Model J-800

CD Spectrometer

Hardware/Function Manual

Spectra Manager™ for JASCO J-800 series

JASCO

P/N: 0302-7511D April 2010

Safety Considerations

To ensure operation safety, this instrument must be operated correctly and maintained according to a regular schedule. Carefully read to fully understand all safety precautions in this manual before operating the instrument. 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.

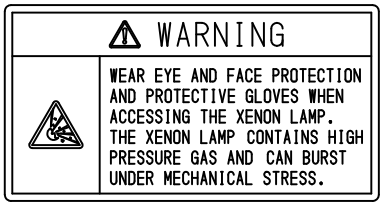
Do not proceed beyond a ***WARNING!*** or **CAUTION** notice until you understand the hazardous conditions and have taken the appropriate steps.

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.

1) ***WARNINGS!*** Handling the Xenon Lamp (Figure. 1 #1)



Part number：0822-0127A

- The xenon lamp is made of quartz glass and is filled with high-pressure gas (5 to 10 atm. pressure, about four times when the lamp is lit).
Twisting, bending or impact can burst the lamp, causing danger with glass fragments. Never open the lid of the light source unit if the lamp is lit or hot.
- When handling the xenon lamp, wear protective clothing such as a thick, long-sleeved shirt, a mask, thick gloves, etc.
- Before replacing the xenon lamp, turn the lamp off and allow it to cool for about 30 minutes.
When replacing the xenon lamp, be careful not to give an impact to the lamp. Never twist the lamp by holding it at both ends.
- Do not mistake the mounting direction (polarity) of the lamp. The cathode will be damaged if the lamp is mounted incorrectly, rendering the lamp inoperable.
- Do not touch the glass portion of the xenon lamp with bare skin.
- If the glass portion of the xenon lamp is contaminated, wipe it with clean gauze moistened with alcohol.
- After removal and before disposal, place the xenon lamp in its case, and store the case in a safe place. If the case is not available, carefully wrap the lamp in foamed plastic or other protective wrapping, and store it in a same place.
- When disposing of the xenon lamp, carefully wrap it in a cloth, smash it with a hammer, and dispose of it as hazardous material.

2) ***WARNING!*** Fuse Rating (Fig. 1 #2)

Part number：0822-0102A

Use only fuses of the designated rating to protect both the operator and the equipment from fire and other hazards. When replacing the fuse, turn OFF the Power switch and unplug the power cable from the outlet to avoid electric shock.

3) ***WARNING!*** Grounding (Figure. 1 #3)

Part number：0822-0109A

If the instrument is operated without being grounded properly, the operator may be subjected to electric shock. Correctly ground the instrument using the grounding terminal on the switchboard. Do not use glasses or water pipes for grounding, because these pipes are often made of non-conductive material.

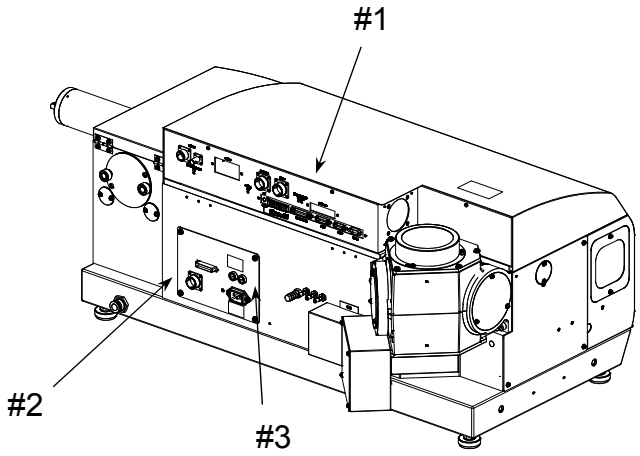


Figure 1 Location of Warning Labels

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.

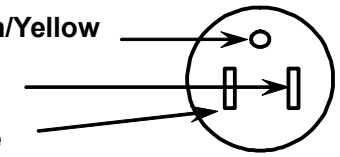
240 Volt (nominal) Supply

	Wire Color
Ground	Green/Yellow
Line	Brown
Neutral	Blue

---

115 Volt (nominal) Supply

	Wire Color
Ground	Green/Yellow
Line	Black
Neutral	White



View of pin side of plug

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"

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.

- 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.

FCC Statement (for USA only)

Federal Communications Commission Radio Frequency Interference Statement

WARNING!: This equipment generates, uses, and can radiate radio frequency energy. If it is not installed and used in accordance with the instruction manual, it may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the users at their own expense will be required to take whatever measures may be required to correct the interference.

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.

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 25 °C.

(5) Operate the instrument in humidity below 70% (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 allows easy access for maintenance.

Note: The above conditions do not guarantee optimal performance of this instrument.

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.

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 ™ and ® marks are not used in all cases in this manual.

(8) 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

Contents

1. Overview and Specifications

1.1 Overview

1.1.1 Principles of operation

When linearly-polarized light passes through an optically-active substance, its two circularly polarized components (i.e. the right and left circularly polarized beams of light) travel at different speeds, and are absorbed in differing degrees by the substance. Thus, the light that passes through the substance is elliptically polarized, and the substance is said to have "Circular Dichroism (CD)". The magnitude of circular dichroism is usually expressed in terms of the molar ellipticity [θ], which is determined according to the following formula:

$$[\theta] = \frac{4500}{\pi}(\varepsilon_L - \varepsilon_R)\log_e 10 \qquad (1)$$

where, ε_L and ε_R are the molecular extinction coefficients for the right and left circularly polarized beams of light. The difference ($\Delta\varepsilon$) between ε_L and ε_R is determined using the following formula:

$$\Delta\varepsilon = \varepsilon_L - \varepsilon_R = \frac{1}{LC}\log_{10}\left(\frac{I_R}{I_L}\right) \qquad (2)$$

Substituting this expression into equation (1) gives:

$$[\theta] = \frac{4500}{\pi LC}\log_e 10 \log_{10}\left(\frac{I_R}{I_L}\right) \qquad (3)$$

In equations (2) and (3), L represents the thickness (in cm) of the absorbing layer, C represents the molar concentration, and I_R and I_L represent the intensities of the right and left circularly polarized beams of light, respectively, after passing through the substance. Theoretically, the molar ellipticity can be derived using equation (3). However, in practice, determining [θ] with a high degree of accuracy is very difficult using equation (3), because the value of I_R/I_L is nearly 1. To avoid this difficulty, we substitute the following quantities.

$$I_A = \frac{1}{2}(I_R + I_L) \qquad (4)$$

$$S = I_R - I_L \qquad (5)$$

Since S/2 I_A is less than 1, equation (3) can be re-expressed as follows, by substituting the expressions from equations (4) and (5):

$$[\theta] = \frac{4500}{\pi LC} \log_e 10 \log_{10} \left(\frac{1 + \frac{S}{2I_A}}{1 - \frac{S}{2I_A}} \right) \qquad (6)$$
$$= \frac{4500}{\pi LC} \log_e 10 \left(\frac{S}{I_A} \log_{10} e \right)$$

Thus, the ratio between I_A and S can be approximated with a sufficiently high accuracy for practical applications.

