207-90592
Oct. 2019

SHIMADZU

Shimadzu UV-Visible Spectrophotometer

UV-2600i
UV-2700i

Instruction Manual

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

This page is intentionally left blank.

Introduction

Read this manual thoroughly before using the product.

Thank you for purchasing this product.

This manual describes the operation, usage cautions, and accessories and options for this product. Read this manual thoroughly before using the product and operate the product in accordance with the instructions in this manual. Keep this manual for future reference.

■ IMPORTANT

- If the user or usage location changes, ensure that this manual is always kept together with the product.
- If this manual or a product warning label is lost or damaged, immediately contact your Shimadzu representative to request a replacement.
- To ensure safe operation, read all Safety Instructions before using the product.
- To ensure safe operation, contact your Shimadzu representative if product installation, adjustment, re-installation (after the product is moved), or repair is required.

■ Notice

- Information in this manual is subject to change without notice and does not represent a commitment on the part of the vendor.
- 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, although not necessarily immediately after detection.
- All rights are reserved, including those to reproduce this manual or parts thereof in any form without permission from Shimadzu Corporation.
- LabSolutions is a trademark of Shimadzu Corporation.
  Windows is a registered trademark of Microsoft Corporation in the United States and/or other countries.
  Third-party trademarks and trade names may be used in this publication to refer to either the entities or their products/services, whether or not they are used with trademark symbol "™" or "®".

Original version is approved in English.

Indications Used in This Manual

Precaution symbols 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 symbols are used in this manual:

Notation	Description
Reference	Indicates the location of related reference information.
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 product operation, read these important safety instructions carefully before use and follow all precaution instructions given in this section.

■Product Applications

⚠ WARNING

- Do NOT use the product for purposes other than those specified.

  This product is a UV-Vis spectrophotometer.
  Using it for an unspecified purpose may result in an accident.
  This product (including accessories) is manufactured for measuring and industrial purposes, and not suitable for household usage.

- Safety regulations and standards

  For notifications on installation and safety controls, follow the necessary procedures in compliance with the laws and regulations applicable in the country where the product is used.

■Installation Site

⚠ 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

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 instrument will not operate at its rated performance. Mains supply voltage fluctuations are not to exceed 10 % of the nominal supply voltage.

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

- 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.
- Please make sure to use only the power cord specified by Shimadzu.

■Operation

⚠ 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 SDS (Safety Data Sheet).
- Be careful not to apply liquid to office equipment such as the PC as well as the instrument.

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

■Inspection and Maintenance

⚠ 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-2600i/2700i 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.

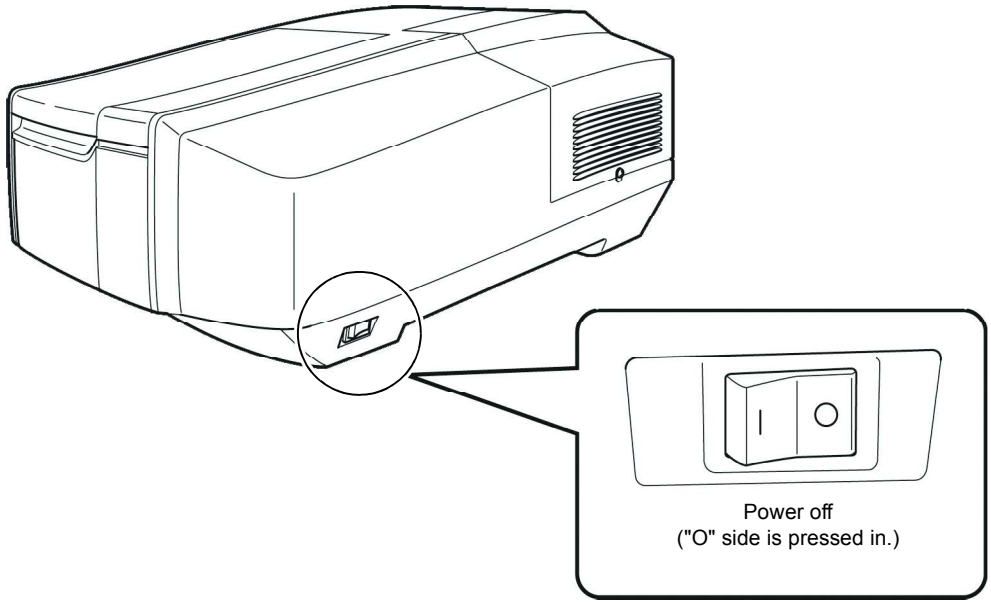
■Repair, Disassembly and Modification

⚠ CAUTION

- Do NOT modify or disassemble the product without permission.
  This may result in accidents due to electric shock or short circuits. It may also result in an injury or equipment failure.
- When repair is necessary, request your Shimadzu representative.
  Failing to do so may result in an ignition, electric shock, or injury.

■In an Emergency

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.



■During a Power Outage

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".

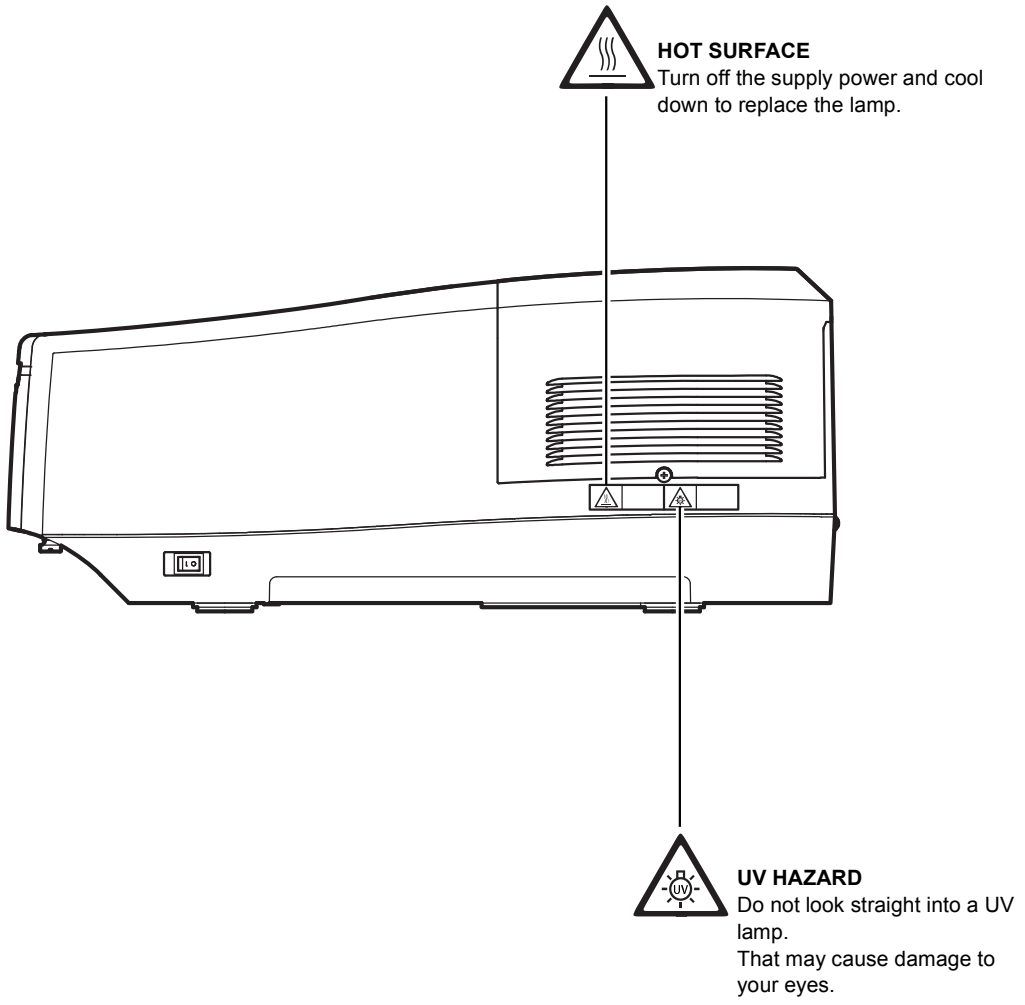
■Warning Labels

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. S206-27714)

Right side

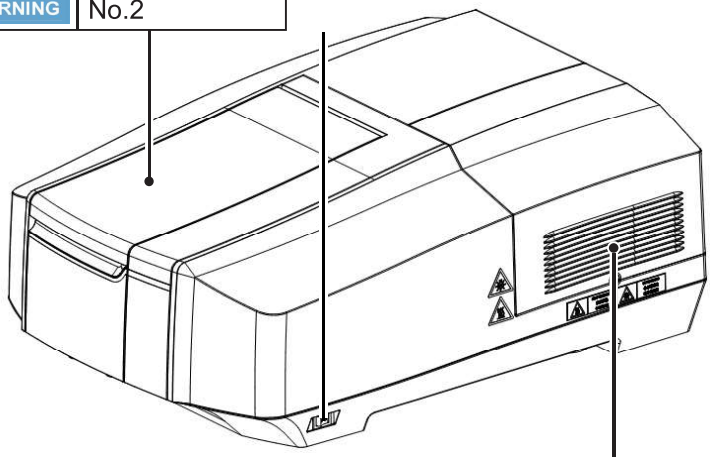


■Residual Risk Information

A residual risk indicates a risk that could not be reduced or eliminated in the process of design and manufacture. Check the risk locations in "Residual Risk Map", and take the relevant protective measures described in "List of Residual Risks".

■Residual Risk Map

The "Mechanical Location" and "No." indicated below are in accordance with those in "List of Residual Risks". For details, see "List of Residual Risks".



Mechanical Location A	
⚠ WARNING	No.2

Residual Risk with No Specific Mechanical Location	
⚠ WARNING	No.1, 7
⚠ CAUTION	No.8

Mechanical Location B	
⚠ WARNING	No.4, 5
⚠ CAUTION	No.3, 6

List of Residual Risks

The "No." and "Mechanical Location" indicated below are in accordance with those in "Residual Risk Map". Be sure to check the actual "Mechanical Location" referring to "Residual Risk Map".

Furthermore, read through and understand the content in "Reference" to take appropriate protective measures.

Preparation

No.	Mechanical Location	Description	Protective Measure taken by machine user	-	-
1	No specific location	⚠ WARNING Vaporized sample may catch fire. Vaporized toxic material may do harm.	When using flammable or toxic samples, provide adequate ventilation.	Reference	"Installation Site" P.iii
				Operation Category	Sample installation
				Required Qualification/ Education	Qualified person received training to use the instrument
2	A	⚠ WARNING The sample may spill on your body because the cover closes during cell replacement and it may result in harm.	Wear protective gloves when using toxic/ biohazardous samples.	Reference	"Operation" P.v
				Operation Category	Sample installation
				Required Qualification/ Education	Qualified person received training to use the instrument

Operation

No.	Mechanical Location	Description	Protective Measure taken by machine user	-	-
3	B	⚠ CAUTION If the lamp is dirtied by fingerprints, or overheats the lamp may damage the instrument or explode.	Wear protective gloves when replacing the lamp to prevent it from being soiled by fingerprints, etc.	Reference	"4.4 Replace the Light Source Lamp"
				Operation Category	Lamp lighting
				Required Qualification/ Education	Qualified person received training to use the instrument

Maintenance

No.	Mechanical Location	Description	Protective Measure taken by machine user	-	-
4	B	⚠ WARNING If the lamp is replaced while it is turned on, it may cause burns or electric shock.	When replacing the lamp, turn "OFF" the power and remove the power plug from the outlet.	Reference	"4.4 Replace the Light Source Lamp"
				Operation Category	Lamp replacement
				Required Qualification/ Education	Qualified person received training to control the instrument
5	B	⚠ WARNING If the lamp is replaced while it is hot, it may cause burns.	When replacing the lamp, turn "OFF" the power and remove the power plug from the outlet. Then, leave it until the lamp cools down.	Reference	"4.4 Replace the Light Source Lamp"
				Operation Category	Lamp replacement
				Required Qualification/ Education	Qualified person received training to control the instrument
6	B	⚠ CAUTION Lamp damage or explosion, due to careless handling during replacement, may result in injury.	Comply with instructions in the manual during lamp replacement. Be careful not to bump the lamp against other objects.	Reference	"4.4 Replace the Light Source Lamp"
				Operation Category	Lamp replacement
				Required Qualification/ Education	Qualified person received training to control the instrument

Installation

No.	Mechanical Location	Description	Protective Measure taken by machine user	-	-
7	No specific location	⚠ WARNING Vibration due to an earthquake may cause toppling over of the instrument and it may result in an injury.	Take countermeasures to prevent toppling over.	Reference	"Installation" P.iv
				Operation Category	Instrument installation
				Required Qualification/ Education	Instrument manager
8	No specific location	⚠ CAUTION Falling or dropping may cause an injury.	The weight of the main body is 23 kg. Install the instrument on a desk or a stand that can sufficiently support the total weight of the instrument including peripherals and has a flat and stable surface with at least 700 mm depth.	Reference	"Installation Site" P.iii
				Operation Category	Instrument installation
				Required Qualification/ Education	Instrument manager

Warranty

Shimadzu provides the following warranty for this product.

1. Period:

Please contact your Shimadzu representative for information about the period of this warranty.
The warranty period of the WI lamp (halogen lamp) and D2 lamp (deuterium lamp) is 2000 hours or 1 year, whichever comes first.

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 you 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. Consumables and equivalent items

    Recording media such as 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, perform an inspection and take appropriate corrective action as described in "Chapter 6 Troubleshooting" of this manual.

If the problem persists, or the symptoms are not covered in the troubleshooting section, 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.

Maintenance, Inspections, and Adjustment

In order to maintain the instrument's performance and obtain accurate measurement data, daily inspection and periodic inspection are necessary.

- For daily maintenance, inspection, and replacement parts, see "Chapter 4 Maintenance" of this manual.
- Periodic inspection should be requested to your Shimadzu representative.
- Replacement cycles described for periodic replacement parts are rough estimate.
  Replacement may be required earlier than the described replacement cycles depending on usage environment and frequency.

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.

Electromagnetic Compatibility

■UV-2600i

Descriptions in this section apply only to the following models:

• 207-26000-58 UV-2600i

This product complies with European standard EN61326, class A for electromagnetic interference (Emissions) and minimum requirement for electromagnetic susceptibility (Immunity).

EN55011 Emissions (Electromagnetic Interference)

This is a class A product and is not designed for use in a residential environment.

When this product causes an electromagnetic disturbance to devices being used near this product, create an appropriate distance between those devices and this product in order to eliminate the disturbance.

■UV-2700i

Descriptions in this section apply only to the following models:

• 207-26100-58 UV-2700i

This product complies with European standard EN61326, class B for electromagnetic interference (Emissions) and industrial immunity test requirements (Immunity).

EN55011 Emissions (Electromagnetic Interference)

This is a class B product.

EN61326-1 Immunity (Electromagnetic Susceptibility)

Compliance with these standards does not ensure that the product can operate at a level of electromagnetic interference that is stronger than the level tested. Interference stronger than the values specified above may cause the product to malfunction.

When installing or using this product, especially in an industrial location:

Locate the product away from any device emitting strong levels of electromagnetic noise.

Use a power source that is separated from the power source of any device emitting strong levels of electromagnetic noise.

To prevent static electricity:

Prior to touching the product, the operator should be sure to discharge the static electricity stored in their body by first touching a grounded metallic structure.

Do not touch any terminals or connectors that are not connected to cables while the product is turned ON.

Contents

3 Operation Procedure

4 Maintenance

5 Replace Sample Compartment

6 Troubleshooting

7 Reference Materials

This page is intentionally left blank.

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 LabSolutions UV-Vis via a PC.

