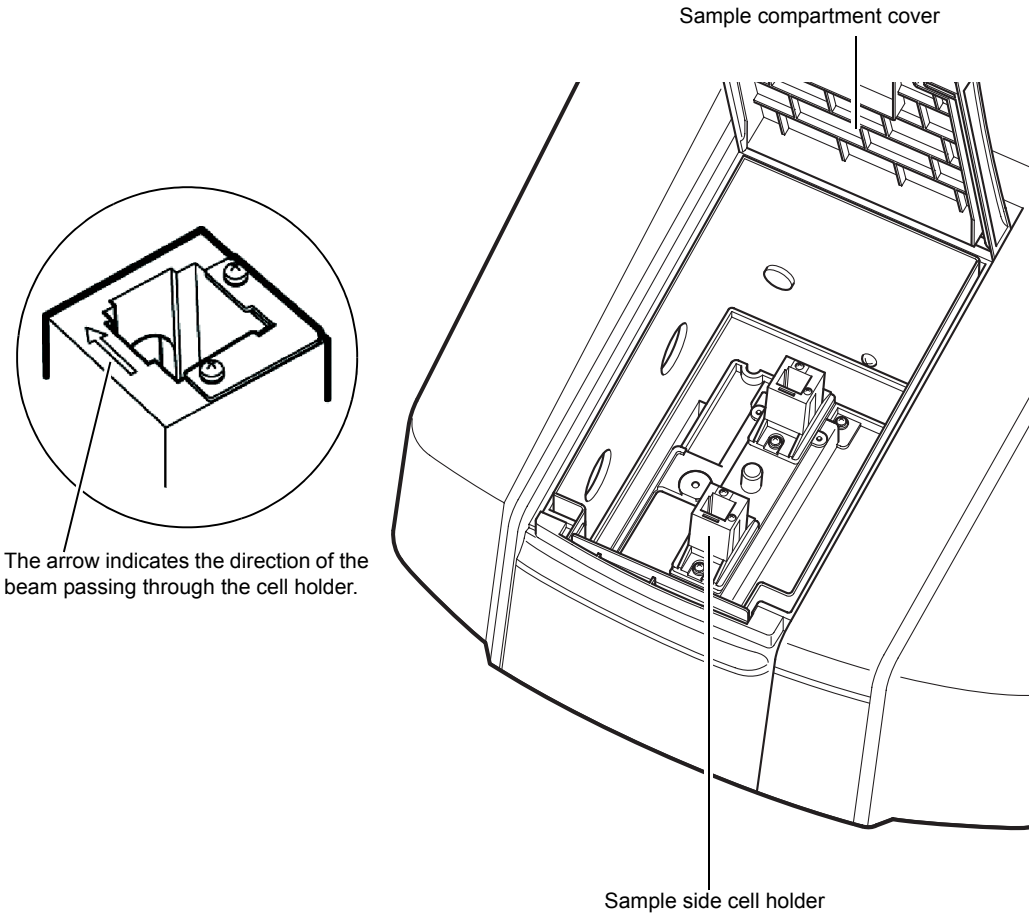


Fig.3-39

3.4.5 Start Measurement

1 Click [Start] on the [Instrument Control Button] bar.
Measurement begins.

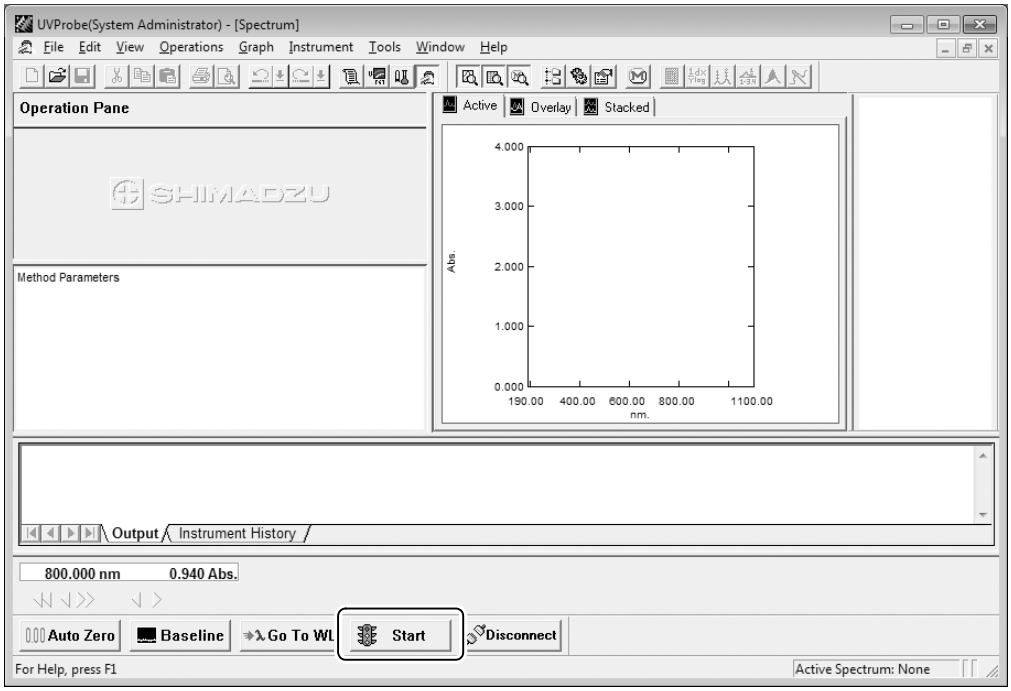


Fig.3-40

3.4.6 Measurement Completion/Save Data

When measurement is complete, the [New Data Set] window (Fig.3-41) appears.

Enter the file name, data storage name (see "3.1.3 Data File Structure"), analyst name, and any comments, and then click the [OK] button.

The procedure for entering file names is given in the following:

1 Click (Browse) button.

The [New Filename] window appears.

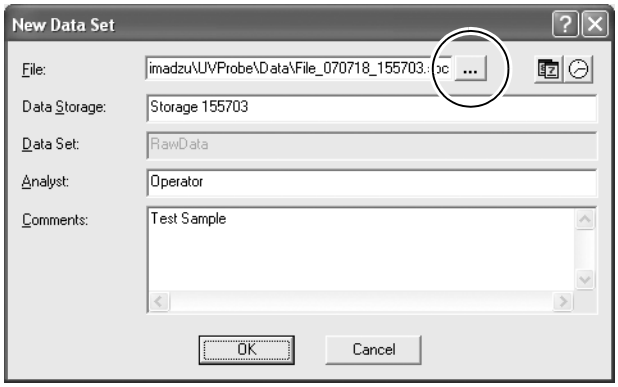


Fig.3-41

2 Enter the file name.

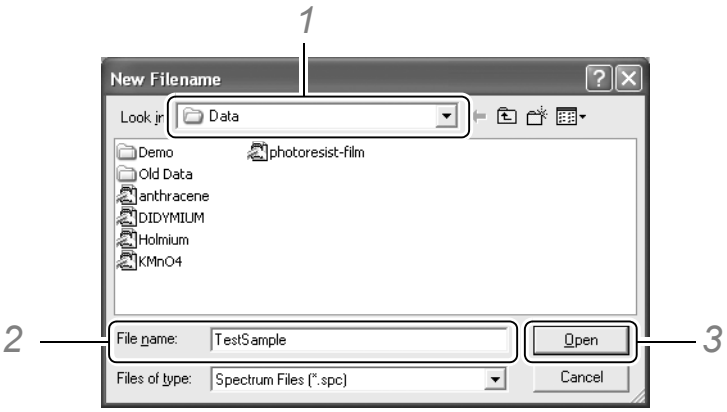


Fig.3-42

1 Select the destination folder to save the data file.
2 Enter the file name.
3 Click [Open].

The [New Filename] window closes, and then the folder path name and the file name appear in the [File] field of the [New Data Set] window.

3 Confirm that the correct path name and file name are displayed in the [File] field of the [New Data Set] window, and click the [OK] button.

NOTE

Except in GLP mode, the data saved in the [New Data Set] (RawData) can only be saved in the PC memory, and so when you exit UVProbe, the data are cleared.

Select [File] - [Save As] or [File] - [Save] to save the data to hard disk.

4 Click [Save] from the [File] menu to save the data.

To change the file name, select [Save As] from the [File] menu.

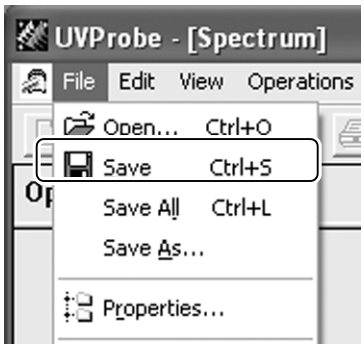


Fig.3-43

3.5 Peak Pick

The peak pick function automatically detects peaks and valleys on spectrum data and time course data (time course change of photometric values), and displays the wavelength (time) and photometric values as tabulated data (Peak Pick Table).
The peak pick operation is executed automatically when data is created after measurement, and the obtained results are saved with the measured data.

If [Peak Pick] in the [Operations] menu is clicked, the Peak Pick Table appears.

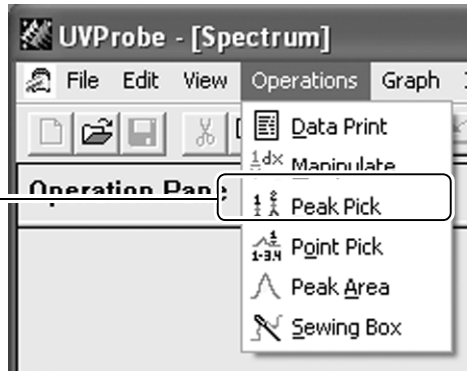
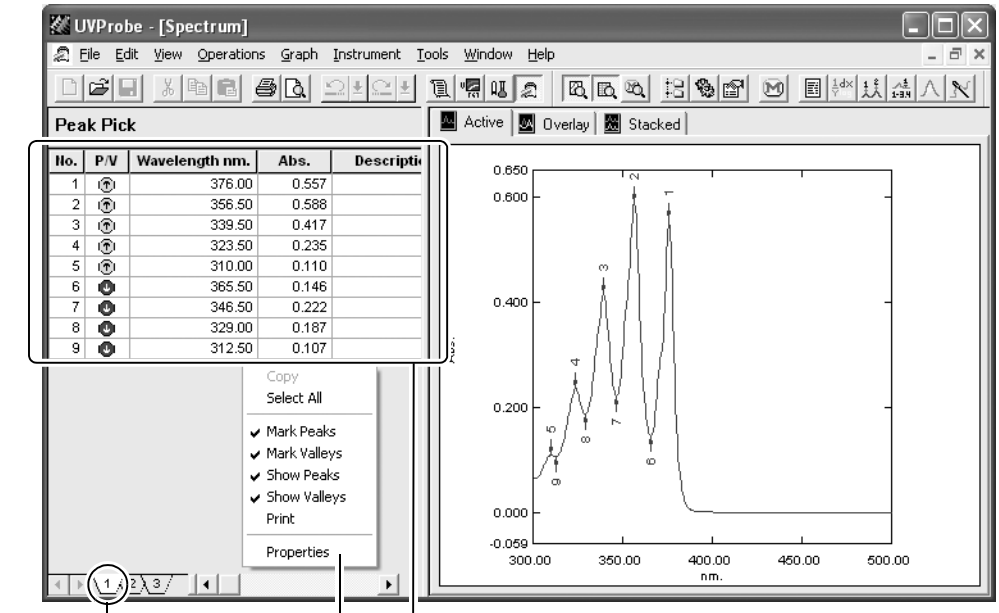


Fig.3-44



"File" Tab
Click the tab to switch between multiple data.

Shortcut menu (Peak Pick Table)
If you right-click the mouse on the pane where the peak pick table is displayed, the shortcut menu appears.

Peak Pick Table (Data processing pane)

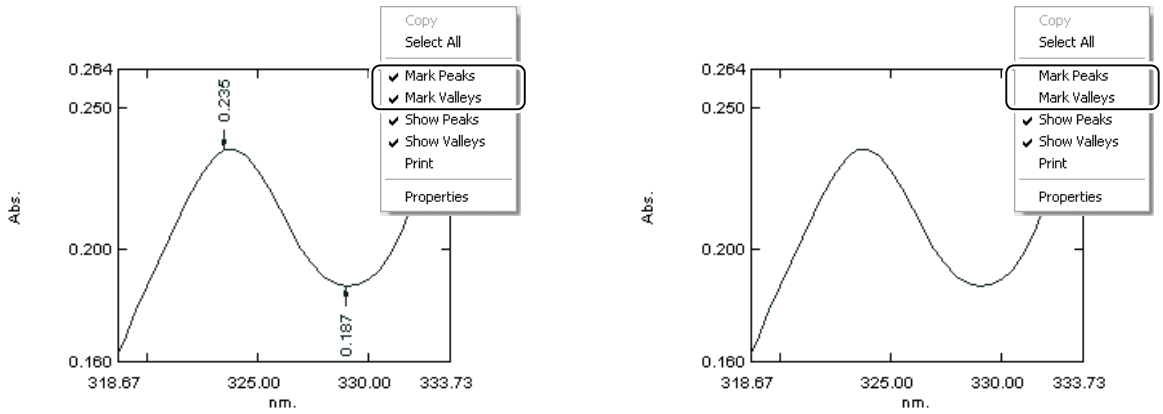
No.	:	Point number that is picked
P/V	:	Indicates whether the data is a peak (↑) or valley (↓).
Wavelength (nm)	:	Corresponding wavelengths for peaks and valleys
Abs.	:	Absorbance, transmittance, reflectance, or energy that corresponds to the peak or valley.
Description	:	Enter notes and comments about the data directly into the cell.

Fig.3-45

3.5.1 Show/Hide Peak (Valley) Marks on Graph

Right-click on the data processing pane to display the Shortcut Menu.

Checking [Mark Peaks] or [Mark Valleys] on the menu toggles between showing and hiding labels and marks on the graph.



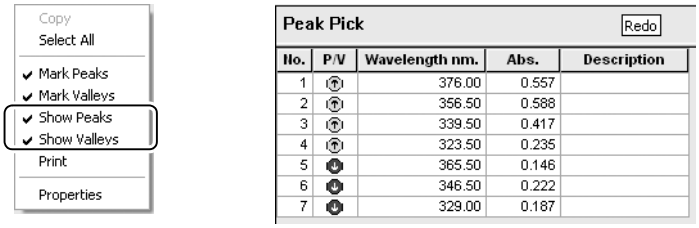
(Showing peak and valley marks) (Hiding peak and valley marks)

Fig.3-46

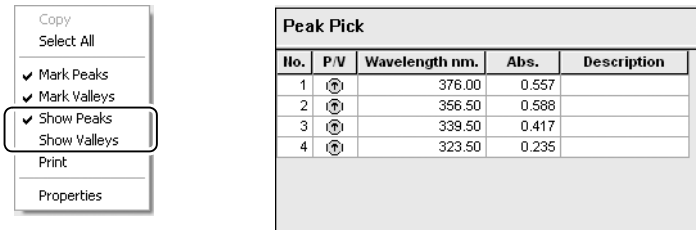
3.5.2 Show/Hide Peaks (Valleys) on Peak Pick Table

Right-click on the data processing pane to display the Shortcut Menu.

Checking [Show Peaks] or [Show Valleys] on the menu toggles between showing and hiding peak and valley data on the Peak Pick Table.



(Showing peak and valley data)



(Hiding valley data)

Fig.3-47

3.5.3 Specify Peak Pick Threshold (Changing Parameters)

By changing the peak pick processing parameters (Threshold, Points), you can control graph-displayed data to prevent errors due to unnecessary peaks or noises are detected.

- Threshold: Refers to the height up to a peak point from the line connecting the two valley points (or assumed valley points) neighboring the peak point.
- Points: The maximum value is detected as a peak only when photometric values increase continuously and decrease continuously by the specified number of points or more.
  Likewise, the minimum value is detected as a valley only when photometric values decrease continuously and increase continuously by the specified number of points or more.

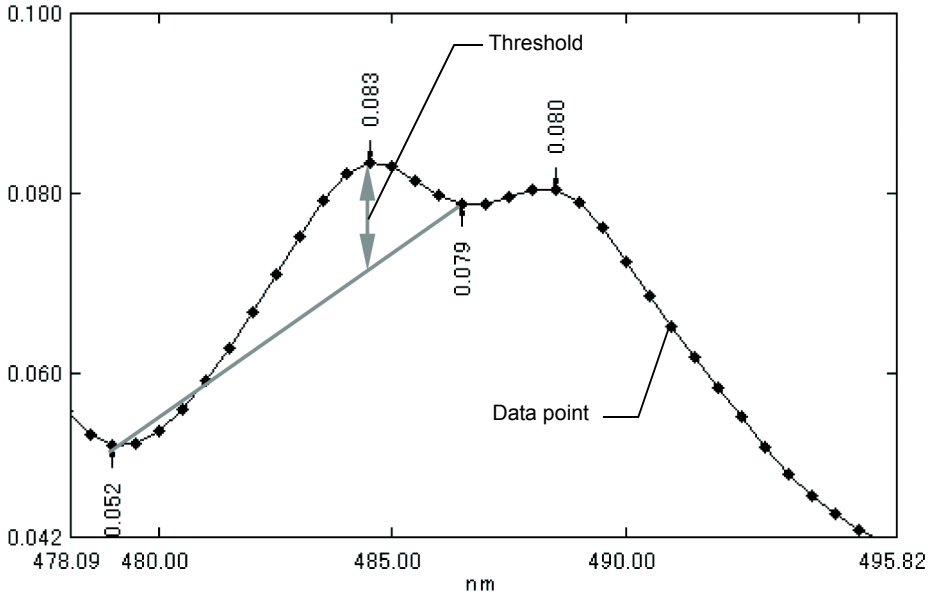


Fig.3-48

Right-click on the data processing pane to display the Shortcut Menu.

Select [Properties] from the menu to display the Properties window for setting peak pick parameters (Threshold, Points).

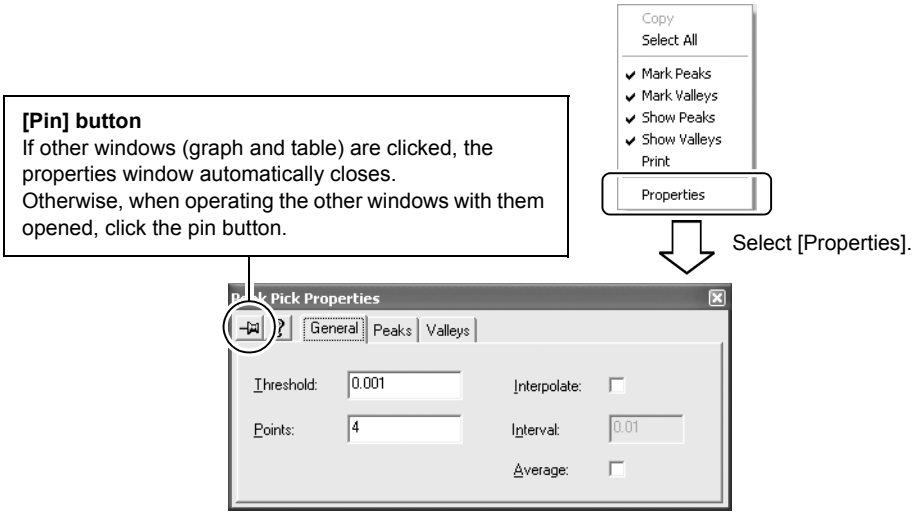


Fig.3-49

■ Example of Changing "Threshold"

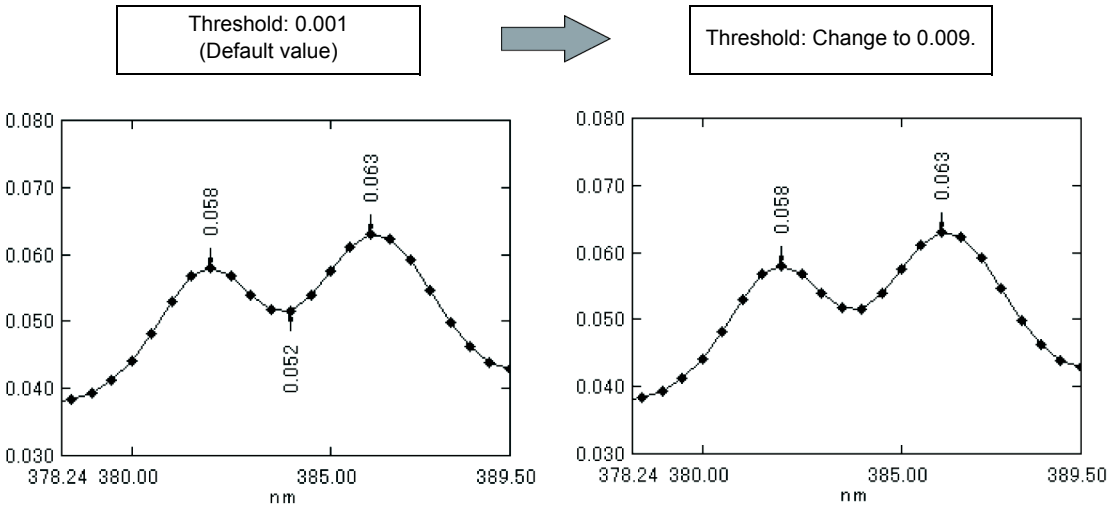


Fig.3-50

■ Example of Changing the Number of "Points"

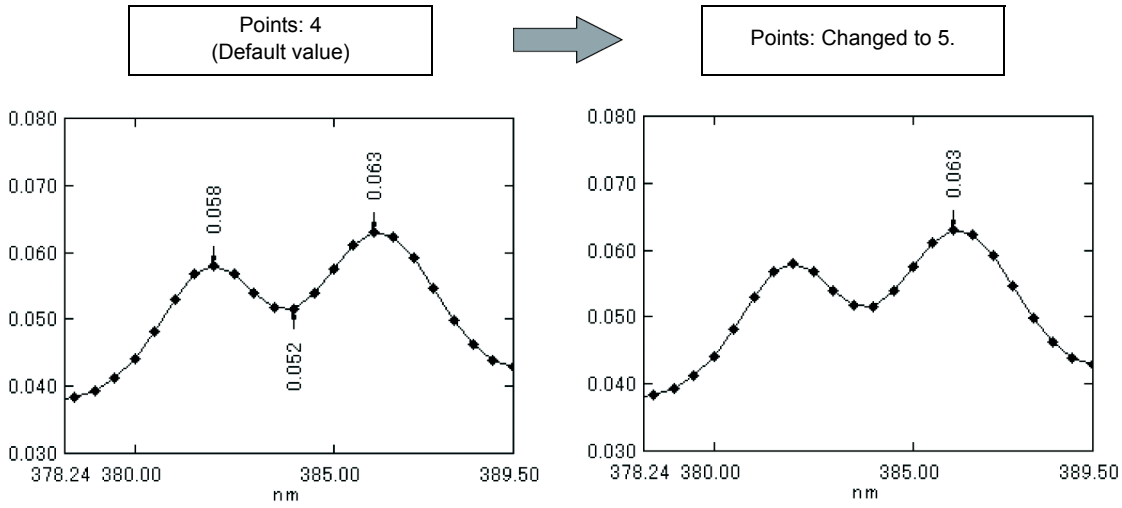


Fig.3-51

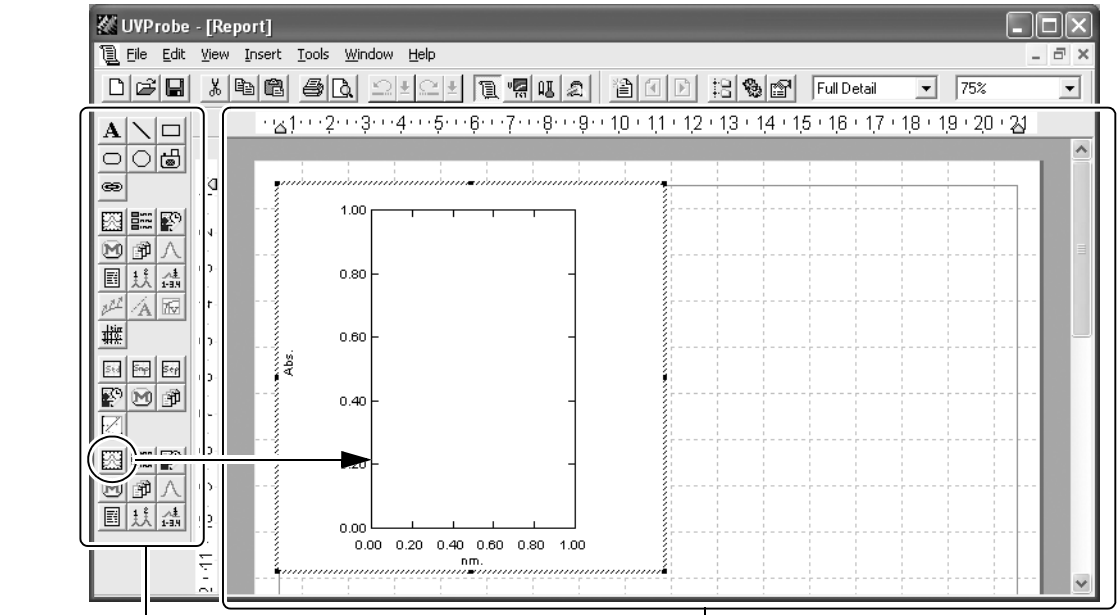
3.6 Print

3.6.1 UVProbe Printing Function

In UVProbe, use the Report Generator module to freely layout and print various graphs and operation tables. You can save created layouts as report files.
To add printed objects to the report, click [Insert Object] from the [Insert] menu or the object tool button (Fig.3-52) from the object tool bar.