If E_A and E_S represent the output voltages of photomultiplier tubes corresponding to light intensities I_A and S, respectively, then $S/I_A = E_S/E_A$. By substituting this expression into equation (6), it can be expressed as follows:

$$[\theta] = \frac{4500}{\pi LC} \log_e 10 \left(\frac{E_S}{E_A} \log_{10} e \right). \qquad (7)$$

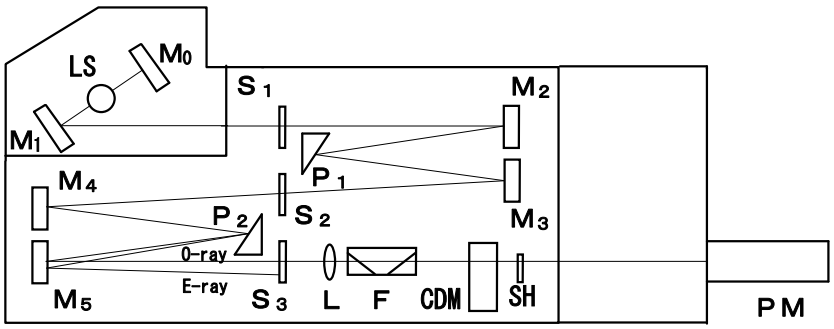
If E_S can be amplified independently of E_A, equation (7) can be expressed as follows.

$$[\theta] = \left(\frac{4500}{\pi LC} \log_e 10 \right) \left(\frac{E_S G}{E_A} \right) \left(\frac{\log_{10} e}{G} \right), \qquad (8)$$

where G represents the amplification factor of E_S. Since the value $E_S G$ can be brought very close to the value of E_A by choosing an appropriate value for G, $[\theta]$ can be determined with a high degree of accuracy.

1.1.2 Optical system

A schematic diagram of the optical system of the Model J-815 CD spectrometer is shown in Fig. 1.1.



M_0, M_1, M_p, $M_2 \sim M_5$: Mirrors LS: Light source
$S_1 \sim S_3$: Slits P_1: First prism (horizontal optical axis)
P_2: Second prism (vertical optical axis) O-ray: Ordinary ray
E-ray: Extraordinary ray L: Lens
F: Filter CDM: Modulator
SH: Shutter PM: Photomultiplier tube

Figure. 1.1 Schematic diagram of optical system

A xenon lamp is used as the light source. The light emitted from the xenon lamp is focused by the M_1 mirror onto the S_1 entrance slit. The optical system between the S_1 entrance slit and the S_2 intermediate slit is referred to as the first monochromator, and the optical system between the S_2 intermediate slit and the S_3 exit slit is referred to as the second monochromator. Such an optical system, composed of two monochromators, is known as a double monochromator. The ability of a double monochromator to reduce stray light makes it indispensable for CD measurement.

The instrument uses crystal prisms (P_1 and P_2) that have different axial orientations, so that the light that passes through the monochromator is not only monochromated, but is also linearly polarized in the horizontal direction.

This linearly-polarized light is modulated by the modulator into right and left circularly polarized beams of light. The modulator subjects a quartz crystal to mechanical stress in order to produce circular polarization in the quartz crystal, based on the principle of the Piezo effect.

When a sample with circular dichroism is placed in the sample compartment, the intensity, I, of the transmitted light is modulated as shown in Fig. 1.2:

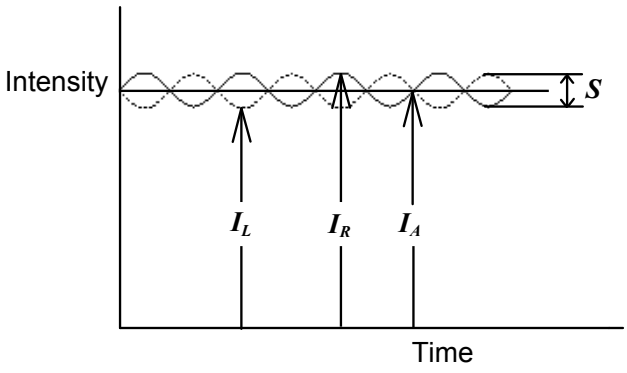


Figure. 1.2 Intensity of transmitted light

The relationship between the minimum and maximum intensities and the right and left circularly polarized light depends on whether the value E_R is smaller or larger than the value E_L. In Fig. 1.2, the solid line represents the case when E_R is greater than E_L, and the dotted line represents the case when E_R is smaller than E_L. For the definitions of I_A and S, refer to Section 1.1.1 ″Principles of operation″.

When light having a modulated intensity such as that shown in Figure 1.2 is incident on a photomultiplier tube, the output signal consists of a DC component equivalent to I_A, and an AC component equivalent to S.

1.1.3 Electrical system

The output signal from the detector (PM photomultiplier tube) consists of an AC component which is electrically modulated by the modulator and a DC component that represents the average intensity of the transmitted light. The CD value can be determined from the ratio of the DC component to the AC component. This instrument varies the PM voltage in order to maintain a constant DC component, and utilizes the AC component as the CD signal. Therefore, once the AC signal has been calibrated using a standard sample, the correct CD value can be determined.

Fig 1.3 shows a block diagram of the electrical system. Since the AC and DC components can be discussed independently of each other, they are described separately in reference to Figure 1.3. The DC component is separated between the preamplifier and the CD amplifier, and is compared with the reference voltage in order to control the voltage of the PM power supply. This voltage is also applied to the PM detector, changing the PM sensitivity. The AC component is converted to a digital signal after being amplified by the preamplifier and the CD amplifier.

The main unit and the personal computer communicate through the RS-232C interface. All parameters of the main unit are set using the personal computer. The CD signal and PM voltage are communicated to the personal computer through the RS-232C interface after being converted to a digital signal and stored in the buffer memory.