1.1 UV-2600i/2700i 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.

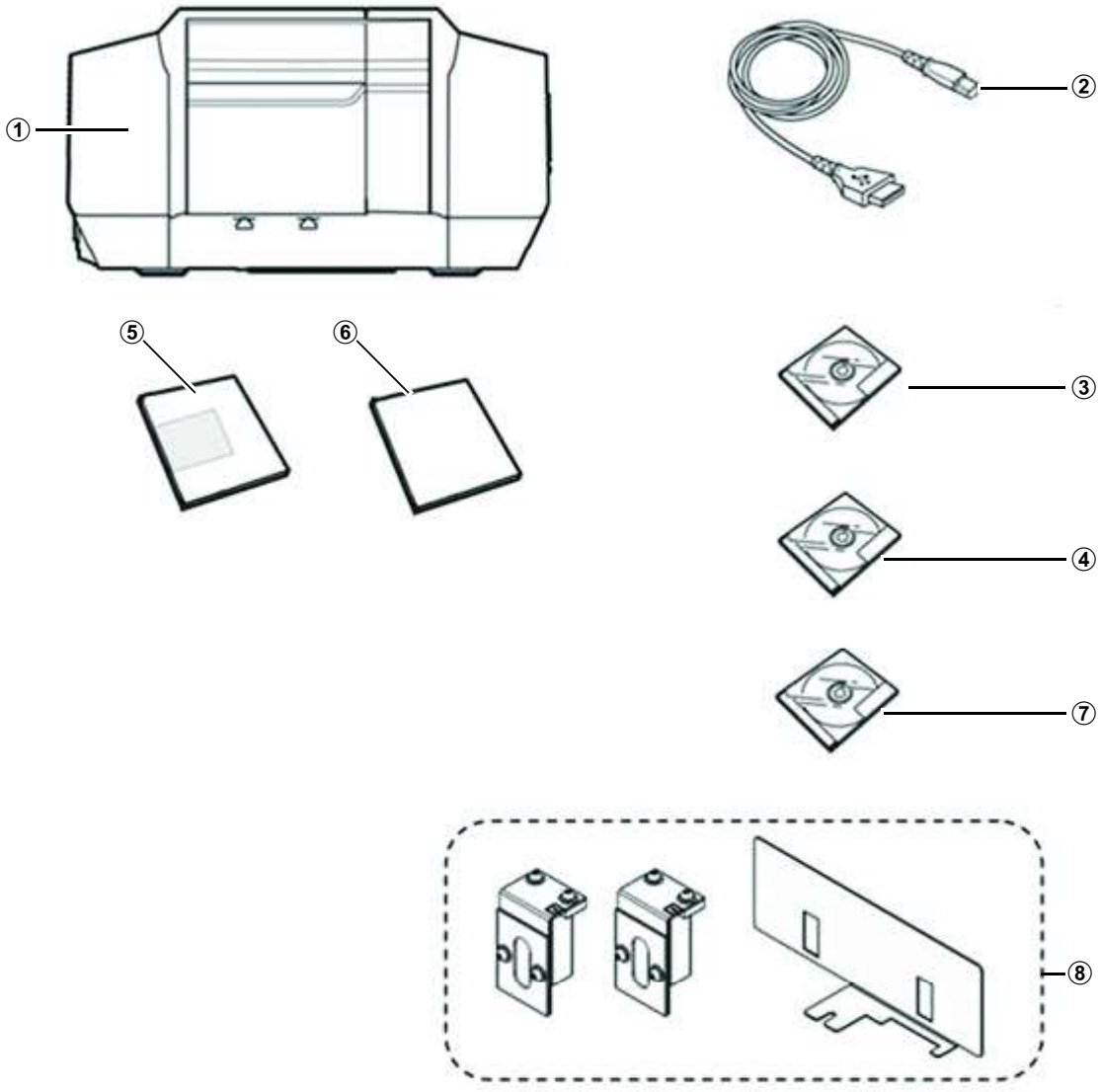


Fig.1-1 Standard Contents

Table 1-1

No.	Check	Part Name	Part No.	Q'ty
①		Spectrophotometer	-	1
②		USB Cable	S088-50602-49	1
③		LabSolutions UV-Vis Software*1 (Install Disc)	-	1
④		UV Performance Validation Software*2 (Install CD)	-	1
⑤		UV-2600i/2700i Instruction Manual (this instruction manual)	S207-90592	1
⑥		LabSolutions UV-Vis Setup Procedure	-	1
⑦		UV Performance Validation Software Instruction Manual	-	1
⑧		High-absorbance measurement kit*3 (only UV-2700i)	-	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 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. S206-28562-91
Abs. 4 dark filter : Part No. S206-28562-92
Partition plate : Part No. S206-27693-02

1.2 Components

1.2.1 UV-2600i/2700i Front View, Top View

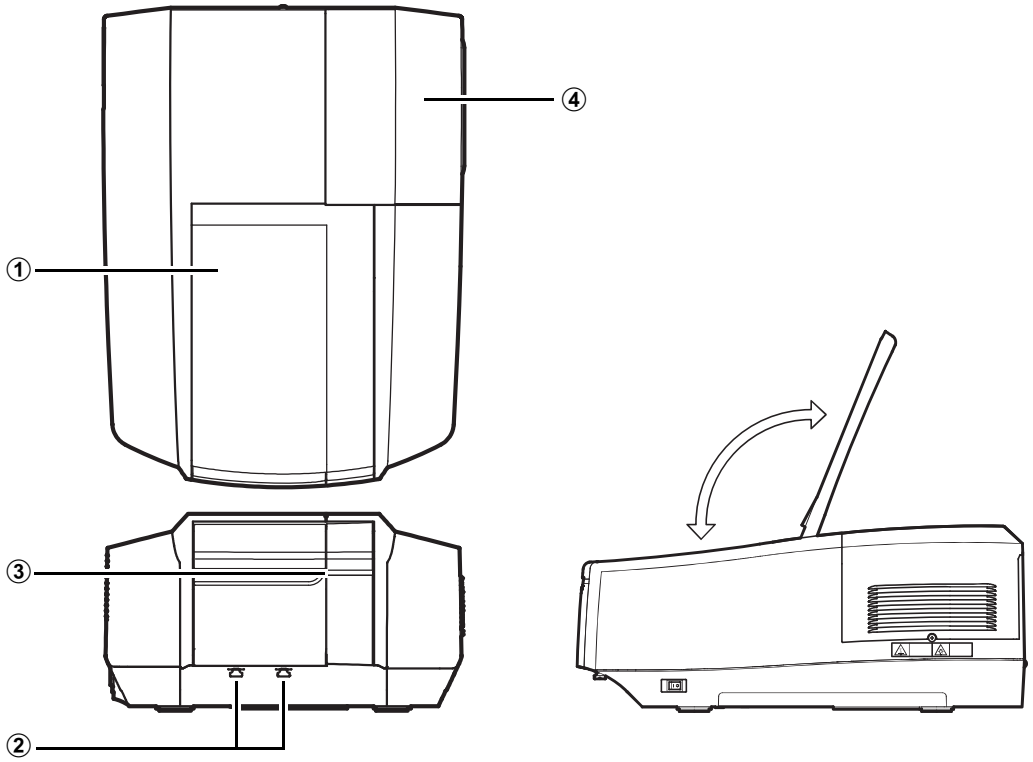


Fig.1-2 UV-2600i/2700i Front and Top Views

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-2600i/2700i Left Side View

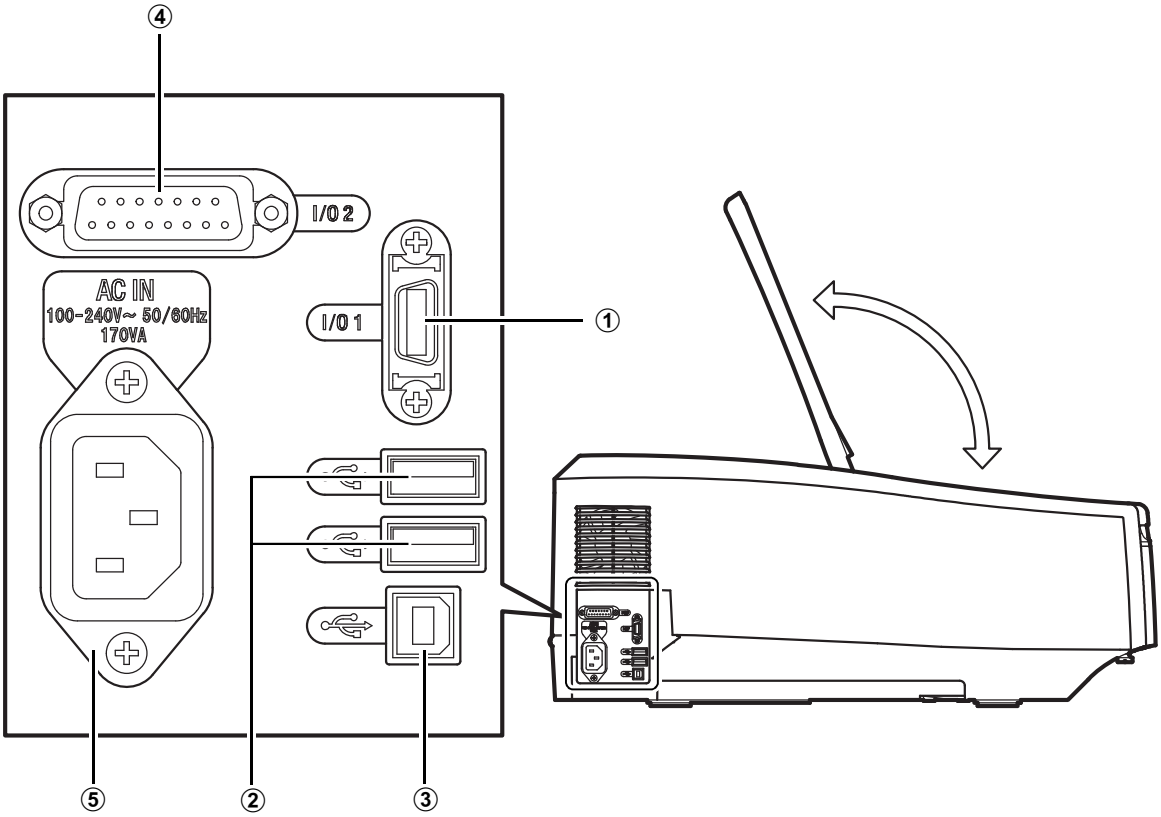


Fig.1-3 UV-2600i/2700i Left Side View

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-100 -> USB Adapter CPS (P/N: S206-25234-91) • For connecting Auto Sample Changer ASC-5 -> USB Adapter ASC (P/N: S206-25235-91) ☞ 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-2600i/2700i Right Side View

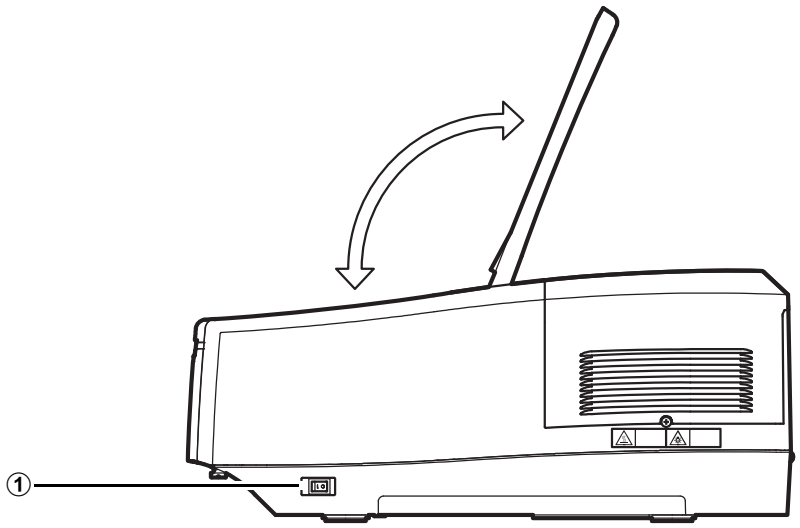


Fig.1-4 UV-2600i/2700i Right Side View

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

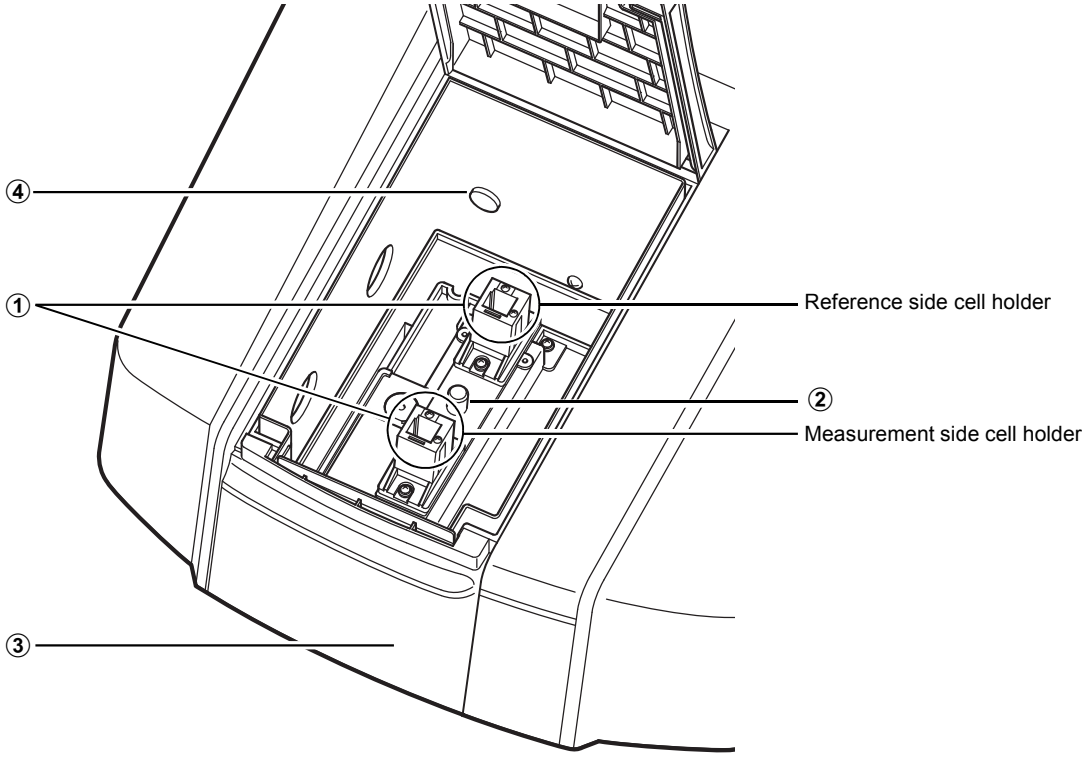


Fig.1-5 Sample Compartment

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

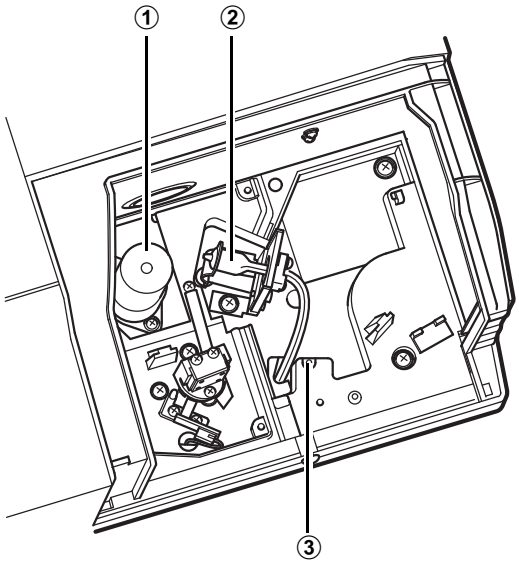


Fig.1-6 Light Source Compartment (UV-2600i)

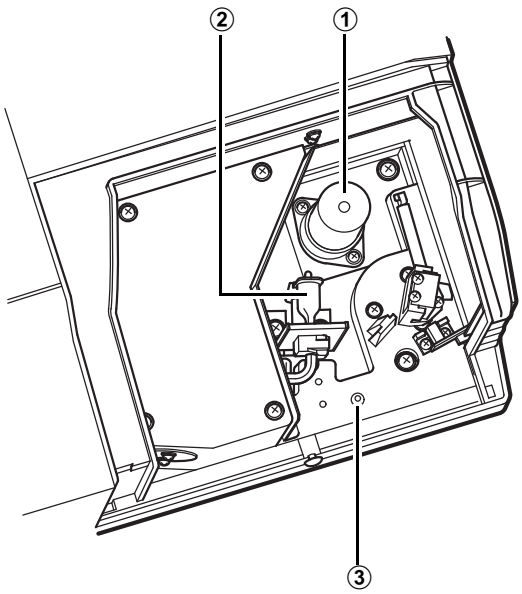


Fig.1-7 Light Source Compartment (UV-2700i)

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.

*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.

