

P-2000

Polarimeter

Hardware/Function Manual

Jasco

Safety Considerations

To ensure operation safety, this instrument must be operated correctly and maintained according to a regular schedule. Read carefully to fully understand all safety precautions in this manual before operating the instrument. To avoid injuries or health hazards, strictly follow the safety precautions mentioned in this manual. Please take a moment to understand what the signal words **WARNING!**, **CAUTION**, and *Note* mean in this manual.

(1) Safety symbols



Instruction manual symbol. If the product is marked with this symbol, refer to the instrument manuals to protect the instrument against damage.

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

CAUTION A **CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against damaging the equipment.

Do not proceed beyond a **WARNING!** or **CAUTION** notice until you understand the hazardous conditions and have taken the appropriate steps.

Note A *Note* provides additional information to help the operator achieve optimal instrument performance.

(2) Warning Label

Warning labels are attached at several locations on this instrument. Do not remove, deface or damage the warning labels. If a warning label peels off the instrument or becomes illegible, contact your local JASCO distributor and state the part number of the label you want to replace.



Figure 1 Warning label

1) Warning for fuse (Fig.2)

Only use fuses of the designated rating to protect both operator and instrument from fire and other hazards. Whenever replacing the lamp, be sure to turn the “Power” switch OFF and unplug the power cable from the power outlet to avoid the risk of electric shock and other hazards.

2) Warning for ground (Fig.2)

If the instrument is not correctly grounded, you may receive an electric shock. Correctly ground the instrument using the grounding terminal on the power board. Do not use water pipes for grounding since they are often made of nonmetals. For safety reasons, do not use gas piping for grounding.

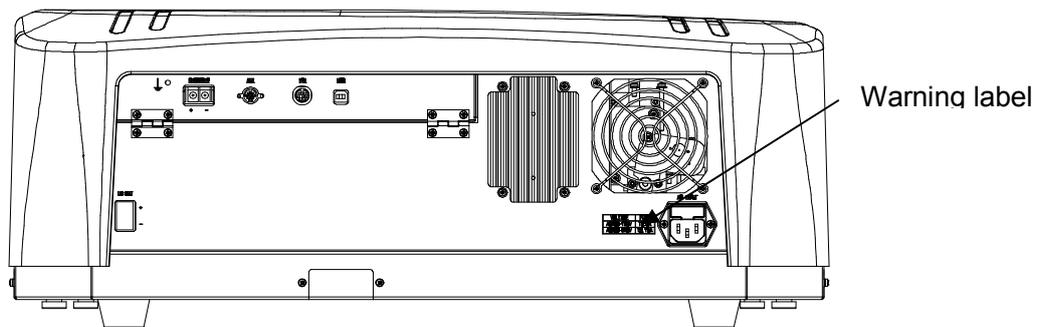
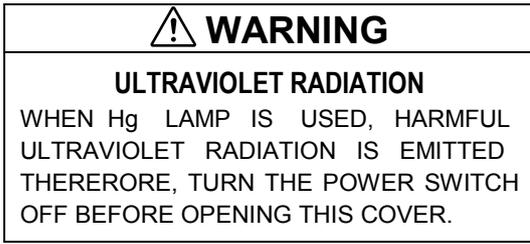


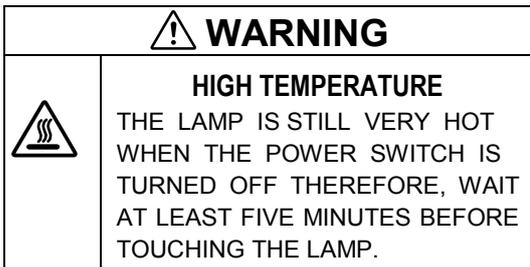
Figure 2 P-2000 rear panel

3) Warning for ULTRAVIOLET RADIATION (1 on Fig. 3)



Part No.:0822-0116A

4) Warning for HIGH TEMPERATURE (2 on Fig. 3)



Part No.:0822-0118A

(3) Warning for carrying

The weights of the instruments are as follows: P-2000: 25 kg. When carrying the instrument, hold the carrying handle at the bottom of the instrument firmly (see Fig. 3).

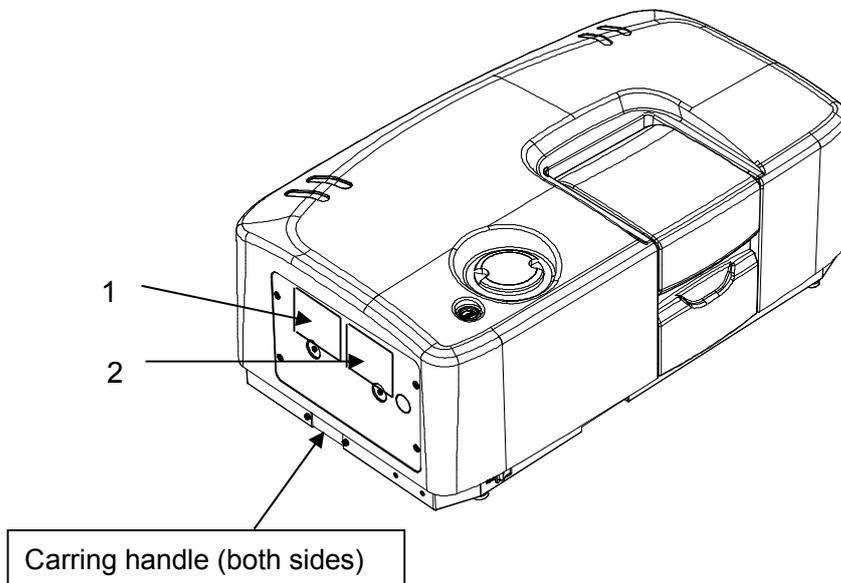


Figure 3 Left side view of P-2000

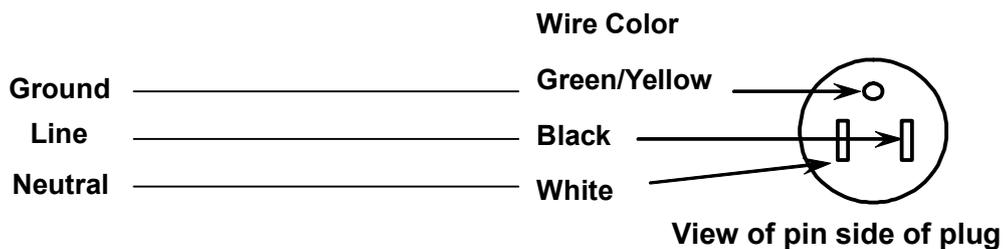
Connecting the power cable

WARNING!: The green/yellow ground core of the mains lead must be connected to a ground that complies with the local electricity supply authority (or equivalent body). The instrument is dangerous if not correctly grounded.

240 Volt (nominal) Supply

	Wire Color
Ground	Green/Yellow
Line	Brown
Neutral	Blue

115 Volt (nominal) Supply



Note: Instruments intended for operation at 115 V, 60 Hz are supplied with a mains cable with a molded plug and socket.

Regulatory Statement

CE Notice

The **CE** symbol indicates compliance of this JASCO system to the EMC (Electromagnetic Compatibility) and Low Voltage Directives of the European Community. This symbol indicates that this JASCO system meets the relevant basic safety and health requirements of the EC Directive based on the following technical standards:

- EN61326-1: "Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements"

<p>WARNING! This is a Class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take corrective measures.</p>
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- IEC61000-3-2: "Electromagnetic compatibility (EMC) Part 3-2: Limits – Limits for harmonic current emissions (equipment input current up to and including 16A per phase) "
- IEC61010-1: "Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements"
- A "Declaration of Conformity" in accordance with the above standards has been made and is on file at JASCO CORPORATION, 2967-5 Ishikawa-machi, Hachioji-shi, Tokyo 192-8537, JAPAN.

Preface

This instruction manual is your guide for using this instrument. It instructs first-time users on how to use the instrument, and serves as a reference for experienced users.

Before using the instrument, please read this instruction manual carefully, and make sure that the contents are fully understood. This manual should be easily accessible to the operator at all times during instrument operation. When not using the instrument, keep this manual in a safe place. If this instruction manual becomes lost, order a replacement from your local JASCO distributor.

Servicing

Contact your local JASCO distributor for instrument servicing. In addition, contact your JASCO distributor before moving the instrument to another location. Consumable parts should be ordered according to part number from your local JASCO distributor. If a part number is unknown, give your JASCO distributor the model name and serial number of your instrument.

Do not return contaminated products or parts that may constitute a health hazard to JASCO employees.

Installation Requirements

To ensure operation safety, observe the following conditions:

- (1) Do not operate the instrument under voltage fluctuations exceeding 10% of the recommended line voltage. Otherwise, the instrument may not function properly.
- (2) Frequency or spike noise in the power supply should be minimal.
- (3) Ensure that the instrument is grounded.
- (4) Operate the instrument in a temperature range of 15 to 30 °C.
- (5) Operate the instrument in a humidity range of 35 to 85% (RH). JASCO recommends operating the instrument in humidity below 60% to avoid the deterioration of the optical components due to the condensation caused by high humidity.
- (6) Operate the instrument in an atmospheric pressure range of 750 to 1060 hPa.
- (7) Avoid strong magnetic fields and sources of high frequency. The instrument may not function properly when near a strong magnetic field or high frequency source.
- (8) Avoid vibration from vacuum pumps, electric motors, processing equipment and machine tools.
- (9) Avoid dust and corrosive gas. Do not install the instrument where it may be exposed to dust, especially in locations exposed to outside air or ventilation outlets that discharge dust particles.
- (10) Do not install the instrument in a location where it may be exposed to direct sunlight.
- (11) Install the instrument in a horizontal and stable position. (This includes a table or desk upon which the instrument is installed.)
- (12) Ensure that no air conditioner blows air directly onto the instrument. This may prevent stable measurement.
- (13) Install the instrument in a location that ensures sufficient space around and beneath it for efficient air circulation and allows easy access for maintenance.

<p><i>Note: The above conditions do not guarantee optimal performance of this instrument.</i></p>

Notices

- (1) JASCO shall not be held liable, either directly or indirectly, for any consequential damage incurred as a result of product use.
- (2) Prohibitions on the use of JASCO software
 - Copying software for purposes other than backup
 - Transfer or licensing of the right to use software to a third party
 - Disclosure of confidential information regarding software
 - Modification of software
 - Use of software on multiple workstations, network terminals, or by other methods (not applicable under a network licensing agreement concluded with JASCO)
- (3) The contents of this manual are subject to change without notice for product improvement.
- (4) This manual is considered complete and accurate at publication.
- (5) This manual does not guarantee the validity of any patent rights or other rights.
- (6) If a JASCO software program has failed causing an error or improper operation, this may be caused by a conflict from another program operating on the PC. In this case, take corrective action by uninstalling the conflicting product(s).
- (7) *Windows* is a registered trademark of *Microsoft Corporation* in the United States and other countries. In general, company names and product names are trademarks or registered trademarks of the respective companies. However, the TM and [®] marks are not used in all cases in this manual.
- (8) When disposing of the instrument, parts, and waste solvents, take appropriate measures in compliance with applicable regulations regarding waste disposal, and correctly dispose of them by yourself, or entrust disposal to a licensed industrial waste disposal company. In any case, comply with the regulations in your country, state, region or province to ensure they are disposed of legally and correctly.
- (9) JASCO and the JASCO logo are registered trademarks of JASCO Corporation in Japan and other countries.

Limited Warranty

Products sold by JASCO, unless otherwise specified, are warranted for a period of one year from the date of shipment to be free of defects in materials and workmanship. If any defects in the product are found during this warranty period, JASCO will repair or replace the defective part(s) or product free of charge.

THIS WARRANTY DOES NOT APPLY TO DEFECTS RESULTING FROM THE FOLLOWING:

- (1) IMPROPER OR INADEQUATE INSTALLATION
- (2) IMPROPER OR INADEQUATE OPERATION, MAINTENANCE, ADJUSTMENT OR CALIBRATION
- (3) UNAUTHORIZED MODIFICATION OR MISUSE
- (4) USE OF CONSUMABLE PARTS NOT SUPPLIED BY AN AUTHORIZED JASCO DISTRIBUTOR
- (5) CORROSION DUE TO THE USE OF IMPROPER SOLVENTS, SAMPLES, OR DUE TO SURROUNDING GASES
- (6) ACCIDENTS BEYOND JASCO'S CONTROL, INCLUDING NATURAL DISASTERS

This warranty does not cover the consumable parts listed below:

- (1) Tungsten lamp, and other light sources
- (2) Mirrors in the light source section, and cell windows
- (3) Fuses, batteries, glassware, chart paper and ink

THE WARRANTY FOR ALL PARTS SUPPLIED AND REPAIRS PROVIDED UNDER THIS WARRANTY EXPIRES ON THE WARRANTY EXPIRATION DATE OF THE ORIGINAL PRODUCT. FOR INQUIRIES CONCERNING REPAIR SERVICE, CONTACT YOUR JASCO DISTRIBUTOR AFTER CONFIRMING THE MODEL NAME AND SERIAL NUMBER OF YOUR INSTRUMENT.