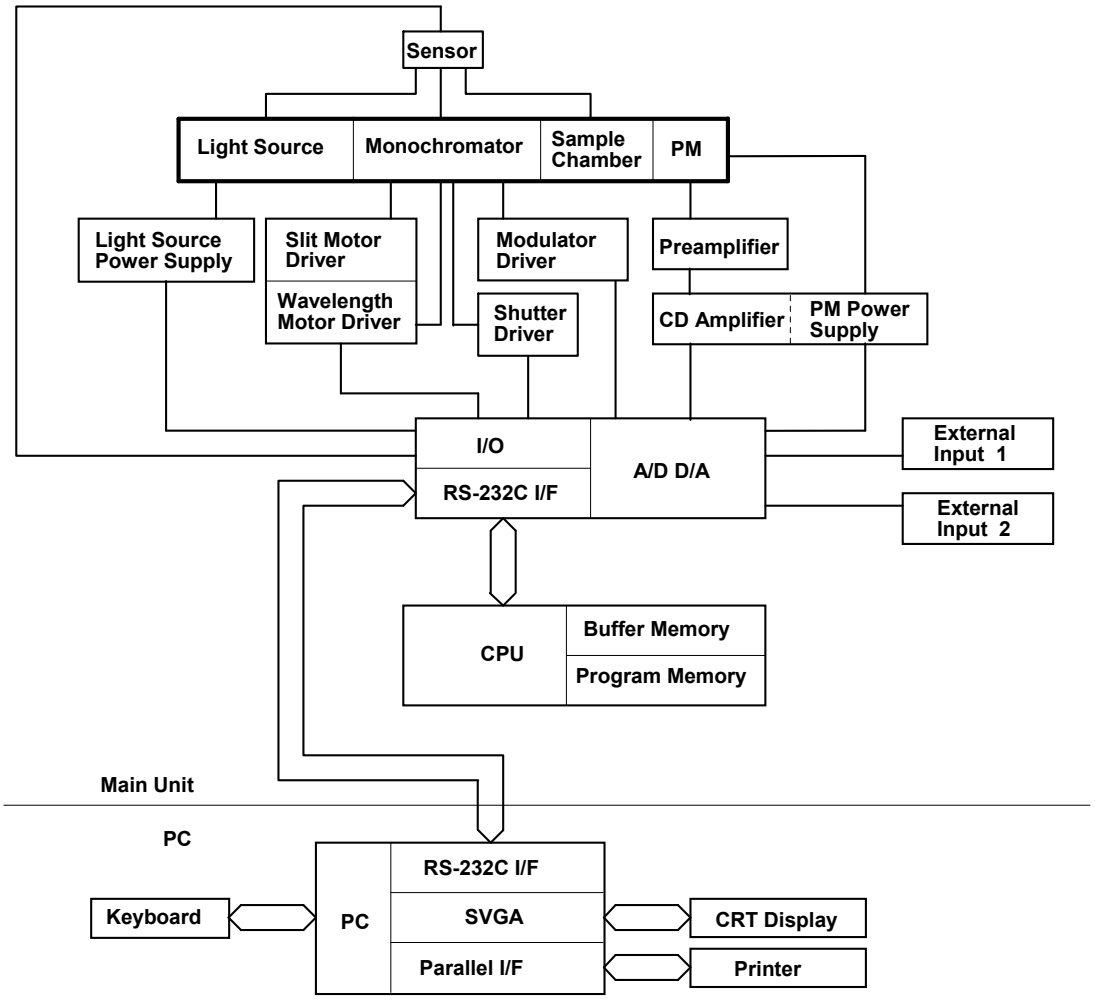


Figure. 1.3 Block diagram of electrical system

1.2 Specifications

Light source:	150 W air-cooled Xenon lamp or 450 W water-cooled Xenon lamp [*1]
Detector:	Head-on photomultiplier tube
Modulator:	Piezoelastic modulator
Measurement wavelength range:	163 to 900 nm (standard detector) 163 to 1100 nm (when optional detector is used)
Wavelength accuracy:	±0.2 nm from 163 to 180 nm ±0.1 nm from 180 to 250 nm ±0.3 nm from 250 to 500 nm ±0.8 nm from 500 to 800 nm ±2.0 nm from 800 to 1100 nm
Wavelength repeatability:	±0.05 nm from 163 to 250 nm ±0.1 nm from 250 to 500 nm ±0.2 nm from 500 to 1100 nm
Spectral bandwidth:	0.01 to 15 nm
Slit width:	1 to 3000 μm
Digital Integration Time (D.I.T.)[*2]:	0.5 msec to 32 sec.
Scanning system:	Continuous scan Step scan (Fixed D.I.T. [*2] and auto D.I.T. [*2] setting)
Scanning speed:	up to 10000 nm/min (continuous scan)
Data interval:	0.025 to 10 nm (continuous scan) 0.1 to 100 nm (step scan) 0.5 msec to 60 min (time change)
CD full scale:	±10, 200, 2000 mdeg
CD resolution:	0.0005 mdeg (at ±10 mdeg full scale) 0.01 mdeg (at ±200 mdeg full scale) 0.1 mdeg (at ±2000 mdeg full scale)
Stray light:	Not more than 0.0003% (at 200 nm)
RMS noise:	185 nm: 0.030 mdeg (150 W light source) 185 nm: 0.020 mdeg (450 W light source[*1]) 200 nm: 0.020 mdeg (150 W light source) 200 nm: 0.020 mdeg (450 W light source[*1]) 500 nm: 0.020 mdeg (150 W light source) 500 nm: 0.020 mdeg (450 W light source[*1]) (spectral bandwidth 1 nm and D.I.T. [*2] 16 sec with Standard Sample Compartment)
Baseline stability:	0.03 mdeg/hr (under spectral bandwidth 1 nm, D.I.T. [*2] 32 sec and wavelength 290 nm)
UV measurement:	Single beam measurement Photometric range: 0 to 5 Abs Photometric accuracy: ±0.01 Abs (0 to 1 Abs, checked using NIST SRM 930D filter)

External input terminal: Two channels (input range: -1 to 1 V DC)
Shutter: Located prior to sample
Sample compartment:

Standard sample compartment dimensions:
140 mm wide × 300 mm deep × 130mm high
Large sample compartment[*3] dimensions:
305 mm wide × 420mm deep × 270mm high

Sample stage can be uninstalled and installed and accepts various accessories and is equipped with constant temperature water inlet/outlet ports.

Nitrogen gas purging: Atmosphere in the light source unit, monochromator unit, and sample compartment can be purged using dry nitrogen gas.

Temperature: 20 ±5°C
Humidity: Lower than 70%
Dimensions: Main unit (standard sample compartment):
1115 mm wide × 576 mm deep × 410 mm high
Main unit (large sample compartment*[3]):
1270 mm wide × 576 mm deep × 410 mm high
Weight: Main unit (standard sample compartment): 87 kg
Main unit (large sample compartment*[3]): 106 kg
Power requirements: 100, 115, 200, 220, 230, 240 V, 50/60 Hz
320 VA (150 W light source)
750 VA (450 W light source[*1])

Notes:
**1: 450 W water-cooled Xenon lamp is only available as a factory-installed option.*
**2: Digital I Integration Time, D.I.T. was previously called "Response".*
**3: Large sized sample compartment is only available as a factory-installed option.*

2. Unpacking and Installation

***Note**: Hold the monochromator bench when you move the main unit.*

2.1 Unpacking

After unpacking the instrument, check the parts received against the list of components (Table 2.1). If any part is missing or damaged, contact your local JASCO distributor.