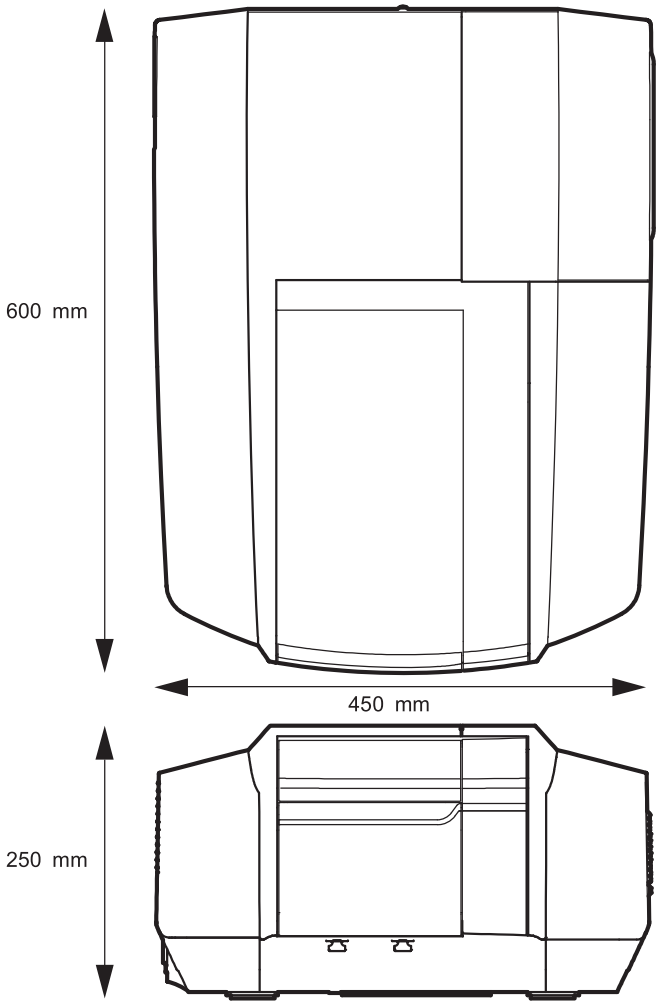


Fig.2-1 Dimensions of Spectrophotometer

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.

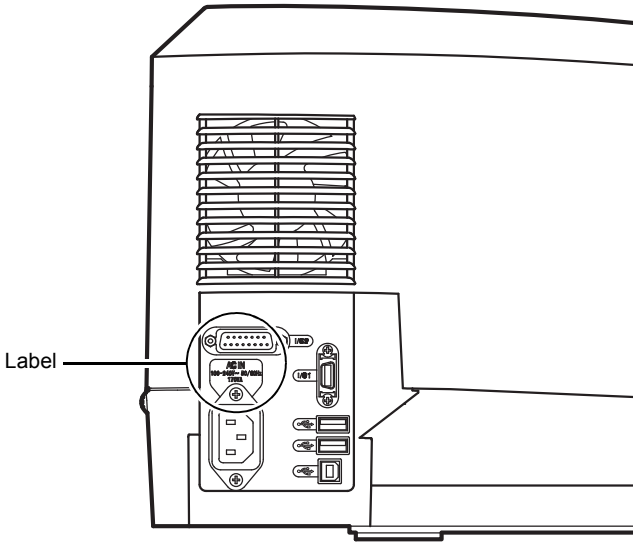


Fig.2-2 Location of the Power Supply Voltage Indication

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 (~100-240V)	170 VA	50/60 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.

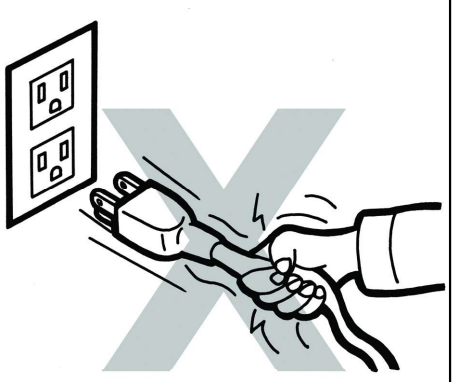


Fig.2-3

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.

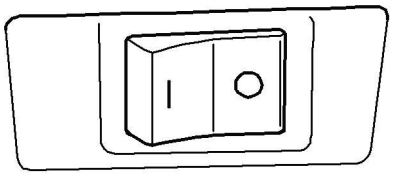


Fig.2-4

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 thirty 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.4-1) 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.

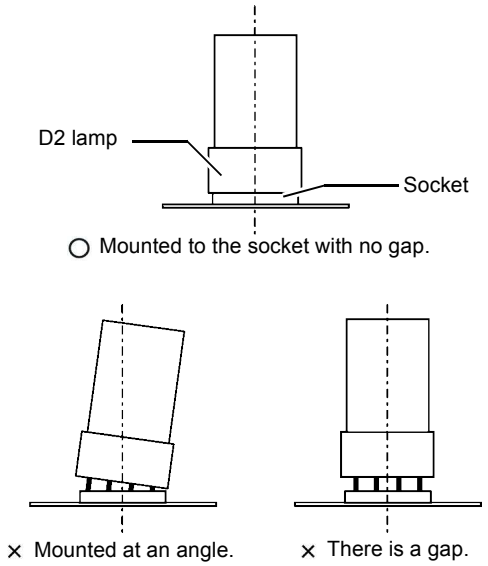


Fig.2-5 Checking D2 Lamp Installation

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 Connection with PC Software

2.5.1 Installation of LabSolutions UV-Vis

Use the supplied software "LabSolutions UV-Vis" to control the instrument using PC.

Reference

Refer to supplied "LabSolutions UV-Vis Setup Procedure" for installation.

2.5.2 Connecting the USB Cable

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

1. Complete "2.5.1 Installation of LabSolutions UV-Vis" 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-2600i/2700i 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 LabSolutions UV-Vis.
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.

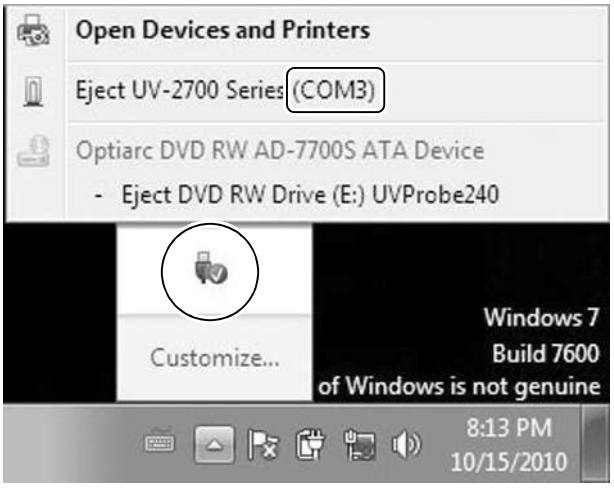


Fig.2-6

NOTE

If you disconnect the COM port before reviewing the COM port number, restart the spectrophotometer or reconnect the USB cable.

7 Register the instrument to LabSolutions UV-Vis.

Enter the COM port number noted in step 6.

Reference

Refer to the supplied "LabSolutions UV-Vis Setup Procedure".

2.6 Turning On the Power and Initialization

2.6.1 Turning the Power On and Off

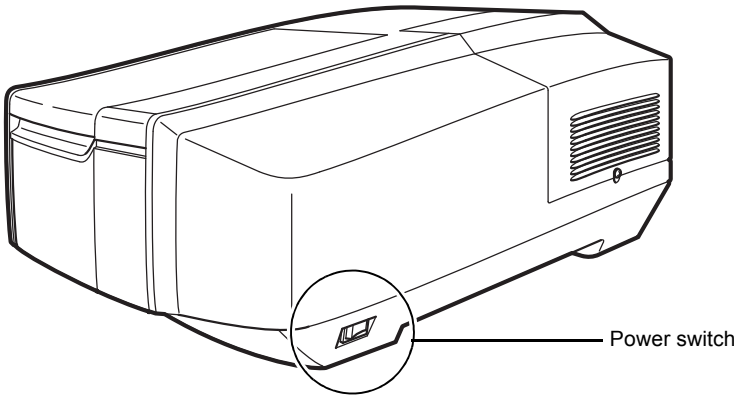


Fig.2-7 Power Switch for UV-2600i/2700i

■ Turning On the Power

1 Press "I" on the power switch (Fig.2-7) 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.

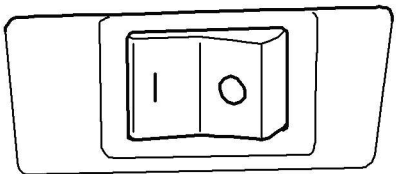


Fig.2-8

2 Start up LabSolutions UV-Vis.

☞ Reference

Refer to "LabSolutions UV-Vis Instruction Manual Basic Operation Guide" stored in the supplied "LabSolutions UV-Vis Install Disc" for the detailed operation procedures of LabSolutions UV-Vis.

■ Turning Off the Power

1 When the measurement operation is being performed, operate LabSolutions UV-Vis to stop the measurement.

2 Disconnect communication if LabSolutions UV-Vis and the spectrophotometer are connected.

3 Press "O" on the power switch (Fig.2-7) to turn off the power.

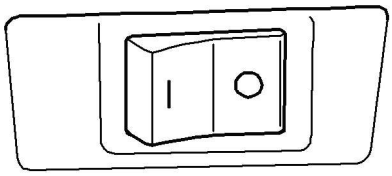


Fig.2-9

2.6.2 Initialization Procedure

When powered on, the spectrophotometer starts initialization and checking for items listed in Table 2-2/Table 2-3.

■ UV-2600i

The initialization operation requires approximately three minutes.

Note, however, it may take about nine minutes maximum if an optional accessory is set up with the instrument (for gain adjustment of a detector when using an ultra-micro cell holder, and for initialization of the cell position when using a multi-cell holder).

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, note where an error is and turn off the power.

☞ Reference

For more details on specific errors, see "6.1 Errors During Initialization".

■ UV-2700i

Initialization requires approximately four minutes. Note, however, it may take about twelve 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).

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.
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.
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, note where an error is and turn off the power.

Reference

For more details on specific errors, 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 Operation Procedure

3.1 Basic Operation

The LabSolutions UV-Vis software (hereafter "LabSolutions UV-Vis"), provided as a standard software, is used to obtain measurements from the UV-2600i/2700i Series.

☞ Reference

Refer to "LabSolutions UV-Vis Instruction Manual Basic Operation Guide" stored in the supplied "LabSolutions UV-Vis Install Disc" for the detailed operation procedures of LabSolutions UV-Vis.

3.2 High-absorbance Measurement

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

NOTE

- UV-2600i
  Compared to the UV-2700i double monochromator, the UV-2600i 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 "3.2.3 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.

3.2.1 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-2700i 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 "3.2.2 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.

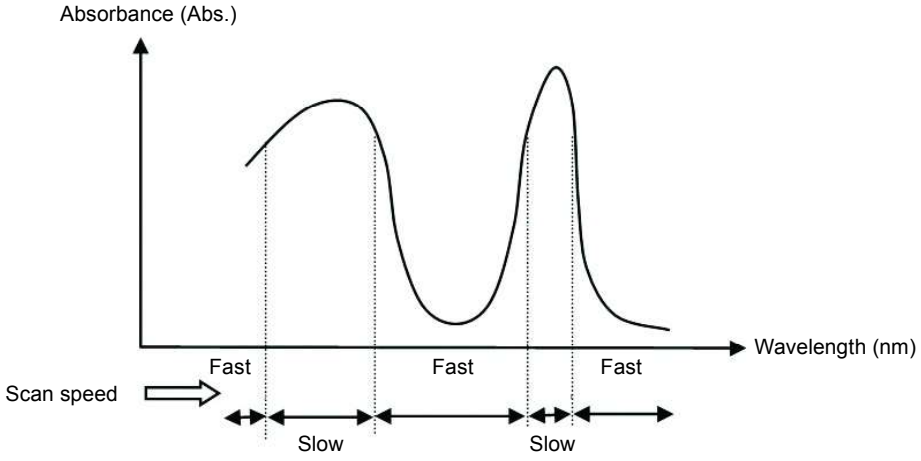


Fig.3-1 Relationship Between Absorbance Spectrum and Scan Speed in High-Absorbance Measurement Mode (Schematic)

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

Table 3-1 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 "3.2.3 High-Absorbance Kit".

3.2.2 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.

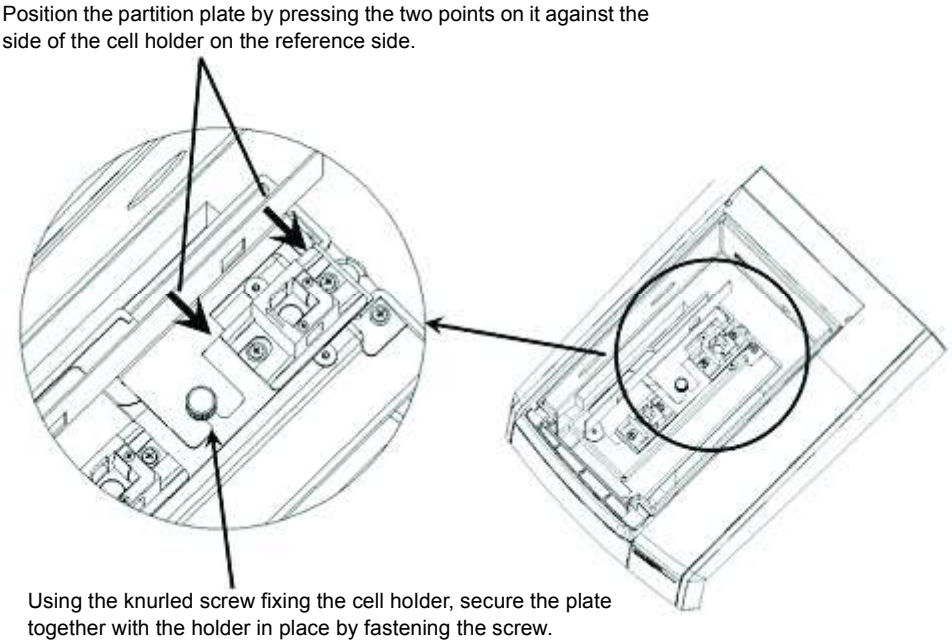


Fig.3-2 Mounting the Partition Plate

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".

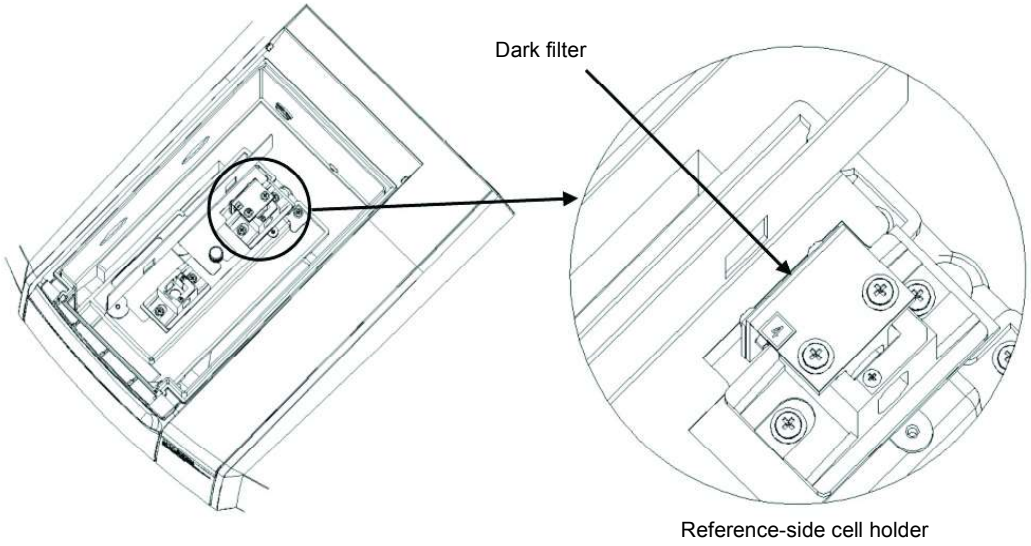


Fig.3-3 Mounting a Dark Filter

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. S206-28500-41)
- Film holder (Part No. S204-58909)

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. S206-28730-41
- Dark filter set for the film holder: Part No. S206-28740-41

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.