JASCO Corporation
2967-5, Ishikawa-machi, Hachioji-shi
Tokyo 192-8537
JAPAN

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1. Unpacking and Installing

WARNING!: This section is intended for trained JASCO service engineers. If the user attempts unpacking and installing, injury may result. Please leave unpacking and installing to a JASCO service engineer.

CAUTION: Use this manual when unpacking/installing the instrument in conjunction with a JASCO service engineer's instructions in the case of a problem.

CAUTION: The analyzer mechanism, light source exchange mirror unit and lamps are secured by lock screws to protect them from being damaged during shipping. Please enable operation according to the instructions given in Section 1.2.

1.1 Unpacking

(1) Unpacking the main unit

Take the main unit out of the carton and make sure that the serial No. displayed on the serial No. label located on the left side of the unit and the serial No. on the inspection certificate are identical. Also ensure that the line voltage is consistent with the power requirement of the instrument.

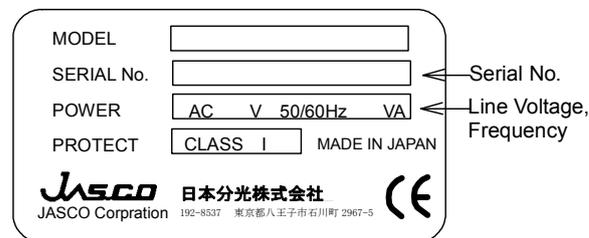


Figure 1.1 Serial No. label

(2) Unpacking the Standard Accessories

Remove the standard accessories from the carton and check them against the packing list. The specifications of each model covered in this manual are given below. If any item is missing or damaged, contact your local JASCO distributor.

Table 1.1 List of standard accessories for P-2000 iRM type

Component	Qty	Remarks
Intelligent remote module(iRM)	1	
iRM touch pen	1	
Compact flash card	1	iRM-800
Card adapter	1	iRM-800
USB memory	1	iRM-1100
Time-delay fuse	2	100 V series: 5 A, 200 V series: 4 A
Cell retainer for water-jacketed cell	1	
Tube for water-jacketed cell	2	5×7 mm, 130 mm
Tube for water-jacketed cell	1	4×7 mm, 300 mm
Tube joint	4	
AC power cable	1	
Software setup CD	1	Spectra Analysis program
Certificate of inspection	1	
Instruction manual	1	

Table 1.2 List of standard accessories for P-2000 PC type

Component	Qty	Remarks
Time-delay fuse	2	100V series: 5 A, 200 V series: 4 A
USB cable	1	
Tube for water-jacketed cell	2	5×7 mm, 130 mm
Tube for water-jacketed cell	1	4×7 mm, 300 mm
Tube joint	4	
AC power cable	1	
Software setup CD	1	
Certificate of inspection	1	
Instruction manual	1	

1.2 Installation

1.2.1 How to Loosen the Analyzer Lock Screw

The analyzer is secured by a lock screw to protect it from vibration during shipping. Loosen the lock screw before turning the power on. When moving the instrument, always be sure to secure the analyzer using the lock screw.

The analyzer lock screw is at the right side of the front of the sample compartment of the polarimeter (Fig. 1.1). Follow the procedure below to loosen the analyzer lock screw.

- (1) Open the sample compartment lid (Fig. 1.2).
- (2) The lock screw for the analyzer can be seen at the right side of the front of the sample compartment. Loosen this screw by turning it counterclockwise by about two rotations and move it back until it stops, then turn it clockwise to fix it in position. This operation releases the analyzer.

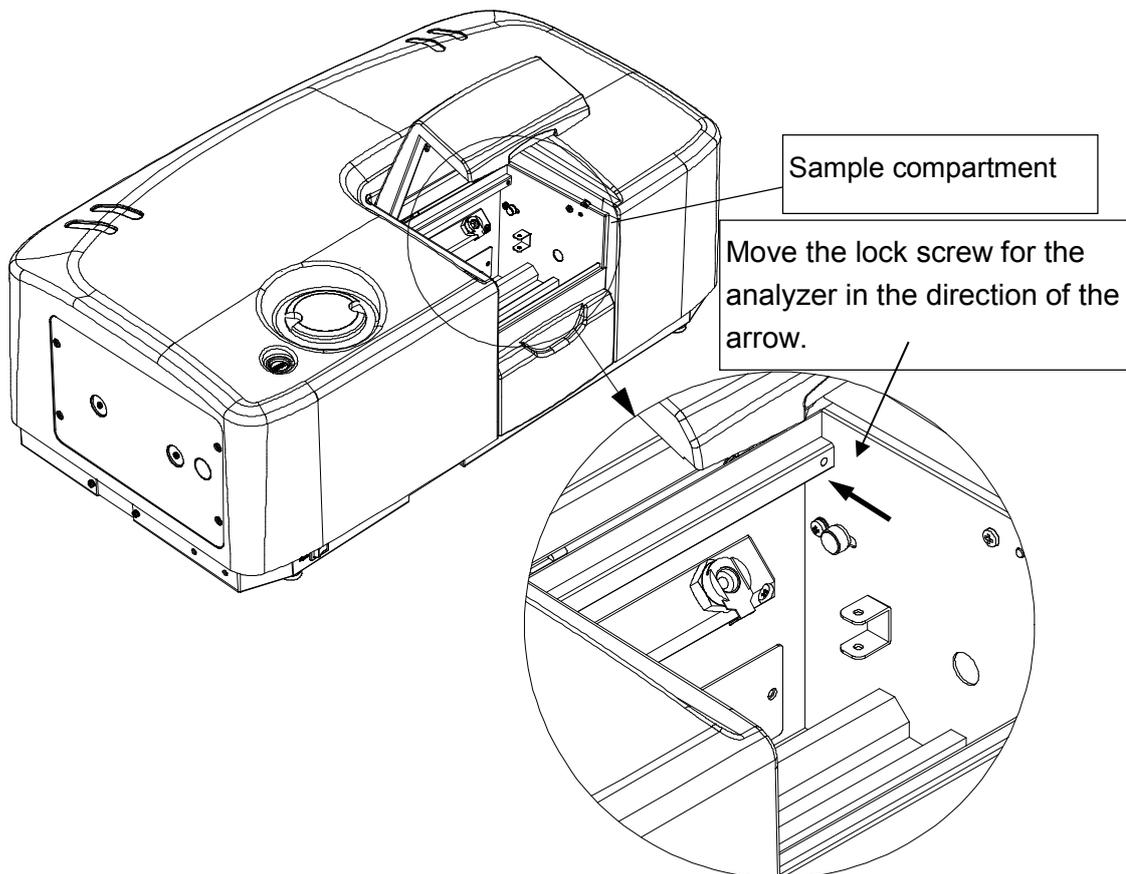


Figure 1.2 Overview of the polarimeter (loosing the lockscrew for the analyzer)

1.2.2 How to Remove the Lock Screw for the Light Source Exchange Mirror

Note: *The light source exchange mirror is an optional accessory.*

The light source exchange mirror is secured by a lock screw to protect it from vibration during shipping. Loosen the lock screw before turning the power on. When moving the instrument, always be sure to secure the light source exchange mirror using the lock screw.

The lock screw for the light source exchange mirror is on the left side of the bottom of the filter insertion part of the polarimeter (Fig. 1.3). Follow the procedure below and loosen the screw for the light source exchange mirror.

- (1) Use a Phillips-head screwdriver.
- (2) There is a lid on the left of the case (Fig. 1.3). Remove the lid by rotating it.
- (3) The lock screw can be seen on the left side of the bottom of the filter insertion part (Fig. 1.4). Turn this screw counterclockwise using a Phillips-head screwdriver and raise it by about 1 cm. This operation makes the light source exchange mirror active.
- (4) Upon completion of the unlocking, re-install the lid.

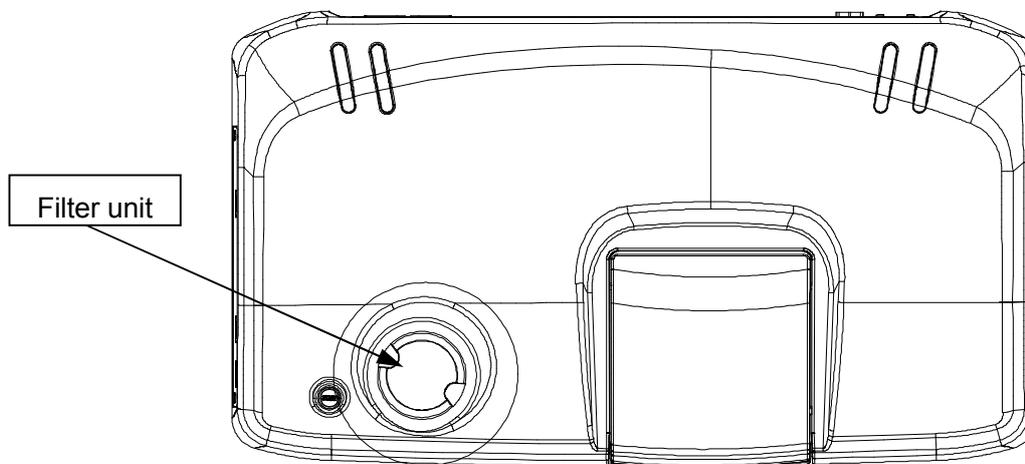


Figure 1.3 Filter unit

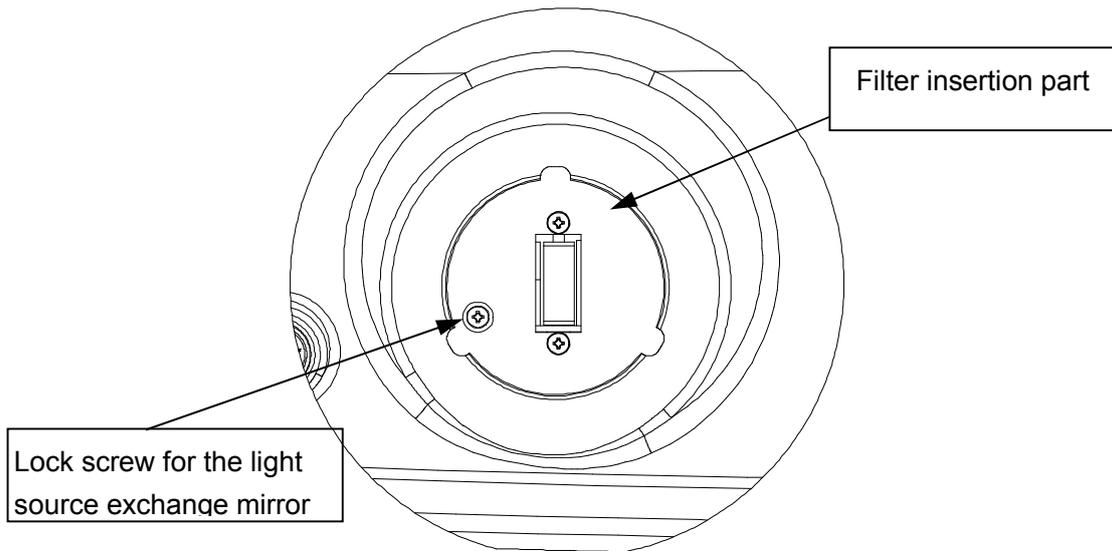


Figure 1.4 Filter insertion part

1.2.3 How to Mount the Lamps

The lamps are removed from the polarimeter to protect them from vibration during shipping. Remove the lamp cover before turning on the polarimeter (Fig. 1.5), and install the lamps as follows (Fig. 1.6).

- (1) Remove the lamp socket from its case.
- (2) Insert the lamp socket into the lamp housing by aligning the pins of the lamp housing with the socket holes.
- (3) Tighten the fixing screw of the lamp socket.
- (4) Mount the lamp housing cover.