Reference

For detailed functions and operation procedures for creating and editing report files, refer to the "Chapter 5 Report Generator" of "Instruction Manual UVProbe Tutorial" or the UVProbe help.



Object Toolbar
You can select items to be printed (Object) from this tool bar. Click a tool button to insert the corresponding object in the report editing area.

Report Editing Area
Adjust the size and position of inserted objects and perform other settings in this area.

Fig.3-52

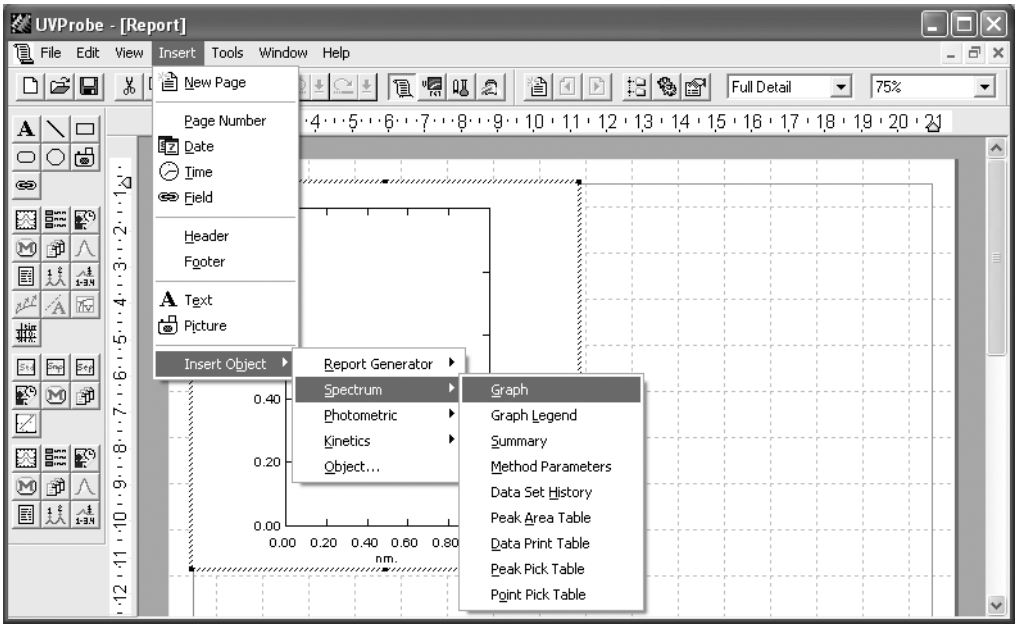


Fig.3-53 [Insert] Menu

3.6.2 Printing Procedure

This section describes the procedure for printing images directly from the measurement modules using the report files that have been installed during installation (Quick Print).

When UVProbe is installed, various report files*2 are installed in the installation folder*1.
By default, each of the report files is linked to the Graph window or data operation tables in each measurement module.

The following is the procedure for the Quick Print function, using as an example the report file "Spc Peak Pick.rpt" linked to the Peak Pick Table in the spectrum module.

*1 This is the folder where the UVProbe-related files are installed. If the directory is not changed, the default directory is as follows.
C:\Program Files\Shimadzu\UVProbe\Reports

*2 These are the print template files. These files are created by the UVProbe Report Generator, in which titles, graph areas, and table areas are arranged. Using Report Generator, you can edit them to desired locations.

Reference

Refer to "Chapter 5 The Report Generator" in "Instruction Manual UVProbe Tutorial".

1 Click [Open] from the [File] menu to open the file.

For example, read "anthracene.spc" on "C:\Program Files\Shimadzu\UVProbe\Data".

2 Click [Peak Pick] from the [Operations] menu.

The Peak Pick Table appears.

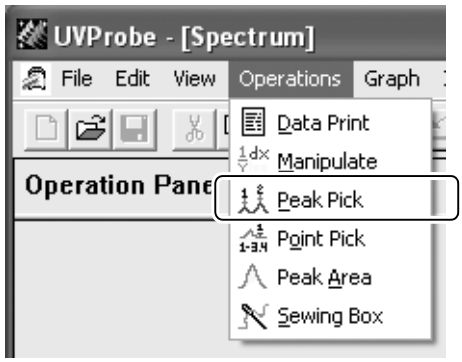


Fig.3-54

3 When multiple files are currently loaded, click the file tab and select a Peak Pick Table to be printed.

The file number for the selected pick table is shown on the [Active] tab of the graph.

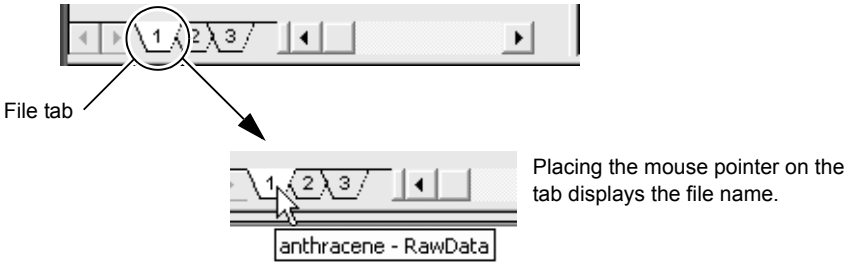


Fig.3-55

4 Select the [Active] tab on the graph.

There are three methods to show graphs, including [Active] tab (for display of one file), [Overlay] tab (for overlaid display of several files), and [Stacked] tab (for separate displays of several files).

☞ Reference

For more details, see "3.1.4 Help Functions". You need to use the keyword "Graph Mode".

5 Right-click on the Peak Pick Table and select [Print] from the displayed menu.

Printing begins.

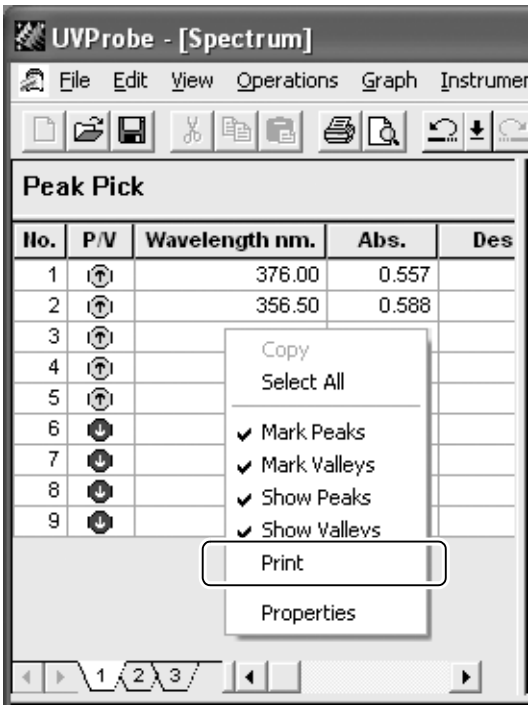


Fig.3-56

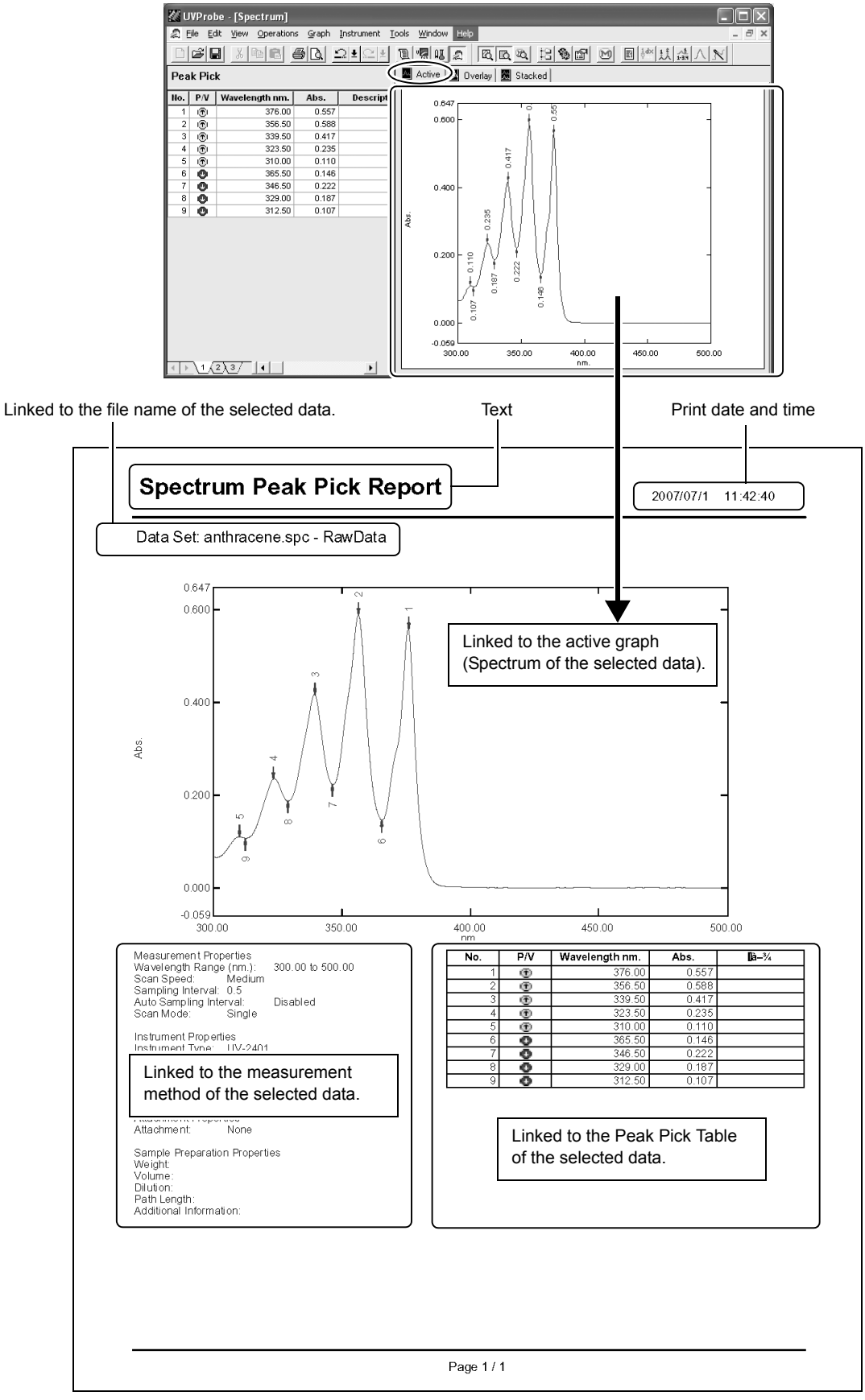


Fig.3-57 Printout example of report file "Spc Peak Pick.rpt"

3.7 High-absorbance Measurement

UV-2700 enables measurement up to a high absorbance range. This section describes measurement parameters for measuring a high absorbance range beyond absorbance "3".

NOTE

- UV-2600
  Compared to the UV-2700 double monochromator, the UV-2600 single monochromator has greater stray light within the measurement light, therefore, does not support high-absorbance measurement.
- Measurement using an accessory equipped with an integrating sphere attachment detector
  In measurement using an integrating sphere attachment (ISR-2600 Series or MPC-2600), an optional accessory, energy of measurement light decreases compared to measurement using a spectrophotometer alone, disabling high-absorbance measurement.
- Wavelength range enabling high-absorbance measurement
  A reference wavelength range enabling measurement up to absorbance "8" is from 400 nm to 650 nm. Note, however, that the actual wavelength range enabling high-absorbance measurement depends on the measurement conditions and the state of the sample.
  Also, in a high-absorbance range, the measurement accuracy required by customers may not be satisfied in terms of the noise level and reproducibility of measurement values. Thus, use the measurement parameters described above as references for measurement around Abs. "8".
  Also, in a high-absorbance range under Abs. "8", it may be possible to set a somewhat broader wavelength range than that mentioned above. However, in a wavelength range where the transmittance property of the dark filter provided as a standard accessory significantly deviate from Abs. 3 and Abs. 4, high-absorbance measurement cannot be performed. Thus, you should assume that the wavelength range enabling high-absorbance measurement is from 350 nm to 750 nm.

  Reference
  See description related to the optical specifications for filters in "3.7.3 High-Absorbance Kit".
- Window plates
  In measurement in a high-absorbance range over Abs. 6, scattered light inside the sample compartment due to stains on the window plates may cause a problem. In particular, stains on the window plate on the monochromator side of the sample beam significantly affect measurement results. Be very careful not to smear the window plate with fingerprints or dirt. Remove stains, if any, with a blower and clean the plate with a cotton bud with a clean dry cloth applied to its tip. We recommend use of a cleaning cloth for lenses of glasses and optical elements. In case the above solution does not remove stains, contact a Shimadzu representative for cleaning or replacement services.
- Slit for low stray light
  By setting to the slit for low stray light, you can reduce stray light in the measurement light. On the other hand, the light intensity decreases to about one fifth, resulting in S/N deterioration of data obtained, compared to a case with a normal slit. Therefore, when using the slit for low stray light, first of all check the calibration curve and judge whether or not you should use it by checking against the S/N characteristics of the obtained data. Basically, measurement with the slit for low stray light is not suitable for high-absorbance measurement that is prone to lack of light intensity. In particular, in a high absorbance range above Abs. 6, it is not suitable due to a poor level of light intensity increase in most cases and we do not recommend its use.

3.7.1 Measurement Overview and Precautions

High-absorbance measurement is prone to create greater noise as very low-intensity light is subject to measurement. This section describes methods enabling low-noise measurement for the spectrum, photometric, and kinetics modules, respectively.

When measuring samples exceeding absorbance "3", set a dark filter with an absorbance of approximately 50% of the absorbance of the sample to be measured on the reference side in order to establish a balance between the energy on the sample and reference sides.

As stated later, the wavelength range where high-absorbance measurement is possible is affected by the transmittance property of the dark filter.
The UV-2700 Series is shipped with a high-absorbance measurement kit complete with two types of dark filters supplied as standard accessories.

This kit also includes a partition plate that reduces the impact of very weak scattered light from the surface of the sample measured, window plates of the sample compartment, and the internal wall of the sample compartment that may affect measurement results. This partition plate works effectively for very high-absorbance measurement exceeding Abs. 6, in particular.

☞ Reference
See "3.7.2 High-Absorbance Measurement Method".

The following summarizes measurement parameters required for high-absorbance measurement by measurement mode.

■ Spectrum Module

Key Point	Measurement Parameter	Description
①	Set the slit width to 5.0 nm.	When the slit width is set to under 5.0 nm, generally, quality data cannot be obtained during high-absorbance measurement due to insufficient light intensity. It may be possible to improve quality by setting the scan speed to a lower value. That is, however, likely to increase measurement time significantly.
②	Set the scan speed by following the instructions below: • For a sample whose maximum absorbance does not exceed Abs. 6 -> According to the desired data quality, select [Medium], [Slow], or [Very slow]. • For a sample whose maximum absorbance exceeds Abs. 6 -> Set to [High absorbance (medium)] or [High absorbance (slow)].	In addition to scan speed parameters ([Fast], [Medium], [Slow], and [Very slow]) commonly used, the scan speed parameters for high-absorbance measurement ([High absorbance (medium)] and [High absorbance (slow)] are provided. For more information, see NOTE ① below.

Key Point	Measurement Parameter	Description
③	Set the sampling pitch to a small value.	It is recommended that a value under 0.5 nm be set. The smaller the value is, the more spectrum noise is reduced. In turn, however, the measurement time increases. Also, we do not recommend use of [Auto Sampling Interval] as it results in a sampling pitch greater than the above, depending on the measurement wavelength range, which may not provide noise reduction. For the relationship between the sampling pitch and spectrum noise, see NOTE ② below.

NOTE

- [High absorbance (medium)] and [High absorbance (slow)] for the scan speed are parameters provided for measuring samples whose absorbance is particularly high (exceeding Abs. 6). When set to any of those parameters, the instrument automatically recognizes the high absorbance range to perform measurement by spending sufficient time only for that particular wavelength range. However, the instrument performs measurement at a normal measurement speed for wavelength ranges with relatively low absorbance. Therefore, even in a high absorbance range, the measurement time can be minimized while decreasing of S/N can also be controlled. Note, however, if the absorbance of the sample is maximum Abs. 6, measurement results are equivalent to those using [Medium] or [Slow] in all ranges, not bringing about such great effect.

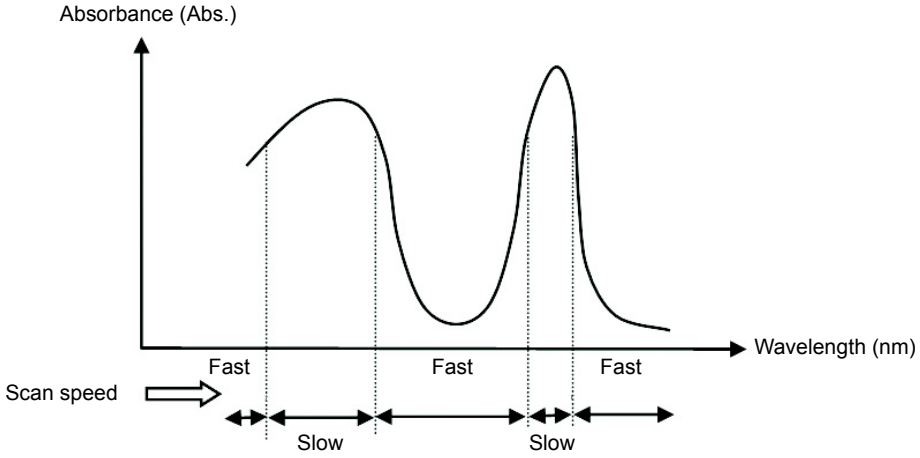


Fig.3-58 Relationship Between Absorbance Spectrum and Scan Speed in High-Absorbance Measurement Mode (Schematic)

The table below summarizes the recommended speed settings related to the sample's maximum absorbance and the desired data quality.

Table 3-4 Table of Recommended Scan Speeds by Absorbance Range and by Data Quality (S/N)

Data Quality (S/N) ->	Normal	High	Highest
Abs. 3 to Abs. 6	(As light intensity is sufficient, high quality data can be obtained at any speed.)	① Medium	② Slow/Very slow
Above Abs. 6	③ High absorbance (medium)	④ High absorbance (slow)	(Not supported due to insufficient light intensity)

Comparing measurement times, generally, [① Medium] requires the shortest time (fastest), followed by [② Slow/Very slow], [③ High absorbance (medium)], and [④ High absorbance (slow)], requiring more time (slower) in that order, although actual time requirement varies depending on conditions.

The ratios of measurement times against each other is approximately as follows:
①:②:③:④ = 1:10:60:200.
Note, however, that the above is only a reference since the actual absorbance distribution of the sample affects results.

In order to reduce spectrum noise, this instrument automatically calculates the arithmetical mean of data at several neighboring points within a range not affecting the shape of the spectrum, and then save them as data values (processing spectrum data for the moving average).

This averaging takes place when a broad slit width and a small sampling pitch are set. In this operation, the smaller the sampling pitch is, the greater the number of points are used for calculating the moving average, which leads to a greater noise reduction effect.

■ Photometric Module

Key Point	Measurement Parameter	Description
①	Set the accumulation time to two seconds.	In order to secure sufficient light intensity, we recommend the settable maximum accumulation time, which is two seconds.
②	Use repeated measurement.	Set the repetition count for the measurement method to more than one to have the average calculated. The recommended value is eight times for measurement at the speed of "High absorbance (medium)" and 32 times for measurement with the speed of "High absorbance (slow)".
③	Set the slit width to 5.0 nm.	When the slit width is set to under 5.0 nm, generally, quality data cannot be obtained during high-absorbance measurement due to insufficient light intensity. It may be possible to improve quality by setting the scan speed to a lower value. That is, however, likely to increase measurement time significantly.

■ Kinetics Module

Key Point	Measurement Parameter	Description
①	Set the accumulation time to two seconds.	In order to secure sufficient light intensity, we recommend the settable maximum accumulation time, which is two seconds.
②	Set the slit width to 5.0 nm.	When the slit width is set to under 5.0 nm, generally, quality data cannot be obtained during high-absorbance measurement due to insufficient light intensity. It may be possible to improve quality by setting the scan speed to a lower value. That is, however, likely to increase measurement time significantly.

NOTE

- In measurement using an integrating sphere attachment (ISR-2600 Series or MPC-2600), which is an optional accessory, energy of measurement light decreases compared to measurement with a spectrophotometer alone, disabling high-absorbance measurement.
- A reference wavelength range enabling measurement up to absorbance "8" is from 400 nm to 650 nm. Note, however, that the actual wavelength range enabling high-absorbance measurement depends on the measurement conditions and the state of the sample. Also, in a high-absorbance range, the measurement accuracy required by customers may not be satisfied in terms of the noise level and reproducibility of measurement values. Thus, use the measurement parameters described above as references for measurement around "8" Abs.
  Also, in a high-absorbance range under Abs. "8", it may be possible to set a somewhat broader wavelength range than that mentioned above.
  However, in a wavelength range where the transmittance property of the standard dark filter significantly deviate from Abs. 3 and Abs. 4, high-absorbance measurement cannot be performed. Thus, you should assume that the wavelength range enabling high-absorbance measurement is from 350 nm to 750 nm.

Reference

See description related to the optical specifications for filters in "3.7.3 High-Absorbance Kit".

3.7.2 High-Absorbance Measurement Method

This section describes the measurement method for samples exceeding absorbance "3".

■ Measuring a Solution Sample Using a Standard Cell Holder and a 10-mm Square Cell

1 When measuring a high-absorbance range exceeding Abs. 6, set the partition plate included in the high-absorbance measurement kit supplied as a standard accessory in the cell holder, as shown in the figure below. Using the knurled screw fixing the cell holder onto the sample compartment of the instrument, secure the plate together with the holder in place by fastening the screw.

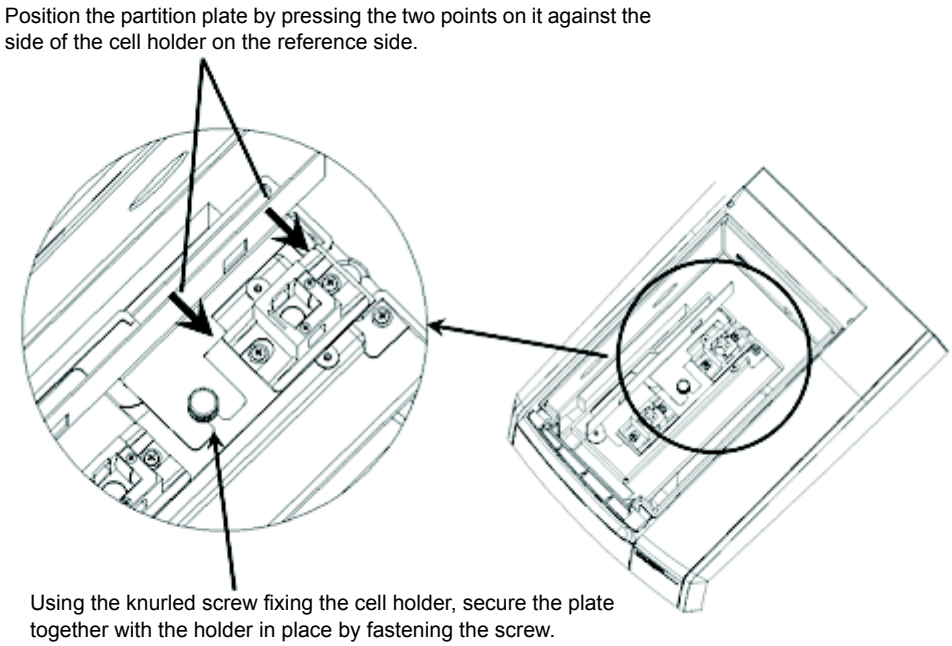


Fig.3-59 Mounting the Partition Plate

NOTE

There is an allowance about 1 mm between the knurled screw and the partition plate mounting position (a notch). You can mount it in any manner within this allowance without affecting measurement data.