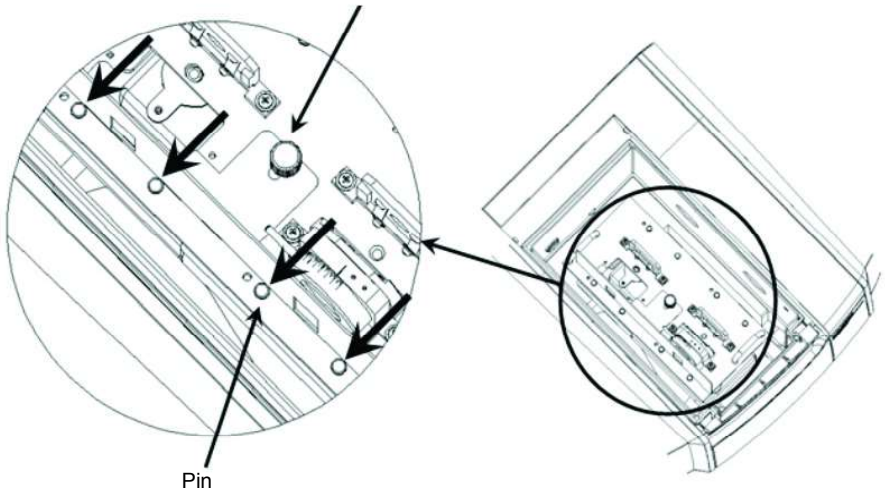
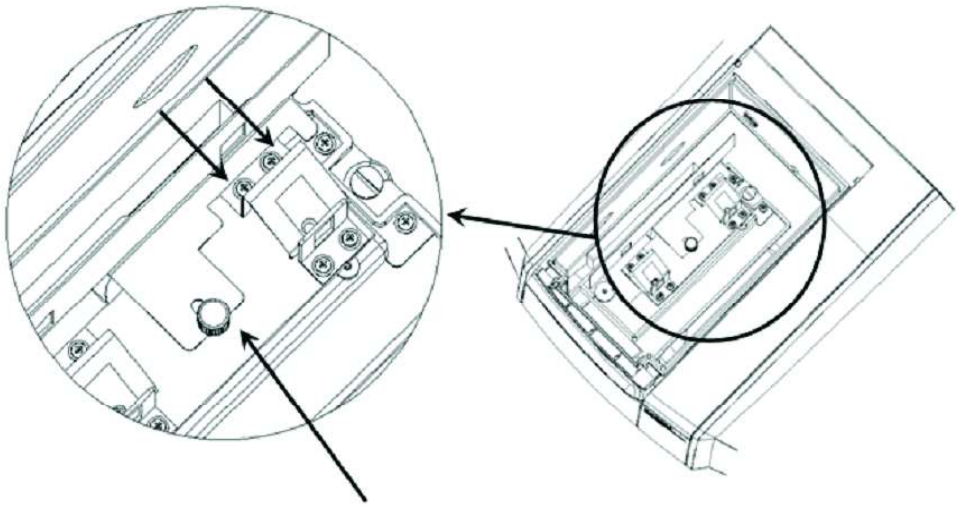


Fig.3-4 Mounting the Partition Plate onto the Rotary Film Holder



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.3-5 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".

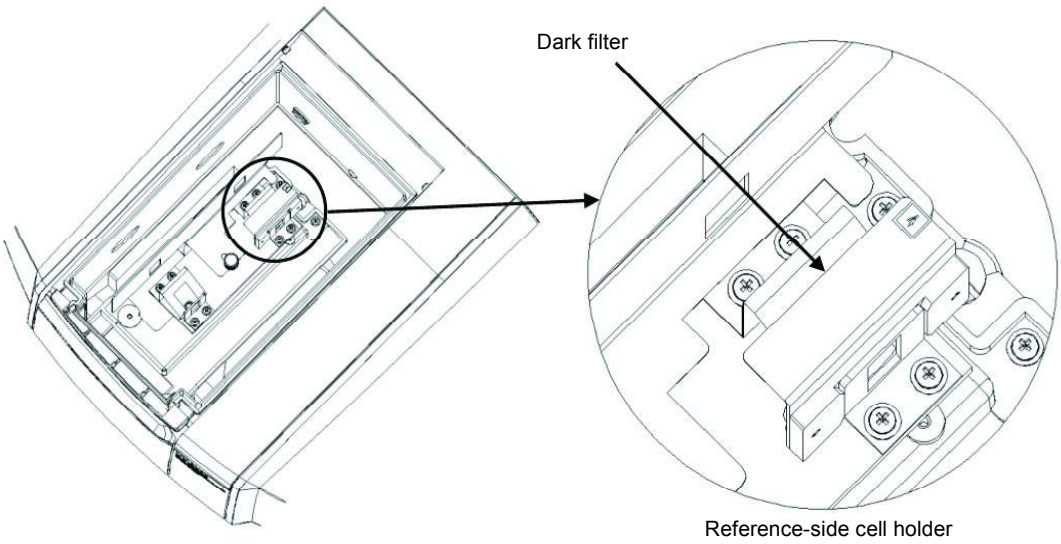


Fig.3-6 Mounting a Dark Filter onto the Film Holder

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.

3.2.3 High-Absorbance Kit

The high-absorbance measurement kit contains the following parts:

No.	Name	Part No.
①	Dark filter for Abs. "3"	S206-28562-91
②	Dark filter for Abs. "4"	S206-28562-92
③	Partition plate	S206-27693-02

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.

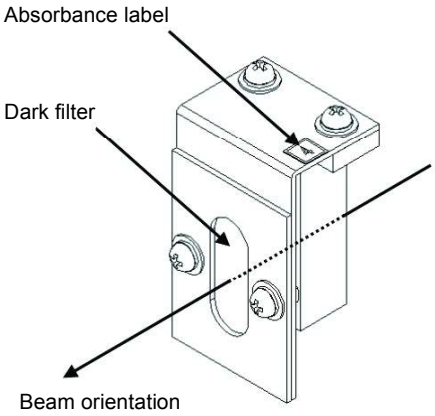


Fig.3-7 Dark Filter

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. S206-82299-91). 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.

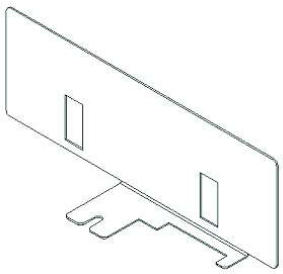


Fig.3-8 Partition Plate

■ 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 3-2

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 LabSolutions UV-Vis 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.

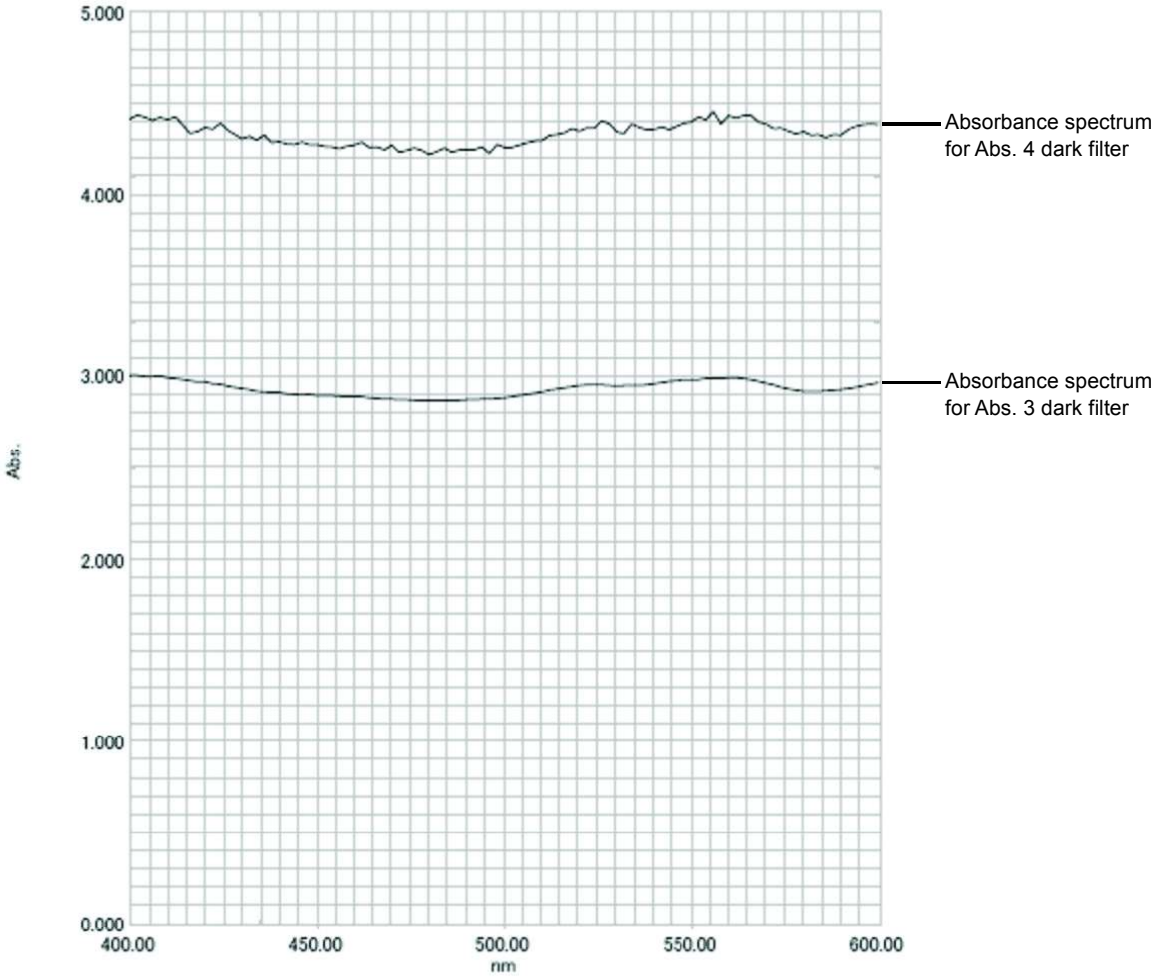


Fig.3-9 Absorbance Spectrum for Dark Filters

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.)

This page is intentionally left blank.

4 Maintenance

4.1 Inspection and Maintenance

To use the UV-2600i/2700i 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-2600i/2700i 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 times of WI (halogen) and D2 (deuterium) lamps used as light sources.

The accumulated lighting times of the lamps are saved even if the power source is turned off. However, some electric problems may reset the saved content. Therefore, use the software's information on lighting times of lamps as a guideline to replace your lamp, and keep and maintain a record of the lighting time of lamp separately.

☞ Reference

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

Select [Maintenance] from the [Instrument] menu of LabSolutions UV-Vis to check or reset the lamp lighting time.

☞ Reference

For more information, refer to "Helps" in LabSolutions UV-Vis.

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.

*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.

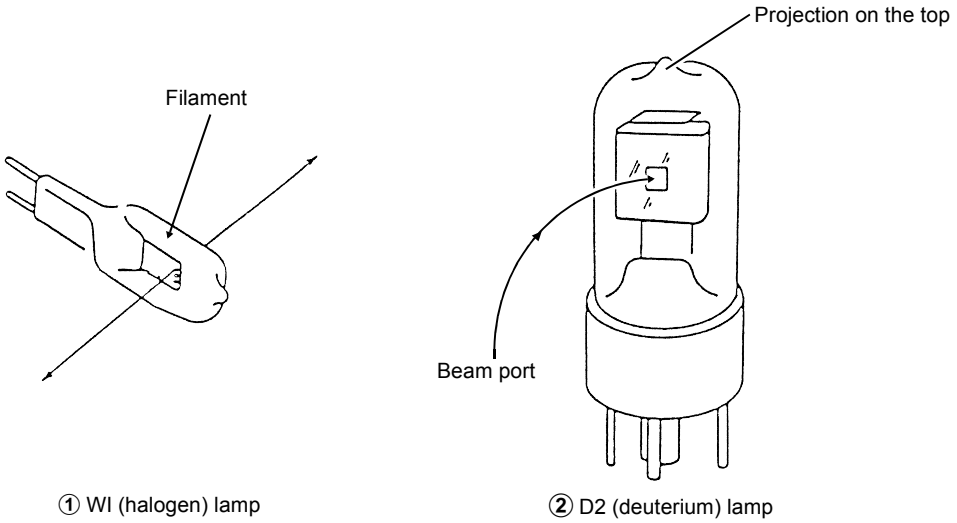


Fig.4-1 Light Source Overview

Table 4-2

No.	Part Name	Part No.	Model Name	Rating Life
①	WI (halogen) lamp	S062-65004-06	64604	Appox. 2000 hours
②	D2 (deuterium) lamp	S062-65055-05	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 thirty 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.4-1) 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.

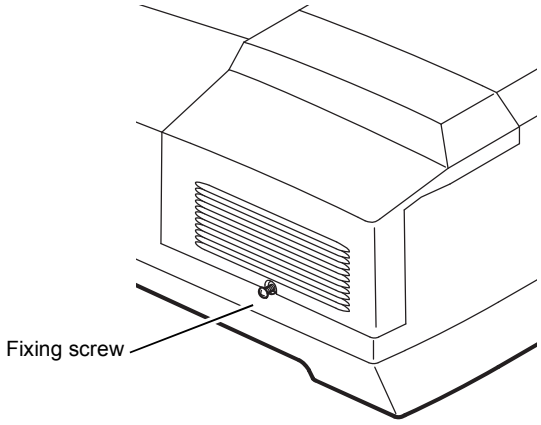


Fig.4-2

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.

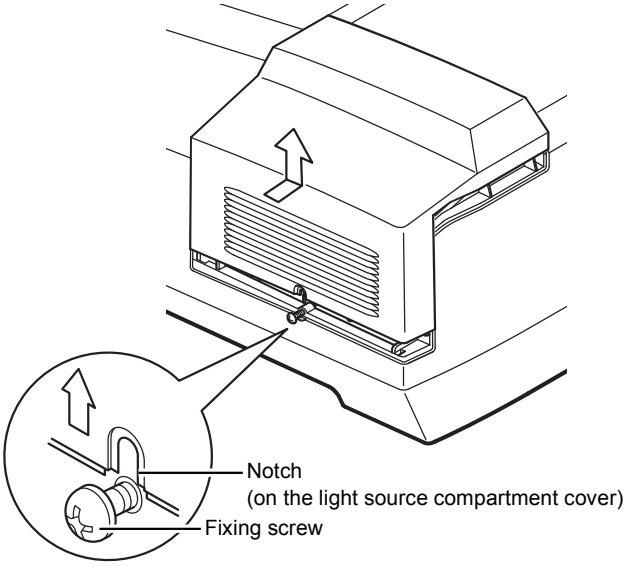


Fig.4-3

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

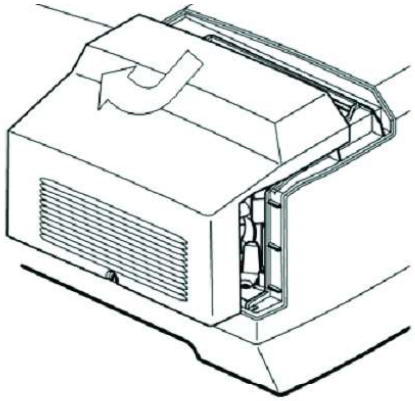


Fig.4-4 Removing the Light Source Compartment Cover

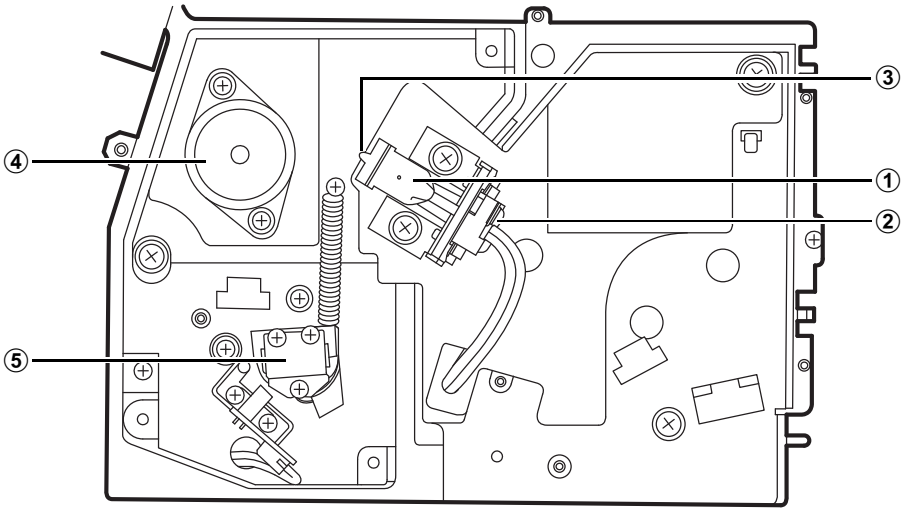


Fig.4-5 Light Source Compartment (UV-2600i)

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

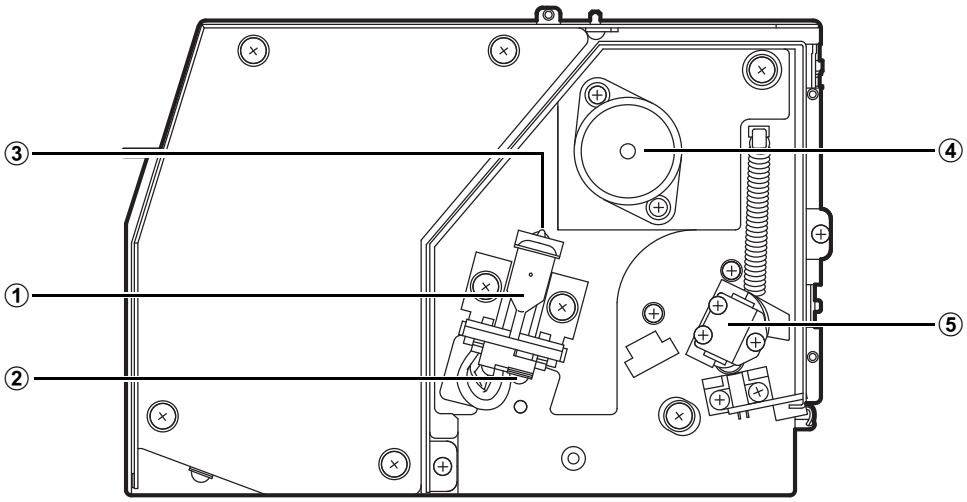


Fig.4-6 Light Source Compartment (UV-2700i)

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.