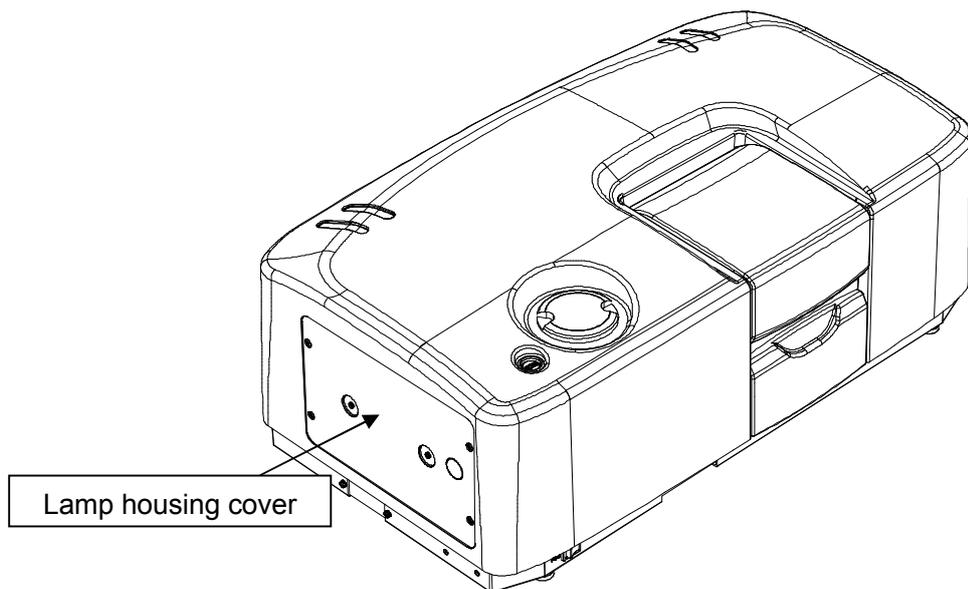


Figure 1.5 P-2000 Lamp housing cover

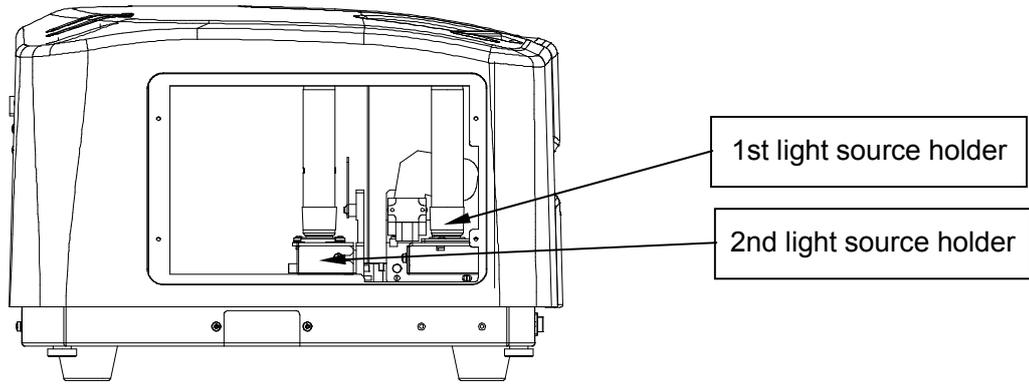


Figure 1.6 Lamp housing

1.3 Connecting the Connector

Note: *Be certain to comply with the instrument installation requirements described in this manual (see page viii). Failure to comply with these requirements can cause faults with the instrument.*

1.3.1 Preparation

Prepare a table which is capable of supporting a weight of about 50 kg (this amount varies according to instrument) and has an area of 700 mm (length) × 600 mm (width) when using the iRM type. If using a PC as well, prepare a table which is capable of supporting a weight of about 70 kg (this amount varies according to instrument) and has an area of 700 mm (length) × 1500 mm (width), allowing space for a printer.

Confirm that the Power switch on the polarimeter is turned OFF. For the PC type, confirm that the Power switch on the PC is also turned OFF.

1.3.2 Connecting the Cable of iRM Type

WARNING!: To prevent injury from an electric shock or other hazards, ensure the instrument is correctly grounded using the grounding terminal on the power board.

CAUTION: For safety reasons, avoid grounding the instrument using either gas piping or water piping, which is often made of insulating materials.

Note: *Use of a 3-pin power plug with a grounding terminal is recommended. Connect the cable from the iRM to the “iRM” connector on the rear of P-2000.*

- (1) Connect the cable from the iRM to the “iRM” connector on the rear of P-2000.
- (2) Connect the AC power cable to the “AC INPUT” connector on the rear of P-2000. Connect the other end of the AC power cable to an electrical outlet.

1.3.3 Connecting the Cable When Using PC

WARNING!: To prevent injury from an electric shock or other hazards, ensure the instrument is correctly grounded using the grounding terminal on the power board.

CAUTION: For safety reasons, avoid grounding the instrument using either gas piping or water piping, which is often made of insulating materials.

Note: *Use of a 3-pin power plug with a grounding terminal is recommended. Connect the USB port located on the rear of P-2000 and the USB port on the PC using the USB cable.*

- (1) Connect the USB connector of the PC to the “USB” connector on the rear of P-2000 using the supplied USB cable.
- (2) Connect the PC and the monitor.

- (3) Connect the AC power cable to the “AC INPUT” connector on the rear of P-2000. Connect the other end of the AC power cable to an electrical outlet.
- (4) Connect the AC power cables to the AC input connector of PC and monitor. Connect the other ends of the AC power cables to an electrical outlet.

After completing the wiring, turn ON the POWER switch on the rear of the polarimeter. Initialization of the polarimeter starts. Initialization takes about seven minutes.

1.4 How to Connecting the Constant-Temperature Circulation Water

When the water jacket cell is used, connect the constant-temperature circulation water bath with the instrument according to the following procedure.

- (1) Connect the tube to the water jacket cell and connect the supplied joint to the opposite end of the tube, then insert it into the connector of the sample compartment of the P-2000 (Fig. 1.7).
- (2) Connect the supplied joint to the tube from the constant-temperature circulation water and insert it into the inlet on the right side of the polarimeter (Fig. 1.8).

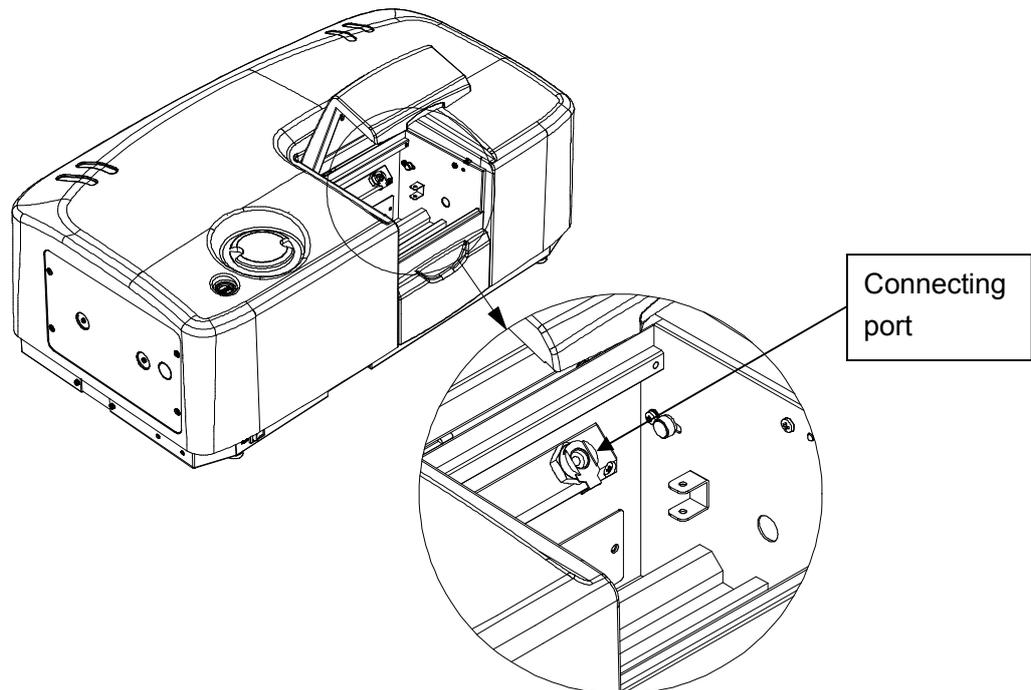


Figure 1.7 P-2000 connecting port of the tube for the water jacket cell

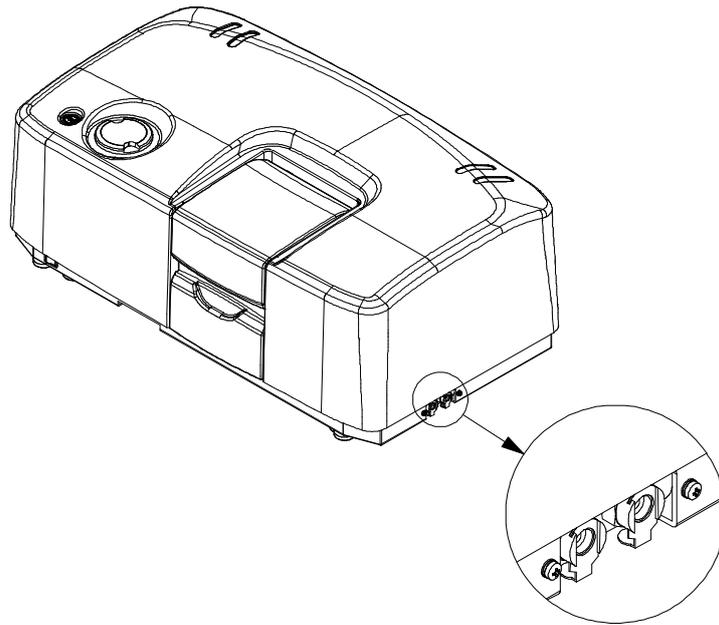


Figure 1.8 P-2000 inlet port for the constant-temperature circulation water

Note: When the constant-temperature circulation water will not be used for a long time, drain the water from the pipes in the instrument using air, etc.

1.5 How to Change the Position of the Port for the Constant-Temperature Circulation Water

The port for the constant-temperature circulation water is usually located on the right side of the instrument, but its location can be adjusted in accordance with the setting conditions. Change its location using the following procedure.

- (1) Loosen the two fixing screws of the port of the constant-temperature circulation water on the right side of the instrument (Fig. 1.9 (1)).
- (2) Fix the tube for circulation water using the clamp near the desired location (Figs. 1.9 and 1.10).
- (3) Fix the port of the constant-temperature circulation water to the desired destination base using the two fixing screws.

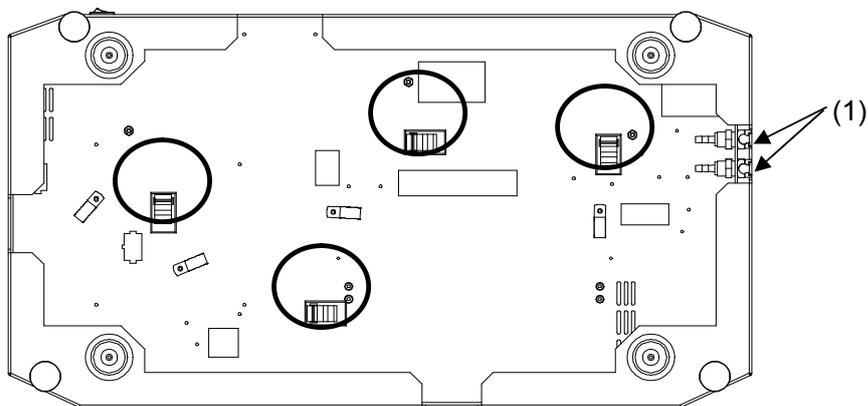


Figure 1.9 Bottom of the P-2000

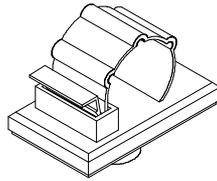


Figure 1.10 Clamp for the tube located at the rear of the base

1.6 How to Mount the Retainer for the Water Jacket Cell for RSC-200

When the water jacket cell is used, attaching the cell to the cell holder using the supplied cell retainer can prevent the cell from shaking with the circulation water tube. Mount the cell retainer according to the following procedure.

- (1) Fix the cell retainer included with the polarimeter using the fixing screw (Fig. 1.11).
- (2) Adjust the position of the cell retainer mounting depending on the path length (Fig. 1.12).

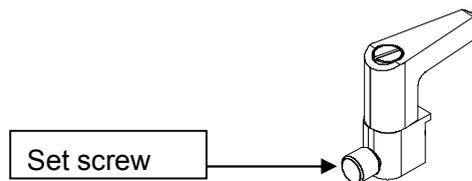


Figure 1.11 Cell retainer for the water jacket cell

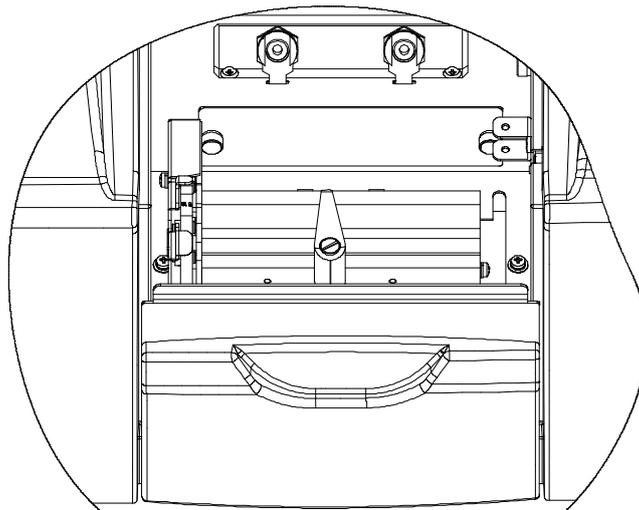


Figure 1.12 Set up when the cell retainer is inserted on the cell holder.