Table 2.1 List of Components for J-815 CD spectrometer

Component	Q′ty	Remarks
J-815 main unit	1	
Modulator element	1	
Detector unit	1	
Cable	1 set	
Nitrogen gas inlet tube	1	3 m
Nitrogen gas outlet tube	1	
Nitrogen gas tube band	2	
Cooling water tube	1	10 m for the 450 W light source*1
Cooling water tube band	3	For the 450 W light source*1
Sample compartment window	1	
Inner sample compartment	1	For large sample compartment*3
Cell holder	1	
Standard samples	1 set	Ammonium d-10-camphor sulfonate, etc.
Tools	1 set	
Disk	1 set	For setup, data, etc.
Instruction manual	1 set	For hardware, software, etc.
Tube for accessories	1 set	For accessories

2.2 Installation Requirements

Install the instrument in a location where the following conditions are satisfied. The instrument should be installed in a room that is maintained at a constant temperature and humidity, because the CD spectrometer is sensitive to fluctuations in the temperature and humidity.

. Room temperature, 20 ±5°C
. Humidity: lower than 70%
. Not exposed to direct sunlight
. Not in the proximity of harmful or corrosive gases
. Not exposed to a high-intensity light source
. Not in the direct path of air currents from air conditioners, or other equipment
. Relatively free of vibration
. Not in the proximity of a high-intensity magnetic or electromagnetic field
. For the 450 W light source*1, access to a water supply (flow rate: 2 λ/min, pressure: 0.5～2.0 kg/cm^2). Cooling water tube: 10 m in length, inside diameter: 12 mm

***Note**: Do not use water at pressures greater than 2.0 kg / cm^2.*

. Within the proximity a nitrogen gas supply. (flow rate: more than 3 λ/min).
. Nitrogen gas tube: 3 m in length, inside diameter: 9.5 mm.

2.3 Reassembly

***Note**: Reassembly of the instrument is performed by your local JASCO distributor.*

2.3.1 Removing the cushion from the main unit

CAUTION: When removing the cushion, be careful not to knock the cam.

The cam and lever on the bottom of the instrument are separated by a cushion and secured with a rubber band to protect the cam from damage and prevent the wavelength from shifting during transit.
Remove the cushion and rubber band after installing the main unit.

(1) Remove the side cover from the main unit.

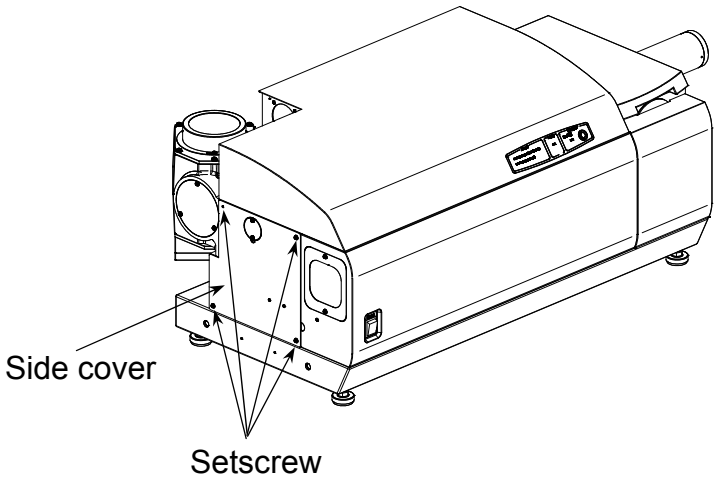


Figure. 2.1 Removing the side cover

(2) Remove the cushion and rubber band.

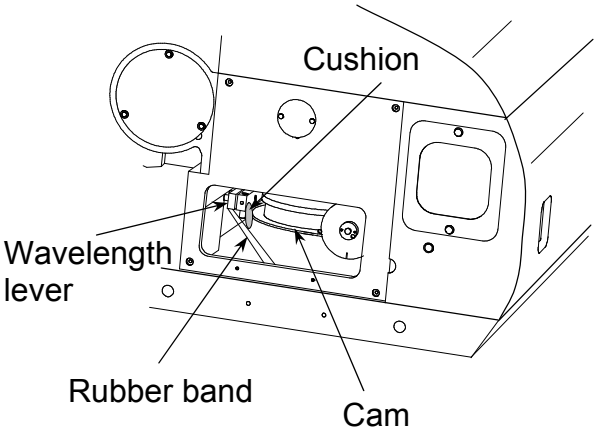


Figure. 2.2 Removing the cushion and rubber band

2.3.2 Installing the modulation element

The modulation element is removed from the main unit prior to shipment to prevent damage from occurring during transit. Install the modulator element in the main unit after installing the main unit.

(1) Remove the electrical system cover from the main unit.

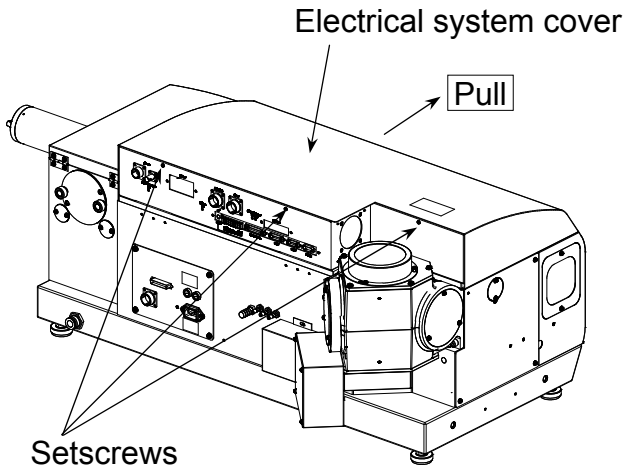


Figure. 2.3 Removing the electrical system cover

(2) Open the monochromator lid.

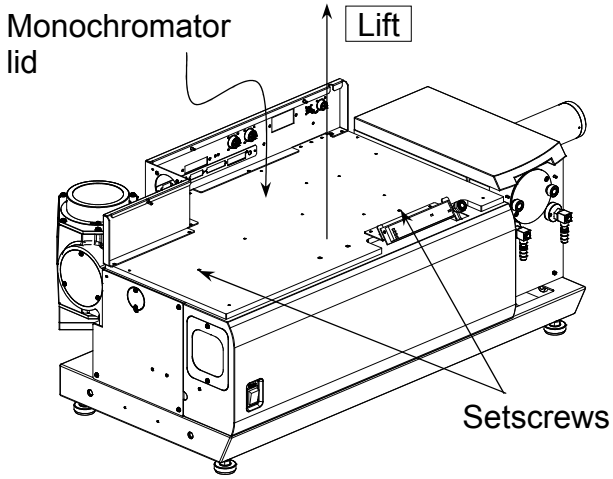


Figure. 2.4 Opening the monochromator lid

(3) Mount the modulator element in the holder and mount it in the main unit. Solder the leads to the terminals.