2 Set a dark filter with an absorbance of about 50% of that of the measurement sample in the reference-side holder.

When measuring a sample of Abs. "3" to Abs. "6": Use a dark filter of Abs. "3".
When measuring a sample of Abs. "6" or more: Use a dark filter of Abs. "4".

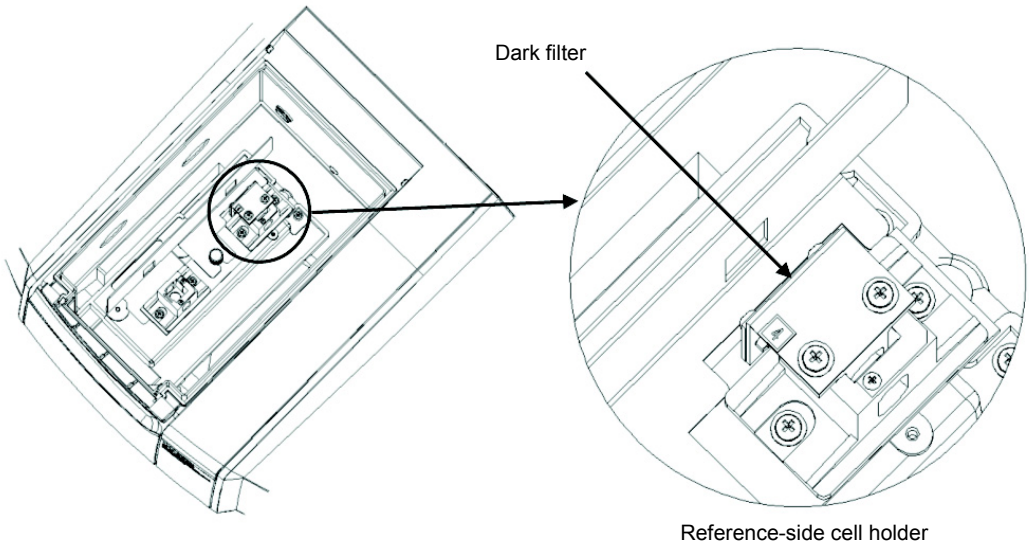


Fig.3-60 Mounting a Dark Filter

3 Set the measurement conditions and perform Baseline or Auto Zero.

4 Set a measurement sample on the sample side.

Go to the next step with the dark filter on the reference side set as it is.

5 Start measurement.

To perform measurement of the next sample without changing the dark filter, repeat step 4 and on.

To change the dark filter and then perform measurement of the next sample, repeat step 2 and on.

■ Measuring a Film Sample Using a Film Holder (Optional)

Use the following film holders (optional accessories) to perform high-absorbance measurement of film-type samples.

- Rotary film holder (Part No. 206-28500-41)
- Film holder (Part No. 204-58909)

Special dark filter sets are provided for those film holder options respectively. Purchase a relevant set. The part numbers of the dark filter sets are as follows:

- Dark filter set for the rotary film holder: Part No. 206-28730-41
- Dark filter set for the film holder: Part No. 206-28740-41

1 When measuring a high-absorbance range exceeding Abs. 6, set the partition plate included in the high-absorbance measurement kit supplied as a standard accessory at the film holder (optional), as shown in the figure below. Using the knurled screw fixing the film holder (optional) onto the sample compartment of the instrument, secure the plate together with the holder in place by fastening the screw.

Make the bent surface of the partition plate contact pins (at four locations) for positioning and then secure it in place with the knurled screw.

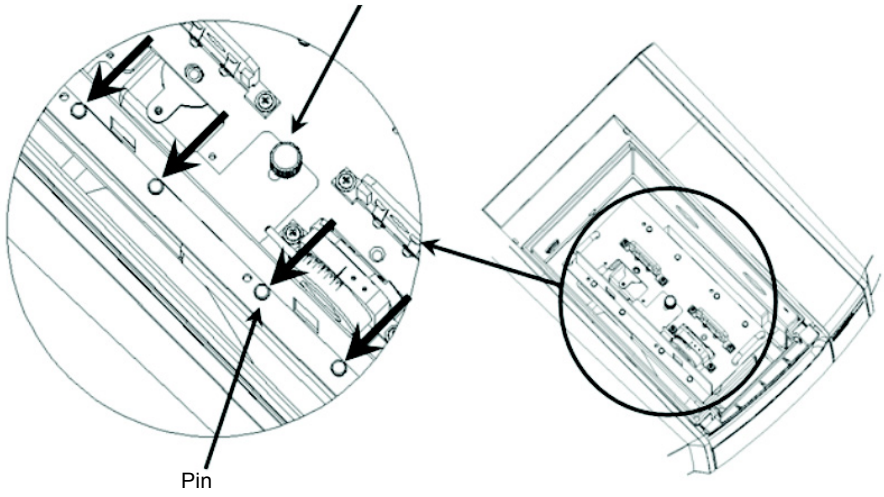
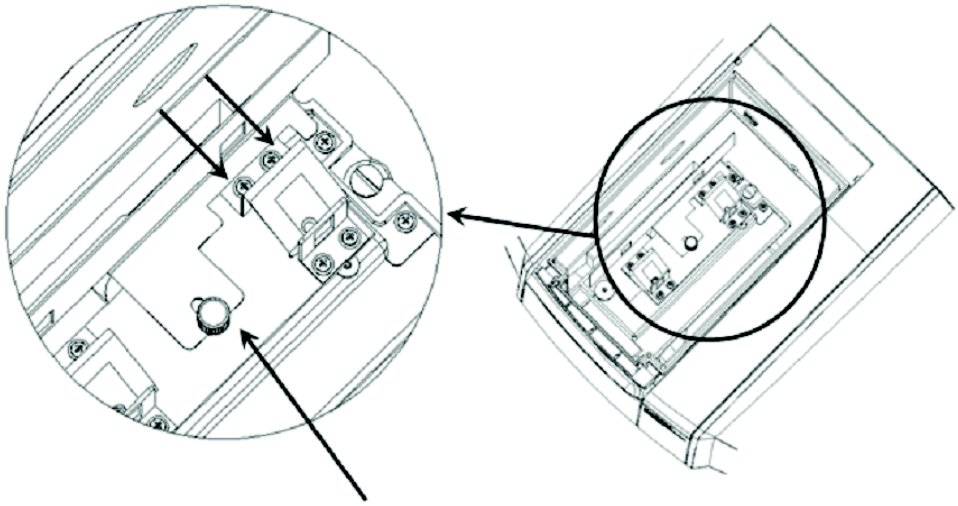


Fig.3-61 Mounting the Partition Plate onto the Rotary Film Holder



Press the partition plate against the side of the film holder on the reference side for positioning and then secure it in place with the knurled screw.

Fig.3-62 Mounting the Partition Plate onto the Film Holder

2 Set a dark filter (optional) with an absorbance of about 50% of that of the measurement sample in the reference-side holder.

When measuring a sample of Abs. "3" to Abs. "6": Use a dark filter of Abs. "3".
When measuring a sample of Abs. "6" or more: Use a dark filter of Abs. "4".

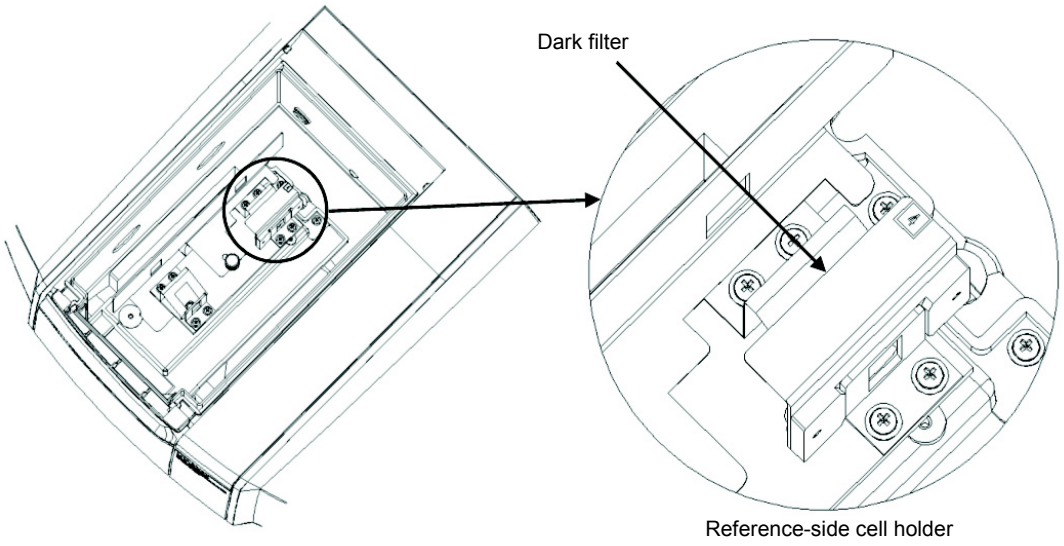


Fig.3-63 Mounting a Dark Filter onto the Film Holder

3 Set the measurement conditions and perform Baseline or Auto Zero.

4 Set a measurement sample on the sample side.

Go to the next step with the dark filter on the reference side set as it is.

5 Start measurement.

To perform measurement of the next sample without changing the dark filter, repeat step 4 and on.

To change the dark filter and then perform measurement of the next sample, repeat step 2 and on.

3.7.3 High-Absorbance Kit

The high-absorbance measurement kit contains the following parts:

No.	Name	Part No.
①	Dark filter for Abs. "3"	206-28562-91
②	Dark filter for Abs. "4"	206-28562-92
③	Partition plate	206-27693-02

Parts 1 and 2 are Abs. "3" and Abs. "4" dark filters for high-absorbance measurement to be mounted onto the reference-side cell holder for establishing balance between the sample-side and reference-side intensity. When used for measuring samples exceeding absorbance "3", they enable low-noise measurement. The number affixed on the top surface represents the absorbance of the dark filter.

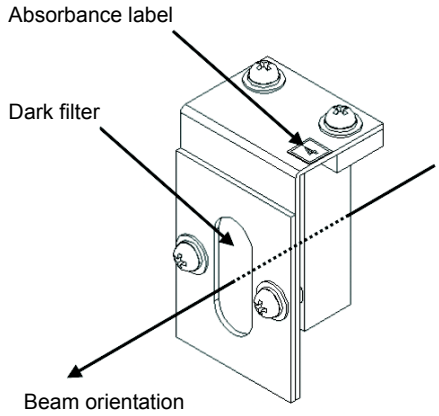


Fig.3-64 Dark Filter

NOTE

As for the Abs. 3 dark filter, a filter made of a metal net in place of a film is also available (Par No. 206-82299-91). Compared to the film type, is applicable to a broader wavelength range. However, it is prone to create greater absorbance variances (individual differences).

Part ③ is a optical partition plate to be set at the cell holder in the sample compartment. It is designed to reduce the impact of very weak scattered light from the surface of the sample measured, window plates of the sample compartment, and the internal wall of the sample compartment that may affect measurement results. Set it within the sample compartment for very high-absorbance measurement exceeding Abs. 6.

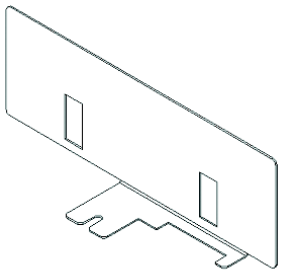


Fig.3-65 Partition Plate

■ Handling of a Dark Filter

Use a blower to remove dust on the film component of the dark filter, if any, Softly wipe off any fat-based stains such as fingerprints, if any exist, using absorbent cotton containing soapy water and quickly flush with water. Use after it is completely dried.

NOTE

Carefully handle the filter not to create a flaw on the surface as it would cause performance degradation.

■ Optical Specifications of the Dark Filters

The following shows the optical specifications of Parts 1 and 2, dark filters.

Table 3-5

No.	Name	Measurable Wavelength Range	Absorbance Range
①	Dark filter for Abs. "3"	400 nm to 650 nm	From Abs. 2.3 to Abs. 3.7 (500 nm)
②	Dark filter for Abs. "4"	400 nm to 650 nm	From Abs. 3.3 to Abs. 4.7 (500 nm)

■ Performance Check

Check performance of the dark filter basically semi-annually. Follow the checking procedure below.

1. In UVProbe spectrum mode, set the measurement method as shown below.

   Wavelength range : From 650 nm to 400 nm
   Scan speed : Medium
   Sampling pitch : 2 nm
   Measuring Mode : Absorbance
   Slit Width : 2 nm
   Detector Unit : Direct

2. Correct the baseline with nothing set on the cell holder in the sample compartment.

3. Measure the absorbance spectrum with the relevant dark filter set on the sample-side cell holder.

4 Check to see if the absorbance measurement value is within the specified range of absorbance listed in Table 3.5.

The wavelengh for checking the specifications is 500 nm.
If it does not satisfy the specifications, purchase a new dark filter.

For reference, see the absorbance spectrum of the Abs. 3 and Abs. 4 filters as measured according to the procedure above.

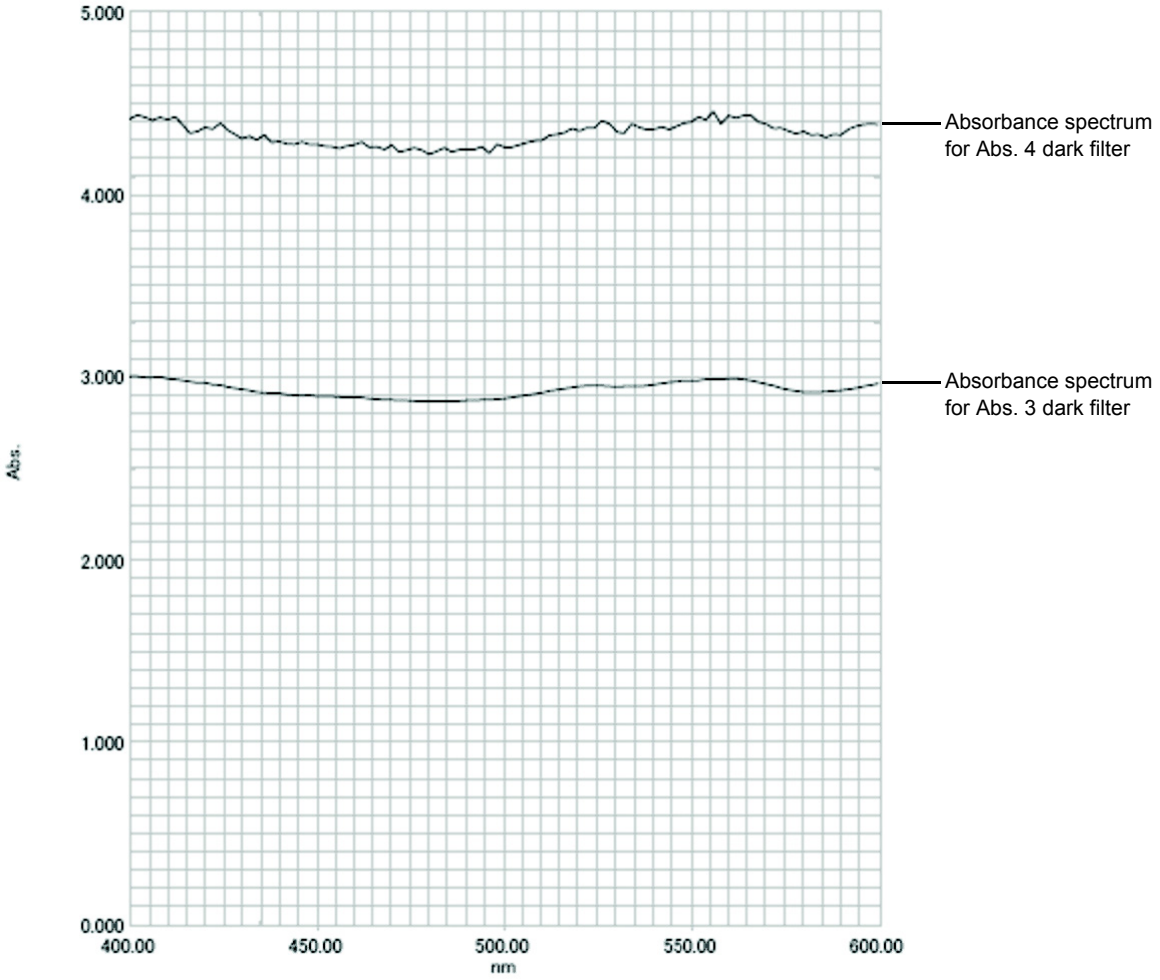


Fig.3-66 Absorbance Spectrum for Dark Filters

NOTE

The dark filters are serviceable for about 2 years. Over time, transmittance of the film is likely to increase due to deterioration of the dye on the film. Or the shape of the transmittance spectrum may change. Periodically perform the above checking. Also note that the serviceable period of the dark filters is affected by the frequency of use as well as the installation environment.

Avoid the risk of chemicals becoming attached to the film surface of the dark filter as it may adversely affect the transmittance properties. In particular, the filters do not tolerate halogenated hydrocarbon (methylene chloride, chloroform, etc.) and nitrogen compounds (N-Methyl-pyrrolidone, dimethylformamide, etc.), requiring much care (the base material of the film is triacetylcellulose.)

4 Maintenance

4.1 Inspection and Maintenance

To use the UV-2600/2700 safely, be sure to perform inspection and maintenance on the instrument.

⚠ WARNING

Unless otherwise specified, be sure to turn off the instrument and remove the power cord from the electrical outlet before inspection and maintenance.

Otherwise, fire, electric shock, or instrument malfunction may result.

⚠ CAUTION

- **When replacing parts, use the part listed in "1.1 UV-2600/2700 Configuration" and "7.2 Service Parts".**

  Using other parts may cause part failure, injury, or instrument malfunction.

- **Never remove the main cover. This may cause injury or instrument malfunction.**

  Before attempting repairs that require removing the main cover, contact your Shimadzu representative.

4.1.1 List of Periodic Inspection & Maintenance Items

Table 4-1

Inspection and Maintenance Item	Daily	1 year	2 years	3 years	Reference
Sample compartment inspection	○				"4.2 Sample Compartment Inspection"
Exterior inspection	○				"4.5 Clean the Exterior"
Lighting time of lamp check	○				"4.3 Checking and Resetting the Lighting Time of Lamp"
WI (halogen) lamp replacement			○		"4.4 Replace the Light Source Lamp"
D2 (deuterium) lamp replacement			○		"4.4 Replace the Light Source Lamp"
Performance check		○	○	○	"4.6 Performance Check"

4.2 Sample Compartment Inspection

⚠ CAUTION

Wipe up spilled samples immediately.

Vapors from a spilled sample may be a health hazard. Also, they may cause corrosion or measurement error.

NOTE

Do not spill water or organic solvent on the instrument.

This may cause an electric or functional failure.

When handling a liquid sample, inspect for spilled sample in the compartment before and after measurement.

When a liquid sample has spilled in the bottom of the compartment, remove the compartment unit from the compartment and wipe it.

Reference

See "5.2 Remove/Install the Sample Compartment Unit (Standard)".

4.3 Checking and Resetting the Lighting Time of Lamp

The instrument can record and display the accumulated lighting time of the WI (halogen) and D2 (deuterium) lamps used for the light source.

The accumulated lighting time of lamp is saved even if the power source is turned off. However, some electric problems may reset the saved content. Therefore, when using the lighting time of lamp as a guideline to replace your lamp, keep and maintain a record of the lighting time of lamp.

Reference

See "4.4.1 Light Source Specifications" for all lamp rating life.

4.3.1 Checking Procedure

1 Click [Configure] from the [Instrument] menu.

The [Configure] window appears.

2 Click the [Lighting Time of Lamp] tab.

Fig.4-1

3 Check the accumulated lighting time of lamp of the light source.

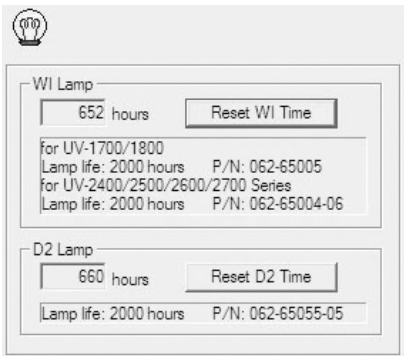


Fig.4-2

4 Click [OK] on the [Configure] window.

The window returns to the Measurement window.

4.3.2 Reset Procedure

After replacing the light source lamp, reset the accumulated lighting time by the following procedure.

Reference

See "4.4.2 Lamp Replacement Procedure" to change light source lamp.

For the lighting time of lamp, only reset (return to 0) is possible. A specific lighting time can not be specified. The procedure for resetting the lighting time of lamp is given below, using the D2 lamp as an example.

1 Click [Configure] from the [Instrument] menu.

The [Configure] window appears.

2 Click the [Lighting Time of Lamp] tab.

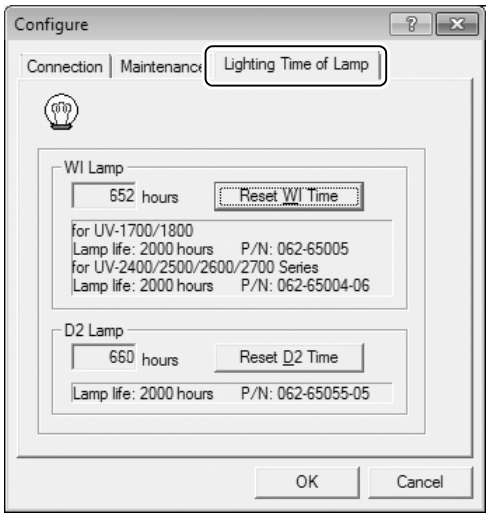


Fig.4-3

3 Click the [Reset D2 Time] to check the D2 lighting time of lamp for 0.

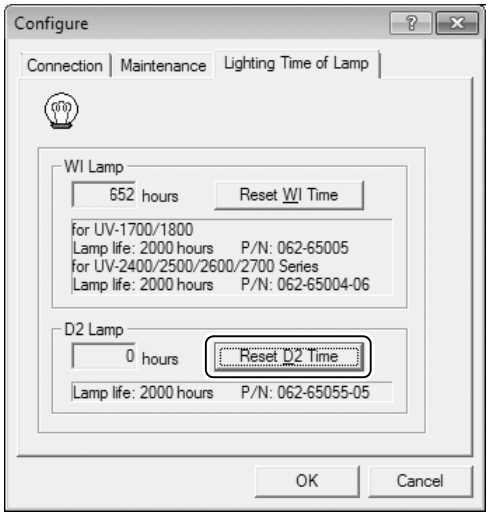


Fig.4-4

4 Click [OK] on the [Configure] window.

The window returns to the Measurement window.

4.4 Replace the Light Source Lamp

4.4.1 Light Source Specifications

The instrument uses two types of light source lamps: D2 (deuterium) and WI (halogen).

The D2 lamp is used for ultraviolet region (185 nm to variable wavelength*1). The WI lamp is used for visible/near-infrared region (variable wavelength*1 to 900 (1400) nm*2).

The closer the lamp service life comes to its end, the smaller the light intensity of each lamp, and the greater the noise in photometric data.

Replace the light source lamp by referring to the rating life*3 in the following table:

*1 The light source can be switched in the range from 290 nm to 370 nm in 0.1 nm increments.

Reference
For more details, see "3.3.1 Advanced Options for Instrument Parameters".

*2 The measurement for near infrared range (min. 900 nm) is possible only when using the integrating sphere attachment ISR-2600Plus (optional accessory).

*3 The rating life is defined as the "average life" of a large number of lamps from each supplier. Please take note that some lamp may burn out before the rating life.