2. Specifications

Faraday cell:	Flint glass
Polarizer:	Dichrome
Max. path length:	100 mm
Detector:	Photomultiplier tube
Measurement method:	Optical zero method with symmetric angle oscillation
Measurement angle range:	$\pm 90.0000^\circ$
Minimum display angle:	0.0001°
Response speed	$6^\circ/\text{sec}$
Integration time:	1 to 100 sec
Measurement accuracy:	$\pm 0.002^\circ$ ($\pm 1^\circ$ or less), 0.2% ($\pm 1^\circ$ or above)
Repeatability of zero:	$\pm 0.002^\circ$
Analog output:	full scale: 1° , 10° , 100° changeover $\rightarrow \pm 1 \text{ V}$ ($\pm 1\%$)
LC output:	$\pm 0.5^\circ \rightarrow \pm 5 \text{ V}$ ($\pm 3\%$ 589 nm (WI))
Temperature measurement point:	Within cell holder/cell
Temperature measurement range:	0.0 to 99.9°C (minimum display unit 0.01°C)
Temperature reading:	Reading after A/D conversion
Temperature accuracy:	$\pm 0.1^\circ\text{C}$ (when the difference between the displayed temperature and temperature in the cell is in the range 15 to 40°C)
External terminal:	"iRM" "USB" "AUX" "Recorder" "LC Out"
Dimensions; Weight:	635 (W) \times 364 (D) \times 249 (H) mm; 25 kg
Power requirements:	AC 100 to 240 V 50/60 Hz 280 VA
Optional accessories:	Light source (Na, Hg, WI) Filter Sample compartment Light source exchange mirror Polarizer (Glan-Taylor prism) Faraday cell (quartz)
Measurement wavelength:	Interference filter (880, 633, 589, 578, 546, 436, 405, 365 nm) Interference filter (334, 325, 313, 302, 296, 280, 253 nm) These filters are for use with the quartz Faraday cell.)

3. Hardware Structure

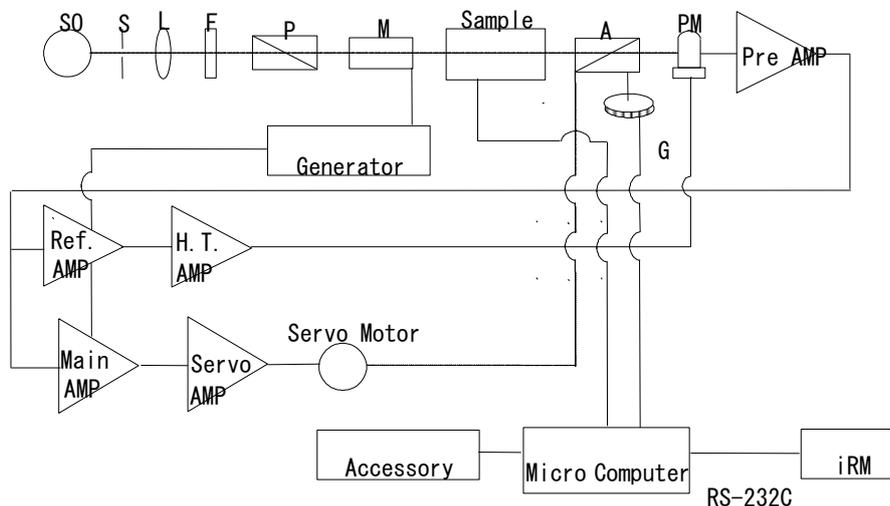
Figure 1.1 shows a schematic diagram of the polarimeter. Light from the light source (light source, SO) passes through slit S, lens L, and filter F before passing through polarizer P. The light between the light source and filter F is unpolarized. This unpolarized light is linearly polarized by the polarizer P. The linearly polarized light then passes through modulator M, the sample compartment, and analyzer A before entering the photomultiplier tube PM for detection.

Note 1 Because the slit is used to keep the diameter of the beam constant, it has two settings for its diameter, 1 mm and 2 mm. The slit synchronizes with the sample compartment aperture and changes automatically.

Aperture diameter of the sample compartment	8mm	3.5mm	1.8mm
Slit diameter	2mm	1mm	1mm

Note 2 The slit of the Hg lamp holder has only $\phi 1\text{mm}$.

The light incident on the detector (PM) is converted into an electrical signal, and is then converted into a digital signal by the A/D converter for input in a microcomputer. The signal processed by the microcomputer is output on the display of the iRM or the monitor of a PC as optical rotation, specific optical rotation, concentration, sugar scale, Brix purity or optical purity depending on the measurement mode that has been set.



SO: Light source S: Slit L: Lens F: Filter P: Polarizer
M: Modulator A: Analyzer PM: Photo multiplier tube G: Gear

Figure 3.1 Schematic diagram

In this polarimeter, a Dichrome sheets are used for the polarizer and analyzer. The axes of the two dichromes are crossed (solid lines in Fig. 3.2). No light enters the detector in this condition. When an optically active material is placed in the sample compartment, the plane of rotation of

the light from the polarizer will be rotated by an angle α , the magnitude of which depends on the degree of polarization of the sample. This condition is indicated by P' in Fig. 3.2. The photomultiplier tube PM detects the intensity of the light which depends on the magnitude of α . When analyzer A is rotated by α degrees, light will again cease to enter the detector. Thus the rotation angle of the sample can be found by working backwards and determining the rotation angle of the analyzer which extinguishes the light.

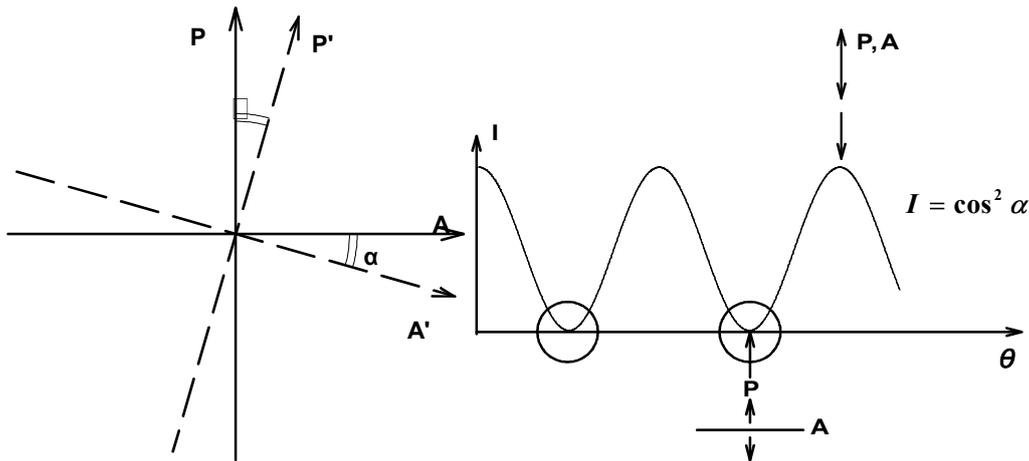


Figure 3.2 Rotation of plane of polarization

Figure 3.3 Light intensity of polarimeter on rotating polarizer

When polarizer P is fixed in a given direction and analyzer A is rotated, if the angle between the polarization axes of P and A is taken to be θ , the relationship between intensity I and θ will be that shown in Fig. 3.3 and can be expressed as $I = \cos^2 \theta$.

Sign $I = \cos^2 \theta$, if θ is varied near 90° , when the axes of P and A are crossed, high accuracy measurements will be difficult since the variation of I will be small. To solve this problem, the instrument uses the optical null-balance method with symmetric angular oscillation using a Faraday cell. Symmetric angle oscillation involves modulating the plane of polarization and measuring the signal as a function of the modulation frequency. The noise caused by signal components of other frequencies can be eliminated, making high sensitivity measurement possible.

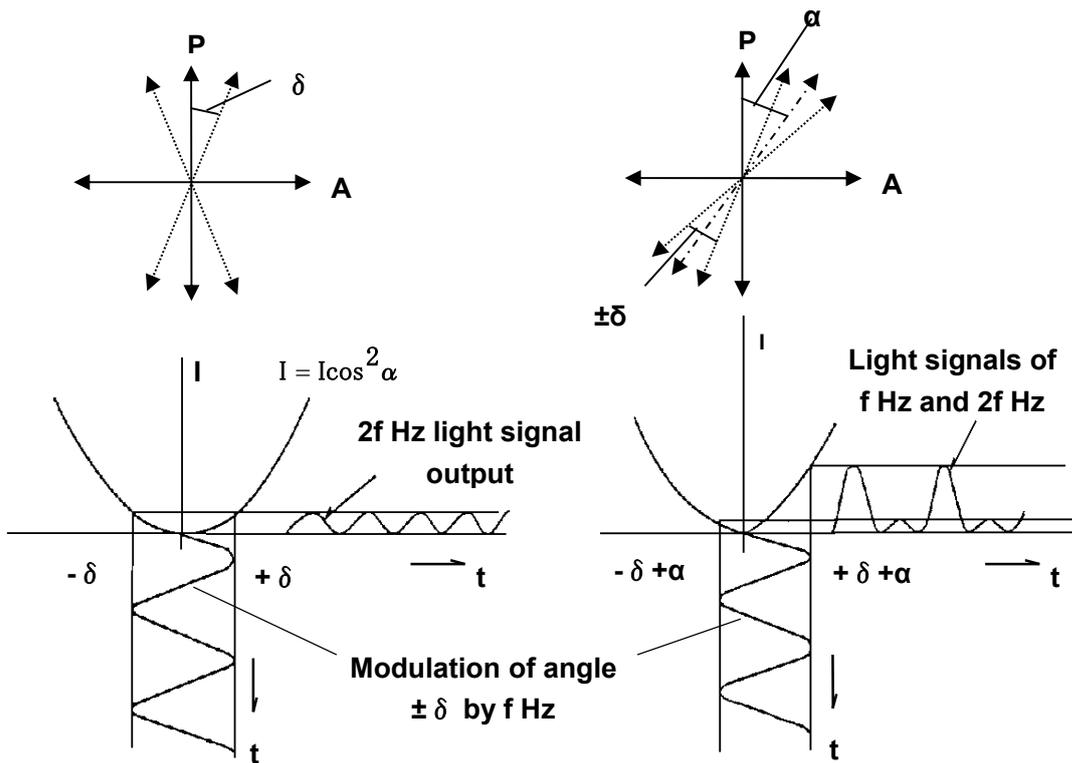


Figure 3.4 Symmetric angular oscillation method (when a sample is not inserted)

Figure 3.5 Symmetric angular oscillation method (when a sample is inserted)

First, consider the setup when there is no sample in the sample compartment. The polarization axes of P and A are crossed and the plane of polarization of the light rays exiting P are made to oscillate left and right in a sine wave having an amplitude of $\pm \delta$ using the Faraday cell. This is called the plane of polarization modulation. The variation of the intensity with time is shown in Fig. 3.4. If the modulation frequency is taken to be f Hz, the intensity of the signal will have a frequency of $2f$ Hz from Fig. 3.4.

Next, consider the situation when a sample is inserted in the sample compartment. Since the plane of polarization of the light from the polarizer will be rotated by an angle α the magnitude of which depends on the rotation angle of the sample, the situation will be that shown in Fig. 3.5 and the f Hz and $2f$ Hz signals will be mixed.

In other words, when the sample rotates the angle of polarization, an f Hz frequency signal will appear. The light signal of this f Hz component is photoelectrically converted in the photomultiplier tube, and then converted into a DC signal by synchronized rectification. The DC signal is input into a servo loop that rotates the analyzer to the position where f -Hz signal is extinguished. Therefore, analyzer A always stops rotating when f Hz is extinguished.

4. Names and Functions of Components

4.1 Appearance of Polarimeter

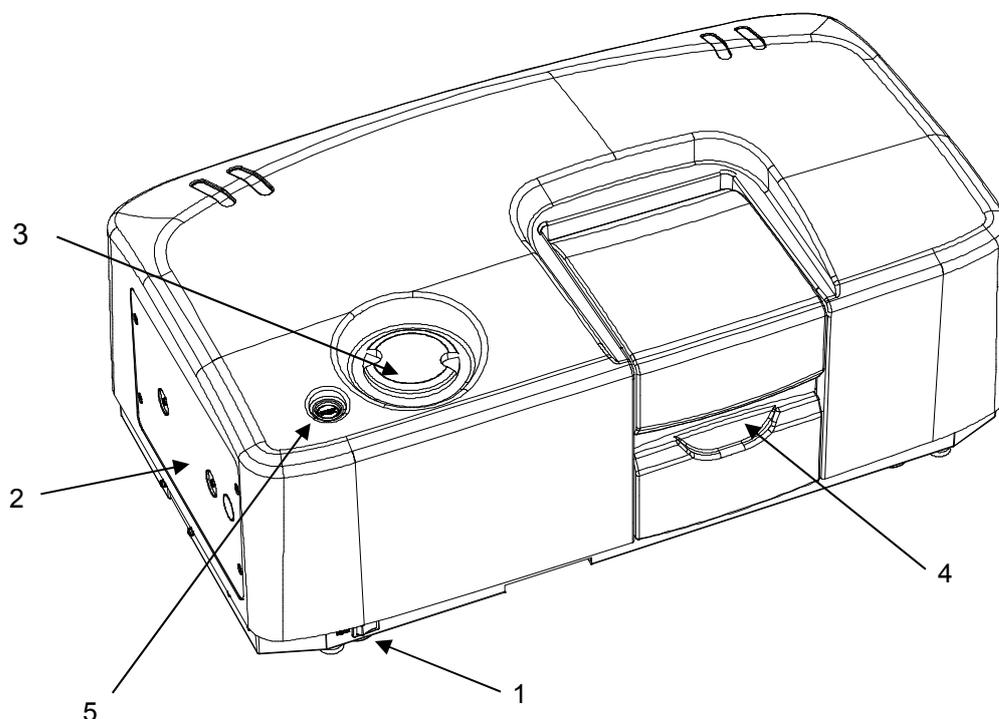


Figure 4.1 Appearance of polarimeter

Component	Function
1 "Power" switch	Power switch. Pressing the switch to the right turns the polarimeter "ON".
2 Lamp housing	The lamp is housed here.
3 Filter unit	Contains an interference filter for changing the wavelength.
4 Sample compartment	Includes the cell holder, light beam aperture changer, and sensors (2 pcs.) for temperature measurement. The aperture adjuster can be set to 8 mm (normal), 3 mm, or 1.8 mm (for micro cell). Always set the sensor for measuring the cell holder temperature in position. When the sensor for measuring the cell holder temperature is used, ensure that it does not block the light path.
5 "Start" lamp	The lamp lights up on when the power switch is turned on. The power lamp also functions as the start switch for measurements.