CAUTION:	Be careful not to damage the modulator element or break the leads.
CAUTION:	Ensure that the leads do not come into contact with the holder, cover or with each other.

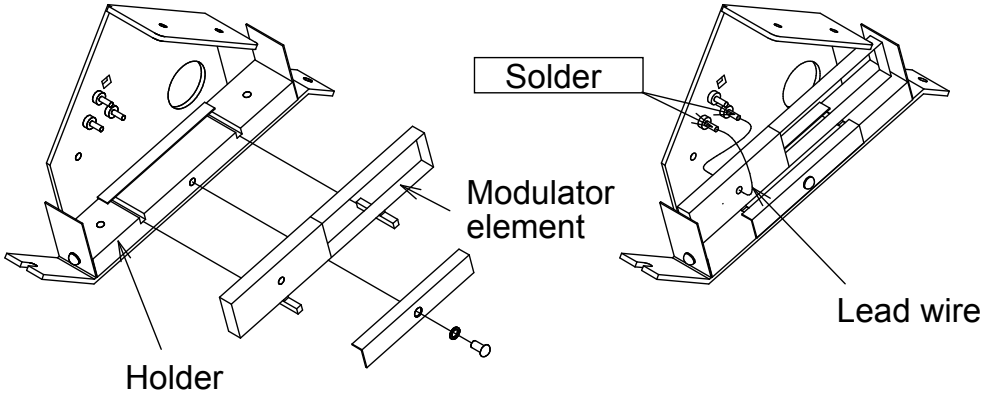


Figure. 2.5 Mounting the modulator element

2.3.3 Installing the detector unit

CAUTION: Handle the detector unit with great care. Do not give knock the detector unit.
CAUTION: Do not loosen any screws, except for the lock screw.
CAUTION: Do not expose the detector window to intense light.

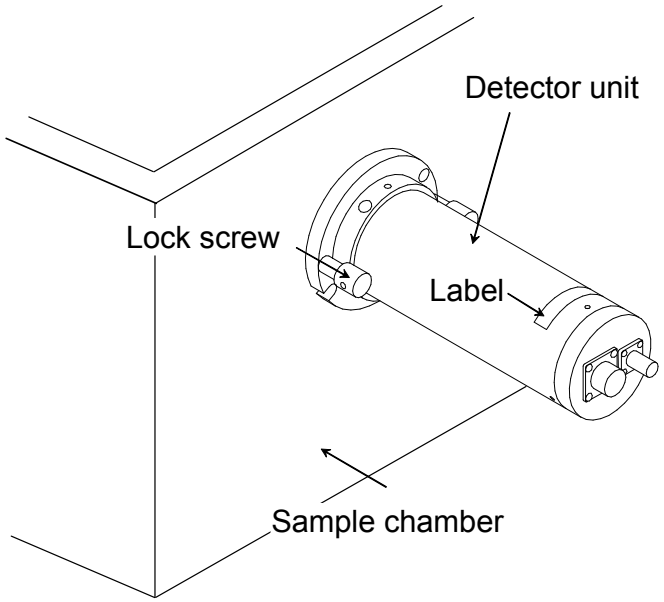


Figure. 2.6 Installation of detector unit

Install the detector unit on the main unit according to the following procedure.

(1) Remove the cover from the detector mounting hole located in the right side panel of the main unit.

(2) Remove the cover from the detector unit.

(3) Gently mount the detector unit on the main unit, and secure it using the lock screw.

CAUTION: Install the detector so that the label faces upward.

2.3.4 Connecting the cables and tubes

Connect the cables and tubes according to the following procedure:

(1) Connecting the cables

1) Using a digital voltmeter, confirm that the supplied line voltage corresponds to the voltage shown on the rating plate.

CAUTION:	The line voltage must be confirmed. An outlet can provide an incorrect voltage due to faulty wiring.

2) Confirm that the ″Power″ switch on the power supply unit is turned OFF.

3) Plug the cables according to Fig. 2.7.

CAUTION:	Ground the grounding terminal of the power cable.
CAUTION:	For details regarding the wiring and connections of the personal computer and printer, refer to their respective instruction manuals.

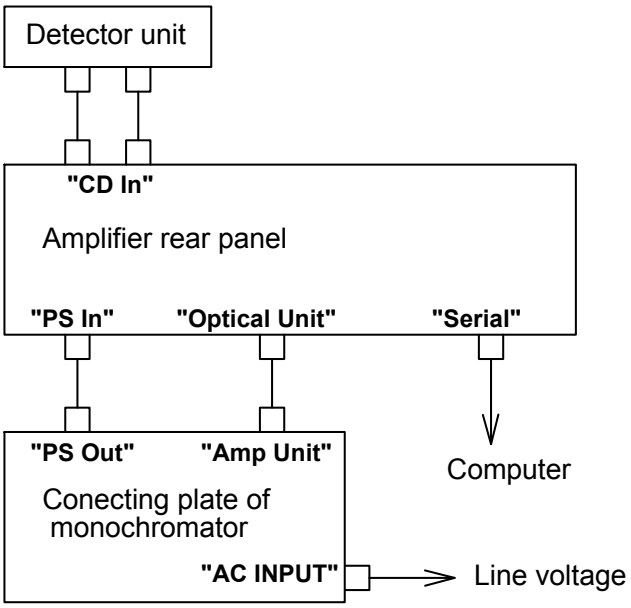


Figure. 2.7 Connection of cables

(2) Connecting the cooling water tubes (450 W light source[*1])

CAUTION:	Connect the tube to the water faucet and the water inlet/outlet ports of the light source unit, using the supplied tube bands.