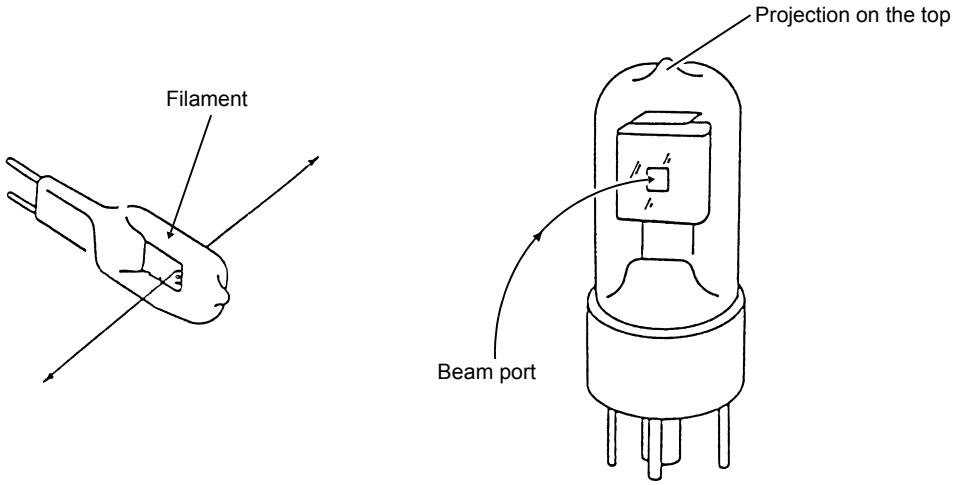


Fig.4-5 Light Source Overview

Table 4-2

No.	Part Name	Part No.	Model Name	Rating Life
①	WI (halogen) lamp	062-65004-06	64604	Appox. 2000 hours
②	D2 (deuterium) lamp	062-65055-05	L6380	Appox. 2000 hours

4.4.2 Lamp Replacement Procedure

⚠ CAUTION

- **Before replacing the lamp, be sure to turn off the instrument power switch and remove the electric plug from the outlet.**
  Otherwise, fire, electric shock, or instrument malfunction may result.
  Do not turn on the instrument power while the light source compartment is visually exposed. The generated ultraviolet ray may damage the eyes.
- **Before replacing the lamp, turn off the instrument and let it stand at least for 30 minutes until the lamp cools down sufficiently.**
  Touching the lamp when it is still hot will burn you.
- **Be careful not to break the lamp.**
  The broken pieces of glass may cause injury.
- **Do not move the WI lamp to the right and left or up and down with it inserted into the socket.**
  The connection part between the pin at the bottom of the lamp and the glass may crack, which would disable the lamp to turn on.

NOTE

- When removing and installing the light source compartment cover, avoid hitting the protrusion (Fig.4-5) on the top of the D2 (deuterium) lamp against the back of the cover.
  Doing so may cause a vacuum leak in the lamp tube.
- When replacing the lamp, wear cloth gloves so as not to leave fingerprints on the glass part.
  When the light source gets hot, a fingerprint will burn onto the bulb and light transmission will deteriorate.
- When replacing the WI (halogen) lamp, you may inadvertently touch the D2 lamp.
  Cover the D2 lamp with a clean paper or cloth or remove the D2 lamp before replacing the WI lamp.

■ Removing the Light Source Compartment Cover

1 Using a Philips screwdriver, loosen the fixing screw located on the side of the light source compartment cover.

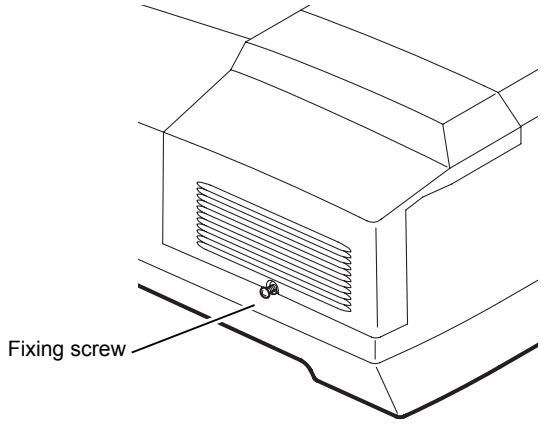


Fig.4-6

2 Lift up the top of the fixing screw on the side of the light source compartment cover to release the cover notch from the fixing screw.

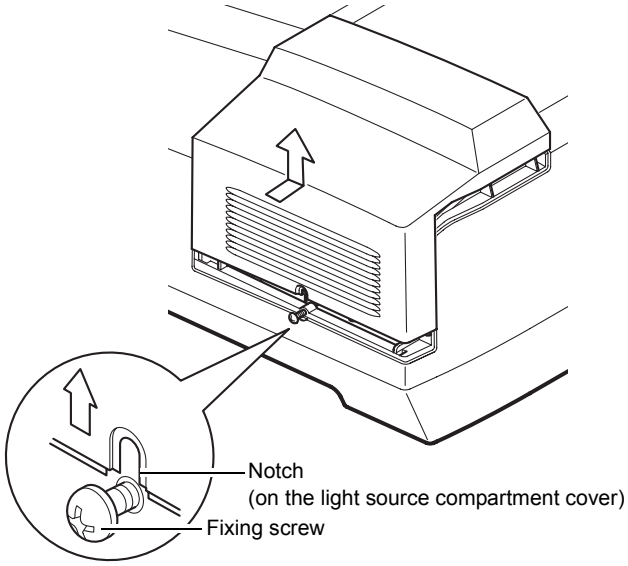


Fig.4-7

3 While lifting up the light source compartment cover at an angle (following the direction of the arrow in Fig. Fig.4-8), remove it from the main body.

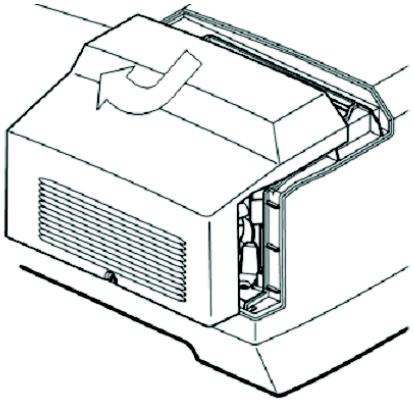


Fig.4-8 Removing the Light Source Compartment Cover

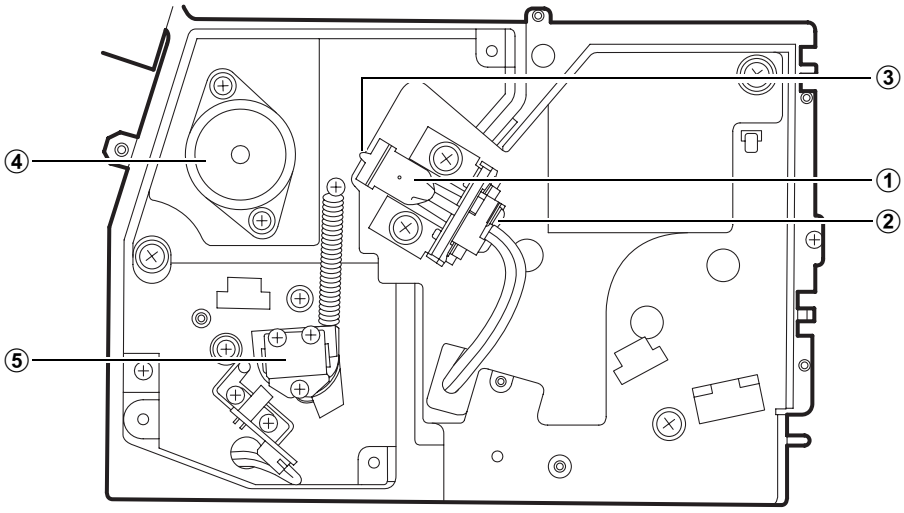


Fig.4-9 Light Source Compartment (UV-2600)

Table 4-3

No.	Name
①	WI lamp
②	WI Lamp Socket
③	WI Lamp Retainer Spring
④	D2 lamp
⑤	Light source switching mechanism

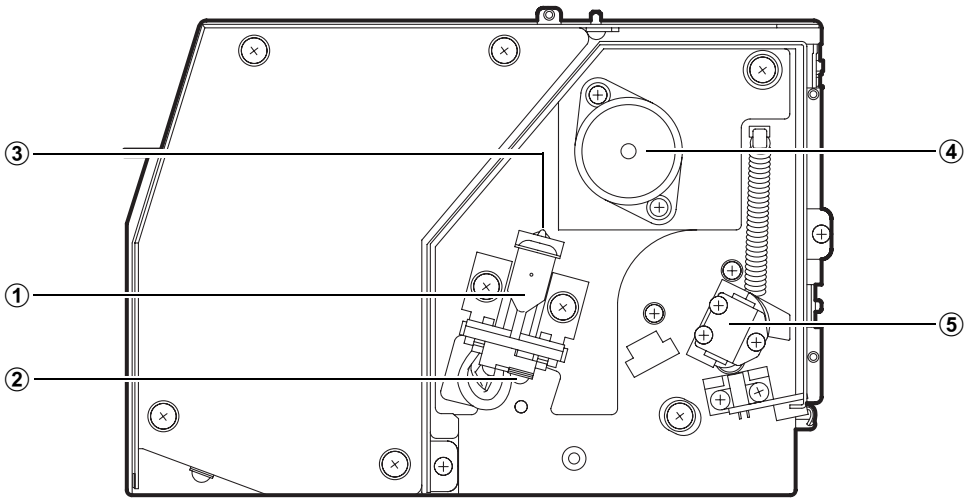


Fig.4-10 Light Source Compartment (UV-2700)

Table 4-4

No.	Name
①	WI lamp
②	WI Lamp Socket
③	WI Lamp Retainer Spring
④	D2 lamp
⑤	Light source switching mechanism

■ Replace the WI (halogen) Lamp

When replacing the WI lamp, you may inadvertently touch the D2 lamp. Cover the D2 lamp with a clean paper or cloth or remove the D2 lamp before replacing the WI lamp.

Reference

When removing D2 lamp, see "■ Replacing the D2 Lamp".

1 Remove the WI lamp retainer spring from the top of the WI lamp.

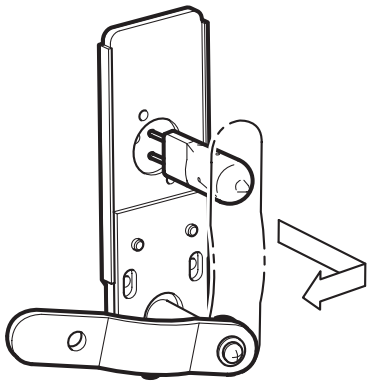


Fig.4-11

2 Pull out the WI lamp from the socket.

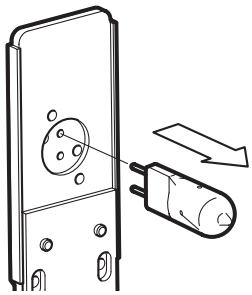


Fig.4-12

3 Wearing cloth gloves, hold the new WI lamp at the top and bottom so as not to taint its beam port.

4 Insert the new WI lamp into the socket. Push it forward until the tips of the two pins on the WI lamp contact the back of the socket and stop.

⚠ CAUTION

Do not move the WI lamp to the right and left or up and down with it inserted into the socket.

The connection part between the pin at the bottom of the lamp and the glass may crack, which would disable the lamp to turn on.

NOTE

WI lamp pins do not have a polarity. There is no problem inserting it from any direction.

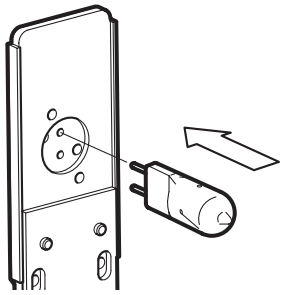


Fig.4-13

5 Return the WI lamp retainer spring, removed in step 1, to the original position.

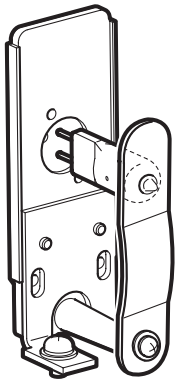


Fig.4-14

6 Reinstall the D2 lamp to the original position.

Be sure that no paper or cloth used for the work is left in the light source compartment.

7 Reinstall the light source compartment cover in opposite order (see also "■ Removing the Light Source Compartment Cover").

8 Insert the electric plug into the outlet, and switch on the instrument. (Press the "|" side on the switch.)

The initialization starts.

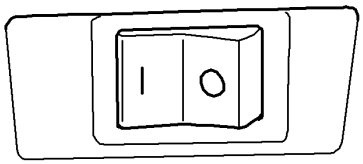


Fig.4-15

9 Run UVProbe and connect all related instruments to check that all initialization items are complete.

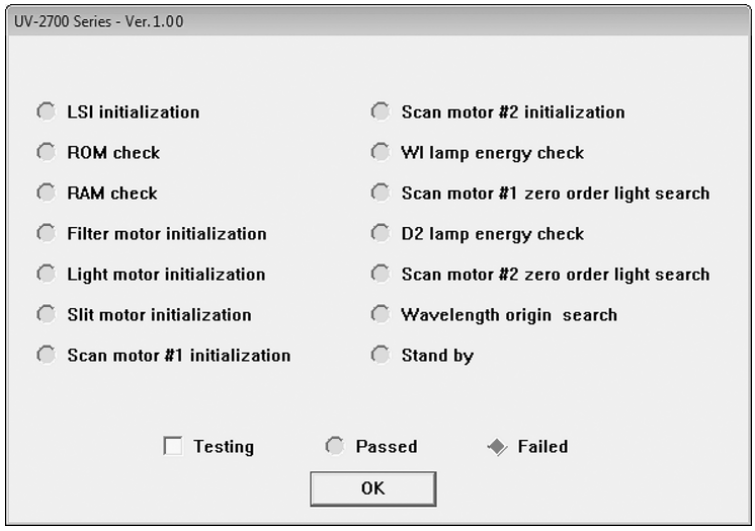


Fig.4-16 (UV-2700)

10 Click [OK] to end the initialization. Reset the accumulated lighting time of lamp of the WI lamp according to "4.3.2 Reset Procedure".

■ Replacing the D2 Lamp

1 Wearing cloth gloves, hold the resin part of the D2 lamp (Fig.4-17), and slowly pull it straight up.

2 Slowly extract the D2 lamp upward to remove it from the socket.

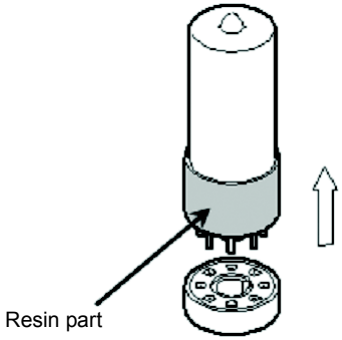


Fig.4-17

3 Insert the new D2 lamp into the socket.

At this time, fit the locating lug at the bottom of the D2 lamp to the socket notch.
Confirm if the D2 lamp is fully inserted into the socket.

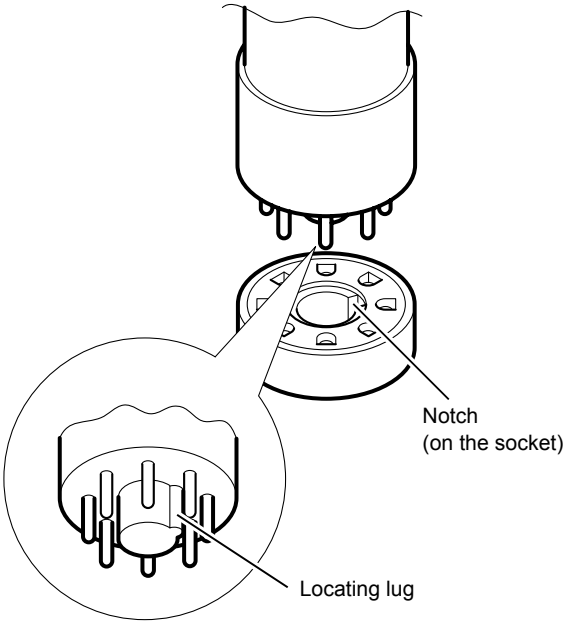


Fig.4-18

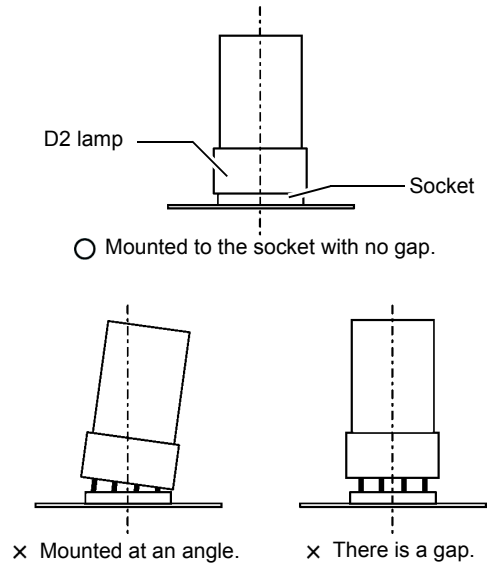


Fig.4-19 Checking D2 Lamp Installation

4 Reinstall the light source compartment cover in opposite order (see also "■ Removing the Light Source Compartment Cover").

5 Insert the electric plug into the outlet, and switch on the instrument. (Press the "|" side on the switch.)
The initialization starts.

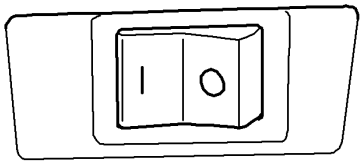


Fig.4-20

6 Run UVProbe and connect all related instruments to check that all initialization items are complete.

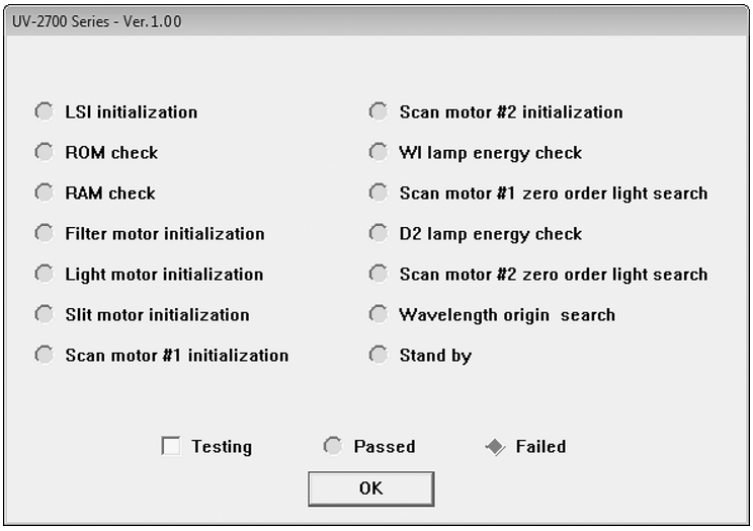


Fig.4-21 (UV-2700)

7 Click [OK] to end the initialization. Reset the accumulated lighting time of lamp of the D2 lamp according to "4.3.2 Reset Procedure".

4.5 Clean the Exterior

When the instrument case or sample compartment cover is soiled, wipe it with a dry, soft cloth or tissue. Remove more stubborn stains by the following procedure.

1. Dip a cloth into watered-down mild detergent and wring it well. Wipe the instrument with it.

2. Dip a cloth into water and wring it well. Wipe off any detergent residue on the instrument completely. Then, wipe the moisture off with a dry cloth.

NOTE

If any water gets onto the instrument, wipe it away immediately to prevent rust. Never use alcohol or thinner solvents for cleaning the instrument. They may cause rust or discoloring.

4.6 Performance Check

Shimadzu recommends that your instrument performance is checked regularly to maintain the measurement accuracy.

UV Performance Validation Software is supplied as a standard accessory to enable checking of the basic performance.

Main characteristics of UV Performance Validation Software:

- Enabled measurement includes measurement of ① baseline flatness, ② noise level, and ③ wavelength accuracy, among others.
- Selecting the inspection item is possible. Also this software gives the criteria for the measured inspection items.
- Creating and saving the inspection condition files such as one-month, six-month, and other inspection are possible.

Reference

Refer to "UV Performance Validation Software Instruction Manual".

5 Replace Sample Compartment

5.1 Removing/Installing the Cell Holder

To install some optional accessories, such as Ultra-micro cell holder (P/N 206-14334), it is necessary to replace the standard cell holder in the sample compartment.

In such a case, remove/install the cell holder by the following procedure.

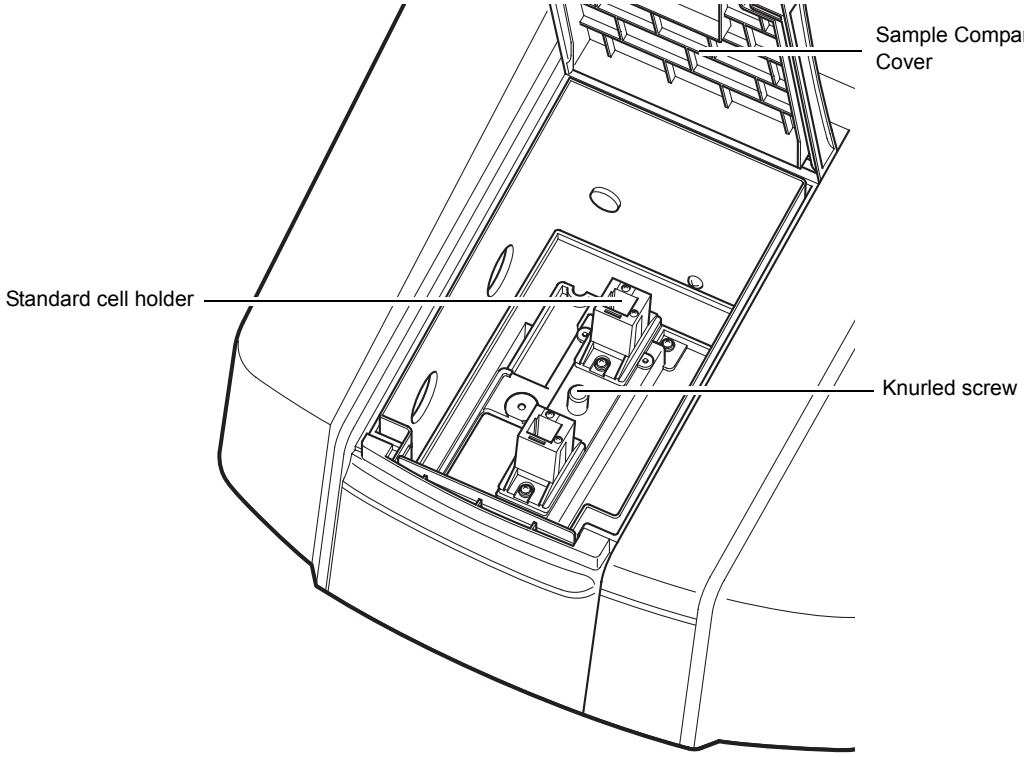


Fig.5-1 Sample Compartment (Standard)

5.1.1 Removing the Cell Holder

1 Open the sample compartment cover.

2 Loosen the knurled screw fixing the cell holder. Remove the cell holder.

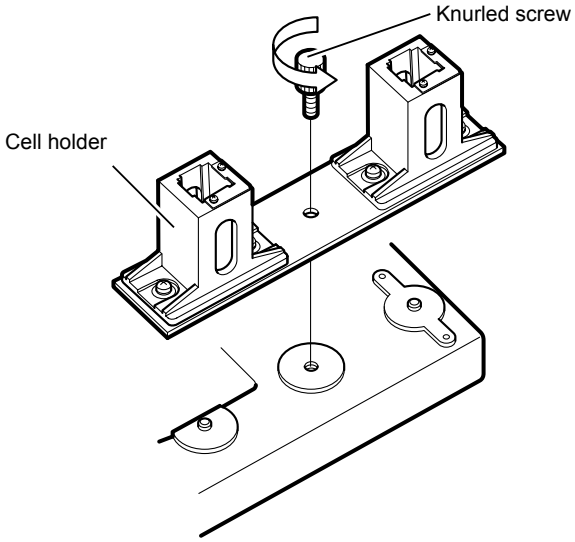


Fig.5-2

5.1.2 Installing the Cell Holder

1 Fit the two positioning holes on the cell holder into the positioning pins on the sample compartment unit to install the cell holder.

NOTE
Install the cell holder so that the beam passes through it as directed by the arrow mark.

2 Secure the cell holder with the knurled screw.

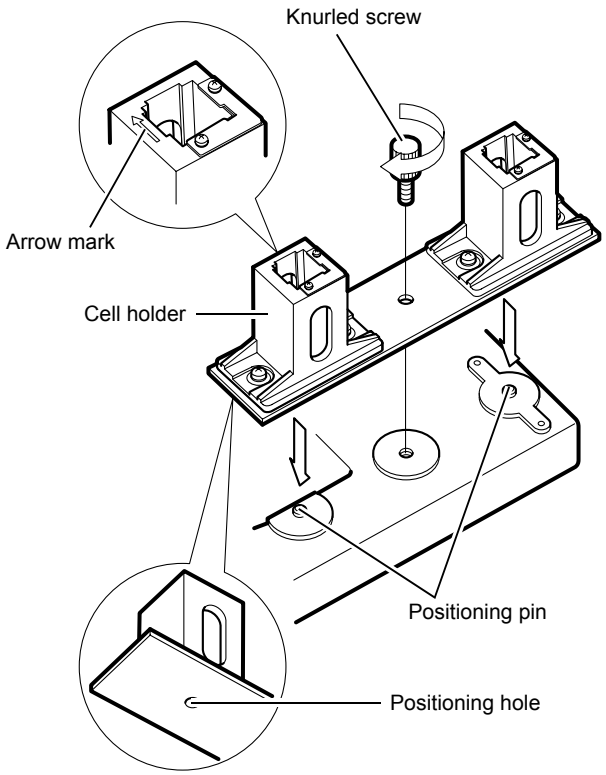


Fig.5-3

5.2 Remove/Install the Sample Compartment Unit (Standard)

To install some optional accessories, such as sipper 160 series (P/N 206-23790-91, etc.), it is necessary to replace the standard sample compartment unit.