4.2 Rear Panel

P-2000 rear panel

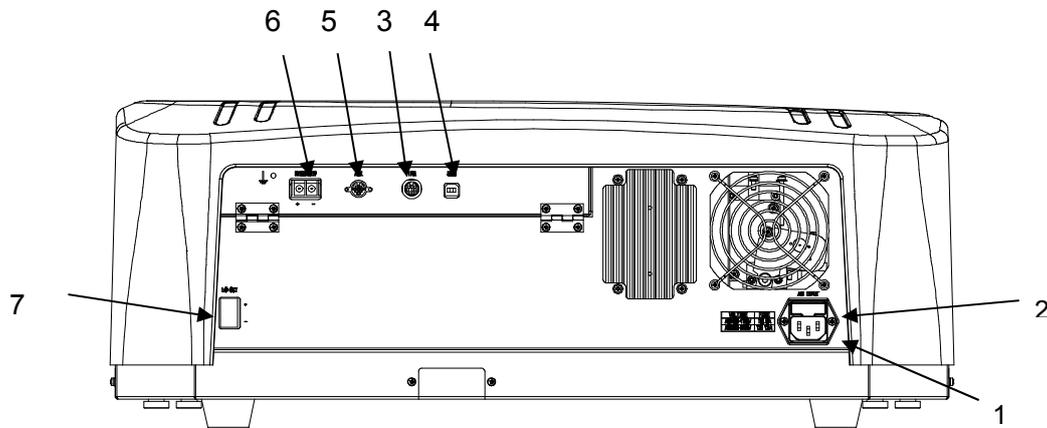


Figure 4.2 P-2000 rear panel

Component	Function
1 "AC Input" connector	Connects the power cable.
2 "FUSE"	The specified fuse for the voltage is housed here.
3 "iRM" connector	Enables power to be supplied to the intelligent remote module (iRM).
4 "USB" connector	Connects to the USB terminal of a PC.
5 "AUX"	Connector for connecting the sampler shopper, etc (optional).
6 "Recorder"	Outputs the optical rotation monitor value using ± 1 V/FS. FS can be set to $\pm 1^\circ$, $\pm 10^\circ$ and $\pm 100^\circ$.
7 "LC Out"	Outputs a direct current voltage which corresponds to the optical rotation using ± 5 V/FS in LC mode. FS corresponds to $\pm 0.5^\circ$.

4.3 Filter Unit

4.3.1 Standard Filter

Remove the lid from the filter unit (see Fig. 4.1-3) and replace the filter (see Fig. 4.3).

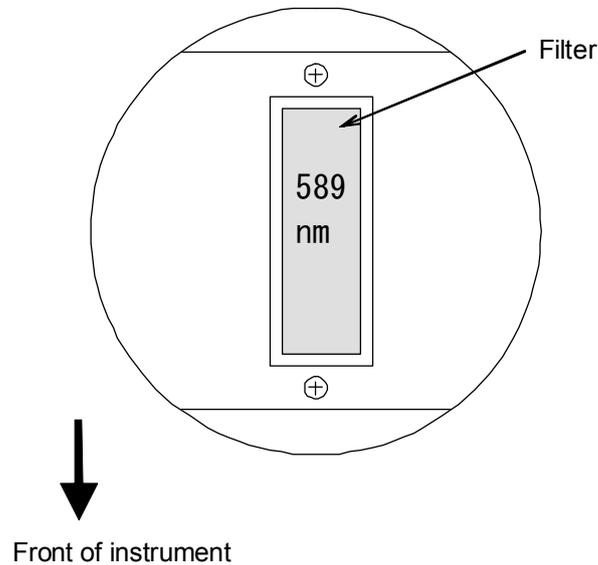


Figure 4.3 Top view of filter unit

Note 1: To remove the lid of the filter unit hold it by both sides and twist in either direction.

Note 2: The filter must be inserted in the specified direction. Insert it by ensuring that the wavelength indication at the top of the filter appears as illustrated. If it is inserted with an incorrect orientation, an error message will be displayed.

Note 3: To keep dust and foreign matter out and to prevent light leakage, keep the lid closed except when replacing.

4.3.2 Filter Changer (Factory-installed option)

4.3.2.1 Overview

PFCG-243 is the filter changer for the P-2000 series polarimeter and it is used by selecting any filter from the interference filters installed in the PFCG-243. One filter from the currently installed filters can be selected from a PC or iRM. When a filter is selected, the filter changer rotates and the selected filter is inserted into the optical path. Refer to the instruction manual “P-2000 Series Polarimeter Instruction Manual (Intelligent Remote Module Type)” or “P-2000 Series Polarimeter Software Manual Spectra Manager Ver. 2 for Windows” for details concerning the iRM or PC operation procedures.

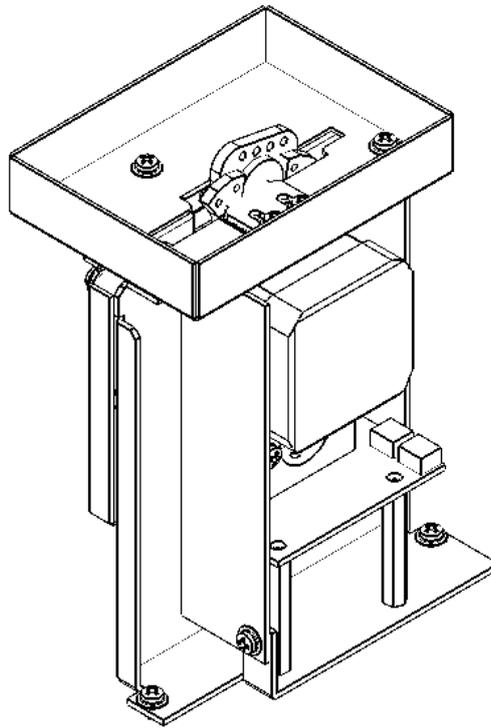


Figure 4.4 PFCG-243 Filter changer

4.3.2.2 Specifications

These filters can be used only on the PFCG-243 filter changer

Part Name	Specifications
PBFC-880/ PBFC-880-CD	880 nm interference filter for the filter changer
PBFC-633 /PBFC-633-CD	633 nm interference filter for the filter changer
PBFC-589 /PBFC-589-CD	589 nm interference filter for the filter changer
PBFC-578 /PBFC-578-CD	578 nm interference filter for the filter changer
PBFC-546 /PBFC-546-CD	546 nm interference filter for the filter changer
PBFC-436 /PBFC-436-CD	436 nm interference filter for the filter changer
PBFC-405/ PBFC-405-CD	405 nm interference filter for the filter changer
PBFC-365/ PBFC-365-CD	365 nm interference filter for the filter changer
PBFC-334/ PBFC-334-CD	334 nm interference filter for the filter changer
PBFC-325/ PBFC-325-CD	325 nm interference filter for the filter changer
PBFC-313/ PBFC-313-CD	313 nm interference filter for the filter changer
PBFC-302/ PBFC-302-CD	302 nm interference filter for the filter changer
PBFC-296/ PBFC-296-CD	296 nm interference filter for the filter changer
PBFC-280/ PBFC-280-CD	280 nm interference filter for the filter changer
PBFC-253/ PBFC-253-CD	253 nm interference filter for the filter changer

A maximum of eight filters can be installed at one time.

Note 1: Filters with “CD” at the end of the part name are calibrated filters. These filters come with a test certificate and a calibration certificate.

Note 2: The filters that are installed in PFCG-243 vary depending on the specifications of the customer’s polarimeter in which the filter changer is installed when the polarimeter is shipped. Please purchase them in accordance with the customer’s needs.

Note 3: The PFCG-243 filter changer is a factory-installed option.

4.3.2.3 How to Mount a Filter

Figures 4.5 and 4.6 show the view from above the filter.

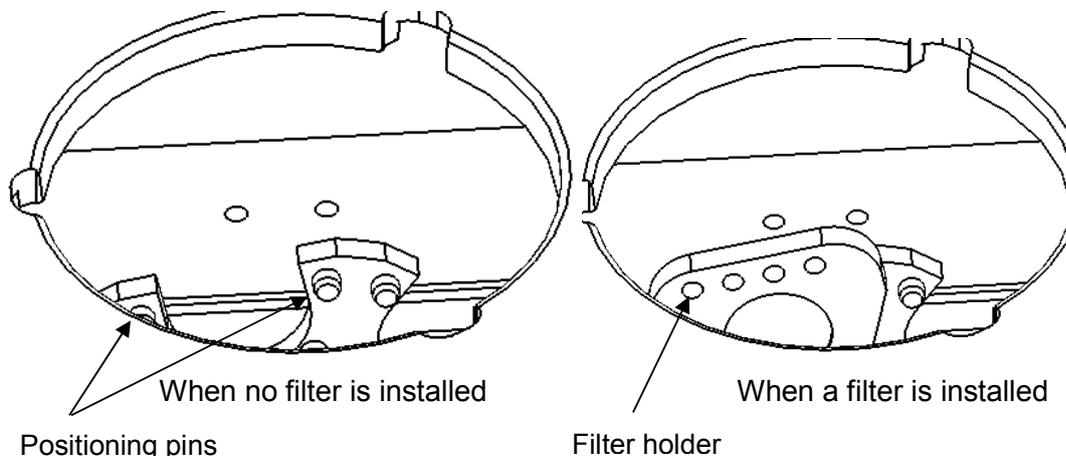
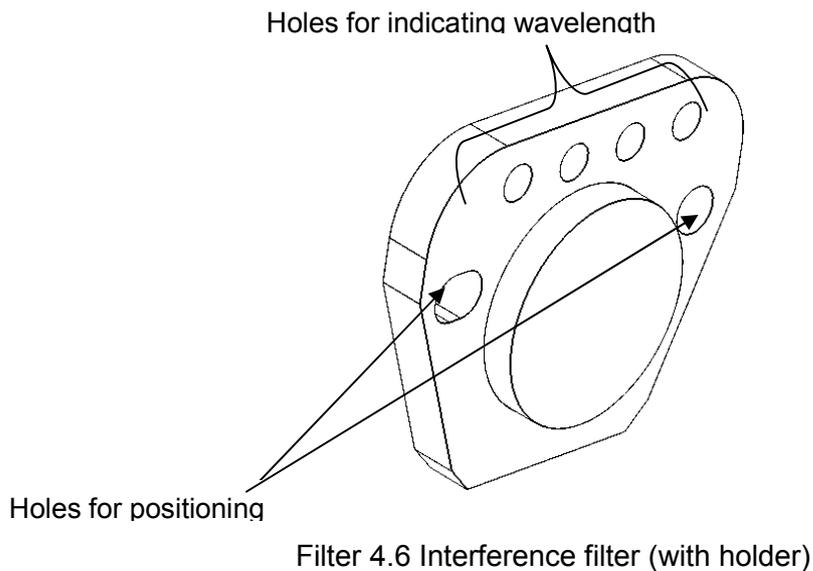
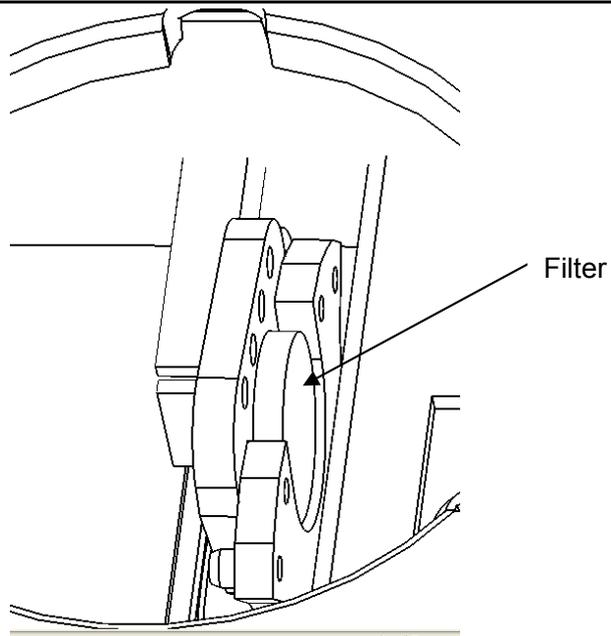


Figure 4.5 Filter changer outline drawing (top view)



Insert the positioning pins into the holes for positioning as shown in Figs 4.5 and 4.6. The filter is attracted to and installed on the filter changer by a magnet attached to the filter changer.