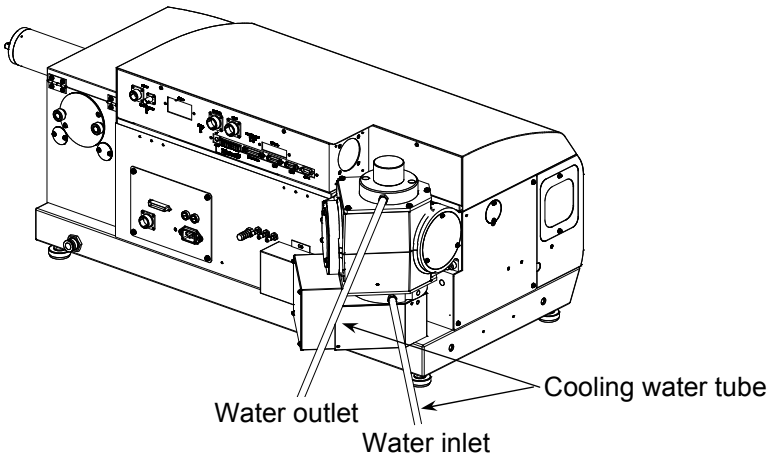


Figure. 2.8

1) Connect the ″Water Inlet″ of the light source cooling water flow sensor to the faucet using the tube.

2) Connect the ″Water Outlet″ of the light source cooling water flow sensor to the ″Water Inlet″ of the light source unit.

3) Connect the ″Water Outlet″ of the light source unit to the water drain port.

4) Feed cooling water to confirm that the system is free from leakage.

(3) Connecting the nitrogen gas tube

Connect a nitrogen gas cylinder (flow meter) to the nitrogen gas inlet.

***Note**: Bind the tube with the tube band, if necessary.*

(4) Connecting the nitrogen gas or leak water outlet port.

The outlet tube for nitrogen gas or leaked circulation water is provided at the bottom of the sample compartment. Connect the tube to the water outlet port, if necessary.

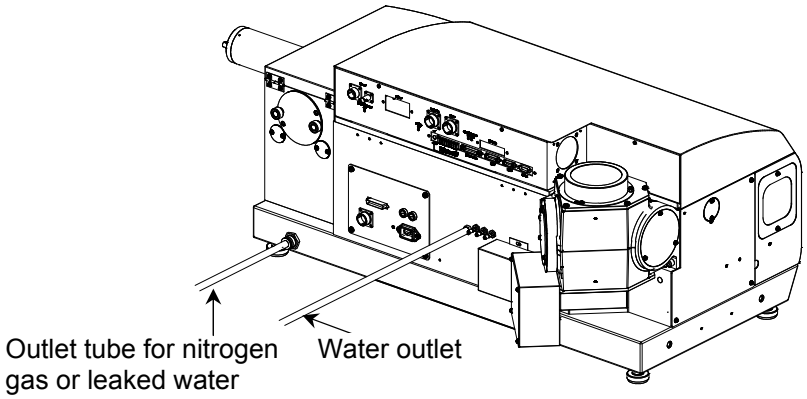


Figure. 2.9

3. Names and Functions of Components

3.1 Overall View

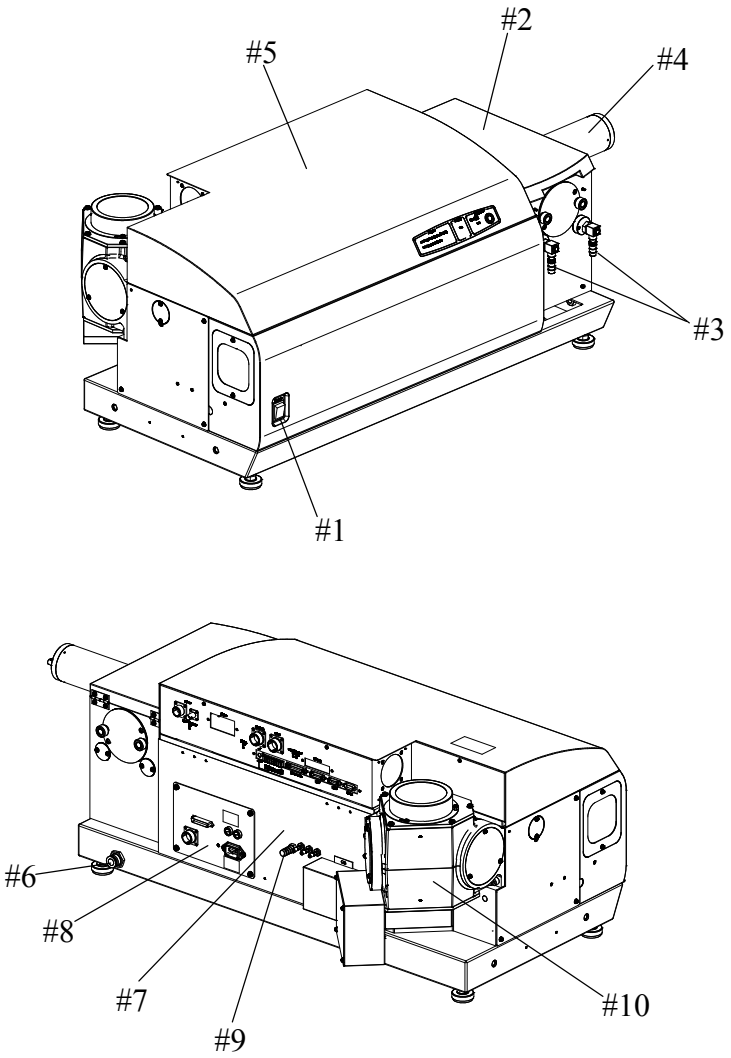


Figure. 3.1 Overall view of 150 W light source and Standard sample compartment unit

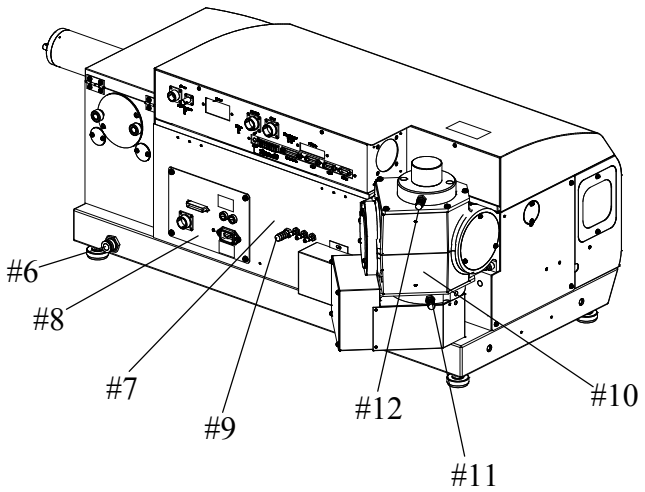


Figure. 3.2 Overall view of 450 W light source[*1]

Component	Function
#1 ″Power″ switch	Power switch of the main unit.
#2 Sample compartment	Set sample.
#3 Constant temperature water ports	Inlet and outlet ports of constant temperature water.
#4 Detector unit	Houses the photomultiplier tube and preamplifier.
#5 Amplifier unit	Houses the amplifier and other elements.
#6 Sample compartment leak water outlet	Outlet for water leaking from the sample compartment.
#7 Monochromator unit	Houses the monochromator and modulator.
#8 Connecting plate	Connected to the electrical system.
#9 Nitrogen gas inlet	Admits nitrogen gas to displace the air in the monochromator.
#10 Light source unit	Houses the light source.
#11 Light source cooling water inlet	Cooling water inlet to the light source.
#12 Light source cooling water outlet	Cooling water outlet from the light source.