In such a case, remove/install the standard sample compartment unit by the procedure described below. For installing/removing optional accessories, refer to the instruction manual of each accessory.

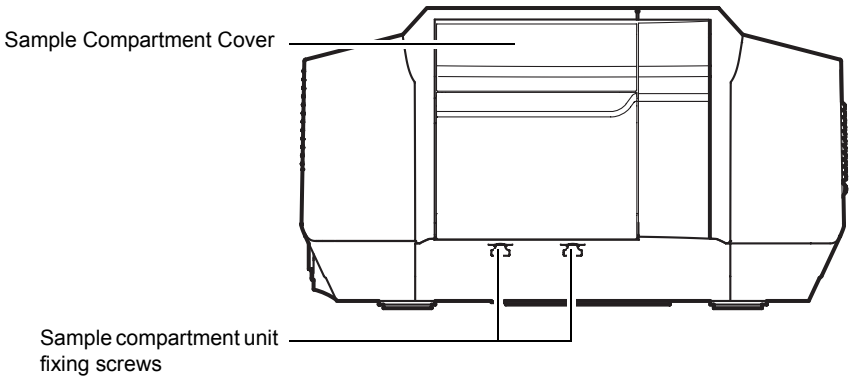


Fig.5-4 Main Body, Front View

5.2.1 Removing the Sample Compartment Unit

1. Loosen the two sample compartment unit fixing screws located at the bottom of the sample compartment (Fig.5-4).

2. Open the sample compartment cover and remove the sample compartment unit.
   1. Pull the front side of the sample compartment while lifting it up.
   2. Pull out the sample compartment in the direction that releases the notch from the fixing pin.

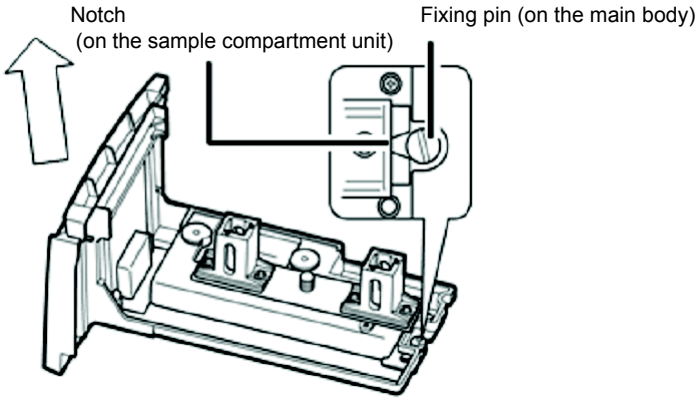


Fig.5-5

NOTE
Do not loosen the fixing pin.

3 While lifting up the sample compartment unit slightly, pull it from the fixing pin in a slanted direction.

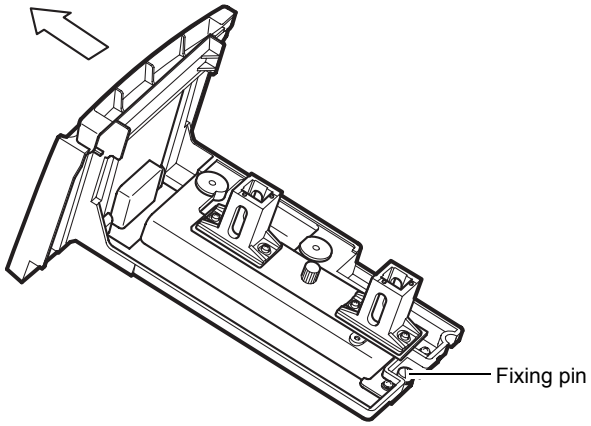


Fig.5-6

5.2.2 Install the Sample Compartment Unit

NOTE

Fix the sample compartment unit securely to the instrument main body using the fixing screws (knurled screws).

If the sample compartment unit is not secured properly, outside light from the gap streams through. Then, it is not possible to acquire accurate data.

1 Open the sample compartment cover to install the sample compartment unit.

1 At an angle from above, insert the notch on the sample compartment unit to the fixing pin at the far side of the sample compartment.

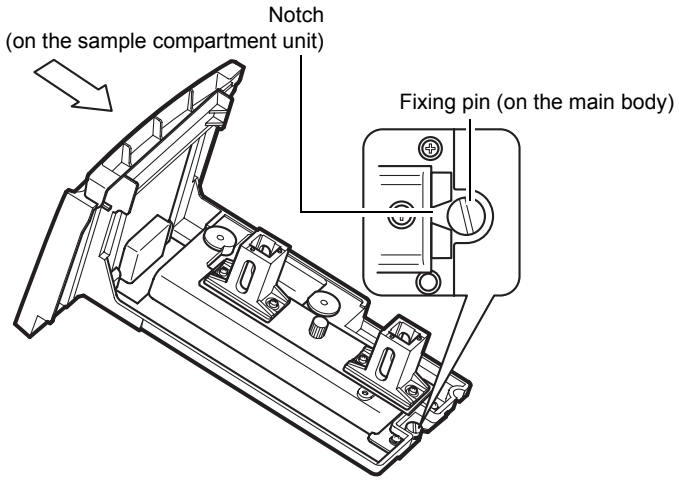


Fig.5-7

2 Push the sample compartment unit forward so that the notch is pressed into the fixing pin.

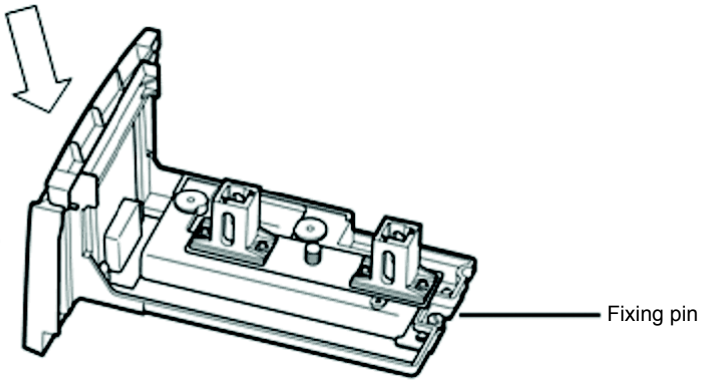


Fig.5-8

3 Check that there is no step between the sample compartment front cover and the instrument.

When a step is found at the lower section on the front after the sample compartment unit has been mounted, check to see if the notch is engaged with the pin as far as possible and if any object is caught underneath the sample compartment unit. Then re-mount the sample compartment unit.

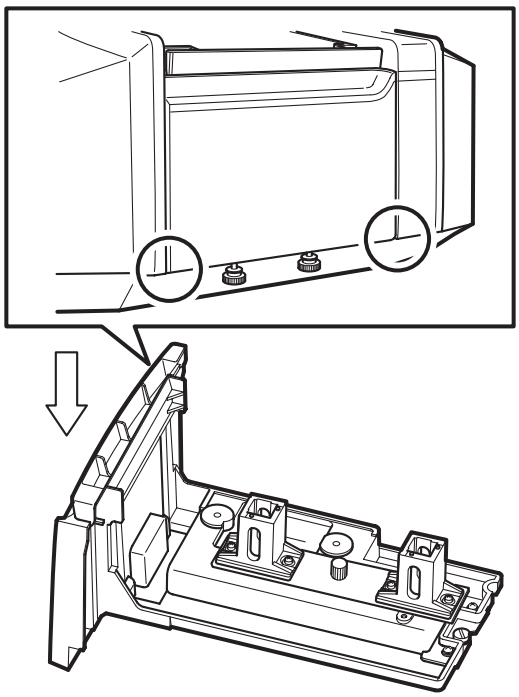


Fig.5-9

2 Tighten the two sample compartment fixing screws (Fig.5-4) to secure the sample compartment unit.

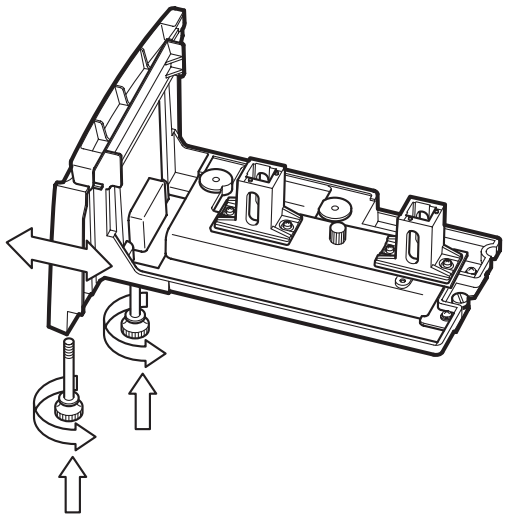


Fig.5-10

NOTE

Align the screw holes on the sample compartment unit with the knurled screws by moving the unit back and forth.

3 Close the sample compartment cover (Fig.5-4).

5.3 Remove/Install the Sample Compartment Front Cover

To install some optional accessories, such as syringe sipper (P/N 206-23890-91), it is necessary to install the designated front plate on the sample compartment.

In that case, remove/install the front plate on the sample compartment by the following procedure. For installing/removing optional accessories, refer to the instruction manual of each accessory.

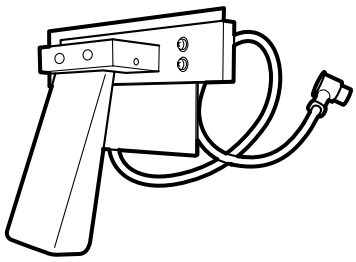


Fig.5-11 Front Plate for Syringe Sipper (Switching Unit)

5.3.1 Removing the Sample Compartment Front Cover and Installing the Front Plate

1 Follow "5.2.1 Removing the Sample Compartment Unit" to remove the sample compartment unit from the instrument.

2 Turn the sample compartment unit upside down. Press the two tabs (2 places) on the cover in the direction of the arrow (see Fig.5-13) and remove the sample compartment front cover from the unit as shown in Fig.5-12.

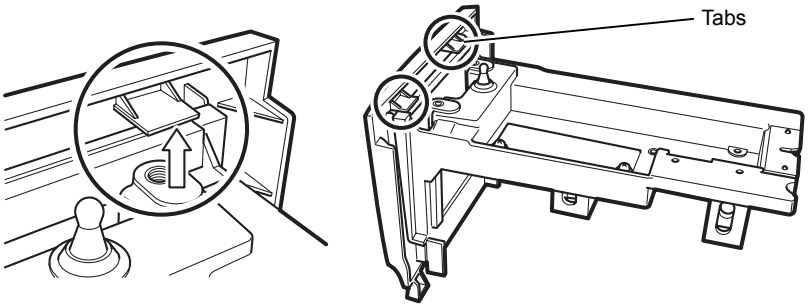


Fig.5-12 Tabs on the Sample Compartment Front Cover

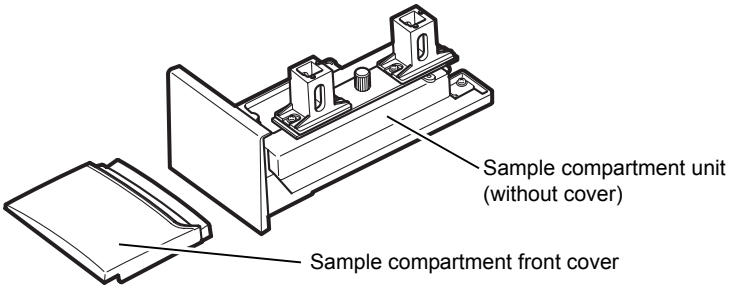


Fig.5-13 Sample Compartment Unit

3 Follow "5.2.2 Install the Sample Compartment Unit" to mount the sample compartment unit (without a cover) on the instrument.

4 Install the designated front plate (optional accessory) to the sample compartment unit.

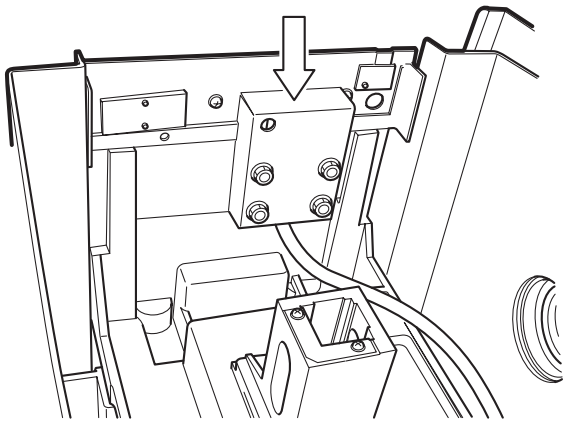


Fig.5-14 Installing the Front Plate

5 Close the sample compartment cover (Fig.5-4).

5.3.2 Installing the Sample Compartment Front Cover

1 Open the sample compartment cover and remove the designated front plate (optional accessory).

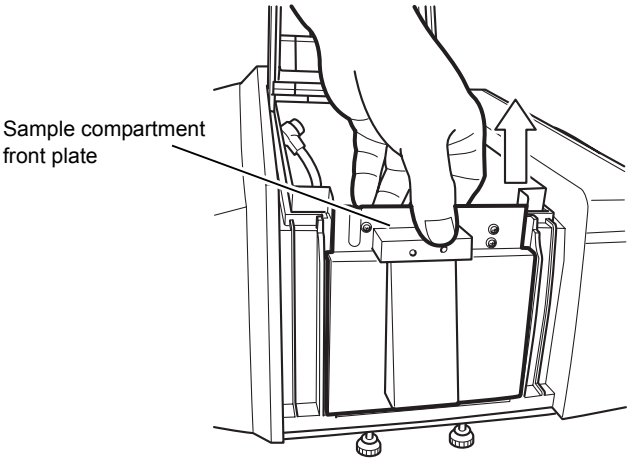


Fig.5-15 Front Plate of the Sample Compartment

2 Follow "5.2.1 Removing the Sample Compartment Unit" to remove the sample compartment unit from the instrument.

3 Fit the protruded parts on the sample compartment unit shown in Fig.5-16 to the corresponding protruded parts on the front cover (2 places).

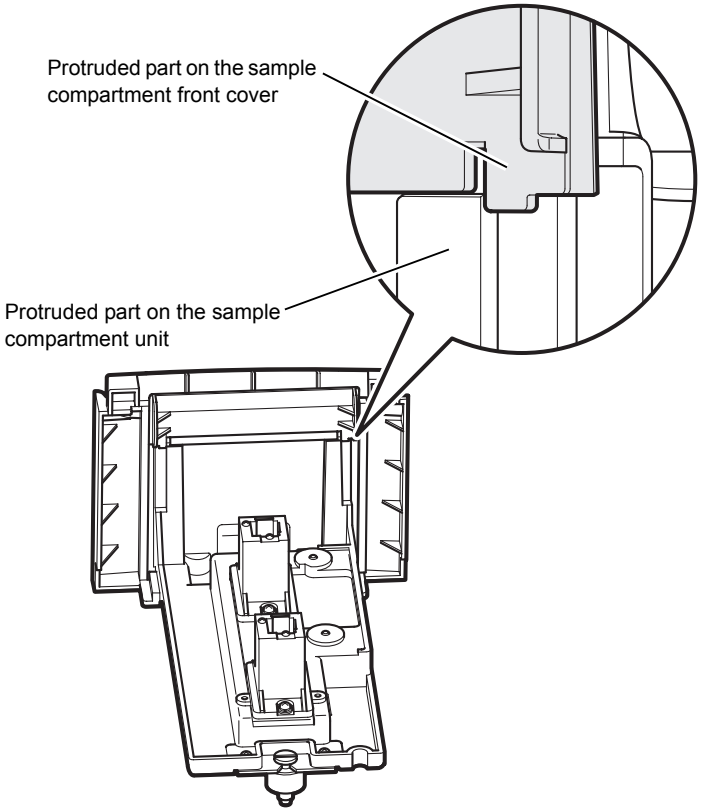


Fig.5-16 Fitting the Sample Compartment Front Cover

4 Snap the sample compartment front cover into the sample compartment unit in the direction of the arrow (see also Fig.5-17).

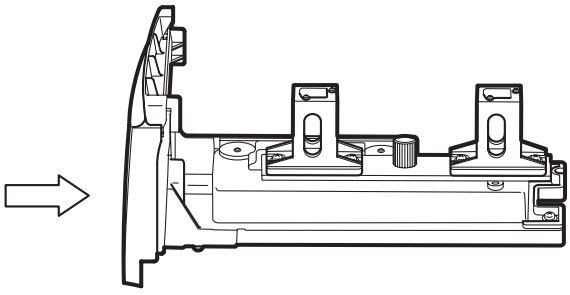


Fig.5-17 Snapping the Sample Compartment Front Cover

5 Follow "5.2.2 Install the Sample Compartment Unit" to mount the sample compartment unit on the instrument.

6 Close the sample compartment cover (Fig.5-4).

6 Troubleshooting

6.1 Errors During Initialization

Turn on the power of the spectrophotometer and connect UVProbe to the spectrophotometer. The initialization window appears to display results in the order of the check items.

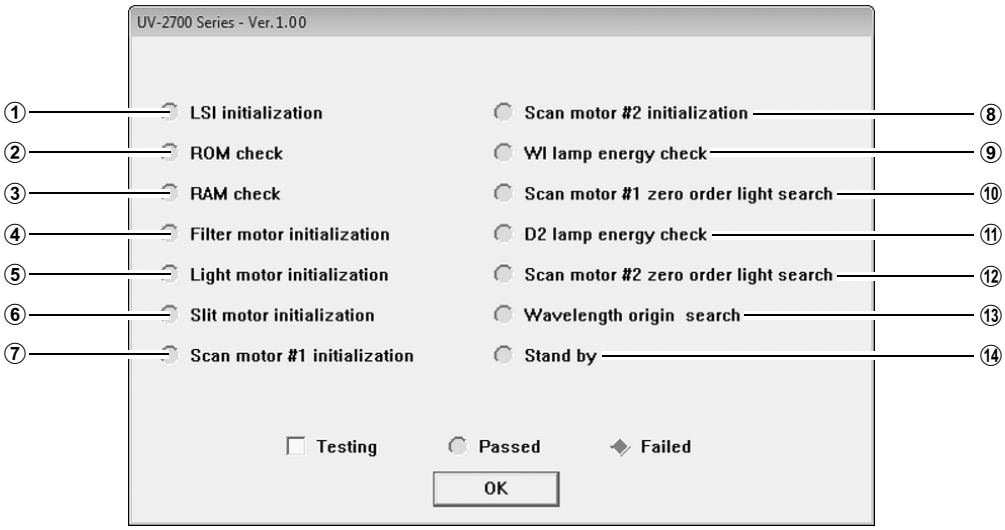


Fig.6-1 Initialization Window (UV-2700)

Table 6-1 Initialization Items

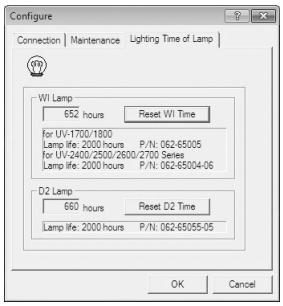
No.	Initialization Items	Description
①	LSI initialization	Initializes each I/O device.
②	ROM check	Checks the program ROM.
③	RAM check	Checks the random-access memory (RAM).
④	Filter motor initialization	Detects the reference position of the stray light filter.
⑤	Light motor initialization	Detects the motor reference position that drives the light source switching mirror.
⑥	Slit motor initialization	Detects the motor reference position that drives the plate to switch the slit.
⑦	Scan motor #1 initialization	Detects the mechanical wavelength origin position of the pre-monochromator (only for UV-2700).
⑧	Scan motor initialization (UV-2600) Scan motor #2 initialization (UV-2700)	Detects the mechanical wavelength origin position of the main monochromator.
⑨	WI lamp energy check	Checks whether or not the WI (halogen) lamp light energy is a sufficient level.
⑩	Scan motor #1 zero order light search	Checks the 0-order light which is the optical origin of the main monochromator (only for UV-2700).
⑪	D2 lamp energy check	Checks whether or not the D2 (deuterium) lamp light energy is at a sufficient level.

No.	Initialization Items	Description
⑫	Scan motor zero order light search (UV-2600) Scan motor #2 zero order light search (UV-2700)	Checks the 0-order light which is the optical origin of the main monochromator.
⑬	Wavelength origin search	Checks wavelength by detecting the emission line at 656.1 nm.
⑭	Stand by	Checks that the instrument initialization ends normally.

When [Failed] is displayed during initialization, perform the appropriate remedial actions by referring to the table below.

If the problem is not resolved by these actions, contact your Shimadzu representative.

Table 6-2

No.	Check Point	Remedial Action	Reference Page
① - ⑧		Turn off the instrument's power switch, and turn it on again to initialize the instrument.	P23
⑨, ⑩, ⑫	Is there anything obstructing the beam in the sample compartment cell holder?	Turn off the instrument's power switch. Remove the obstruction and turn on the power switch again.	P23
	Can you see the WI lamp light that streams from the gap of the light source compartment cover?	If not, the WI lamp will turn off. Turn off the instrument's power switch, and turn it on again. If the lamp does not turn on, replace the WI lamp (see also "4.4 Replace the Light Source Lamp").	P23 P87
	Did the source lamp exceed the lamp life hours?	Click [Configure] from the [Instrument] menu in UVProbe to display [Configure] window (Fig.4-1). Then, click the [Lighting Time of Lamp] tab.  Fig.6-2 If the lighting time of lamp has exceeded the lamp service life hours, replace the lamp (see also "4.4 Replace the Light Source Lamp").	P23 P87

No.	Check Point	Remedial Action	Reference Page
⑪, ⑬	Is there anything obstructing the beam in the sample compartment cell holder?	Turn off the instrument's power switch. Remove the obstruction and turn on the power switch again to initialize the instrument.	P23
	Is the sample compartment cover opened?	Turn off the instrument's power switch. Close the sample compartment cover and turn on the power switch again to initialize the instrument.	P23
	Did the source lamp exceed the lamp life hours?	Click [Configure] from the [Instrument] menu in UVProbe to display [Configure] window (Fig.4-1). Then, click the [Lighting Time of Lamp] tab (Fig.6-2). If the lighting time of lamp has exceeded the lamp service life hours, replace the lamp (see also "4.4 Replace the Light Source Lamp").	P23 P87

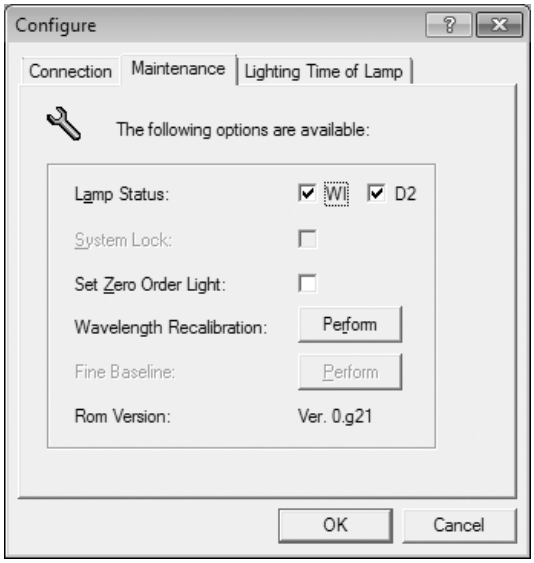
6.2 Problems: Symptoms and Solutions

Check whether the problem exhibits the following symptoms before requesting a repair. Contact your Shimadzu representative if the error cannot be resolved through the remedial action described below, or if the symptom is not covered in the table.

Table 6-3

Symptom	Typical Cause	Remedial Action	Reference Page
Turning on the power switch does not supply the power.	Is the power cord plug connected properly?	Connect the power cord plug correctly.	P12
	Is the power cord trapped underneath or twisted?	Replace the power cord with a cord of the same type if it is damaged.	P1 P12
	Does the supplied power satisfy the power supply specification of the UV-2600/2700?	Use a power supply that satisfies the power supply specification of the UV-2600/2700.	P11
	Is the fuse blown out?	The fuse may have blown out. The fuse needs to be checked and replaced. Contact your Shimadzu local sales or representative.	