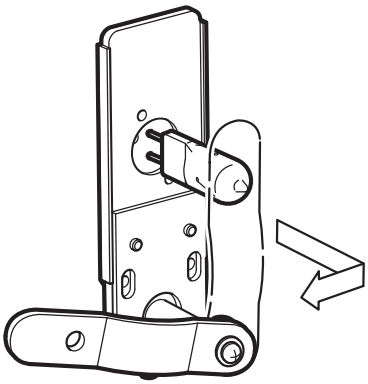


Fig.4-7

2 Pull out the WI lamp from the socket.

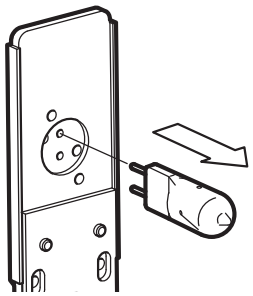


Fig.4-8

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.

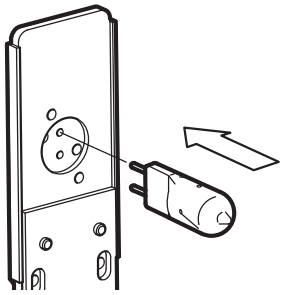


Fig.4-9

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

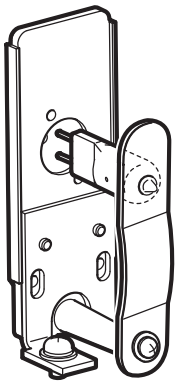


Fig.4-10

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.

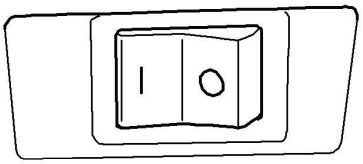


Fig.4-11

9 Run LabSolutions UV-Vis and connect all related instruments to check that all initialization items are complete.

10 Complete the initialization and reset the cumulative lighting time of the WI lamp on the [Maintenance] window of LabSolutions UV-Vis.

■ Replacing the D2 Lamp

1 Wearing cloth gloves, hold the resin part of the D2 lamp (Fig.4-12), and slowly pull it straight up.

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

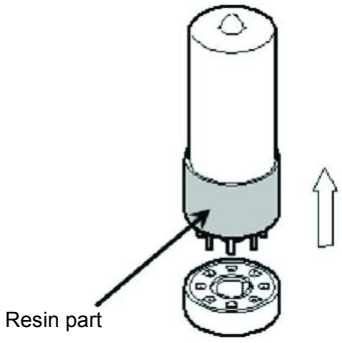


Fig.4-12

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.

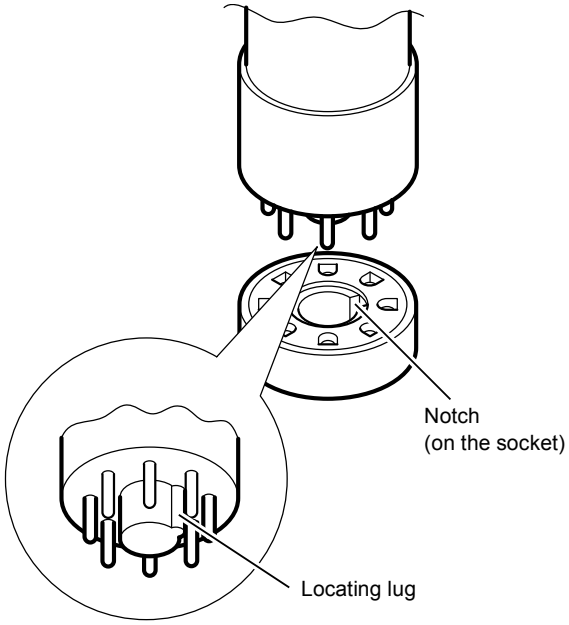


Fig.4-13

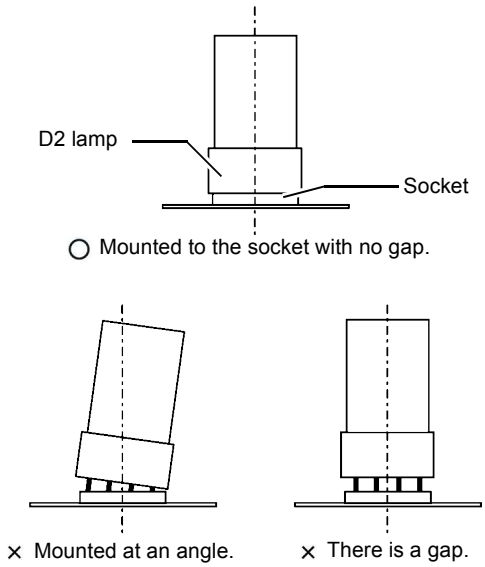


Fig.4-14 Checking D2 Lamp Installation

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.

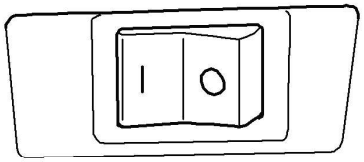


Fig.4-15

6 Run LabSolutions UV-Vis and connect all related instruments to check that all initialization items are complete.

7 Complete the initialization and reset the cumulative lighting time of the D2 lamp on the [Maintenance] window of LabSolutions UV-Vis.

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".

This page is intentionally left blank.

5 Replace Sample Compartment

5.1 Removing/Installing the Cell Holder

To install some optional accessories, such as Ultra-micro cell holder (P/N. S206-14334), 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.

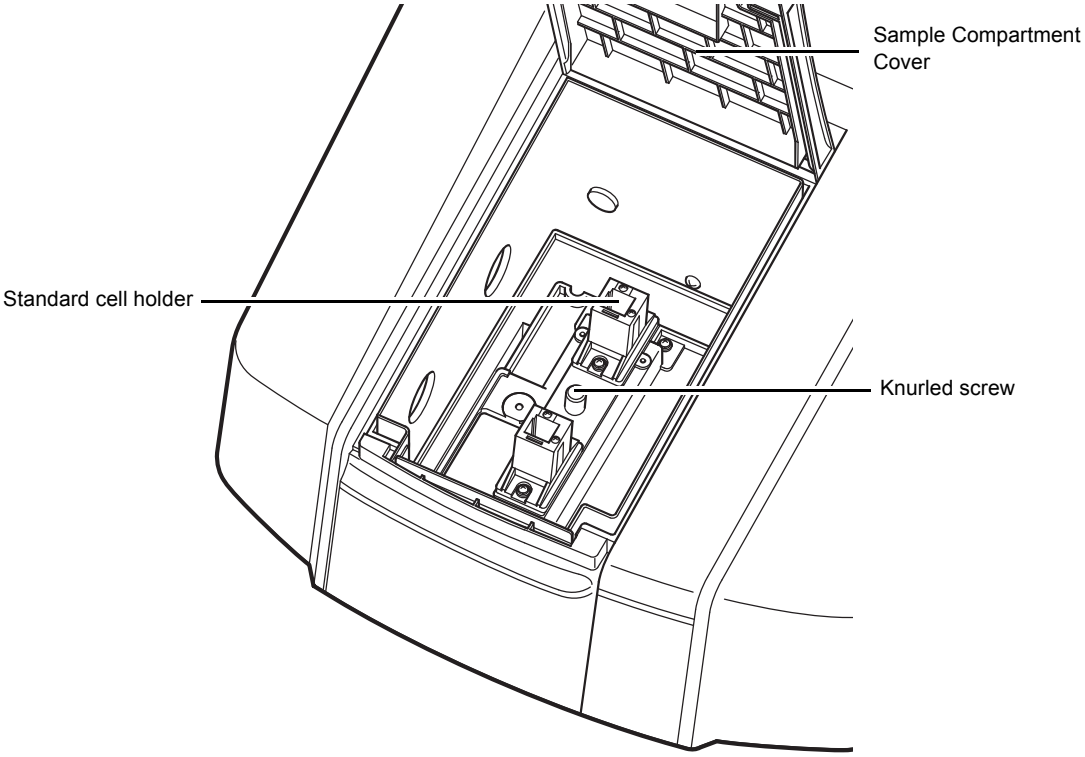


Fig.5-1 Sample Compartment (Standard)

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.

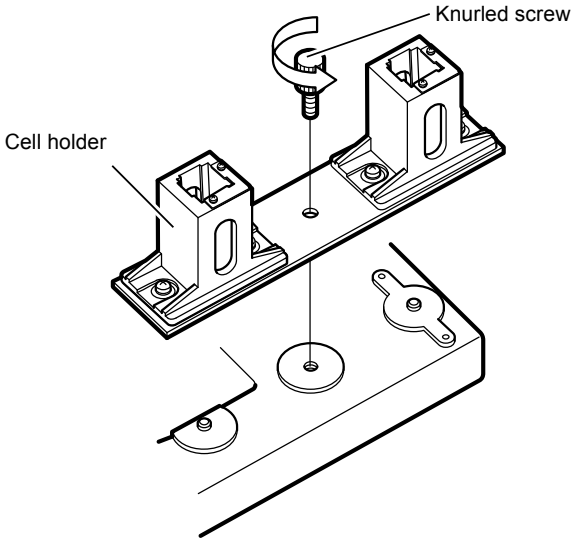


Fig.5-2

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.

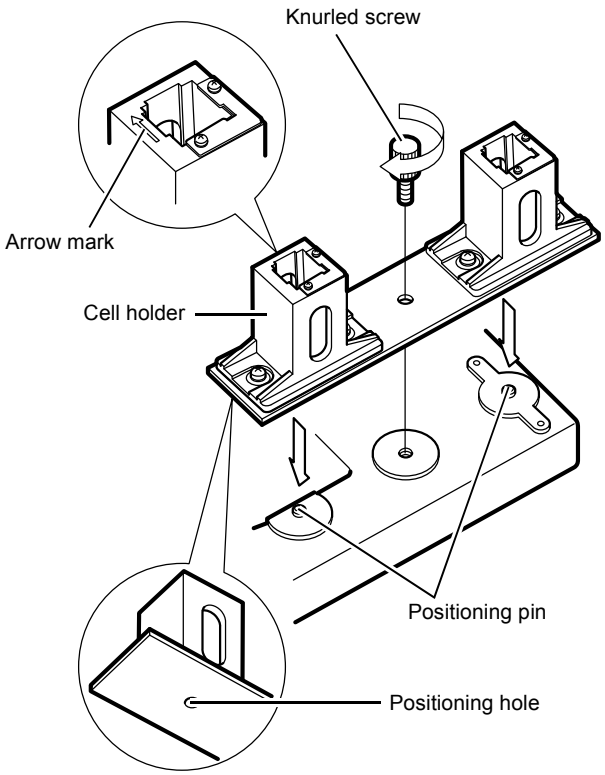


Fig.5-3

5.2 Remove/Install the Sample Compartment Unit (Standard)

To install some optional accessories, such as sipper 160 series (P/N. S206-23790-91, 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.

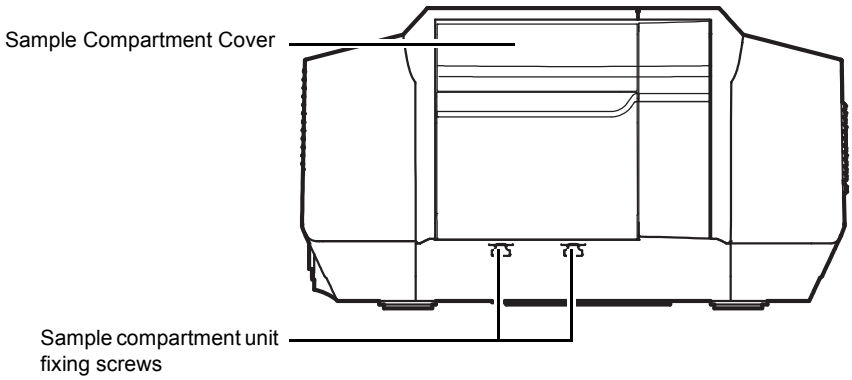


Fig.5-4 Main Body, Front View

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.

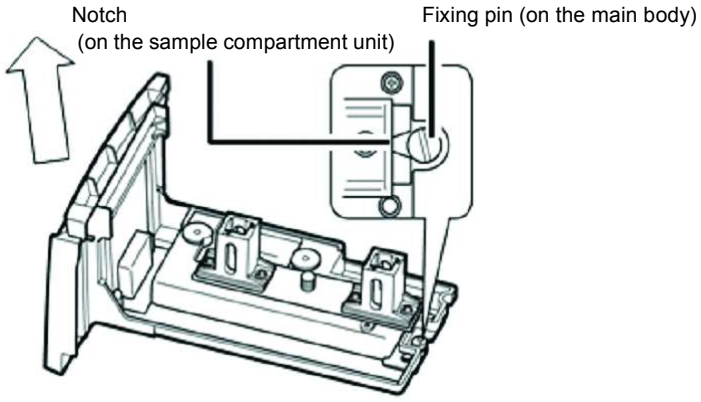


Fig.5-5

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.

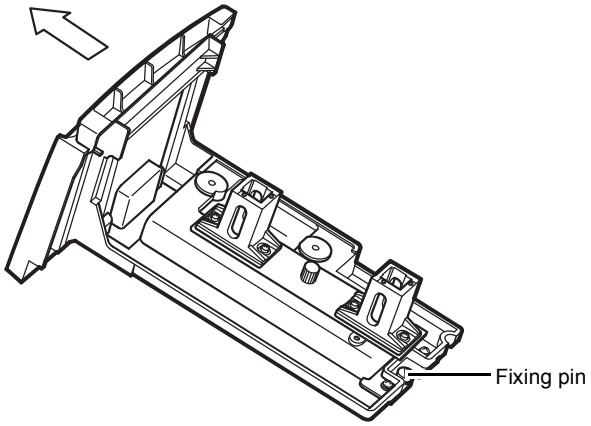


Fig.5-6

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.

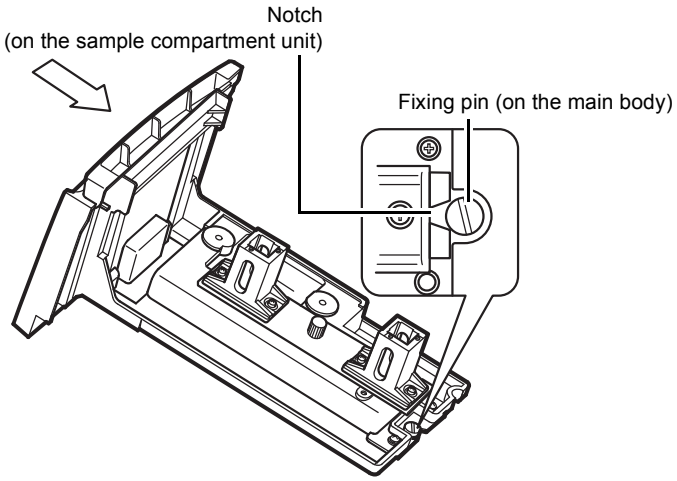


Fig.5-7

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

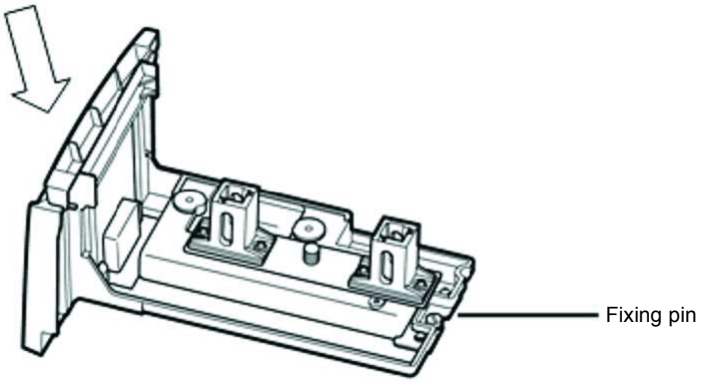


Fig.5-8

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.