3.2 Panels

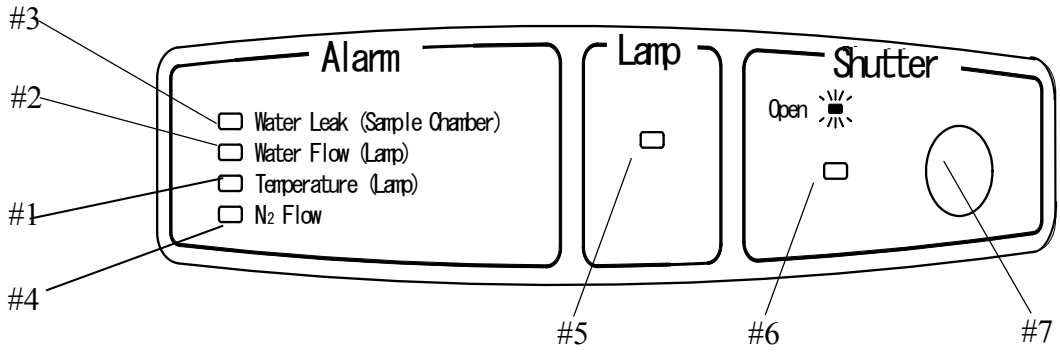


Figure. 3.3 Front panel of amplifier unit

Component	Function
#1 ″Temperature (Lamp)″ LED	Lights up if the light source temperature becomes abnormally high. The light source is automatically turned off when this occurs.
#2 ″Water Flow (Lamp)″ LED	Lights up if there is insufficient cooling water to the 450 W light source[*1].
#3 ″Water Leak (Sample Compartment)″ LED	Lights up if there is a water leak in the sample compartment. Use of the optional constant temperature water stop valve automatically prevents water leaks.
#4 ″N2 Flow″ LED	Lights up if the nitrogen gas flow rate is insufficient. This alarm is effective when the optional PC-controlled flowmeter or the flowmeter with sensor is used.
#5 ″Lamp″ LED	Lights up when the light source is turned ON.
#6 ″Shutter″ LED	Lights up when the shutter is open.
#7 ″Shutter″ button	Opens/closes the light shield shutter.

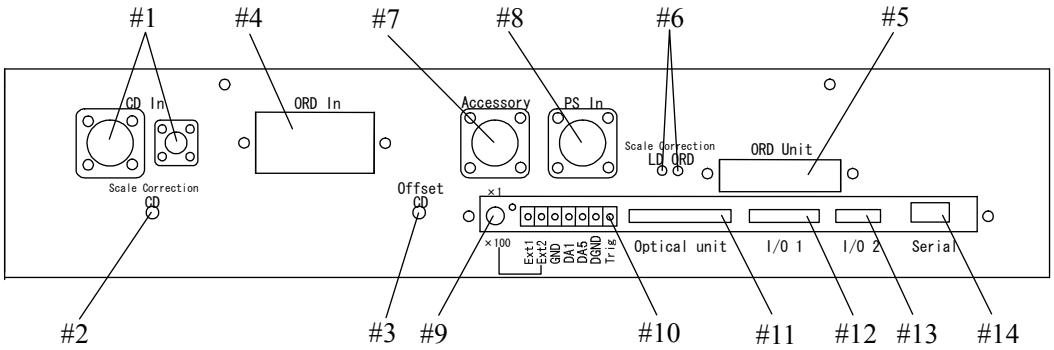


Figure. 3.4 Rear panel of amplifier unit

Component	Function
#1 ″CD In″ connector	Connects to the connector on the detector unit.
#2 ″Scale Correction CD″	Trimmer for adjusting the CD scale using a standard sample.
#3 ″Offset CD″ trimmer	Trimmer for adjusting offset of CD.
#4 ″ORD In″ connector port	Connects to the connector on the optional ORD unit.
#5 ″ORD Unit″ connector port	Connects to the connector on the optional ORD unit.
#6 ″Scale Correction LD/ORD″ adjustment mounting port	Port for mounting the optional LD/ORD scale adjustment.
#7 ″Accessory″ connector	Connector for optional accessories.
#8 ″Ps In″ connector	Connects to the ″Ps Out″ connector on the rear panel of the monochromator unit.
#9 ″X1/X100″ selector switch	Changes over the ″Ext2″ terminal input voltage gain. Set it to X100 to amplify the gain by a factor of 100.
#10 I/O terminals ″Ext1″ terminal ″Ext2″ terminal ″GND″ terminal ″DA1″ terminal ″DA5″ terminal ″DGND″ terminal ″Trig″ terminal	 Input terminal for analog signal (-1 to 1 VDC) Input terminal for analog signal (-1 to 1 VDC) Grounding terminal (for analog signal) Output terminal for analog signal (0 to 1 VDC) Output terminal for analog signal (0 to 5 VDC) Grounding terminal (for digital signal). Trigger signal input terminal.
#11 ″Optical Unit″ connector	Connects to the ″Amp Unit″ connector on the rear panel of the monochromator unit.
#12 ″I/O 1″ connector	Connects to an optional accessory.
#13 ″I/O 2″ connector	Connects to an optional accessory.
#14 ″Serial″ connector	Connects to the serial port of a computer.