Symptom	Typical Cause	Remedial Action	Reference Page
Cannot establish communication with UVProbe.	Is the included USB cable being used?	Use the included USB cable.	
	Is the USB cable properly and securely connected?	Be sure to securely connect the cable both on the PC and on the instrument. If the problem cannot be resolved, connect the USB cable to a different USB connector on the PC.	
	Is the COM Port on the PC properly set?	Check the COM Port number of the instrument on the bottom right of the screen on the PC, and then click [Configure] from the [Instrument] menu of the UVProbe to set the Connection COM Port.	P17 P19
	Is the USB driver properly installed?	Install the USB driver according to the Installation window of the UVProbe Software. **NOTE** If an exclamation mark (!) is displayed during the steps described in "2.5.2 Connecting the USB Cable", an older version of the USB driver may have been installed. Turn on the power of the instrument and right click the driver with an exclamation mark (!) while the USB cable is connected. Select the option for updating the driver. Update is complete if the exclamation mark (!) disappears.	P16 P17
Red marks (error indication) appear for any initialization items.		Perform an appropriate action by following the instructions in "6.1 Errors During Initialization".	P107
Numeric values cannot be entered.	Is the setting of the keyboard on the PC correct? e.g. [Num Lock] is off.	Use the correct setting.	
	Is the entered value correct?	Values in an invalid range cannot be entered. Check the value again and enter the correct value.	

Symptom	Typical Cause	Remedial Action	Reference Page
Photometric values are wrong.	Is the light source lamp lit?	Click [Configure] from the [Instrument] menu in UVProbe to display the [Configure] window (Fig.4-1). Then, click the [Maintenance] tab.  Fig.6-3 When the [WI] and [D2] columns of [Lamp Status] are not checked: Action A When the lamp is off: 1) Check the [WI] and [D2] columns. If Action A cannot solve the problem, check by performing the following procedure: 1) Click [Disconnect] on UVProbe and turn off the communication with UVProbe. 2) Turn off the power of the instrument. 3) Turn on the power switch again after a while. 4) Click [Connect] and initialize the instrument. 5) Perform Action B if the light source lamp does not turn on and an error is displayed. Perform Action C if the light source lamp turns on but turns off again. Action B The light source lamp is out. Replace it with a new lamp. Action C The instrument detects an error and forcibly turns off the lamp. The fan is not working or the thermo sensor on the circuit board has detected overheating. Turn off the power switch of the instrument and contact your Shimadzu representative.	P23 P87
	Are measurement parameters such as wavelength properly set?	Check the entered parameters again.	P53

Symptom	Typical Cause	Remedial Action	Reference Page
Photometric values are wrong.	Is the slit width appropriate?	Change the slit width and perform measurement again.	P53
	Did the light source lamp exceed the lamp life hours?	If the light source lamp has exceeded the lamp life hours, replace the lamp.	P87
	Is the sample for measurement correct?	Check if you used the correct sample.	
	Is the cell being used an appropriate one?	Use a cell according to the purpose of measurement. Glass cells cannot be used in the ultraviolet range. Use a quartz cell for such a case.	
	Is a cell phone being used near the instrument?	The measured value may be influenced depending on the type of cell phone or the radio wave conditions. Avoid using a cell phone near the instrument during measurement.	
	Is the optional accessory correctly mounted on the sample compartment and its connector appropriately engaged?	Ensure that the optional accessory is correctly mounted on the sample compartment and that the connector is appropriately engaged.	P4 P100
	Have correct measurement parameters been configured for the optional accessory?	Ensure that the detector unit, slit width, and wavelength range are correctly set for the optional accessory used.	P48
	Can you hear any abnormal noises coming from the motor in the front of the instrument?	The sector motor may not be operating normally. Contact your Shimadzu representative.	
Baseline flatness significantly exceeds normal specifications.	When correcting the baseline, did you put a solvent with high absorbance in the cell holder on only one side?	Place cells with the same solvent in both the sample side and the reference side and perform baseline correction again.	
	Is the beam on only one side restricted?	Set the beam conditions so that they are identical on both the sample side and the reference side. Some of the unit specifications may not be met if the beam is too restricted.	
	Are you using an optional accessory?	Some of the unit specifications such as baseline may not be met when certain optional accessories are installed.	

Symptom	Typical Cause	Remedial Action	Reference Page
Baseline is bent too much.	Did you correct the baseline while a sample with large absorbance is set?	Remove the sample in the sample compartment and then correct the baseline. In addition, make the slit width larger.	
	Did you correct the baseline with the wavelength outside of the measurement range?	Correct the baseline in a wider wavelength range including the measurement range. Some of the unit specifications such as baseline may not be met when certain optional accessories are installed.	
Neither light source lamp lights.	Is the cooling fan working?	Check if air is expelled from the exhaust port located on the left side rear of the instrument. If the fan has stopped, turn off the power switch of the instrument and contact your Shimadzu representative.	
There is much noise.	Is the slit width sufficiently wide?	Widen the slit width.	P53
	Is absorbance of the light bean on the reference side (R) too strong?	Remove the cell on the reference side (R) and then correct the baseline and perform measurement again. If there is anything that absorbs light on the reference side (R), remove it and then perform measurement again.	
	Did the light source lamp exceed the lamp life hours?	If the light source lamp exceeds the lamp life hours, replace the lamp.	P87
	Did you correct the baseline with the wavelength outside of the measurement range?	Correct the baseline in a wider wavelength range including the measurement range.	
The error beep sounds and the LED lights in red.	Is there any obstacle on the exhaust port of the cooling fan?	Turn off the power switch of the instrument. Check if there is any obstacle within 10 cm from the exhaust port of the fan which disturbs expelling of air. If there is any obstacle, remove it. Turn on the power switch again after a while because abnormal temperature may exist. If the condition cannot be improved, contact your Shimadzu representative.	
	Is the cooling fan working?	Check if air is expelled from the exhaust port located on the left side rear of the instrument. If the fan has stopped, turn off the power switch of the instrument and contact your Shimadzu representative.	
	Is the light source lamp lit?	If the light source lamp met the lamp life hours, replace the lamp.	P87

Symptom	Typical Cause	Remedial Action	Reference Page
High-absorbance measurement yields abnormal results. (Only for UV-2700)	Are the measurement conditions appropriate?	Follow "3.7 High-absorbance Measurement" to configure appropriate measurement conditions.	
	Is the energy level sufficient?	One indication is that there are at least three energy values at 500 nm as a requirement for measurement in energy mode, with the slit width set to 5 nm, and PMT gain set to 1. If this requirement is not satisfied, replace the lamp. If the problem still persists after replacing the lamp, contact a Shimadzu representative.	
	Are window plates of the sample compartment stained?	In particular, stains on the window plate on the monochromator side (beam entrance) relative to the sample beam significantly affect measurement results. According to the NOTE in "3.7 High-absorbance Measurement", request cleaning or replacement.	
It takes long time for UVProbe start up.	Has the size of the instrument history file for the instrument become too large	It may take long time for the accumulated instrument history data to be loaded, resulting in slower startup of the software. Follow the procedure below to delete the instrument history data or transfer the history to the database. [Without UVProbe-Agent (optional software) Connection] 1) Click the [Instrument History] tab in the Output window. 2) Select all lines in the instrument history. 3) On the right-click menu, click [Copy] and copy the instrument history to the clip board. 4) Save the copied data on the PC by pasting them in a text file. 5) Select all lines in the instrument history in UVProbe again. 6) Click [Delete] on the right-click menu. The instrument history is deleted. [In GLP Mode with UVProbe-Agent Connected] Transfer the instrument history data to the database. Transfer and register all data displayed on the [Instrument History] tab in the Output window into the database. 1) Click the [Instrument History] tab in the Output window to display the Instrument History page. 2) Click [Transfer to D.B.] on the right-click menu. 3) Click [Yes] in response to the message. The history is transferred to the database. **NOTE** After the transfer, all the history in the Instrument History page is cleared.	

6.3 Beep

Except for a case of excess energy, the beep sounds only once and will not continue.

On failure, a long beep sounds three times and the LED lights in red.

Reference
See "6.2 Problems: Symptoms and Solutions".

Table 6-4

Status of Instrument	Beep	Pattern
Start-up of instrument	Blip	—
Initialization of instrument successfully completed.	Blip, blip, blip, blip (four short beeps)	— — — —
Start of measurement	Blip (one short beep)	—
Measurement completion	Blip, blip (two short beeps)	— —
Failure	Bleep, bleep, bleep (three long beeps)	—— —— ——
Excess energy*	Bleep, blip (one long beep and one short beep)	——— –
Auto Zero	Blip, blip, blip (three short beeps)	— — —

* Refers to the condition where a detector is saturated because too much light is irradiated on it. This symptom occurs when too much light is irradiated against low gain is set for energy measurement. It can be avoided by reducing the irradiance level on the detector or stop irradiation.

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7 Reference Materials

7.1 Specifications

7.1.1 Hardware Specifications

Table 7-1

Item	UV-2600	UV-2700
Specified Wavelength Range	185 nm to 1400 nm	
Measurement Wavelength Range	185 nm to 900 nm	
	220 nm to 1400 nm When using the integrating sphere attachment ISR-2600Plus	Integrating sphere attachment ISR-2600Plus cannot be used.
Spectral band width (Resolution)	0.1 nm, 0.2 nm, 0.5 nm, 1.0 nm, 2.0 nm, 5.0 nm, low stray light 2.0 nm, low stray light 5.0 nm (eight widths)	
Resolution	0.1 nm	
Wavelength Accuracy	± 0.1 nm (656.1 nm D2), ± 0.3 nm (All regions)	
Wavelength Repeatability	±0.05 nm	
Wavelength Scanning Speeds	When moving wavelength: Approximately 14,000 nm/min When scanning wavelength: Approximately 4,000 nm/min to 0.5 nm/min	
Light source switching	Automatic switching with wavelength range. Variable wavelength can be set in range from 290 nm to 370 nm (in increments of 0.1 nm). Default value: 323 nm	
Stray Light	Max. 0.005 % (220 nm, NaI) Max. 0.005 % (340/370 nm, $NaNO_2$) Max. 1.0 % (198 nm, KCl)	Max. 0.00005 % (220 nm, NaI) Max. 0.00002 % (340/370 nm, $NaNO_2$) Max. 1.0 % (198 nm, KCl)
Photometric System	Double beam optics	
Photometric Range	Absorbance: -5 Abs to 5 Abs, Transmittance: 0 % to 100000 %	Absorbance: -8.5 Abs to 8.5 Abs, Transmittance: 0 % to 100000 %
Photometric Accuracy	±0.002 Abs (0.5 Abs), ±0.003 Abs (1 Abs), ±0.006 Abs (2 Abs), ±0.3%T Inspect by the filter according to NIST930D and NIST1930.	
Photometric Repeatability	Max. 0.001 Abs (0.5 Abs), max. 0.001 Abs (1 Abs), max. 0.003 Abs (2 Abs) ±0.1%T	
Noise level	Max. 0.00003 Abs (500 nm, RMS)	Max. 0.00005 Abs (500 nm, RMS)
Baseline Flatness	±0.0003 Abs (200 nm to 860 nm) 1 hour after the light source turns on.	±0.0004 Abs (200 nm to 860 nm) 1 hour after the light source turns on.
Baseline Stability	Max. 0.0002 Abs/h (700 nm) 1 hour after the light source turns on.	Max. 0.0003 Abs/h (700 nm) 1 hour after the light source turns on.
Light source	50 W halogen lamp, Deuterium lamp Built-in automatic light source positioning mechanism	

Item	UV-2600	UV-2700
Monochromator	Czerny-Turner monochromator Use Lo-Ray-Ligh (Low Stray Light Diffraction Grating).	Pre-monochromator: Littrow monochromator Use Lo-Ray-Ligh (Low Stray Light Diffraction Grating). Main monochromator: Czerny-Turner monochromator Use Lo-Ray-Ligh (Low Stray Light Diffraction Grating).
Detector	Photomultiplier R-928	
Sample Compartment	Interior dimensions: W150 x D260 x H140 mm	
Dimensions	W450 x D600 x H250 mm	
Weight	23 kg	
Operating Temperature	15 °C to 35 °C	
Operating Humidity	30 % to 80 % (No condensation, max. 70 % at 30 °C)	
Power Supply	AC 100 V to 240 V, 50/60 Hz	
Power Consumption	170 VA	

7.1.2 Software Specifications (UVProbe)

Table 7-2

Item	Specifications
Supported OS	Windows XP/Windows Vista/Windows 7
Measurement Mode	Spectrum, kinetics (time feed measurement), photometric (quantitative measurement)
Overall	Multitask operation (Measurement, data processing, and other processing at the same time are possible.) User defined layout of the Measurement window (Modification of the wavelength, displayed character size, font, and color is possible. Setting the displayed digit number is possible.), support GLP/GMP (security, history), real time concentration display. Print-out function as UVPC format (only spectrum)
Spectrum Measurement Mode	Comparing several spectrum data/mutual processing are possible. Original data, various data processing based on the original data, and management of processing history Scaling of spectrum, automatic scaling, and Undo/Redo function Add comments in the Spectrum window, automatic data processing function of spectrum data
Spectrum Data Processing	Standardization, pick points, detecting peak/valley, area calculating One to four-order-differentiation, smoothing, inverse, square root, logarithm, absorbance/transmittance transform, index transform Kubelka-Munk transform, ensemble average, interpolation process, four fundamental operations (between different spectrum data, between spectrum data and coefficient)
Photometric Mode (Quantitative Analysis)	Quantitative analysis by single-wavelength, multi-wavelength (including single wavelength, dual-wavelength, triple wavelength), and spectrum (peak in the specified wavelength range, maximum/minimum value, area, and other parameters are possible.) K-factor method, one-point calibration curve method, multi-point calibration curve method (1st, 2nd, 3rd order function fits, pass-through-zero specification) Photometric processing by user defined function (+, −, ×, ÷. log, exp, and other functions and coefficient can be considered.) Correction functions such as weight-correction, dilution ratio correction, and others for each sample coefficient Display average function and standard sample for repeated measured data, unknown sample table, and calibration curve at the same time Acceptance function and cell blank function by the measurement result
Kinetics Sticks Mode (Time-Feeding Measurement)	Comparing several time feeding data/mutual processing are possible. Record by the single wavelength, dual-wavelength difference, and ratio. Time feeding data and enzyme table, simultaneous display of several graphs, calculate enzyme activity value (for single cell, multi-cell), calculate Michaelis-Menten constant and create graph (Michaelis-Menten, Lineweaver-Burk, Hanes, Woolf, Eadie-Hofstee), Dixon plot, Hill plot, and others Centralization processing of sample information such as original data and sample weight, dilution ratio, and others Event record such as reagent addition and others during measurement, time feeding spectrum data processing (according to spectrum data processing), cell blank function

Item	Specifications
Report Generator	Free format preview, print function Create print template layout, quick print by edit and registered template. Support the automatic print (only for spectrum mode) and printing several pages. Insert the layout of date, time, text, line, circle, rectangle, and others. Support of the insertion of spectrum data, quantitative data, method, history, and others. Support of header/footer. Specify the graph line thickness (for each module), font style, and size. Print the summary of label/data.
Part11 Support	Connection function with UVProbe Agent (automatic register of database spectrum/ photometric data (quantitative)) Connection and lock function with Shimadzu user authentication tools (unlock by password) Automatic data save function at print/end Event log/instrument history transfer facility

☞ **Reference**

For information about the specifications of the UV Performance Validation Software, refer to the "UV Performance Validation Software Instruction Manual".

7.2 Service Parts

7.2.1 Consumable Parts

Table 7-3

Part Name	Part No.	Replacement by	Remarks
WI (halogen) Lamp	062-65004-06	Customer	Light source (for visible/near infrared range)
D2 (deuterium) Lamp	062-65055-05	Customer	Light source (for ultraviolet region)

* The service life of lamps is 2000 hours. The replacement timing depends on the frequency of use.

7.2.2 Maintenance Parts

Table 7-4

Part Name	Part No.	Replacement by	Remarks	Replacement Cycle
Mirror, R (20 × 30.40) -FR	206-27672-91	Shimadzu service representative	Light source switching mirror	3 year
Quartz Plate	206-25346-91	Shimadzu service representative	5 pieces per unit	3 year
O-ring	036-15501-21	Shimadzu service representative	Used for fixing the quartz plate 5 pieces per unit	3 year
M11 ASSY	206-27616-95	Shimadzu service representative	Mirror inside Monochromator Only for UV-2700	6 year
ASSY, Sector Motor	206-27647-95	Shimadzu service representative	Sector Motor	6 year
Abs. 3 Dark Filter	206-28562-91	Customer	Only for UV-2700	2 year
Abs. 4 Dark Filter	206-28562-92	Customer	Only for UV-2700	2 year

* Replacement cycle above is a recommended value.

* When performing high-absorbance measurement exceeding Abs. 6, periodically replace the window plates of the sample compartment. In particular, the window plate on the monochromator side (beam entrance) relative to the sample beam greatly affect measurement results. We recommend that you replace the window plate approximately once a year.

NOTE

Replace the window plate and the O-ring of the light source compartment at the same time.

7.2.3 Repair Parts

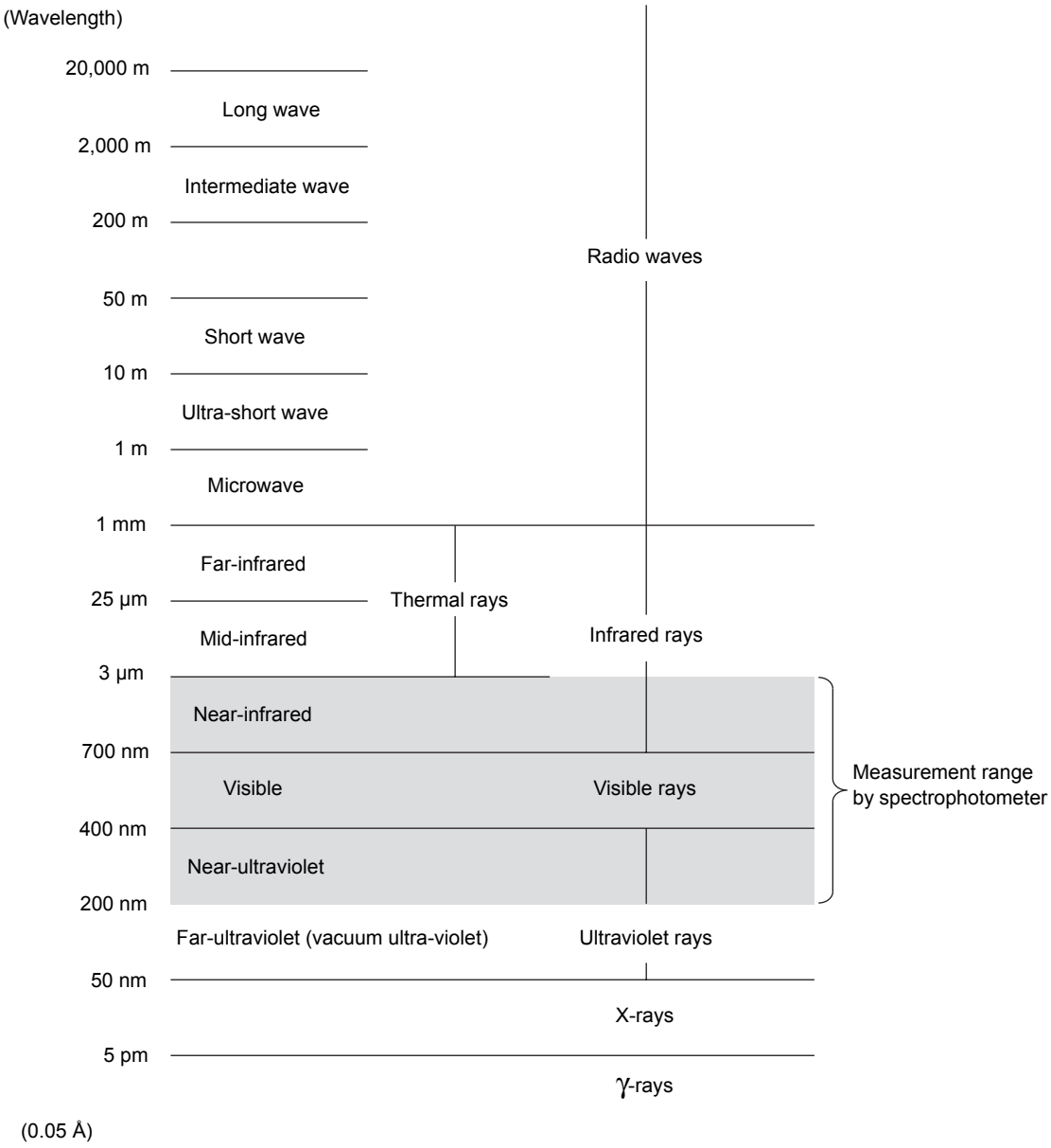
Table 7-5

Part Name	Part No.	Replacement by	Remarks
Power Cord	071-60816-12	Customer	
Sample Compartment Unit (standard)	206-60184-07	Customer	
Standard Cell Holder	206-82009-91	Customer	
Sample Compartment Front Cover ASSY	206-27653-91	Customer	
Sample Compartment Cover	206-27710	Customer	
Partition Plate (for high-absorbance measurement)	206-27693-02	Customer	Only for UV-2700

7.3 Spectrophotometer Basics

7.3.1 What is Light?

Light is a type of electromagnetic radiation with a speed of 3.0×10^8 m/sec. Examples of electromagnetic waves include X-rays, ultraviolet rays, visible light, infrared rays, and radio waves. Electromagnetic waves are classified by the length of wavelength.



(Notes) 1 mm = 10^{-3} m, 1 μm = 10^{-6} m, 1 nm = 10^{-9} m, 1 pm = 10^{-12} m

Fig.7-1 Types of Electromagnetic Waves

Wavelength is defined as the length of a single cycle and is usually indicated by a sign called lambda, λ. For the range of ultraviolet and visible light, a unit called nm (nanometer) is used.

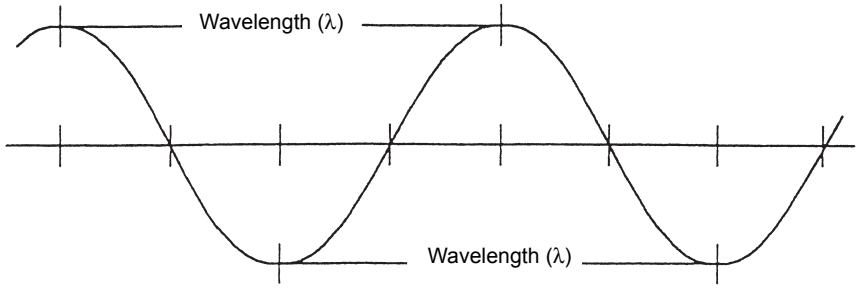


Fig.7-2 Wavelength

Generally, rays of various wavelengths are mixed in the light emitted from a light source (although some emit rays of specific wavelength such as laser light source, or others emit light of several specific wavelengths such as mercury lamps).

The light of a certain wavelength extracted selectively by the use of a monochromator is called monochromatic light. Light that includes all the rays in the wavelength range of visible rays is called white light.

The relation between wavelength and color is as follows:

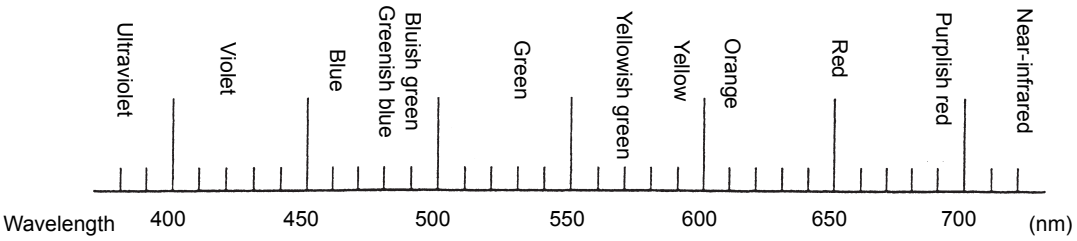


Fig.7-3 Wavelength and Color of Light

When white light is irradiated on some substance and the substance absorbs the blue light, it appears yellow, which is the (additive) complementary color of blue. If blue monochromatic light is irradiated on this substance, the light is absorbed and the substance appears black, indicating that no color exists.

Table 7-6

Wavelength (nm)	Color	Complementary Color
400 - 435	Violet	Yellowish green
435 - 480	Blue	Yellow
480 - 490	Greenish blue	Orange
490 - 500	Bluish green	Red
500 - 560	Green	Purplish red

Wavelength (nm)	Color	Complementary Color
560 - 580	Yellowish green	Violet
580 - 595	Yellow	Blue
595 - 610	Orange	Greenish blue
610 - 680	Red	Bluish green
680 - 700	Purplish red	Green

7.3.2 Ultraviolet/Visible Spectrum

The energy (E) of light can be expressed as follows.

$E = ch/\lambda$

c is the velocity of light, h is Planck's constant, and λ is wavelength.

When light is irradiated on a substance, the light of certain wavelengths is absorbed according to the molecule structure of that substance. This happens as the result of the fact that the electrons existing at the ground state of the molecule absorb light energy and a transition to excitation state occurs.