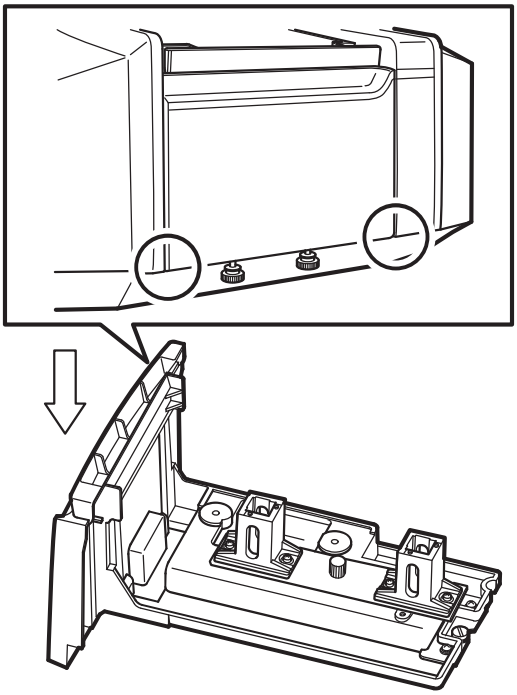


Fig.5-9

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

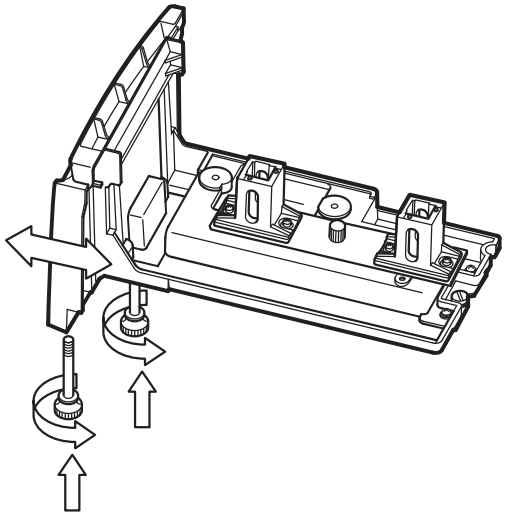


Fig.5-10

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. S206-23890-91), 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.

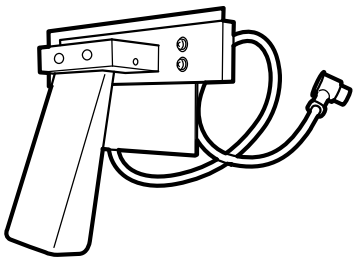


Fig.5-11 Front Plate for Syringe Sipper (Switching Unit)

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.

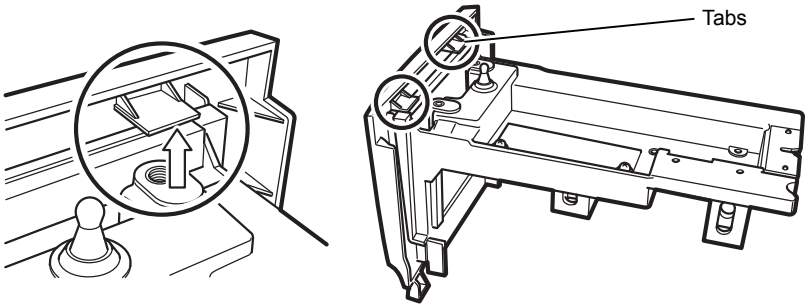


Fig.5-12 Tabs on the Sample Compartment Front Cover

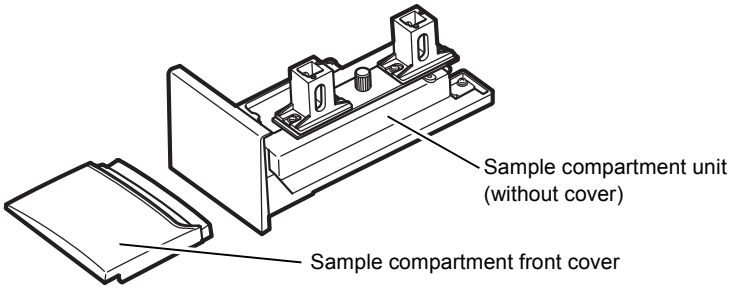


Fig.5-13 Sample Compartment Unit

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.

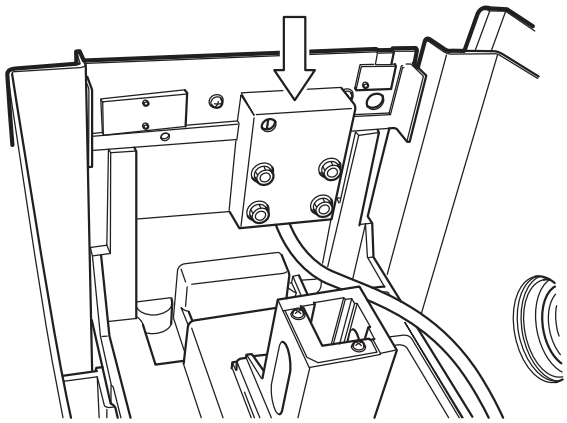


Fig.5-14 Installing the Front Plate

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).

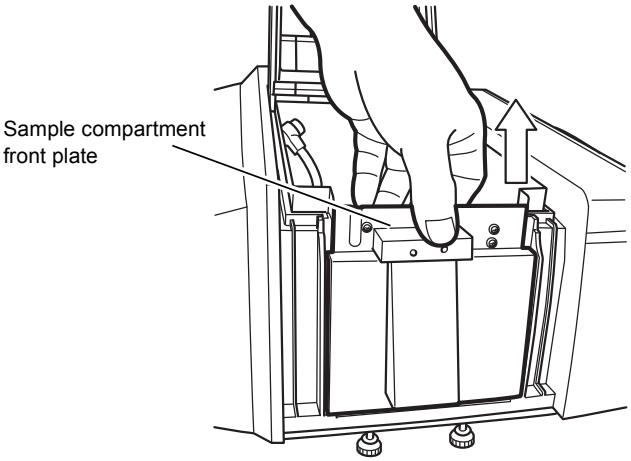


Fig.5-15 Front Plate of the Sample Compartment

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).

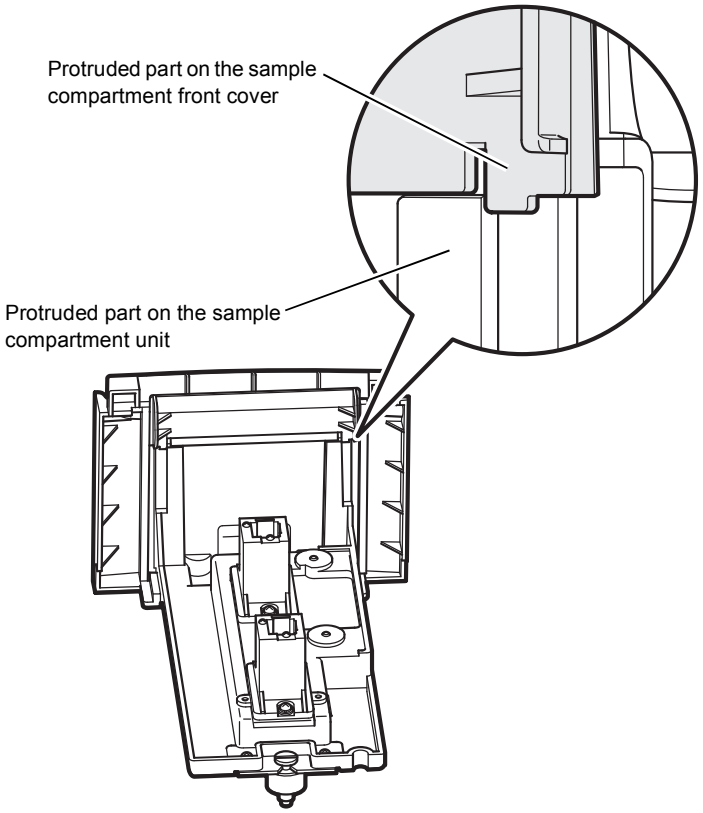


Fig.5-16 Fitting the Sample Compartment Front Cover

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

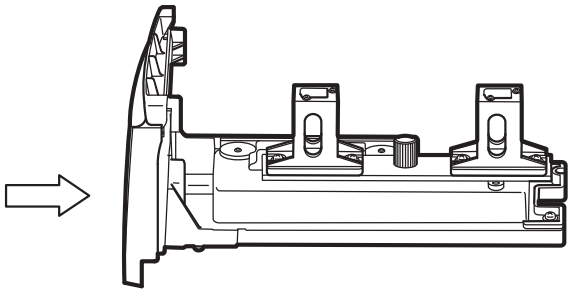


Fig.5-17 Snapping the Sample Compartment Front Cover

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 LabSolutions UV-Vis to the spectrophotometer. The initialization window appears to display results in the order of the check items.

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 (only for UV-2700i)	Detects the mechanical wavelength origin position of the pre-monochromator.
⑧	Scan motor initialization (UV-2600i) Scan motor #2 initialization (UV-2700i)	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 (only for UV-2700i)	Checks the 0-order light which is the optical origin of the main monochromator.
⑪	D2 lamp energy check	Checks whether or not the D2 (deuterium) lamp light energy is at a sufficient level.
⑫	Scan motor zero order light search (UV-2600i) Scan motor #2 zero order light search (UV-2700i)	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.	P18
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.	P18
	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").	P18 P40
	Did the source lamp exceed the lamp life hours?	In the LabSolutions UV-Vis software, select [Maintenance] from the [Instrument] menu. Check the lamp lighting time, and if the lighting time of each light source lamp exceeds the "lamp service life" time, replace the lamp according to "4.4 Replace the Light Source Lamp".	P18 P40
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.	P18
	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.	P18
	Did the source lamp exceed the lamp life hours?	In the LabSolutions UV-Vis software, select [Maintenance] from the [Instrument] menu. Check the lamp lighting time, and if the lighting time of each light source lamp exceeds the "lamp service life" time, replace the lamp according to "4.4 Replace the Light Source Lamp".	P18 P40

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-2600i/2700i?	Use a power supply that satisfies the power supply specification of the UV-2600i/2700i.	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.	
Cannot establish communication with LabSolutions UV-Vis.	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 select [Instrument] from the [Environmental Settings] window of the LabSolutions UV-Vis to set the Connection COM Port.	P16
	Is the USB driver properly installed?	Install the USB driver according to the Installation window of the LabSolutions UV-Vis 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 P16

Symptom	Typical Cause	Remedial Action	Reference Page
Red marks (error indication) appear for any initialization items.		Perform an appropriate action by following the instructions in "6.1 Errors During Initialization".	P61
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.	
Photometric values are wrong.	Is the light source lamp lit?	In the LabSolutions UV-Vis software, select [Light Source] from the [Instrument] menu. Check the lighting condition of each light source, and if it is not [On], perform Action A. Action A Check [D2 Lamp] and [WI Lamp] to turn them [On]. If Action A does not solve the problem, disconnect communication between the instrument and LabSolutions UV-Vis and turn "OFF" the power of the instrument. Turn "ON" the power again after a while and start initialization. If the light source lamp does not turn on and an error is displayed, perform Action B. If the light source lamp turns on but turns off again, perform Action C. 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.	P18 P40
	Are measurement parameters such as wavelength properly set?	Check the entered parameters again.	P25
	Is the slit width appropriate?	Change the slit width and perform measurement again.	P25
	Did the light source lamp exceed the lamp life hours?	If the light source lamp has exceeded the lamp life hours, replace the lamp.	P40
	Is the sample for measurement correct?	Check if you used the correct sample.	

Symptom	Typical Cause	Remedial Action	Reference Page
Photometric values are wrong.	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 P54
	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.	P25
	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.	
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.	

Symptom	Typical Cause	Remedial Action	Reference Page
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.	P25
	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.	P40
	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.	P40
High-absorbance measurement yields abnormal results. (Only for UV-2700i)	Are the measurement conditions appropriate?	Follow "3.2 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 "3.2 High-absorbance Measurement", request cleaning or replacement.	

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.

This page is intentionally left blank.

7 Reference Materials

7.1 Hardware Specifications

Table 7-1

Item	UV-2600i	UV-2700i
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-2600i	UV-2700i
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	

7.2 Service Parts

7.2.1 Consumable Parts

Table 7-2

Part Name	Part No.	Replacement by	Remarks
WI (halogen) Lamp	S062-65004-06	Customer	Light source (for visible/near infrared range)
D2 (deuterium) Lamp	S062-65055-05	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 7-3

Part Name	Part No.	Replacement by	Remarks	Replacement Cycle
Mirror, R (20 × 30.40) -FR	S206-27672-91	Shimadzu service representative	Light source switching mirror	3 year
Quartz Plate	S206-25346-91	Shimadzu service representative	5 pieces per unit	3 year
O-ring	S036-15501-21	Shimadzu service representative	Used for fixing the quartz plate 5 pieces per unit	3 year
M11 ASSY	S206-27616-95	Shimadzu service representative	Mirror inside Monochromator Only for UV-2700i	6 year
ASSY, Sector Motor	S206-27647-95	Shimadzu service representative	Sector Motor	6 year
Abs. 3 Dark Filter	S206-28562-91	Customer	Only for UV-2700i	2 year
Abs. 4 Dark Filter	S206-28562-92	Customer	Only for UV-2700i	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

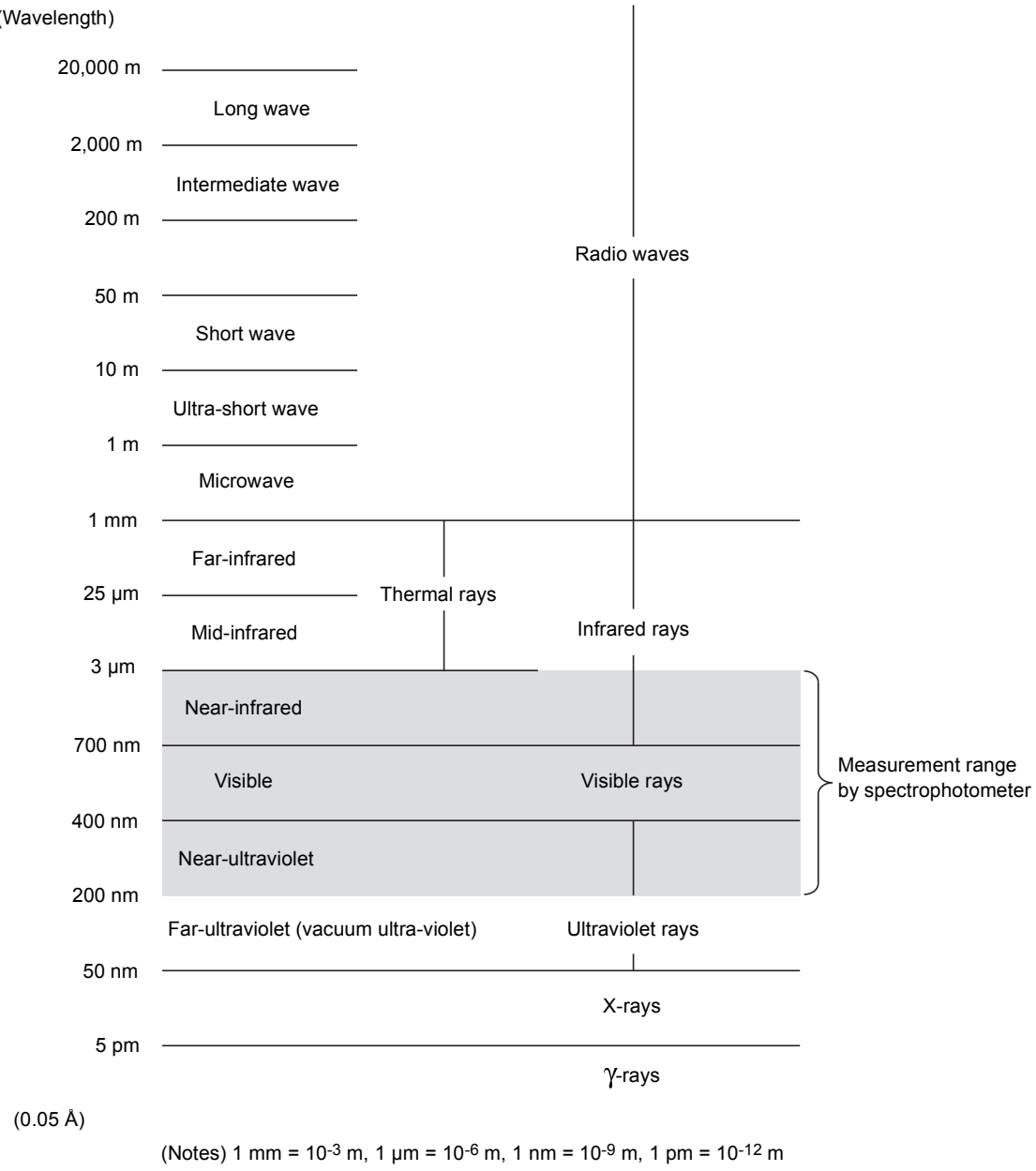
Table 7-4

Part Name	Part No.	Replacement by	Remarks
Sample Compartment Unit (standard)	S206-60184-07	Customer	
Standard Cell Holder	S206-82009-91	Customer	
Sample Compartment Front Cover ASSY	S206-27653-91	Customer	
Sample Compartment Cover	S206-27710	Customer	
Partition Plate (for high-absorbance measurement)	S206-27693-02	Customer	Only for UV-2700i

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.