- Note 1:** To remove the lid of the filter unit hold it by both sides and twist in either direction.
- Note 2:** The filter must be inserted in the specified direction. Insert it as illustrated (see next figure). Install the filter so that the filter locates at the right of the holder when viewing the polarimeter from the front side.



Note 3: To keep dust and foreign matter out and to prevent light leakage, keep the lid closed except when replacing.

4.4 Intelligent Remote Module (iRM-800)

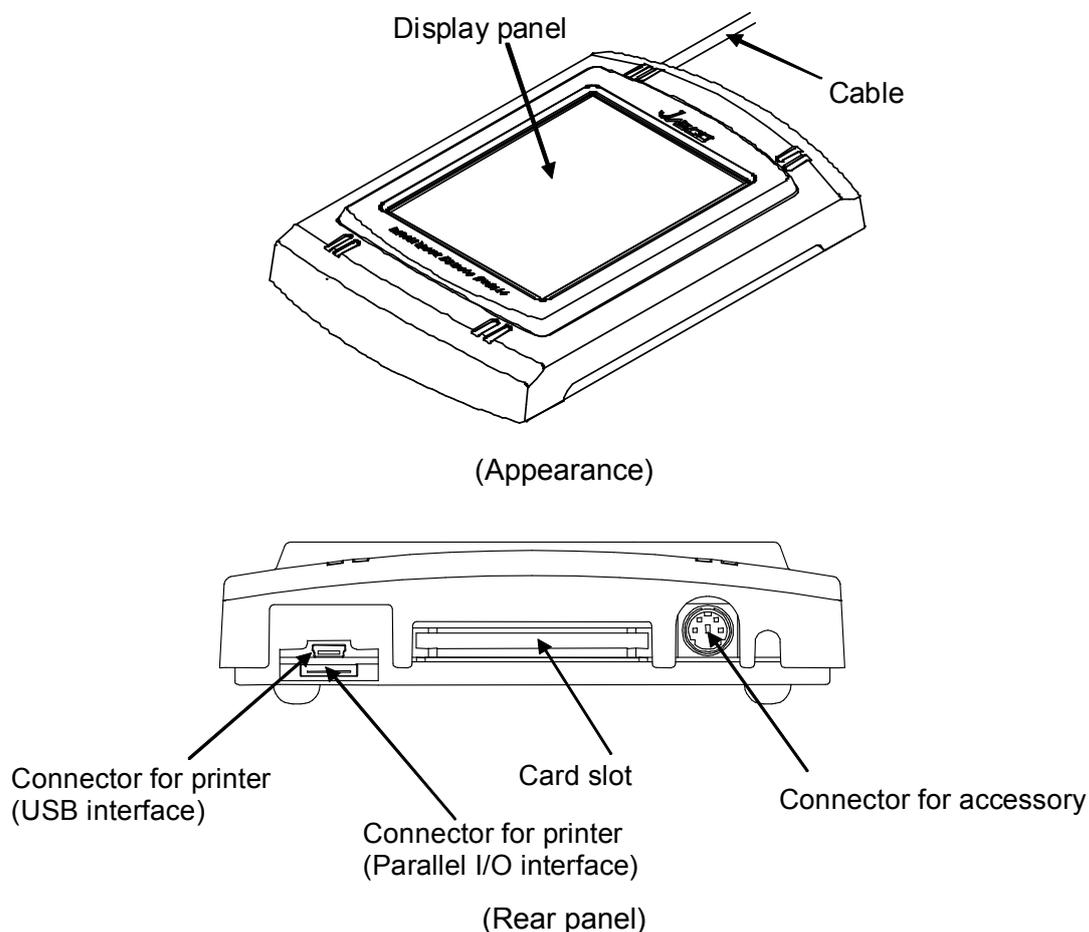


Figure 4.7 Intelligent remote module

Component	Function
Display panel	320 x 240 pixel color LCD. Displays wavelength, absorbance, measurement parameters, etc. Also used for selecting menus and editing measurement parameters via the touch key pad.
Cable	Connects to the main unit.
Card slot	Accepts a compact flash card or a flash ATA card. Card adapter is necessary for the compact flash card.
Connector for printer	Connector for the printer (USB interface and parallel I/O interface).
Connector for accessory	Connects to an accessory.

4.5 Intelligent Remote Module (iRM-1100)

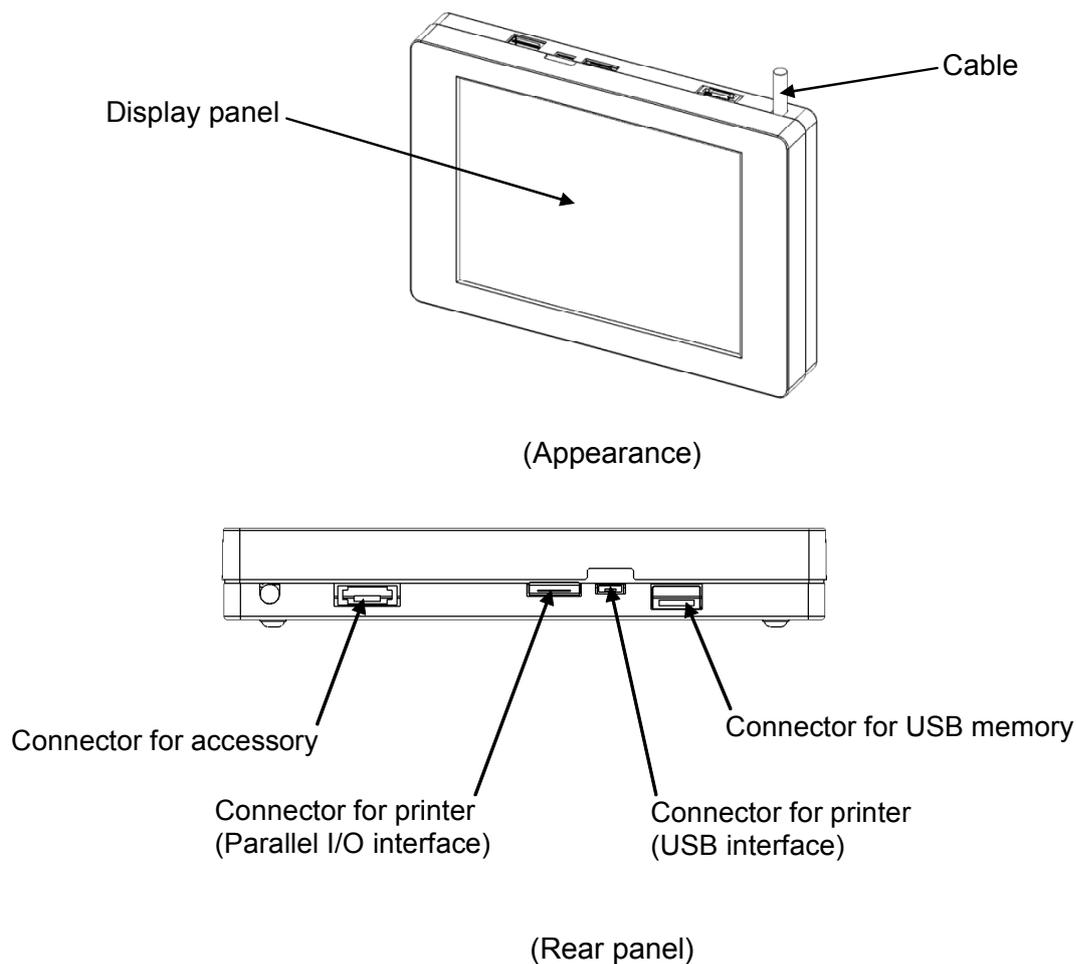


Figure 4.8 Intelligent remote module

Component	Function
Display panel	640 × 480 pixel color LCD. Displays wavelength, absorbance, measurement parameters, etc. Also used for selecting menus and editing measurement parameters via the touch key pad.
Cable	Connects to the spectrophotometer.
Connector for USB memory	Accepts a USB memory.
Connector for printer	Connector for the printer cable (USB interface and parallel I/O interface).
Connector for accessory	Connector for the RS-232C cable.

5. Maintenance

Always be attentive to the environment in which the instrument is installed ensuring that it is clean so that the instrument will operate stably for a long period. The following describes how to clean the sample chamber when a sample has been spilt, check if the instrument is operating properly and replace fuses and lamps.

5.1 Cautions Regarding Use

- Wait for about 30 minutes after turning ON the "Power" and starting up the measurement program before operating.
- Do not place anything on top of the instrument.
- On completing measurements, be sure to remove the sample from the sample compartment.
- On completing the measurements for a day, turn OFF the "Power" switch, wait for about 15 minutes for the lamp to cool down.

5.2 Cleaning the Sample Compartment

If a sample is spilt in the sample chamber, wipe it off with gauze or something similar, remove the sample cell holder by the following procedure and clean it.

Note: Use ethanol to clean the sample compartment. Do not use other organic solvents since they may remove the paint.

5.2.1 Removing the sample cell holder

- 1) Remove the cell holder temperature sensor from the cell holder by sliding it upward.

Note: Do not apply stress to the signal wire of the temperature sensor.

- 2) Unscrew the two setscrews from the base of the sample cell holder using a screwdriver. Lift the front panel of the sample cell holder to remove it from the P-2000.

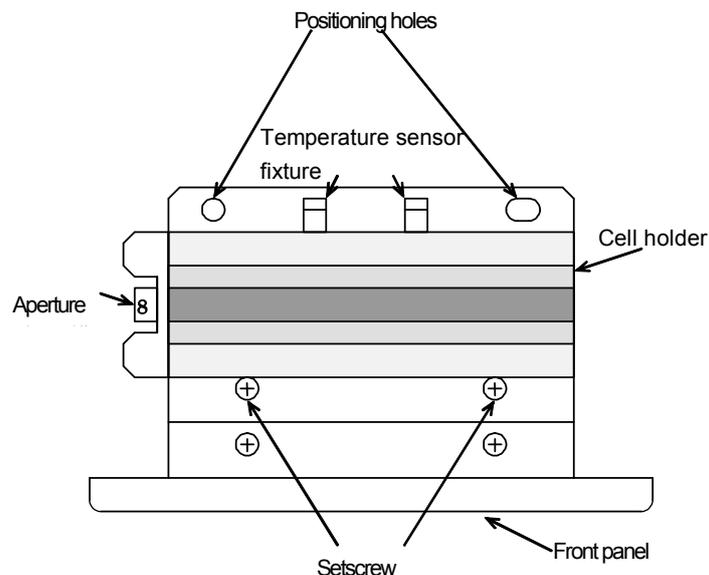


Figure 5.1 Sample cell holder (Top view)

5.2.2 Cleaning the Sample Cell Holder

- (1) For water-soluble samples

Carefully wipe off spilt samples with gauze or something similar. Wipe off the sample completely using gauze wetted with water. Finally, wipe off any moisture using gauze wetted with ethanol and then allow the sample compartment to dry.

- (2) For non-water-soluble samples

Carefully wipe off spilt samples with gauze or the like. Wipe off the sample completely with gauze wetted with ethanol and then allow the sample compartment to dry.

5.2.3 Remounting the Sample Cell Holder (see Fig. 5.1)

- (1) Install the sample cell holder.

- 1) Insert the positioning pins in the sample compartment in the positioning holes in the sample cell holder.
- 2) Tighten the two setscrews to fix the sample cell holder to the polarimeter.

- (2) Ensure that the beam is incident on the center of the aperture using the following procedure.

- 1) Turn on the "Power" switch.
- 2) Temporarily remove the filter.
- 3) Place a sheet of white paper in front of the cell holder and visually check if the beam is incident on the center of the aperture.
- 4) Install the cell holder temperature sensor.

<p><i>Note: At this point, ensure that no stress is applied to the signal wire of the temperature sensor.</i></p>

- 5) Mount the filter in its original position.

5.3 Consumable Components

Table 5.1 lists consumable components which have limited warranty periods.