The amount of absorption differs depending on wavelength, and so the absorption spectrum (the curve measuring absorption when monochromatic light is irradiated to a substance with varying wavelengths.) becomes unique to that substance. The analysis of substances based on this principle is called absorptiometry and this method allows ① Identification, ② Quantitative analysis, and ③ Analysis of electron state. Also, the excited molecule loses energy due to heat and collision with other molecules and returns to its original ground state. This process is called "radiationless transition". In addition, the molecule may emit the absorbed light energy as light when returning to the ground state. Fluorescent light and phosphorescence exhibit the behavior and analysis utilizing these phenomena is called fluorometry.

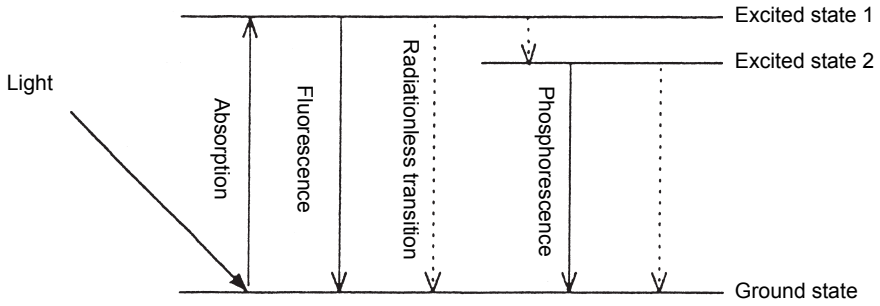


Fig.7-4 Molecule Energy

7.3.3 Bouguer-Beer's Law

This law, which is the basic principle of quantitative analysis, is also called Lambert-Beer's law.

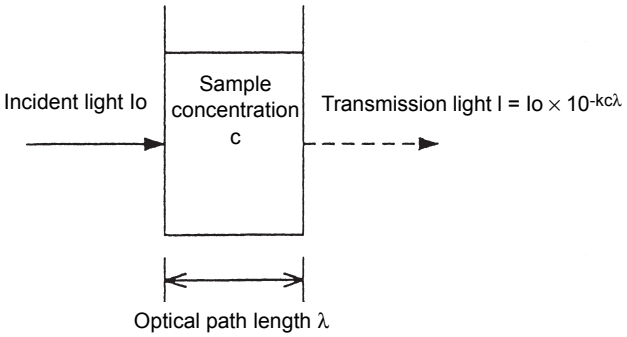


Fig.7-5 Bouguer-Beer's Law

When light of intensity Io strikes an object and light of intensity I transmits, the following relational formula is established, where k proportionality constant.

$$I = Io \times 10^{-kc\lambda}$$

At this time, I/Io is called transmittance (T), I/Io × 100 is percent transmittance (%T) and (1/T) = log (Io/I) is called absorbance (Abs).

$$T = I/Io = 10^{-kc\lambda}$$

$$Abs = \log (1/T) = \log (Io/I) = -kc\lambda$$

As known from the above formula, transmittance is not proportional to the concentration of the sample, but absorbance is proportional to the concentration of the sample (Beer's law) and is proportional to optical path length (Bouguer's law). Also, the proportional constant at the time when the optical path length is 1 cm and the concentration of object component is 1 mol/l is called molar absorptivity and is represented by the sign of ε. This molar absorptivity becomes a value unique to the substance under specific conditions.

To fulfill Bouguer-Beer's law, it is necessary to satisfy conditions such as being free from stray light, emission, scattering, and reflection.

7.3.4 Qualitative Analysis and Quantitative Analysis

To analyze what a substance is and what substances it consists of is called qualitative analysis, while analysis of the amount of these substances is called quantitative analysis.

■ Spectrum and Chemical Structure (Qualitative Analysis)

The absorbance of ultraviolet/visible ray is determined by chromophore (functional group that absorbs light such as C = C, C = O, N = N, and N = O, having multiplet bonding) and auxochrome (functional group that bonds with chromophore and changes its absorbance position and intensity such as −OH, −NH2, and −SH, having non-bonding electron pair), and so is related to the chemical structure. In this case, absorbance may change depending on introduction of substitution group and types of solvent. Movement of the absorbance wavelength to a longer wavelength is called "bathochromic movement", and its movement to a shorter wavelength is called "hypsochromic movement". Also, an increase of absorbance is called the "hyperchromic effect" and a decrease is called the "hypochromic effect".

■ Colorimetric Analysis (Quantitative Analysis)

Analysis to perform quantitative analysis by comparing the color darkness of a substance is called colorimetric analysis. When the substance is transparent, if absorbance exists in the invisible ultraviolet/near infrared area, it is measured. The latter is broadly included in colorimetric analysis.

7.3.5 Calibration Curve

The quantitative method to measure the concentration of a sample with unknown concentration from the absorption of a sample with known concentration is provided in two methods: Calibration curve method and Standard additive method.

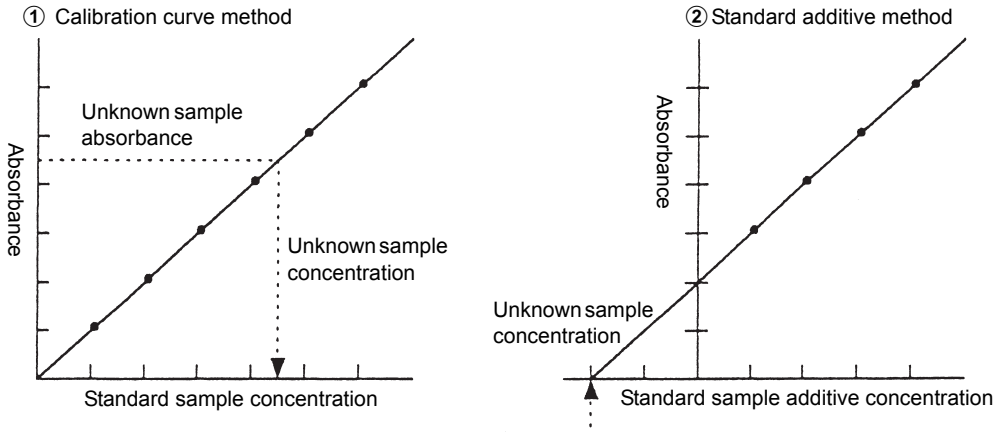


Fig.7-6 Calibration Curve

In the calibration curve method, standard samples are operated according to an established method and then measured for absorbance. A calibration curve is prepared by using the absorbance obtained here in the vertical axis and the standard sample in the horizontal axis. There are times when the calibration curve does not make a straight line such as when the solution to be measured is a suspension. Although the calibration curve is sure to pass the origin when a blank solution is used, if it is not used, the curve may not pass the origin. Next, the concentration of the object components in the unknown sample is obtained using this calibration curve.

In the standard additive method, standard sample is added by stages to four or more samples of measurement sample solution of the same concentration. Similarly to the calibration curve method, a relation curve between added value and absorbance is prepared. The concentration of the object component in the unknown sample is obtained from the point where the related curve crosses the vertical axis. This method is applied only when the related curve is straight as far as to the low concentration range.

Generally, extra-large absorbance wavelength is used as measurement wavelength for quantitative analysis.

7.3.6 Solvent Selection

Generally when a sample is analyzed, it is measured as a solution. Accordingly, the type and the concentration of the solvent must be adequate. A solvent that dissolves the sample well and that is free from mutual action, has small absorbance in measurement wavelength range and has small volatility is desired. A cell with a lid is necessary for volatile solvent.

As a solvent, water is excellent for measuring absorbance in visible/ultraviolet range, as it has no absorbance itself. On the other hand, many of the normally used organic solvents are transparent to the human eye, so it can be mistakenly believed that absorbance does not exist in ultra-violet range either. The solvents and their available operating wavelength ranges are as follows:

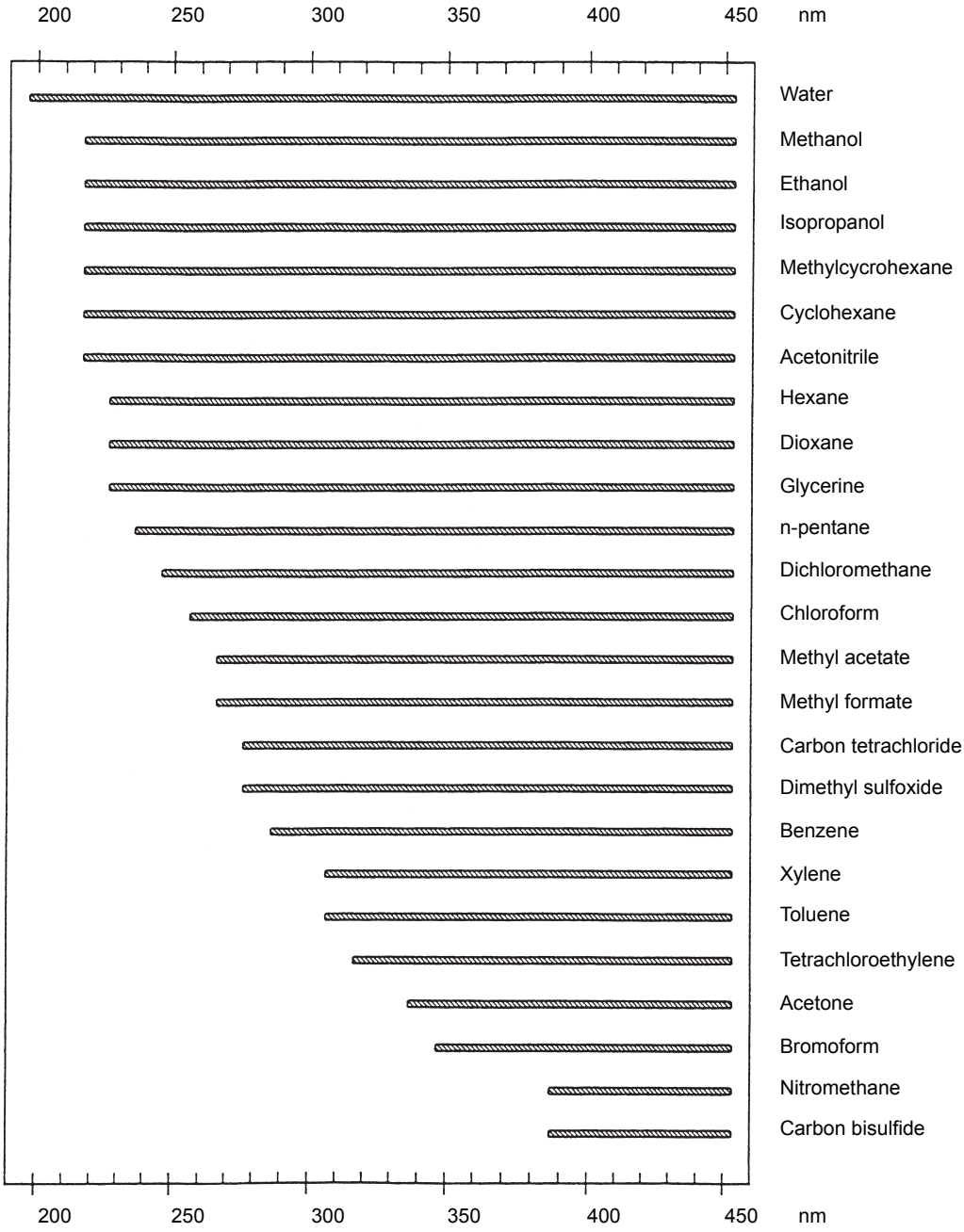


Fig.7-7 Wavelength Range for Solvent to be Used (using a 10 mm cell)

7.3.7 Calibration Curve Curvature

Generally, calibration curve is a straight line. However some calibration curves at some midpoint for various reasons. The probable causes are ① drift of measurement circuit, ② fluorescent sample, ③ stray light, ④ broad band width, and ⑤ measurement at the spectrum shoulder.

①As a spectrophotometer has some drift immediately after power is supplied to it, it should be allowed to warm up for 30 min. to 1 hour. Also, drift may be observed over a long period of time, so it is important to check the wavelength accuracy and measurement accuracy periodically using a filter etc.

②When a sample emits fluorescent light and if that light enters the detector, the absorbance may appear low and the amount of fluorescent light increases as sample concentration becomes higher. As a result, the calibration curve may be bent toward the lower side. If this occurs, it is necessary to reduce the influence of fluorescent light as much as possible by increasing the distance between the sample and the detector or by inserting a mask between the sample and the detector.

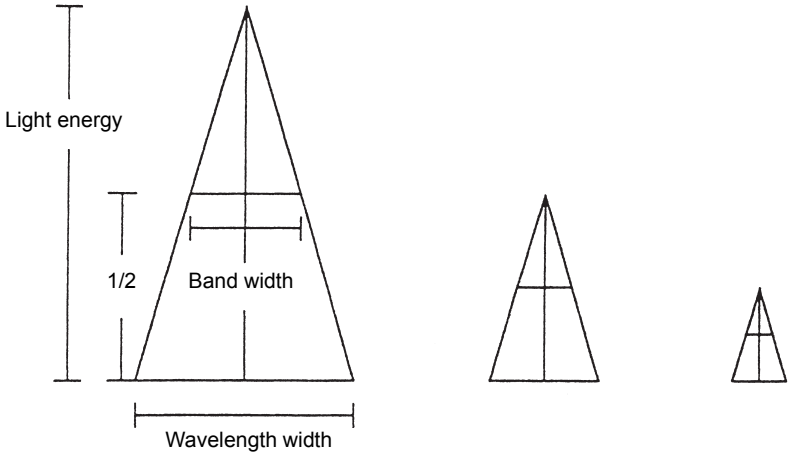
③Stray light is the total of the light of the wavelength deviated from a certain spectrum width having the set wavelength of the monochromator placed in the center and the light emitted from monochromator, but does not transmit the sample and pass the side of the sample. For example, with 0.1 % of stray light included in the monochromatic light, when a sample with the wavelength of λo and absorbance of 2 (transmittance 1 %) is measured, because 0.1 % stray light is added in addition to 1 % of the light with the wavelength of λo, the transmitted light will have 1.1 % of transmittance (absorbance 1.959), causing 2 % error. As known from this, the higher the sample absorbance is, the larger the error due to stray light becomes. To reduce stray light, it is generally effective to form a double-monochromator by connecting two monochromators. Although it is expensive due to the complex mechanism, the amount of stray light is reduced from one-fiftieth (1/50) to one-one thousandth (1/1000) of that of normal single monochromator.

Table 7-7 Absorbance Error due to Stray Light

Stray Light (%)	Absorbance								
	0.8	1.0	1.2	1.5	1.8	2.0	2.5	3.0	4.0
1	0.0222	0.0370	0.0595	0.1150	0.2081	0.2967	0.6150	1.0370	2.0000
0.5	0.0133	0.0190	0.0309	0.0615	0.1169	0.1739	0.4096	0.7759	1.7059
0.2	0.0045	0.0077	0.0126	0.0257	0.0507	0.0783	0.2119	0.4762	1.3213
0.1	0.0022	0.0038	0.0063	0.0130	0.0261	0.0409	0.1188	0.3005	1.0409
0.05	0.0011	0.0019	0.0032	0.0065	0.0132	0.0209	0.0635	0.1758	0.7799
0.02	0.0004	0.0007	0.0012	0.0026	0.0053	0.0085	0.0365	0.0790	0.4770
0.01	0.0002	0.0003	0.0006	0.0013	0.0026	0.0042	0.0134	0.0413	0.3009
0.005	0.0001	0.0001	0.0003	0.0006	0.0013	0.0021	0.0067	0.0211	0.1791
0.002	0.0000	0.0000	0.0001	0.0003	0.0005	0.0008	0.0027	0.0085	0.0791
0.001	0.0000	0.0000	0.0000	0.0001	0.0002	0.0004	0.0013	0.0043	0.0413
0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0004	0.0043

(Test and Engineering Vol.9 No.9, 702, 1981)

④A halogen lamp or deuterium lamp is used as the spectrophotometer light source. Because these lamps emit a continuous spectrum, taking out 500 nm monochromatic light from the monochromator does not mean that only the light of 500 nm is taken out, but the light in a wavelength range having a certain width is taken out.



Band width	1	1/2	1/4
Area	1	1/4	1/16
Total quantity of light energy	1	1/4	1/16

Fig.7-8 Band Width and Light Energy

Because the absorption coefficient of a substance differs depending on wavelength, even if the central wavelength is the same, with different bandwidth, the wavelength width of the light to be taken out varies. This causes the absorption coefficient to be changed in appearance and this results in absorbance change. It is sufficient to set the bandwidth of a spectrophotometer from one-eighth (1/8) to one-tenth (1/10) of the half width of a sample's absorbance spectrum. The half-width of the absorbance spectrum means the width at the half of the peak of the absorbance spectrum. Because the absorbance spectrum often has a broad half-width in colorimetric analysis, a bandwidth of 10 nm is sufficient. Making the bandwidth extremely narrow generates large noise due to energy shortage and may result in poor measurement accuracy. If the bandwidth is made large, the peak height becomes low in appearance and this may cause the calibration curve to be bent.

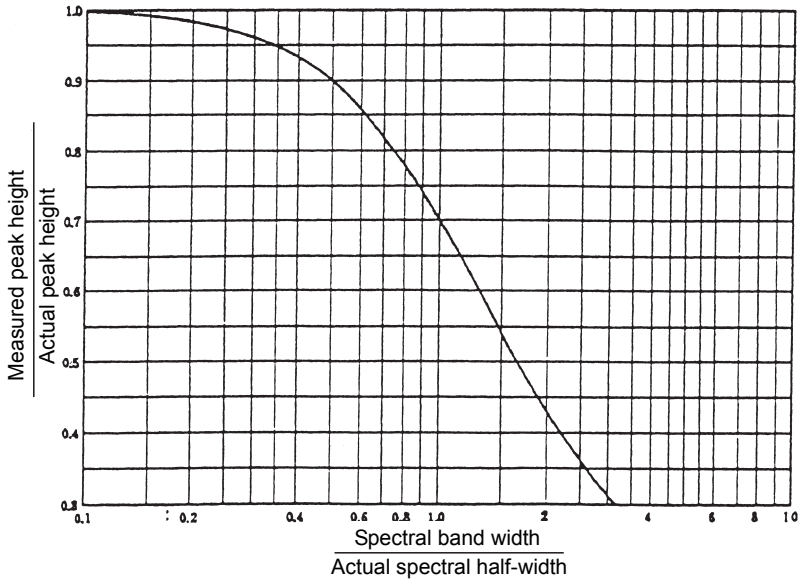
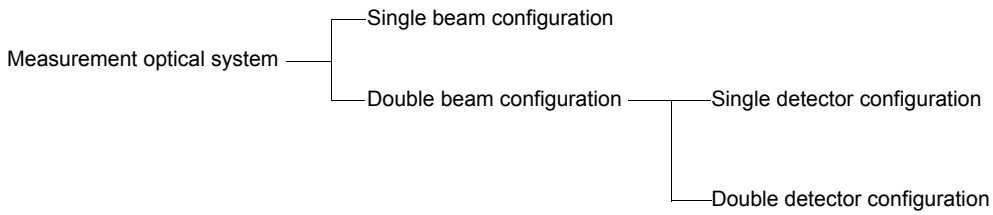


Fig.7-9 Band Width and Peak Height

7.3.8 Spectrophotometer Types

Spectrophotometers can be categorized broadly by optical systems as follows:



■ Single and Double Beam Configurations

- Single beam configuration
  Only one beam passes through the sample compartment. First, set the transmittance to 100 % or the absorbance to 0 using the cell filled with solvent. Then replace it with the cell containing sample and perform measurement.

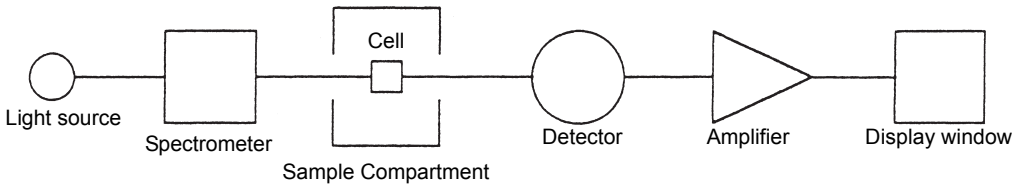


Fig.7-10 Single Beam Configuration

- Double beam configuration
  This configuration divides the monochromatic light into two beams using mirrors, such as a rotating mirror and a semi-transparent mirror, so as to make two beams, the sample beam and reference beam. When the sample cell with sample in it is placed for the sample beam and the reference cell with solvent in it is placed for reference beam in the sample compartment, each transmitted light enters the detector. The feature of this configuration then is that transmittance and absorbance can be measured once from the sample sign I and the reference sign Io simultaneously.

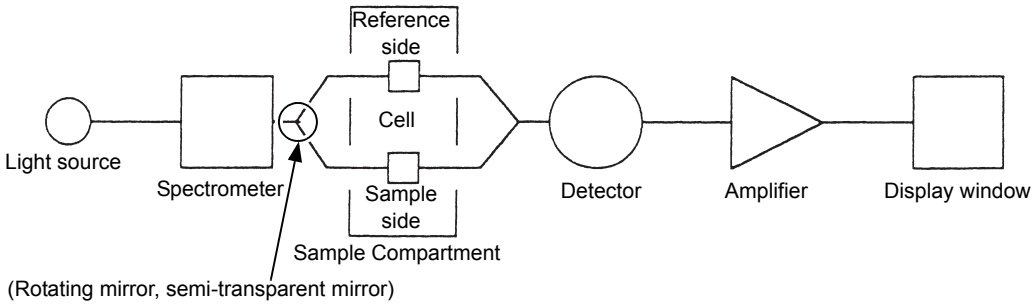
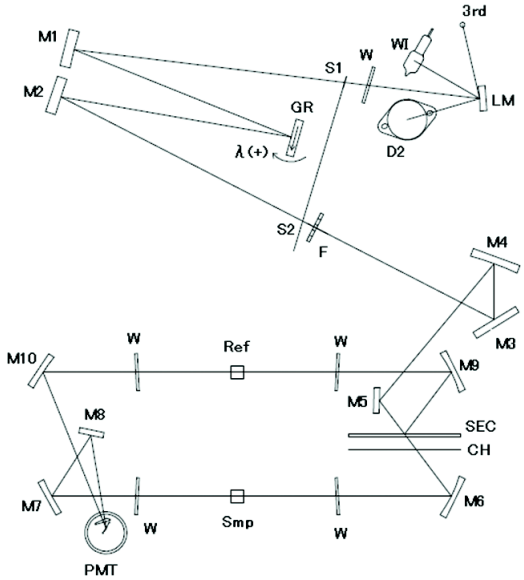


Fig.7-11 Double Beam Configuration

■ Single and Double Detector Configuration

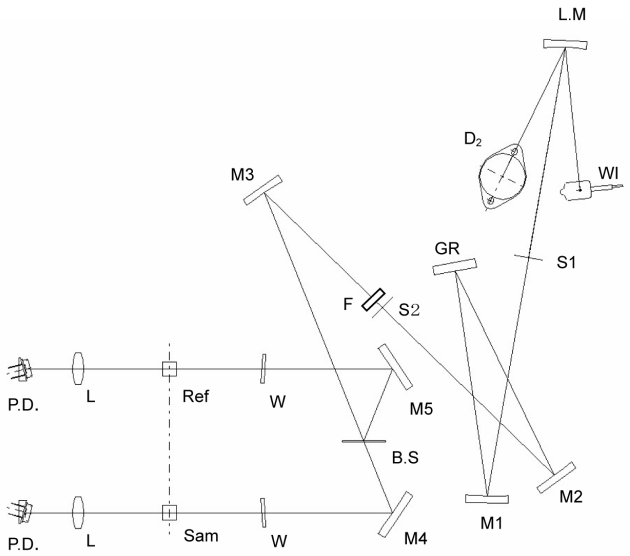
- Double beam - single detector configuration
  In this configuration, a sample beam and reference beam alternately enter one detector. So unlike the double-detector configuration, the result is less likely to be influenced by the difference in characteristics of the two detectors.



WI: Halogen lamp
D2: Deuterium lamp
LM: Light source switching mirror
W: Window plate
S1-2: Slit
M1-10: Mirror
GR: Grating
F: Filter
CH: Chopper
SEC: Sector mirror
PMT: Photomultiplier

Fig.7-12 Double Beam - Single Detector Configuration (UV-2600 Series)

- Double beam - double detector configuration
  In this configuration, the sample beam and the reference beam enter different detectors respectively. Thus, it is necessary to use two detectors with similar characteristics. The advantage of this configuration is that it is not necessary to always pass two beams to the same detector as in the case of the single detector configuration, and so a larger space is possible in the sample compartment, convenient for measuring unclear samples by keeping them in close contact with the light receiving surface. However, in the case of the photomultiplier, this configuration is not used because matching the detector is difficult.