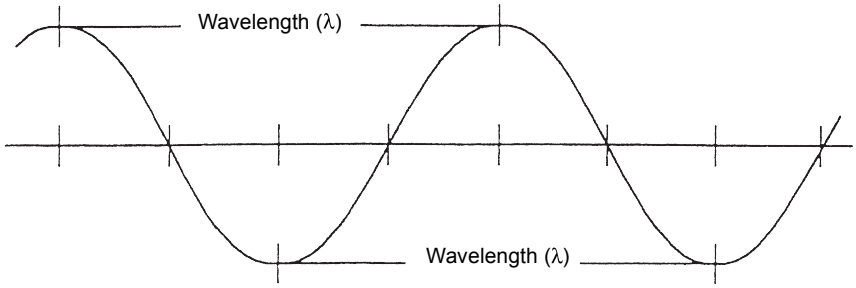


Fig.7-2 Wavelength

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:

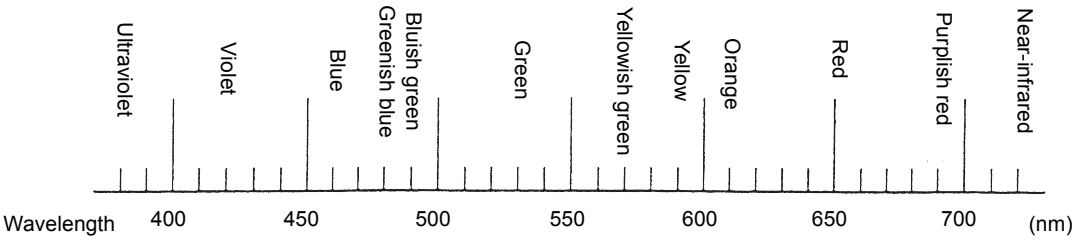


Fig.7-3 Wavelength and Color of Light

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 7-5

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.

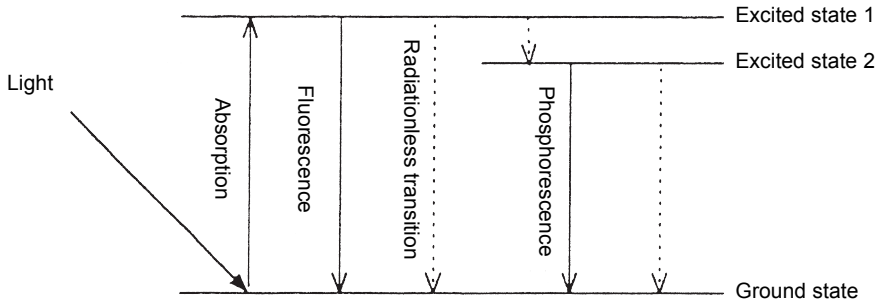


Fig.7-4 Molecule Energy

7.3.3 Bouguer-Beer's Law

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

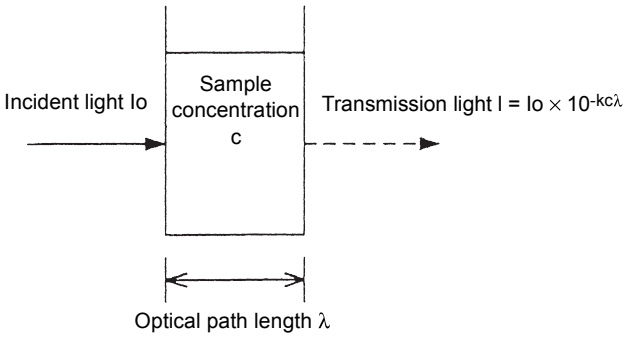


Fig.7-5 Bouguer-Beer's Law

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.

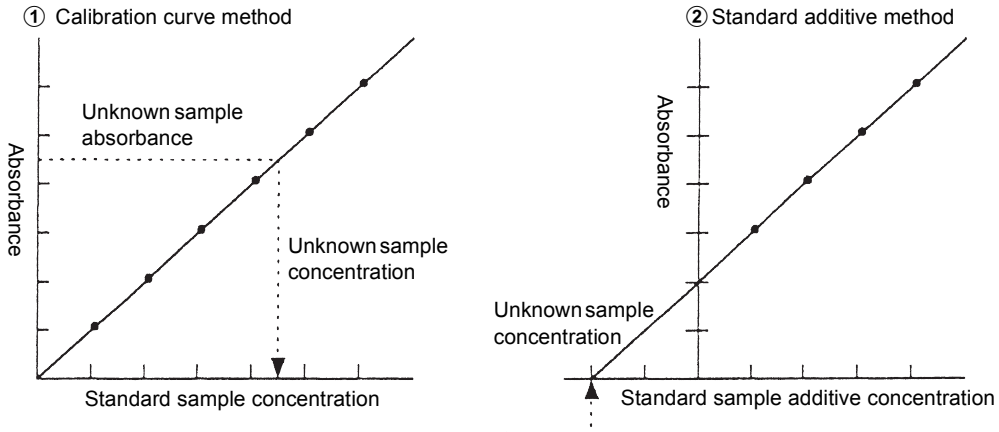


Fig.7-6 Calibration Curve

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:

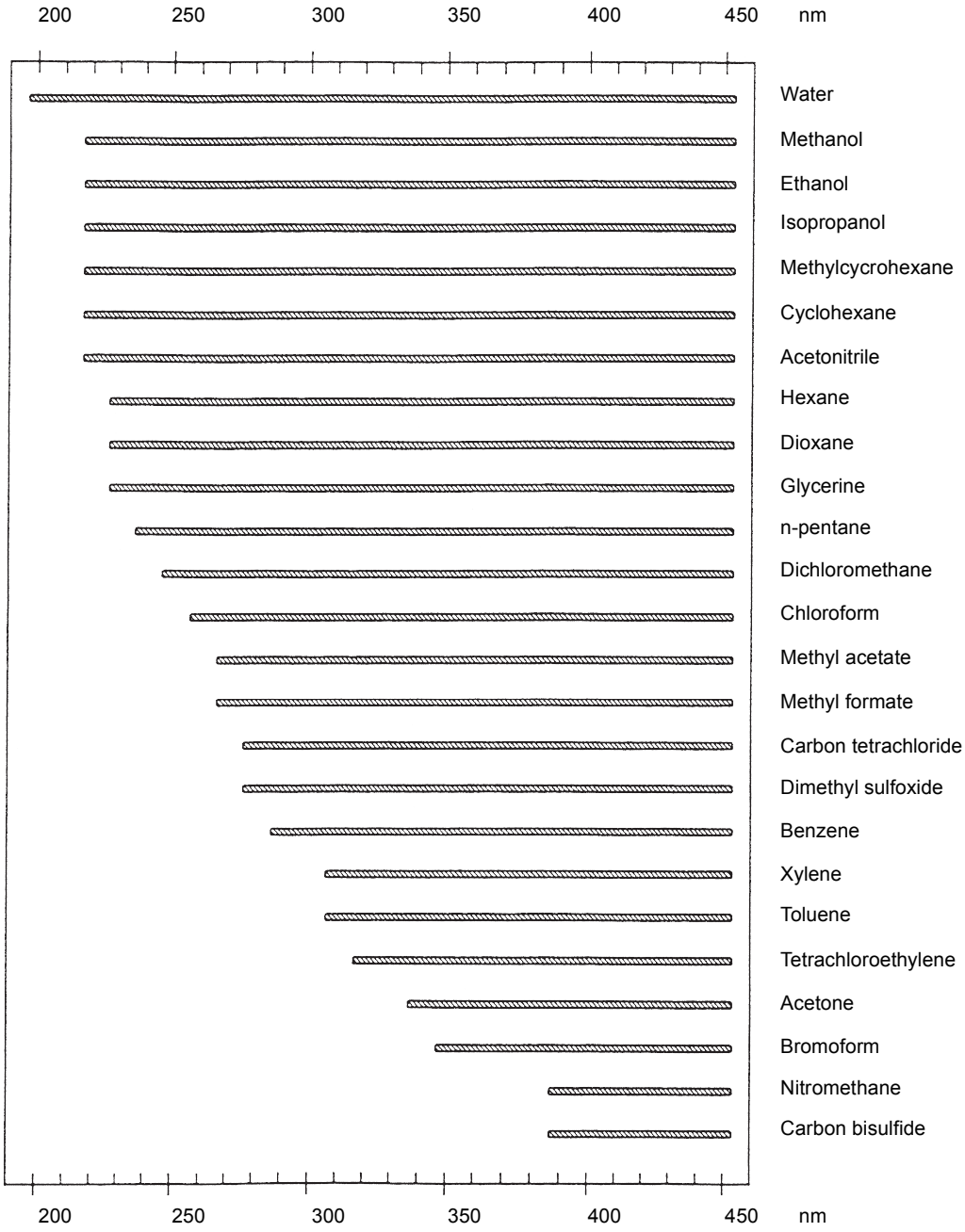


Fig.7-7 Wavelength Range for Solvent to be Used (using a 10 mm cell)

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.

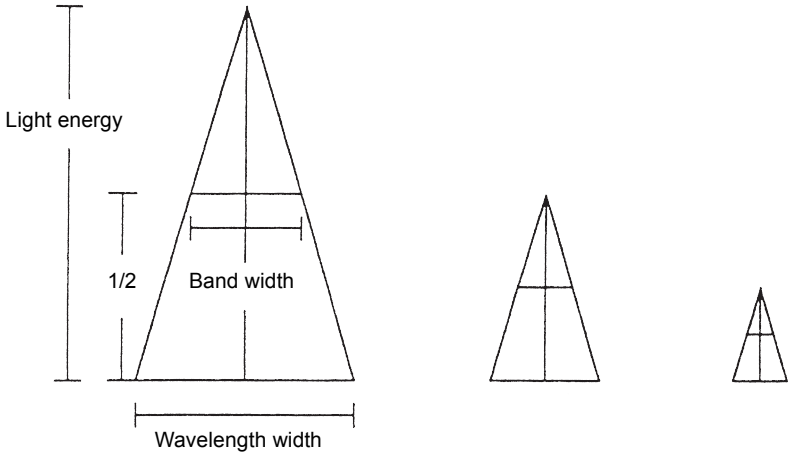
③Stray light is the total of the light of the wavelength deviated from a certain spectrum width having the set wavelength of the monochromator placed in the center and the light emitted from monochromator, but does not transmit the sample and pass the side of the sample. For example, with 0.1 % of stray 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 7-6 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.

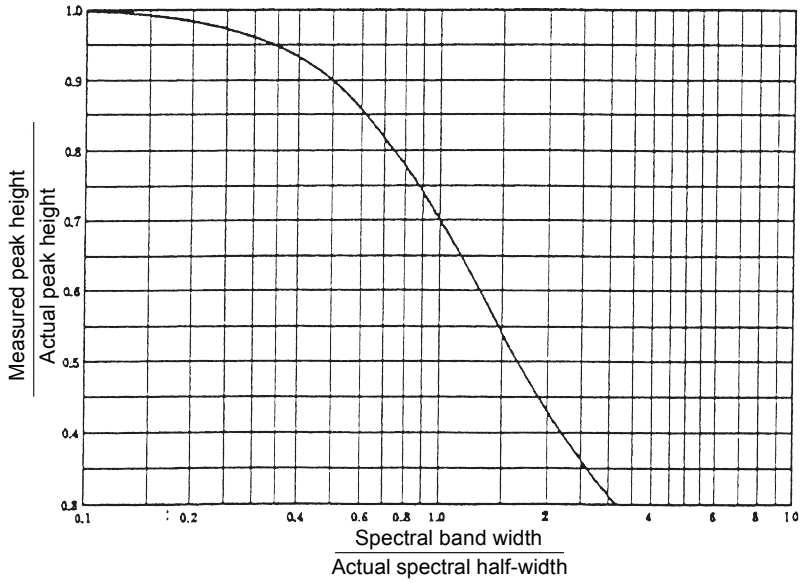
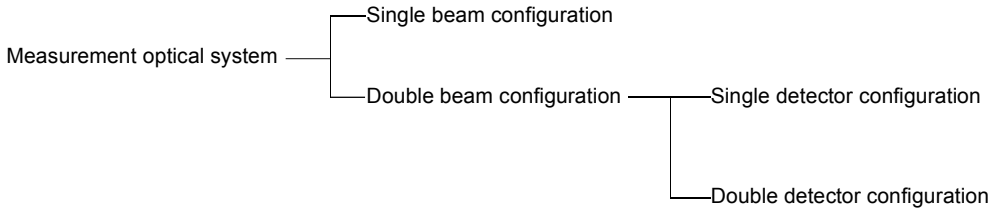


Fig.7-9 Band Width and Peak Height

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.

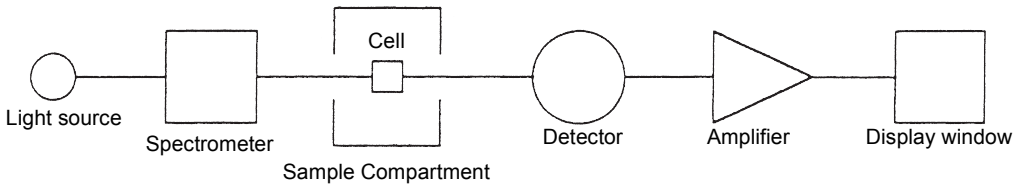


Fig.7-10 Single Beam Configuration

- 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.

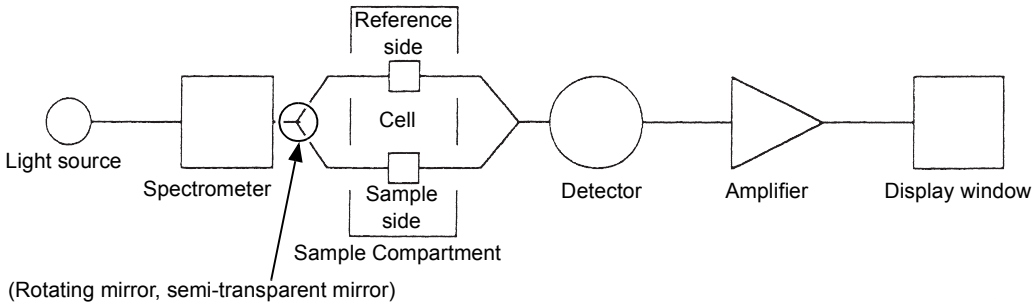
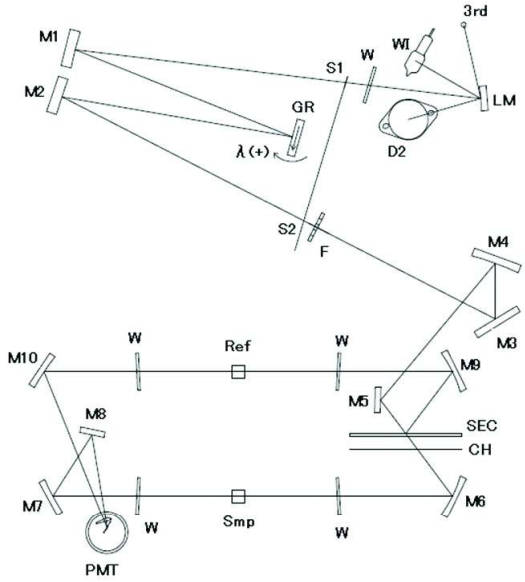


Fig.7-11 Double Beam Configuration

■ Single and Double Detector Configuration

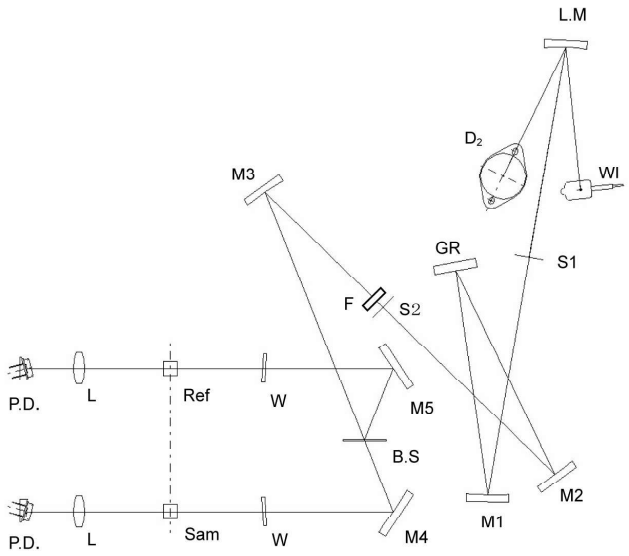
- Double beam - single detector configuration
  In this configuration, a sample beam and reference beam alternately enter one detector. So unlike the double-detector configuration, the result is less likely to be influenced by the difference in characteristics of the two detectors.