Table 5.1 Consumable components list

Part number	Component	Remarks (standard)
5330 - 0080	Sodium lamp	Na/10 Life: Approx. 500 hrs
5330 - 0030	Mercury lamp	Hg/100 Life: Approx. 800 hrs
5330 - 0099	Halogen lamp	64258(P) Life: Approx. 2000 hrs
1009 - 0042A	Interference filter (589 nm)	589 nm/12 nm Life: Approx. 1 year
1009 - 0043A	Interference filter (578 nm)	578 nm/12 nm Life: Approx. 1 year
1009 - 0044A	Interference filter (546 nm)	546 nm/12 nm Life: Approx. 1 year
1009 - 0045A	Interference filter (436 nm)	436 nm/12 nm Life: Approx. 1 year
1009 - 0059A	Interference filter (365 nm)	365 nm/12 nm Life: Approx. 1 year
6940 – H124A	Interference filter (589 nm) with holder	589 nm/12 nm Life: Approx. 1 year
6940 – H125A	Interference filter (578 nm) with holder	578 nm/12 nm Life: Approx. 1 year
6940 – H126A	Interference filter (546 nm) with holder	546 nm/12 nm Life: Approx. 1 year
6940 – H127A	Interference filter (436 nm) with holder	436 nm/12 nm Life: Approx. 1 year
6940 – H129A	Interference filter (365 nm) with holder	365 nm/12 nm Life: Approx. 1 year
1103 – 4206	Cylindrical glass cell	10 (inner diameter) ϕ × 100 mm (other types of cells are available)

Note 1: The warranty for all parts supplied and repairs provided under the instrument warranty expires on the same day as the day when the warranty of the original product expires.

Note 2: The lamp is not covered by the instrument warranty.

Note 3: The lifetime of the interference filter depends on the number of hours it is used and the environment in which it is used.

5.4 Performance Check

About once every 6 months, measure a standard sample and check that there are no problems with the instrument. If there is a problem, contact your nearest JASCO distributor.

Use a 5% (W/V) aqueous sucrose solution as the standard sample. The specific optical rotation of a 5% (W/V) aqueous sucrose solution is 66.5°.

Note 1: The following procedure is same as that for the "Accuracy of OR" in the "Validation" program. For details, refer to the P-2000 Operation Manual for the iRM, "Accuracy of OR".

- (1) Turn the power switch on the P-2000 according to the "P-2000 Operation Manual".
- (2) Set the light source to Wl or Na. Allow the instrument to warm up for about 30 minutes.
- (3) Start the "OR Measurement" program and set the parameters as follows.

Filter	589 nm
D.I.T.	5 sec
Cycle Times	1 time
Temperature	20.0°C (When the thermostatted cell holder is attached)
Temp. correct.	OFF
Auto. meas.	OFF
Data Mode	Optical Rotation
Factor	1.0000

[Subtract Blank] check box OFF

(Sample compartment aperture ϕ 8 mm)

- (4) Confirm that the sample compartment is empty and press the  icon (or select [Control] - [Zero Clear]). The value shown on the data display changes to 0.000.
- (5) Perform cell blank measurement and clear
 - 1) Fill distilled water in a clean 100 mm cell, insert the cell in the cell holder of the sample compartment, then close the lid.
 - 2) Press the  icon (or select [Control] - [Zero Clear]). The value of the data display changes to 0.000.

Note 1: Always place the cell in the same position in the cell holder, facing the same direction.

Note 2: Wipe the cell window to remove water droplets or other adhered contaminants to ensure that it is clean during storage.

- (6) Measuring the standard sample
 - 1) Remove the cell from the sample compartment, discard the water, wash 2 - 3 times with a 5% (W/V) standard aqueous sucrose solution, then fill the cell with the sucrose solution.

- 2) Clean the cell window and insert the cell in the sample compartment. Then, replace the cell in the same position in the cell holder facing the same direction as previously.
- 3) Press the  icon (or select [Measure] - [Start]).
- 4) Next, remove the sample from the sample compartment. Place it back in the sample compartment five times to confirm the repeatability of the data.

<Acceptance criteria>

At a temperature of 20 to 30°C, the data must lie within the range $+3.325 \pm 0.007^\circ$.

The results of repeated measurements must also be within this range.

Note: The acceptance criteria for the Wl lamp correspond to the expected value in the Test Certificate for the interference filter. This expected value is calculated for a 100 mm cell. Also the measurement value deteriorates with changes in the transmittance of the filter.

The reference values for the specific optical rotations of aqueous sucrose solution are listed below.

Table 5.2 Specific optical rotation $[\alpha]_{\lambda 20}$ (degree) of aqueous sucrose solution (20°C)

$$[\alpha]_{\lambda} = 21.648 / (\lambda^2 - 0.0213); C = 26$$

Line	$[\alpha]_{\text{obs}}$	$[\alpha]_{\text{calc}}$	$[\alpha]_{\text{obs}} - [\alpha]_{\text{calc}}$	Line	$[\alpha]_{\text{obs}}$	$[\alpha]_{\text{calc}}$	$[\alpha]_{\text{obs}} - [\alpha]_{\text{calc}}$
	Degrees	Degrees	Degrees		Degrees	Degrees	Degrees
Li 6708	50.51	50.50	+0.01	Fe 4384*	126.5*	126.7	+0.12
Cd 6438	55.04	55.05	-0.01	Fe 4376*	127.2*	127.2	±
Zn 6362	56.51	56.45	+0.06	Hg 4368	128.49	128.3	+0.12
Na 5893	66.45	66.44	+0.01	Fe 4363*	128.5*	128.7	-0.2
Cu 5782	69.10	69.16	-0.06	Fe 4337*	129.8*	129.8	±
Hg 5780	69.22	69.21	+0.01	Fe 4315*	130.7*	131.3	-0.6
Cu 5700	71.24	71.30	-0.06	Fe 4282*	133.6*	133.6	±
Hg 5461	78.16	78.18	-0.02	Fe 4272*	134.2*	134.3	-0.1
Cu 5218	86.21	86.25	-0.04	Fe 4261*	134.9*	135.1	-0.2
Cu 5153	88.68	88.63	+0.05	Fe 4191*	140.0*	140.2	-0.2
Cu 5106	90.46	90.44	+0.02	Fe 4144*	144.2*	143.9	+0.3
Cd 5086	91.16	91.20	-0.04	Fe 3889*	166.7*	166.7	±
Zn 4811	103.07	103.03	+0.04	Fe 3833*	171.8*	172.3	-0.5
Cd 4800	103.62	103.53	+0.09	Fe 3826*	173.1*	173.2	-0.1
**							
Zn 4722	107.38	107.33	+0.05				
Zn 4680	109.49	109.48	+0.01				
Cd 4678	109.69	109.48	+0.11				

The indicated values were obtained by measuring light using the photographic method.

T.M. Lowry : "Optical Rotatory Power", P131 Longmans, Green & Co. (1935)

Due to a misprint in the above reference, the following values have been calculated by us.

Handbook of Chemistry and Physics, 42nd Edition (1960 - 1961) P3019

$$[\alpha]_{20_D} = 66.412 + 0.01267 \times d - 0.00376 \times d^2 \quad (d = 0 \text{ to } 50)$$

$$\alpha_{t_D} = \alpha_{20_D} \{ 1 - 0.00037 (t - 20) \}; \quad (t = 14 \text{ to } 30 \text{ } ^\circ\text{C})$$

National Bureau of Standards

$$[\alpha]_{20_D} = 66.529; \quad (C = 26)$$

5.5 Replacing Light Source

5.5.1 Replacing Halogen Lamp

WARNING!: The lamp may become very hot when turned on for extended periods. Avoid touching the lamp directly. Wait at least 15 minutes after turning the lamp off before handling.

Note: Wear clean cloth gloves when handling the lamp. If the lamp surface is contaminated, clean it with a cloth dipped in ethanol, then wipe it with a dry cloth.

- (1) Wait at least 15 minutes after turning the light source off.
- (2) Remove the lid from the lamp housing on the left side of the instrument. The lamp can be seen at the extreme right.

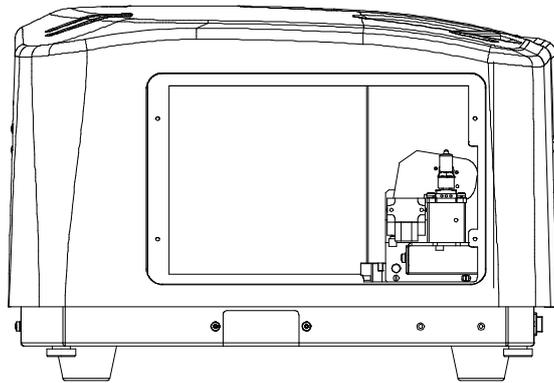


Figure 5.2 Lamp housing

- (3) Remove the cable that is connected to the lamp socket from the connector on the polarimeter, loosen the fixing screw and remove the lamp socket from the lamp housing.
- (4) Remove the old lamp from the socket and insert a new lamp in the socket. Here, adjust the height of the filament so that it is aligned with the position of the aperture.
- (5) Mount the lamp socket in the lamp housing and tighten the fixing screw.
- (6) Replace the lid.
- (7) Turn on the "Power" switch and check that the instrument operates properly (see Section 5.4 "Performance Check," for details).

5.5.2 Replacing Na lamp

<Replacing a sodium (Na) lamp>

WARNING!: The lamp may become very hot when turned on for extended periods. Avoid touching the lamp directly. Wait at least 15 minutes after turning the lamp off before handling.

Note: *Wear clean cloth gloves when handling the lamp. If the lamp surface is contaminated, clean it with a cloth dipped in ethanol, then wipe it with a dry cloth.*

- (1) Wait at least 15 minutes after turning the light source off.
- (2) Remove the lid from the lamp housing on the left side of the instrument. The lamp can be seen at the extreme right.

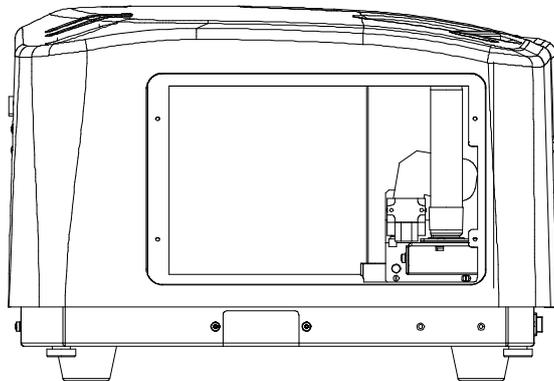


Figure 5.3 Lamp housing

- (3) Remove the cable that is connected to the lamp socket from the connector of the polarimeter, loosen the fixing screw and remove the lamp socket from the lamp housing.
- (4) Take a new lamp from its case and insert it perpendicularly into the socket by aligning the prongs of the lamp with the socket holes.
- (5) Mount the lamp socket in the lamp housing and tighten the fixing screw.
- (6) Replace the lid.
- (7) Turn on the "Power" switch and check that the instrument operates properly (see Section 5.4 "Performance Check," for details).

<Replacing a sodium (Na) lamp with a mercury (Hg) lamp (optional) >

WARNING!: The lamp may become very hot when turned on for extended periods. Avoid touching the lamp directly. Wait at least 15 minutes after turning the lamp off before handling.

Note: Wear clean cloth gloves when handling the lamp. If the lamp surface is contaminated, clean it with a cloth dipped in ethanol, then wipe it with a dry cloth.

- (1) Remove the Na lamp socket by following steps (1) through (3) of “Replacing the sodium (Na) lamp.”
- (2) Take the Hg lamp from its case and insert it perpendicularly into the socket by aligning the prongs of the lamp with the socket holes.

Note: Use a special Hg lamp socket.

- (3) Insert the cable that is connected to the lamp socket into the connector of the polarimeter, mount the lamp socket in the lamp housing and tighten the fixing screw.
- (4) Replace the lid.
- (5) Turn the “Power” switch on and check that the instrument operates properly (see Section 5.4 “Performance Check,” for details).

Note 1: Put the removed lamp in a case and store it in a safe place.

Note 2: Perform the same steps to replace a Hg lamp with a Na lamp.

5.5.3 Replacing Hg Lamp

WARNING!: The lamp may become very hot when turned on for extended periods. Avoid touching the lamp directly. Wait at least 15 minutes after turning the lamp off before handling.

Note: Wear clean cloth gloves when handling the lamp. If the lamp surface is contaminated, clean it with a cloth dipped in ethanol, then wipe it off with a dry cloth.

- (1) Wait at least 15 minutes after turning the light source off.
- (2) Remove the lid from the lamp housing on the left side of the instrument. The lamp at the right side of the front is the sodium (Na) lamp; the one in the center at the rear is the mercury (Hg) lamp.

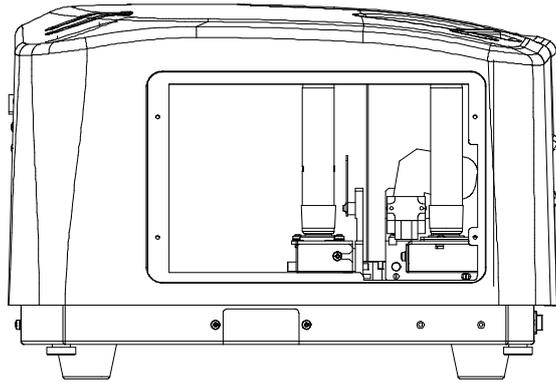


Figure 5.4 Lamp housing

- (3) Remove the cable that is connected to the lamp socket from the connector of the polarimeter, loosen the fixing screw and remove the lamp socket from the lamp housing.
- (4) Remove the new lamp from its case and insert it perpendicularly into the socket by aligning the prongs of the lamp with the socket holes.
- (5) Mount the lamp socket in the lamp housing and tighten the fixing screw.
- (6) Replace the lid back.
- (7) Turn on the “Power” switch and check that the instrument operates properly (see Section 5.4 “Performance Check,” for details).