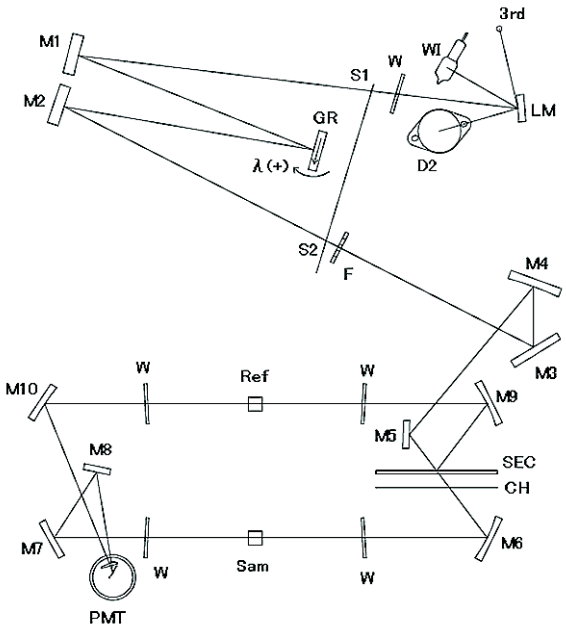
WI: Halogen lamp
D2: Deuterium lamp
W: Window plate
S1-2: Slit
LM: Light source switching mirror
M1-5: Mirror
GR: Grating
F: Filter
B.S.: Beam splitter
Sam: Sample cell
Ref: Reference cell
L: Lens
P.D.: Photodiode

Fig.7-13 Double Beam - Double Detector Configuration (UV-1800)

■ Single Monochromator and Double Monochromator

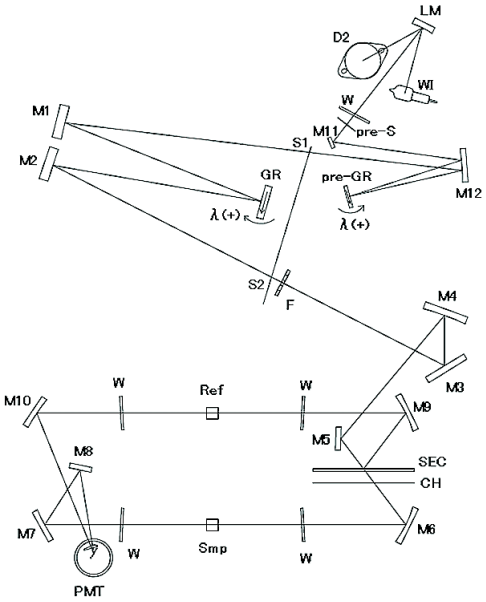
A single monochromator system has one monochromator and a double monochromator system has two monochromators aligned in a series. Accordingly, when two monochromators are aligned in parallel as in the case of a two-wavelength spectrophotometer, the system is not called a double monochromator even though it has two monochromators.

The double monochromator disperses the monochromatic light emerging from the first monochromator again by means of the second monochromator. So stray light is greatly reduced and a calibration curve of good linearity is obtained even though absorbance becomes high, allowing analysis of samples with a broad concentration range.



WI: Halogen lamp
D2: Deuterium lamp
LM: Light source switching mirror
W: Window plate
S1-2: Slit
M1-10: Mirror
GR: Grating
F: Filter
CH: Chopper
SEC: Sector mirror
Sam: Sample cell
Ref: Reference cell
PMT: Photomultiplier

Fig.7-14 Single Monochromator Configuration (UV-2600 Series)



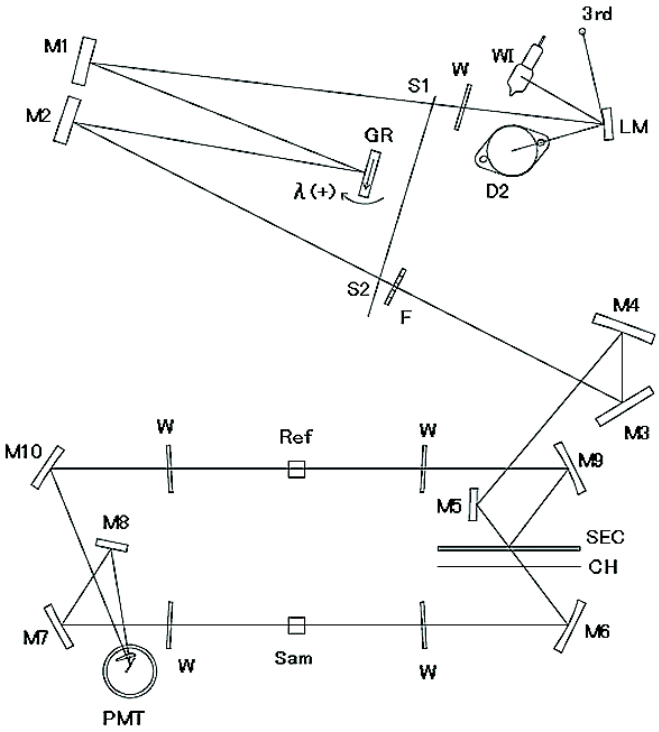
WI: Halogen lamp
D2: Deuterium lamp
LM: Light source switching mirror
W: Window plate
pre-S: Slit
pre-GR: Grating
S1-2: Slit
M1-12: Mirror
GR: Grating
F: Filter
CH: Chopper
SEC: Sector mirror
Sam: Sample cell
Ref: Reference cell
PMT: Photomultiplier

Fig.7-15 Double Monochromator Configuration (UV-2700 Series)

7.4 UV-2600/2700 Measurement System

7.4.1 Optical System

■ UV-2600 Optical System



WI: Halogen lamp
D2: Deuterium lamp
LM: Light source switching mirror
W: Window plate
S1-2: Slit
M1-10: Mirror
GR: Grating
F: Filter
CH: Chopper
SEC: Sector mirror
Sam: Sample cell
Ref: Reference cell
PMT: Photomultiplier

Fig.7-16 Schematic Optical System (UV-2600)

The light coming from the light source (D2 or WI lamp) is reflected by mirror LM and then enters the monochromator.

Light source switching is entirely automatic, with the instrument selecting the next light source by rotating the mirror LM according to the wavelength.

- D2 (deuterium) Lamp: 185 nm to variable wavelength
- WI (halogen) Lamp: Variable wavelength to 900 (1400*) nm

Variable wavelength can be set from 290 nm to 370 nm (default setting: 323 nm).

* Optional accessory: When the integrating sphere attachment ISR-2600 Plus is used.

The light source switching mirror is set at a position where optimum brightness of light source lamps can be obtained whenever the power switch is turned on. Also, all optical elements except the light source are cut off by the window plate (W) from the outside air to be dust-free in the optical system.

There are eight widths for slit width, i.e. 0.1 nm, 0.2 nm, 0.5 nm, 1.0 nm, 2.0 nm, 5.0 nm, low stray light 2.0 nm, and low stray light 5.0 nm. Shimadzu recommends the slit width 2.0 nm for the usual measurement.

The monochromator (entrance slit (S1), mirror (M1), diffraction grating (GR), mirror (M2), exit slit (S2)) is the Czerny-Turner type to decrease chromatic aberration. The Shimadzu Lo-Ray-Ligh (Low Stray Light Diffraction Grating) blazed holographic grading is used for the diffraction grading. It has 1300 lines/mm and ensures the high resolution and low stray light for the monochromator.

When the light emits from the monochromator, higher-order light is suppressed by filter (F). Next, the light is reflected by the mirrors (M3 to 5) and the chopper (CH) splits the beam for sample and reference measurements. Then, after the each beam passes through each cell, two beams strike the detector (photomultiplier (PMT)).

The position relation between the cell holders and the beams is shown in Fig.7-17.

The exit slit S2 image appears near the center location on the optical length 10 mm from the cell in the sample compartment. Table 7.8 shows the sectional dimensions (approximation) of the beam on the image surface.

Use the black cells to reduce the scattered light as possible as you can when using micro cell.

Reference

See "7.5 List of Cells".

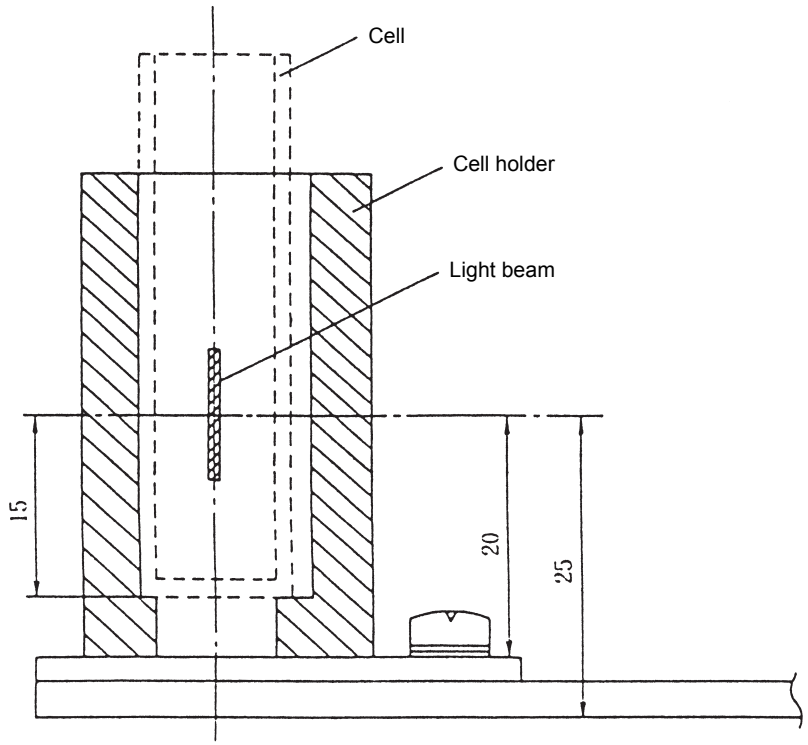
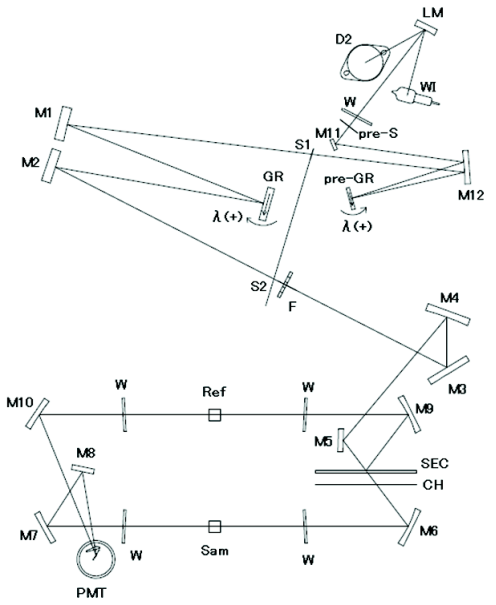


Fig.7-17 Positional Relationship of Cell Holder (Cell) and Light Beam "UV-2600/2700"

Table 7-8 Table of Sectional Dimensions of Measurement Beam by Slit Width Setting

Slit (nm)	Beam width (nm)	Beam height (mm)
5.0	3.5	12
2.0	1.5	12
1.0	0.8	12
0.5/0.2/0.1	0.4 max.	12
5.0 L (slit for low stray light)	3.5	9
2.0 L (slit for low stray light)	1.5	9

■ UV-2700 Optical System



WI:	Halogen lamp
D2:	Deuterium lamp
LM:	Light source switching mirror
W:	Window plate
pre-S:	Slit
pre-GR:	Grating
S1-2:	Slit
M1-12:	Mirror
GR:	Grating
F:	Filter
CH:	Chopper
SEC:	Sector mirror
Sam:	Sample cell
Ref:	Reference cell
PMT:	Photomultiplier

Fig.7-18 Schematic Optical System (UV-2700)

The light coming from the light source (D2 or WI lamp) is reflected by mirror LM and then enters the monochromator. Light source switching is entirely automatic, with the instrument selecting the next light source by rotating the mirror LM according to the wavelength.

- D2 (deuterium) Lamp: 185 nm to variable wavelength
- WI (halogen) Lamp: Variable wavelength to 900 nm

Variable wavelength can be set from 290 nm to 370 nm (default setting: 323 nm).

The light source switching mirror is set at a position where optimum brightness of light source lamps can be obtained whenever the power switch is turned on. Also, all optical elements except the light source are cut off by the window plate (W) from the outside air to be dust-free in the optical system.

There are eight widths for slit width, i.e. 0.1 nm, 0.2 nm, 0.5 nm, 1.0 nm, 2.0 nm, 5.0 nm, low stray light 2.0 nm, and low stray light 5.0 nm. Shimadzu recommends the slit width 2.0 nm for the usual measurement.

The pre-monochromator (entrance slit (pre-S), mirror (M12), diffraction grating (pre-GR)) is the compact Littrow type. The Shimadzu Lo-Ray-Ligh (Low Stray Light Diffraction Grating) blazed holographic grading is used for the diffraction grading. It has 1000 lines/mm and ensures the high resolution and low stray light for the monochromator.

UV-2600 uses the same optical system in the downstream of the pre-monochromator.

7.4.2 Electrical System

Fig.7-19 shows the schematic electrical system of UV-2600/2700.

The control center is the microcomputer (CPU), which performs all controls of light sources, light sources switching, wavelength shifting, slit control, filter switching, light path switching, gain setting, USB interface, and others.

After the beam passes through monochromator, the sector mirror splits the beam for the sample and reference beam. Next the detector receives two beams (photodiodes) and the pre-amplifier converts it into the voltage signal. The signal is then sent to an A/D converter and finally read by the CPU.

In energy-measurement mode (of spectrum mode), only the signal for the sample-side beam is read. In this case, S/R switching status is [Normal]. If the status [Reverse], only the signal for the reference-side beam is read.

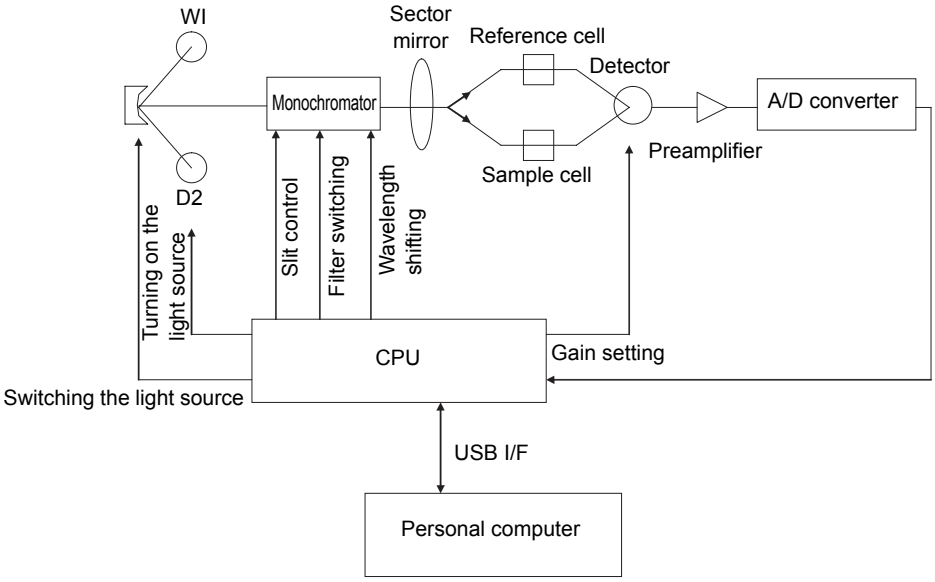


Fig.7-19 Schematic Electrical System

7.5 List of Cells

Table 7-9 List of Optional Cells

Name		Shape	Quartz (S Cell)	Glass (G cell)	Q'ty	Special Holder
Rectangular cell, optical length 10 mm		A	200-34442	200-34565	1	Not required.
Rectangular cell, matching type		A	201-98716	201-98746	2/ sets	Not required.
Rectangular cell with stopper, optical length 10 mm		B	200-34444	200-34444-01	1	Not required.
Semi-micro cell, optical length 10 mm Required sample volume min. 1.0 ml		C	200-66501	200-66501-01	1	Not required.
Semi-micro black cell, optical length 10 mm Required sample volume min. 1.0 ml		D	200-66551		1	Not required.
Super-micro black cell, optical length 5 mm Required sample volume min. 25 µl		K	208-92116		1	Ultra Micro Cell Holder (206-55050-91) is req'd.
Super-micro black cell, optical length 10 mm Required sample volume min. 50 µl		L	200-66578-11		1	Ultra Micro Cell Holder (206-55050-91) is req'd.
Micro black cell, optical length 10 mm Required sample volume min. 50 µl		M	200-66578-12		1	Ultra Micro Cell Holder (206-55050-91) is req'd.
Cylindrical Cell (OD 25 ϕ) (ID 22 ϕ)	l (Optical Length) = 10 mm	E	200-34448 (Quartz Window)	200-34448-01 (Glass Window)	1	Cylindrical Cell Holder (204-06216) req'd.
	l = 20 mm		200-34472 (Quartz Window)	200-34472-01 (Glass Window)	1	
	l = 50 mm	F	200-34473-01 (Quartz Window)	200-34473-03 (Glass Window)	1	
	l = 100 mm		200-34473-02 (Quartz Window)	200-34473-04 (Glass Window)	1	
Rectangular Long Absorption Cell	l = 20 mm	G	200-34446	200-34446-01	1	Long-Path Rectangular Cell Holder (204-23118-01) req'd.
	l = 50 mm		200-34944	200-34944-01	1	
	l = 100 mm		200-34676	200-34676-01	1	
Short Optical Length Cell	l = 1 mm	H	200-34660-01	200-34662-01	1	Short Optical Length Cell Spacer req'd.
	l = 2 mm		200-34655	200-34662-11	1	
	l = 5 mm		200-34449	200-34449-01	1	
Spacer for Short Optical Length Cell	For 1 mm	J	204-21473-03		1	Not required.
	For 2 mm		204-21473-01		1	
	For 5 mm		204-21473-02		1	
Micro Multi-Cell (8 cells) Required Sample Volume 100 µl		N	208-92089		1	Micro Multi-Cell Holder (206-53945-91) req'd.
Micro Multi-Cell (16 cells) Required Sample Volume 100 µl		P	208-92088		1	Micro Multi-Cell Holder (206-53945-91) req'd.

Name	Shape	Quartz (S Cell)	Capacity	Optical Width of Cell	Special Holder	Remarks
Flow Cell, optical length 10 mm	I	200-34670	1.5 ml	4 × 36	Not required. But Front Plate with Holes is necessary.	For general use without Tube
For Syringe Sipper Rectangular Flow Cell (Ultra-Micro), Optical Length 10 mm Standard Required Sample Volume min. 0.9 ml	Q	208-92114	30 µl	ϕ2	Not required.	With Tube
For Syringe Sipper Rectangular Flow Cell (Micro), Optical Length 10 mm Standard Required Sample Volume min. 1.0 ml	R	208-92113	80 µl	ϕ3	Not required.	With Tube
For Syringe Sipper Rectangular Flow Cell (Semi-Micro), Optical Length 10 mm Standard Required Sample Volume min. 5.0 ml	S	208-92005	390 µl	3.5 × 11	Not required.	With Tube

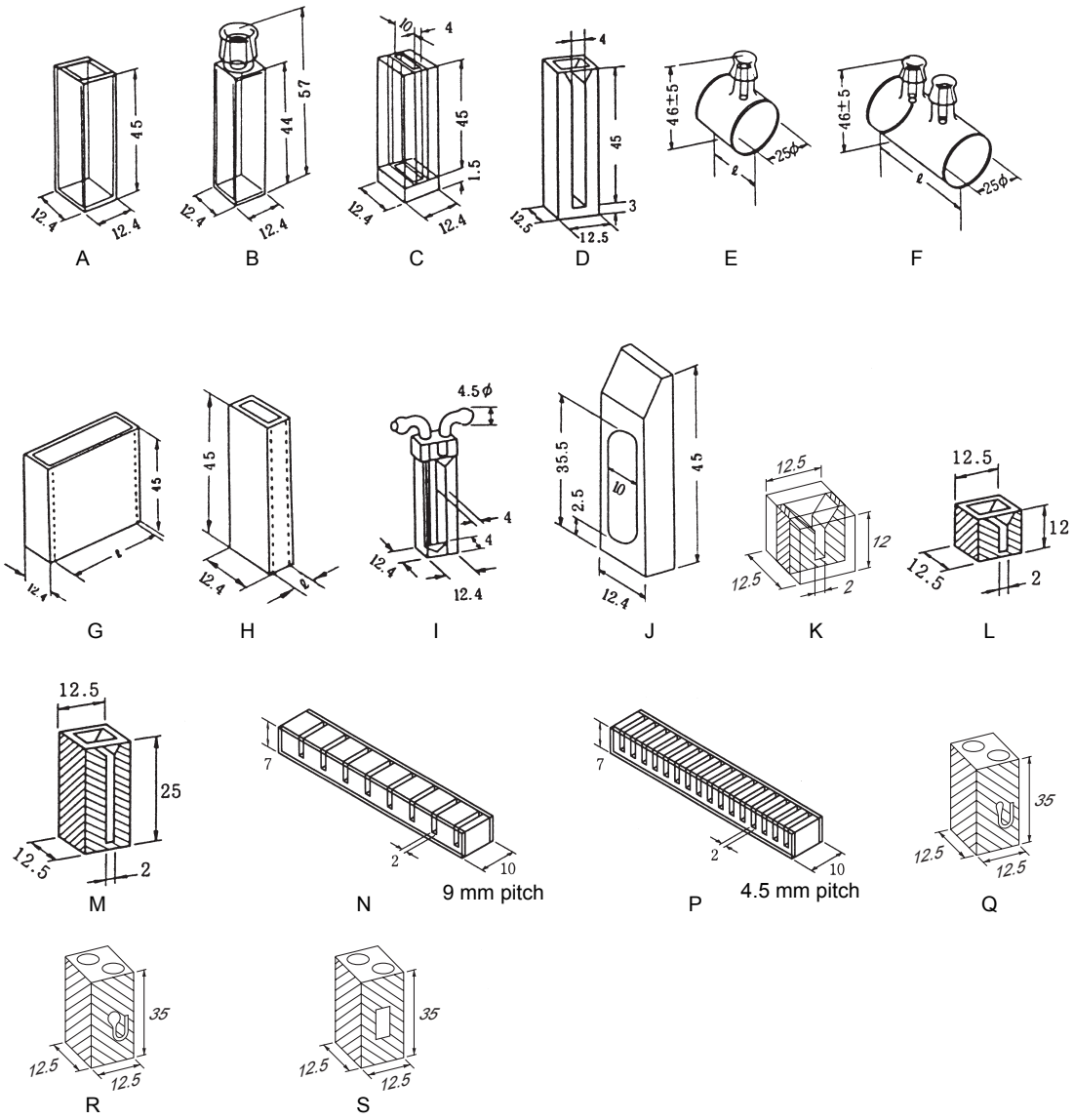


Fig.7-20 Optional Cell Shapes

7.6 Cleaning the Cell

Remove the sample from the cell immediately after the measurement.

After measuring water solution samples, wash the cell with water thoroughly, then wash it with ethanol lightly, and let it dry well.

Wash with distilled water
↓
Wash with ethanol
↓
Dry

If the cell is stained, remove the stain by dipping the cell into a cleaning agent or acid.

⚠ CAUTION

When using cleaning agent, acid, or organic solvent, provide ventilation and wear protective gloves, protective glasses, and other protectors if needed.

If they are used for a long time or frequently, there is a risk of poisoning or dermatitis.

Clean the cell using a cleaning agent appropriate for the sample measured, according to the instructions for the cleaning agent.
↓
Clean with distilled water.
↓
Dry

If the cell gets stained with organic matter, first dip it into an organic solvent such as acetone and then wash it with distilled water.

However, when washing the flow cell for the sipper 160 series (optional accessory), it is necessary to replace the "PVC tube for peristaltic pump" since the tube corrodes and hardens from the solvent.

If the flow cell is left empty over a period of time after cleaning, measurement results may not be accurate due to air bubbles attaching inside the cell.

Be sure to fill the flow cell with distilled water after washing.

Index

S

T

U

V

W

Record of Revision

Date	Revision	Description of Change	Remarks
08-2011	A	• The following figures are replaced. 2.6.1: Fig.2-19 2.6.2: Fig.2-22, Fig.2-23 4.4.2: Fig.4-16, Fig.4-21 6.1: Fig.6-1 • 1.2.6: Correction of Table 1-6 • 2.6.2: Correction of Table 2-2 and Table 2-3 • 6.1: Correction of Table 6-1 • Others: Correction of errors	