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-2600i 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.



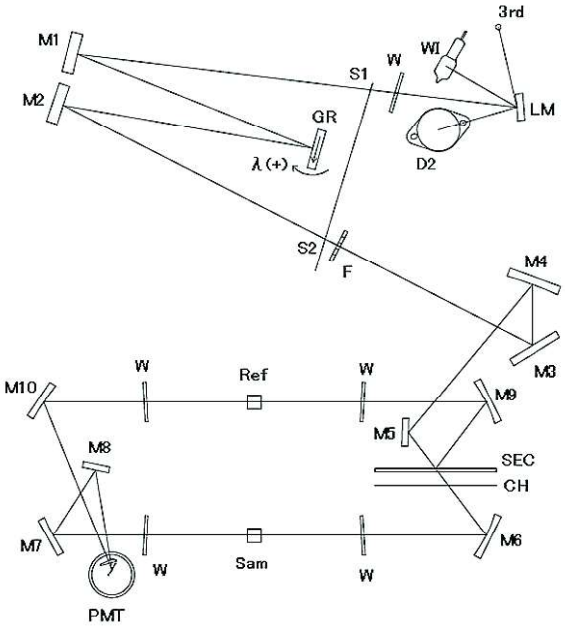
WI: Halogen lamp
D2: Deuterium lamp
W: Window plate
S1-2: Slit
LM: Light source switching mirror
M1-5: Mirror
GR: Grating
F: Filter
B.S.: Beam splitter
Sam: Sample cell
Ref: Reference cell
L: Lens
P.D.: Photodiode

Fig.7-13 Double Beam - Double Detector Configuration

■ Single Monochromator and Double Monochromator

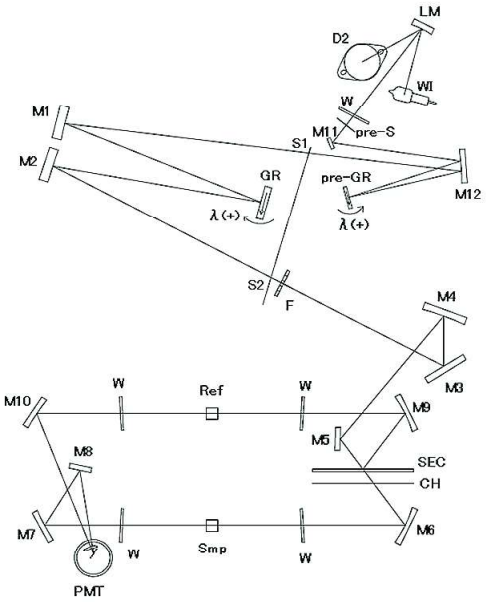
A single monochromator system has one monochromator and a double monochromator system has two monochromators aligned in a series. Accordingly, when two monochromators are aligned in parallel as in the case of a two-wavelength spectrophotometer, the system is not called a double monochromator even though 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-2600i Series)



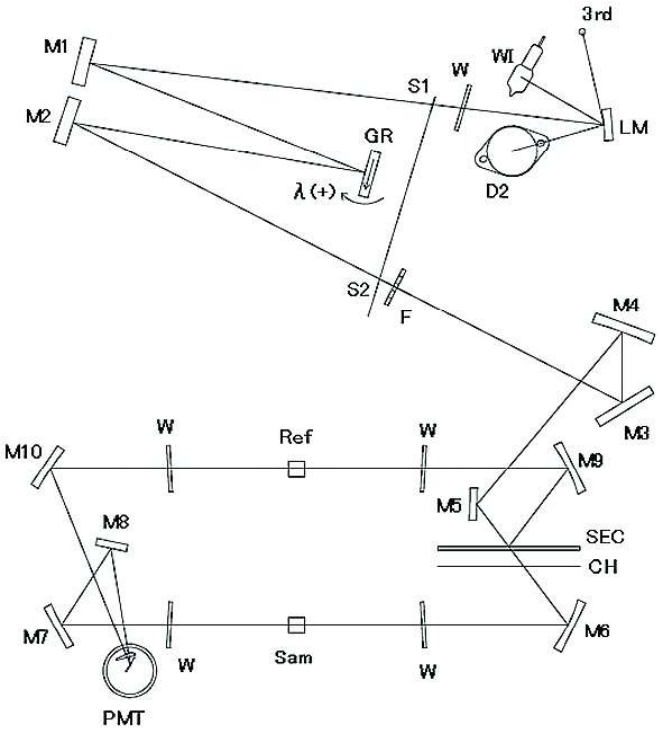
WI: Halogen lamp
D2: Deuterium lamp
LM: Light source switching mirror
W: Window plate
pre-S: Slit
pre-GR: Grating
S1-2: Slit
M1-12: Mirror
GR: Grating
F: Filter
CH: Chopper
SEC: Sector mirror
Sam: Sample cell
Ref: Reference cell
PMT: Photomultiplier

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

7.4 UV-2600i/2700i Measurement System

7.4.1 Optical System

■ UV-2600i 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-2600i)

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".

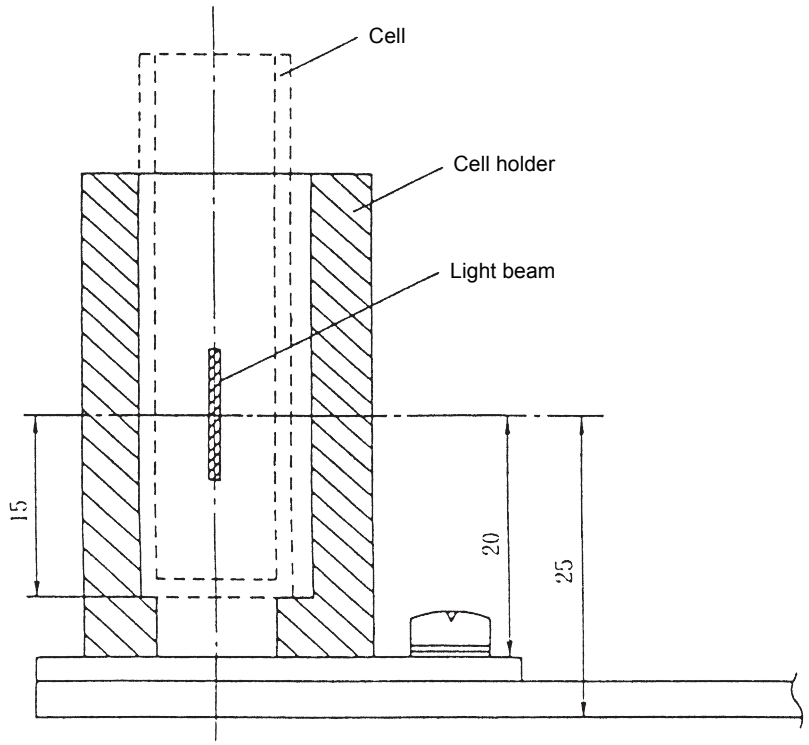
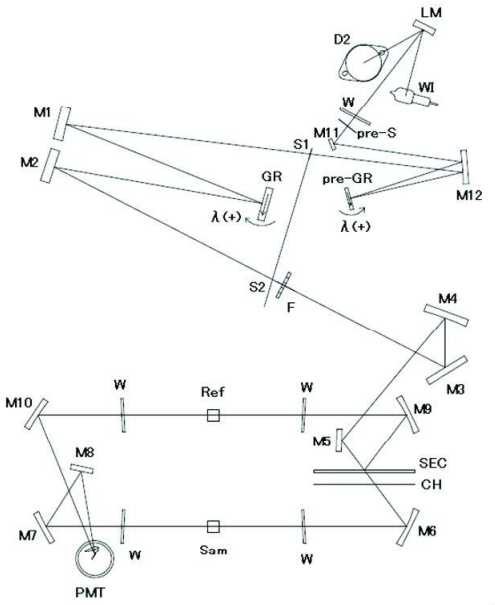


Fig.7-17 Positional Relationship of Cell Holder (Cell) and Light Beam "UV-2600i/2700i"

Table 7-7 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-2700i 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-2700i)

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-2600i 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-2600i/2700i.

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.

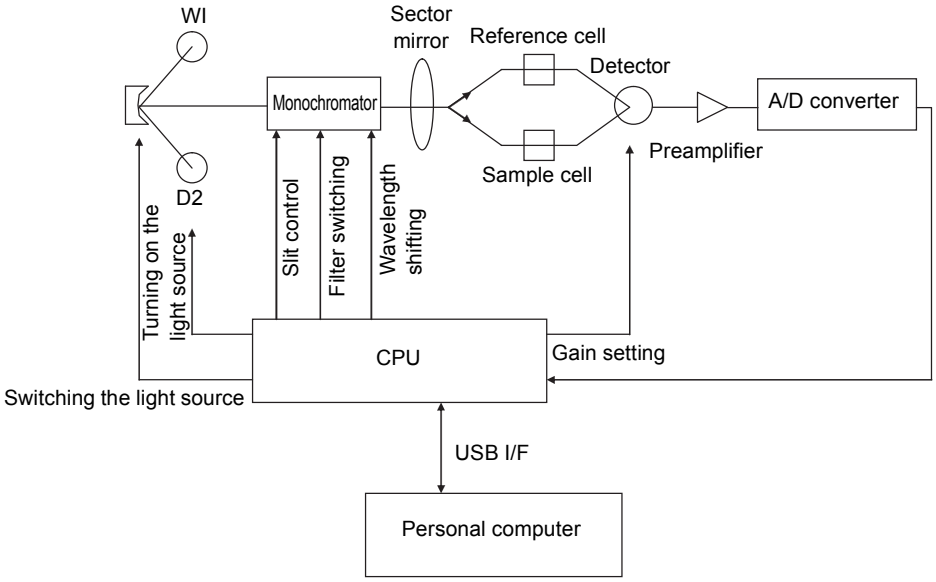


Fig.7-19 Schematic Electrical System

7.5 List of Cells

Table 7-8 List of Optional Cells

Name		Shape	Quartz (S Cell)	Q'ty	Special Holder
Rectangular cell, optical length 10 mm		A	S200-34442	1	Not required.
Rectangular cell, matching type		A	S201-98716	2/sets	Not required.
Rectangular cell with stopper, optical length 10 mm		B	S200-34444	1	Not required.
Semi-micro cell, optical length 10 mm Required sample volume min. 1.0 ml		C	S200-66501	1	Not required.
Semi-micro black cell, optical length 10 mm Required sample volume min. 1.0 ml		D	S200-66551	1	Not required.
Super-micro black cell, optical length 5 mm Required sample volume min. 25 µl		K	S208-92116	1	Ultra Micro Cell Holder (S206-14334) is req'd.
Super-micro black cell, optical length 10 mm Required sample volume min. 50 µl		L	S200-66578-11	1	Ultra Micro Cell Holder (S206-14334) is req'd.
Micro black cell, optical length 10 mm Required sample volume min. 50 µl		M	S200-66578-12	1	Ultra Micro Cell Holder (S206-14334) is req'd.
Cylindrical Cell (OD 25 ϕ) (ID 22 ϕ)	l (Optical Length) = 10 mm	E	S200-34448 (Quartz Window)	1	Cylindrical Cell Holder (S204- 06216) req'd.
	l = 20 mm		S200-34472 (Quartz Window)	1	
	l = 50 mm	F	S200-34473-01 (Quartz Window)	1	
	l = 100 mm		S200-34473-02 (Quartz Window)	1	
Rectangular Long Absorption Cell	l = 20 mm	G	S200-34446	1	Long-Path Rectangular Cell Holder (S204- 23118-01) req'd.
	l = 50 mm		S200-34944	1	
	l = 100 mm		S200-34676	1	
Short Optical Length Cell	l = 1 mm	H	S200-34660-01	1	Short Optical Length Cell Spacer req'd.
	l = 2 mm		S200-34655	1	
	l = 5 mm		S200-34449	1	
Spacer for Short Optical Length Cell	For 1 mm	J	S204-21473-03	1	Not required.
	For 2 mm		S204-21473-01	1	
	For 5 mm		S204-21473-02	1	
Micro Multi-Cell (8 cells) Required Sample Volume 100 µl		N	S208-92089	1	Micro Multi-Cell Holder (S206-53945-91) req'd.
Micro Multi-Cell (16 cells) Required Sample Volume 100 µl		P	S208-92088	1	Micro Multi-Cell Holder (S206-53945-91) req'd.

Name	Shape	Quartz (S Cell)	Capacity	Optical Width of Cell	Special Holder	Remarks
Flow Cell, optical length 10 mm	I	S200-34670	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	S208-92114	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	S208-92113	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	S208-92005	390 µl	3.5 × 11	Not required.	With Tube

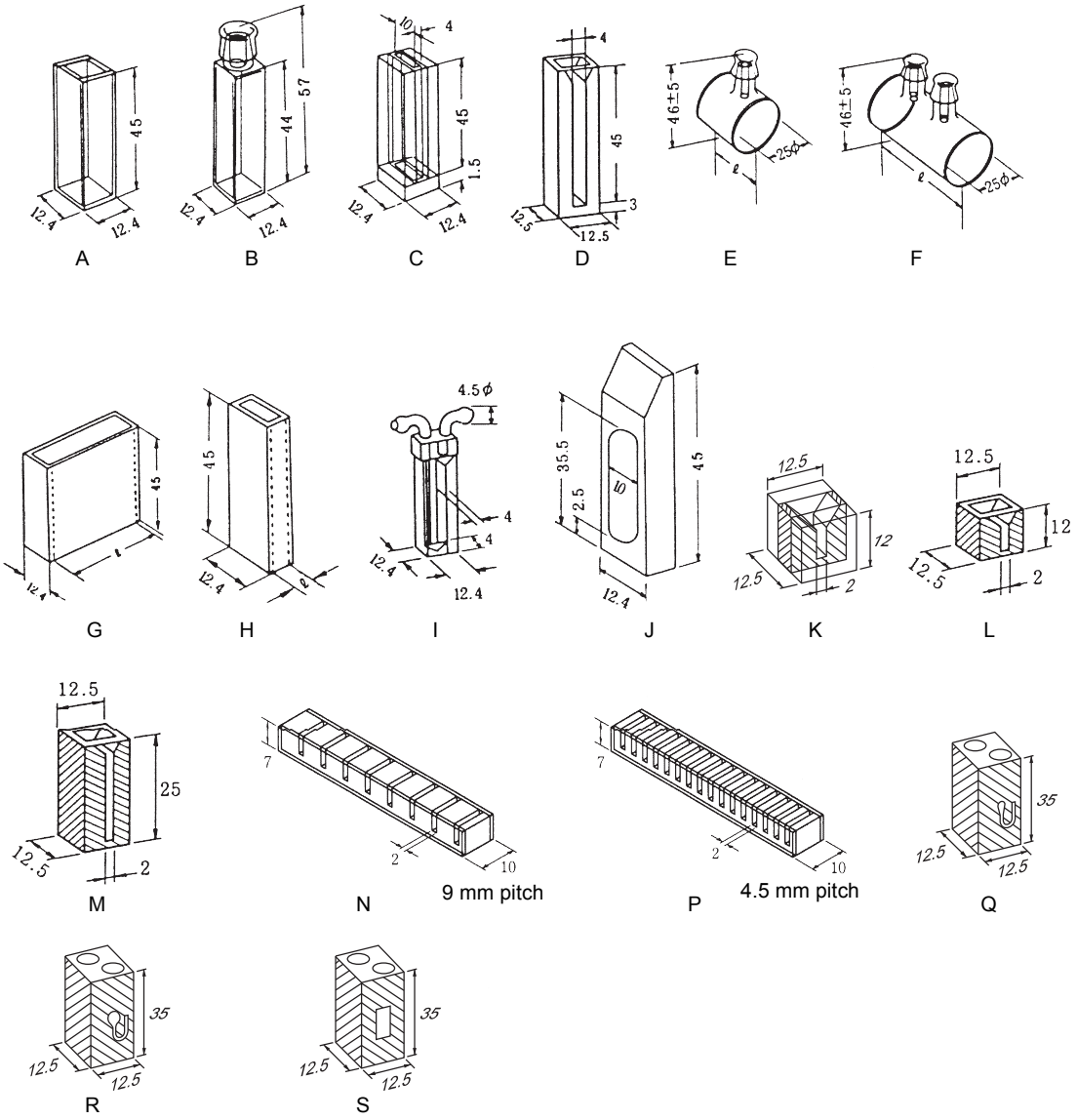


Fig.7-20 Optional Cell Shapes

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

This page is intentionally left blank.