5.6 Replacing Fuses

WARNING!: Only use fuses of the rated capacity to prevent personal injury and to protect the instrument from fire and other hazards.

WARNING!: To prevent injury from an electric shock or other hazards, always turn off the power and unplug the AC power cable from the outlet before replacing fuse.

P-2000 requires 5 A time-delay fuses (P/N: 5840-H105A 5/set) when using a 100 V voltage supply and 4 A time-delay fuses (P/N: 5840-H104A 5/set) when using a 200 V voltage supply.

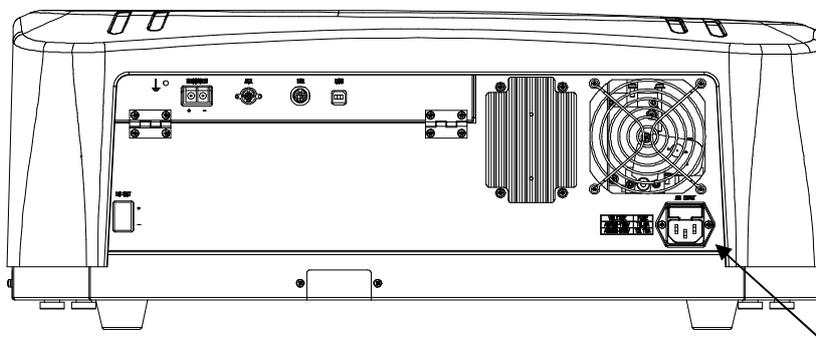


Figure 5.5 Rear Panel

Fuse holder

- (1) Turn off the “Power” switch and unplug the power cable from the outlet

- (2) Insert a flat-head screwdriver under the fuse holder, then pull forward to remove the fuses along with the holder (Fig. 5.5).
- (3) Take the old fuses out of the holder, and replace with new ones. Insert the fuse holder in its original position.
- (4) Plug the power cable into the “AC INPUT” and turn the power switch on, and then check that the instrument can be operated.

Note: *If the fuses burn out again soon after replacement, contact your nearest local JASCO distributor.*

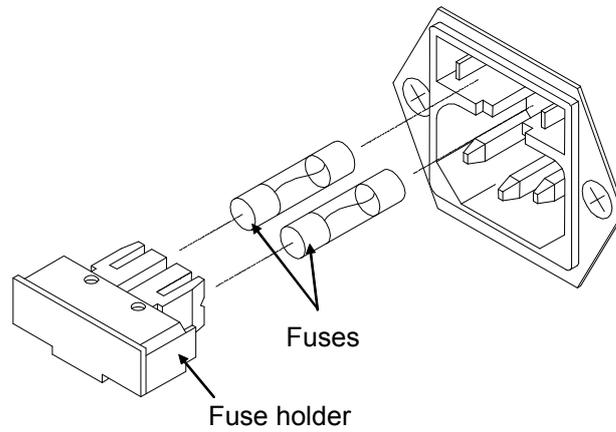


Figure 5.6 Fuse holder

5.7 Handling Cylindrical Glass Cell, Water-Jacketed Cell, and SUS Demountable Cell

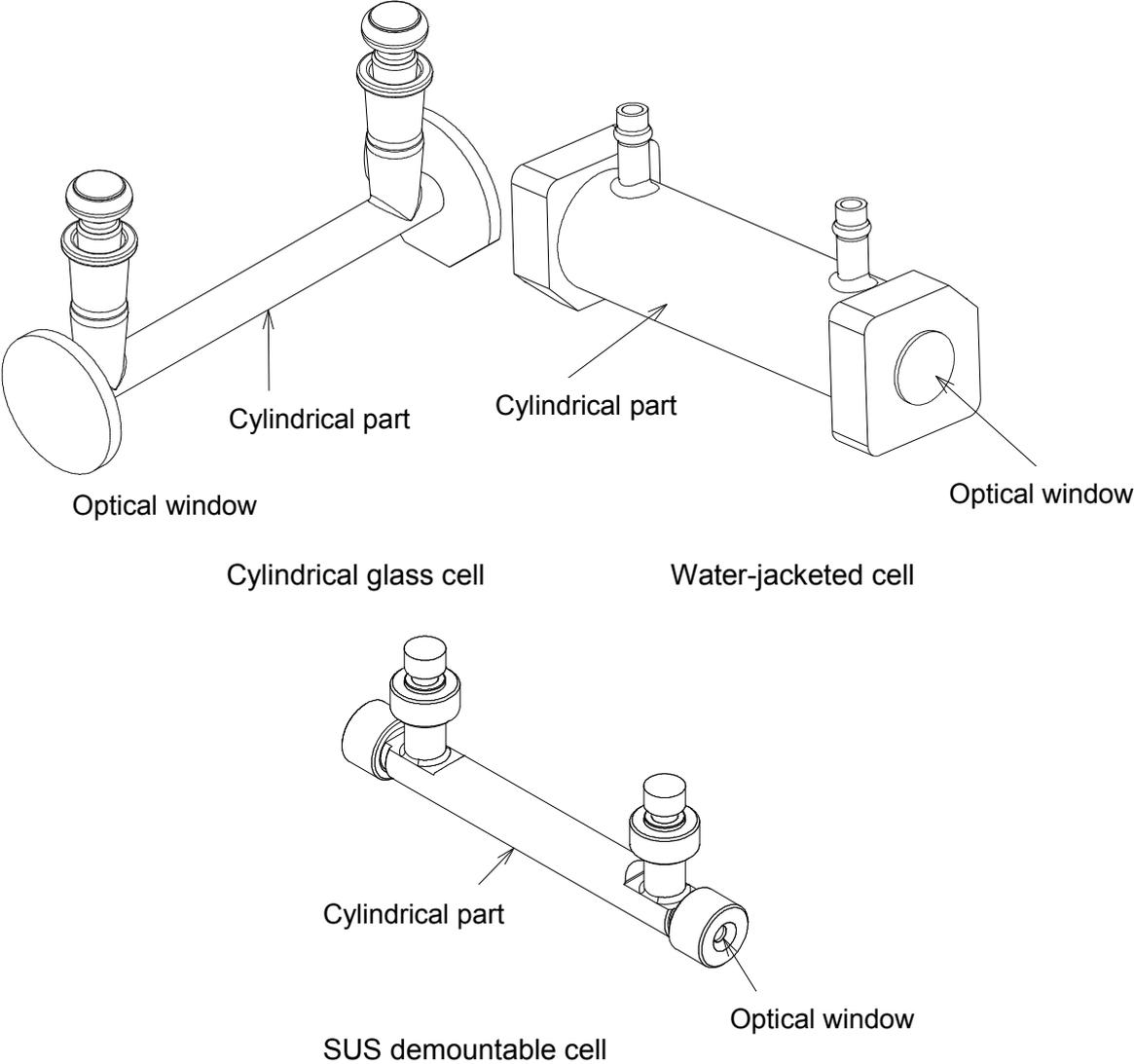


Figure 5.7 Different cells

- The cylindrical glass cell and the water-jacketed cell are made of glass. Handle these glass cells carefully and protect them from impact since broken fragments of glass may travel and injure the user.
- Be sure not to damage the optical window of the cell. When placing the cell on a table, ensure that the optical window is not in contact with the table.
- Handle the cylindrical part only when the cell is inserted in or removed from the cell holder and when the sample is inserted into the cell using a pipette.
- When a measurement is performed at an ultraviolet wavelength, the measurement is sensitive to grease from the user's hand, and an error may result. Clean the cell as soon as possible after use.
- The optical window and the cylindrical cell are attached using a special adhesive with an joining method. Clean the cell carefully after soaking it in a dilute mild detergent.

5.8 Procedure for Assembling a SUS Demountable Cell

The stainless (SUS) demountable cell can be cleaned by disassembling and soaking all of it in a washing solution. Refer to Section 5.7 "Handling Cylindrical Glass Cell, Water-Jacketed Cell, and SUS Demountable Cell" for cautions about washing. Cautions regarding its assembly are described below.

- (1) After cleaning the windows and other components assemble the stainless steel cell by referring to the following figure. Be careful not to fasten the window plates too tightly against the tube.

Note: Stop rotating the screw cell cap when the window is fastened sufficiently to seal the liquid sample against the side wall of the tube. If the cell cap is twisted too tightly, artifacts may appear in the signal due to strain.

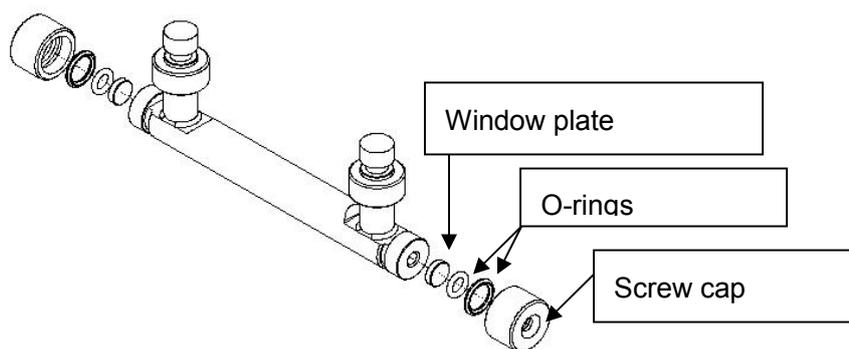


Figure 5.8 Assembly of the stainless steel cell

- (2) Pour a sample into the sample cell. Ensure that there are no air bubbles in the optical path of the stainless steel cell by looking into the cell through the window. If there are bubbles in the cell, remove them by tilting the cell.

Note 1: There may be some bubbles in the path if it is not possible to see through the cell when a transparent solution is poured into the stainless steel cell.

Note 2: Remove bubbles in the cell by tilting or rotating the cell.

- (3) Set the cell on the trough of PTC- Peltier sample holder of P-2000 polarimeter and measure the optical rotation. If necessary, measure the sample temperature (or control the sample temperature) by inserting the temperature sensor through the hole of the Teflon cap and immersing it in the sample.

Materials

Window plates: quartz

Cell tube: stainless steel SUS 316

O ring: Viton

Cell cap: Teflon

6. Troubleshooting

If the polarimeter does not operate normally, it may be due to the following causes:

- Incorrect operation
- Deterioration of consumable parts
- Instrument trouble

Possible causes and corrective actions to be taken against these problems are given below in the troubleshooting chart. If the symptom is not fixed by following the procedure in the table, the most likely cause is instrument failure. Please contact your nearest local JASCO distributor giving the model name and serial number and a full description of the symptoms.

When checking the instrument, observe the following warnings and cautions.

WARNING!: To prevent injury to the eyes, avoid directly looking at the light (ultraviolet ray) emitted from the deuterium lamp. Always wear glasses (regular or UV protective glasses) while adjusting lamp.

WARNING!: The lamp may become very hot when turned on for extended periods. Avoid touching the lamp directly. Wait at least 15 minutes after turning the lamp off before handling.

WARNING!: To prevent injury from an electric shock or other hazards, always turn off the power and unplug the AC power cable from the outlet before checking the electrical system.

Note 1: Before plugging in the power cable, ensure that the power switch is in the OFF position.

Note 2: Never touch the mirror or any other optical elements directly.

Symptoms	Check	Possible solutions
The instrument does not operate at all.	<p>Check if the power cable is securely plugged into the outlet.</p> <p>Remove the power cable from the outlet and check the fuse in the main unit.</p>	<p>Reconnect the cable securely, if it is properly connected.</p> <p>Replace the fuse if it blows (see Section 5.6). If the fuse blows immediately after replacement, the electrical system is faulty. Contact your local JASCO distributor.</p>
WI lamp does not come on.	Check the WI lamp to see if it has burnt out.	Replace the lamp with a new one if it is burnt out (see Section 5.5.1).
Na lamp does not come on.	Check the NaI lamp to see if it has burnt out.	Replace the lamp with a new one if it is burnt out (see Section 5.5.2).
Hg lamp does not come on.	Check the Hg lamp to see if it has burnt out.	Replace the lamp with a new one if it is burnt out (see Section 5.5.3).
No repeatability.	<ol style="list-style-type: none"> 1. Check if light is incident on the sample compartment. 2. The absorption of the solvent is too strong. 3. Filter has deteriorated. 4. Lamp output has deteriorated. 	<ol style="list-style-type: none"> 1. If not, adjust the position of the lamp. 2. Replace the solvent with a more suitable one. 3. Replace the filter with a new one. 4. Replace the lamp with a new one.

JASCO Corporation
2967-5, Ishikawa-machi, Hachioji-shi
TOKYO, JAPAN

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