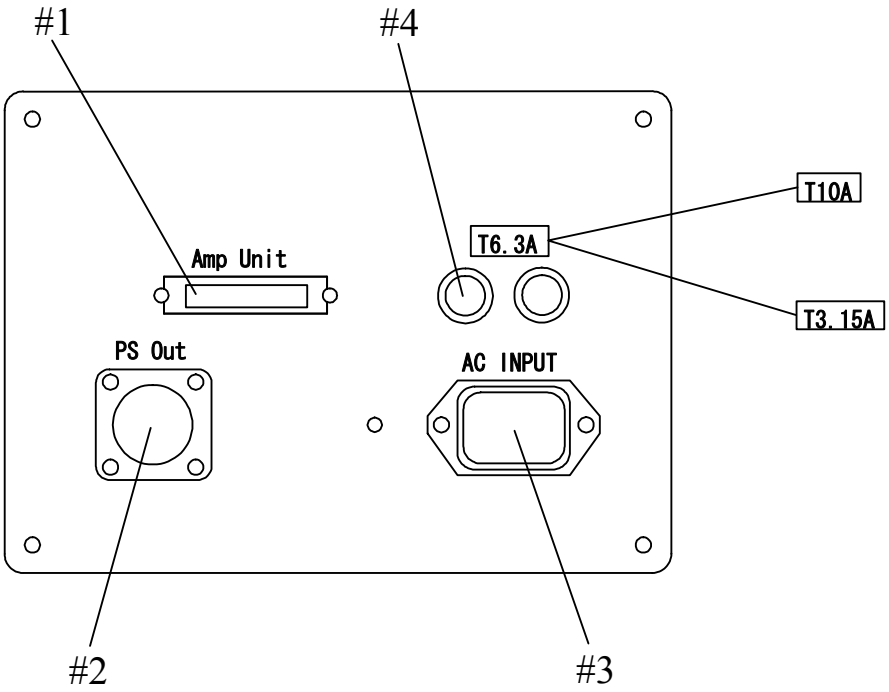
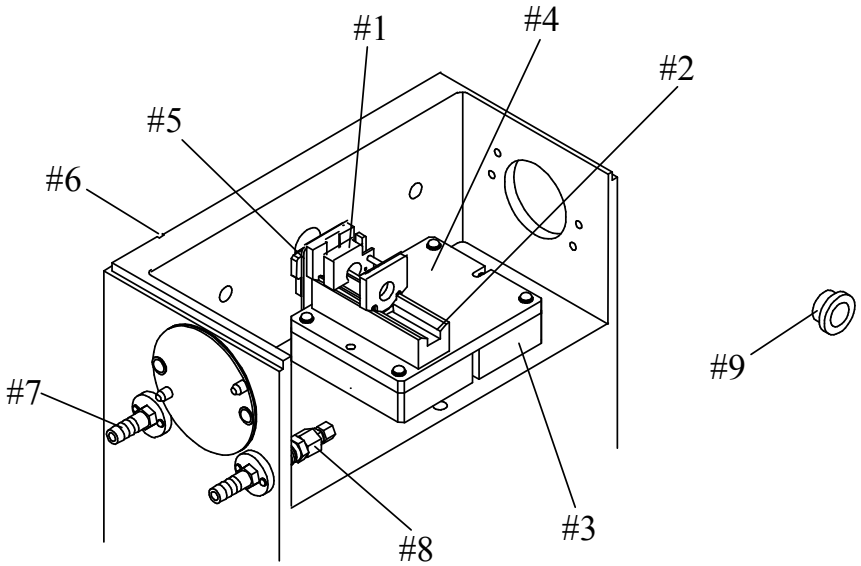


Figure. 3.5 Rear panel of monochromator unit

Component	Function
#1 ″Amp Unit″ connector	Connects to the ″Optical In″ connector on the rear panel of the amplifier unit.
#2 ″PS Out″ connector	Connects to the ″PS In″ connector on the rear panel of the amplifier unit.
#3 Receptacle	Power inlet receptacle
#4 Fuse	
″T3.15A″ label	For 200 VAC line voltage.
″T6.3A″ label	For 100 VAC (150 W light source) or 200 VAC (450 W light source[*1]) line voltage.
″T10A″ label	For 100 VAC line voltage.

3.3 Sample Compartment

Standard sample compartment



Large sample compartment[*3]

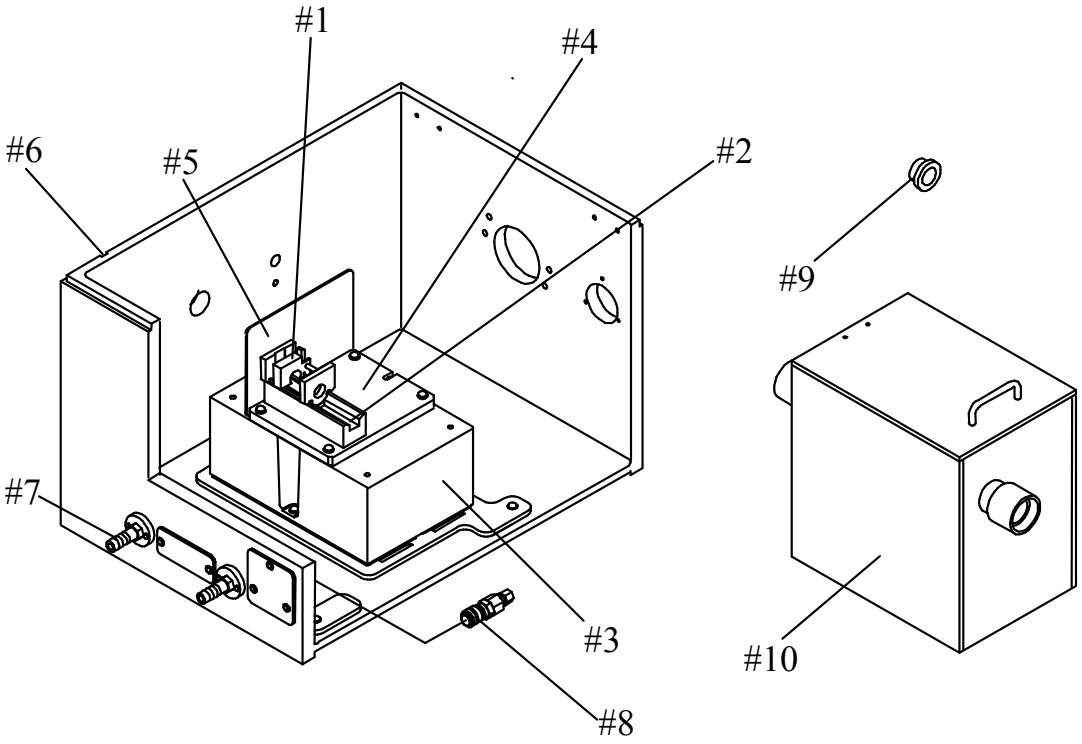


Figure. 3.6 Sample compartments

Component	Function
#1 Cell holder	Sets the cell.
#2 Cell holder mount	Sets the cell holder.
#3 Sample stage sub-base (1)	Remove this when a medium-sized accessory such as a Peltier-type thermostatted cell holder is mounted.
#4 Sample stage sub-base (2)	Remove this when a small-sized accessory such as a sample changer is mounted.
#5 Light shield plate	Changes the beam diameter to 8 mm or 13 mm depending on the cell to be used.
#6 Detector protective switch	Turns OFF the power switch for the detector which sets the detector voltage to zero when the sample compartment lid is opened.
#7 Constant temperature water inlet/outlet ports	
#8 Joint	Removable joint for constant temperature water.
#9 Window plate	Attaches to the sample compartment window when measuring a sample that emits a harmful gas to protect the monochromator unit.
#10 Inner sample compartment	Sample compartment that permits nitrogen gas to be displaced more efficiently.

3.4 Detector Unit

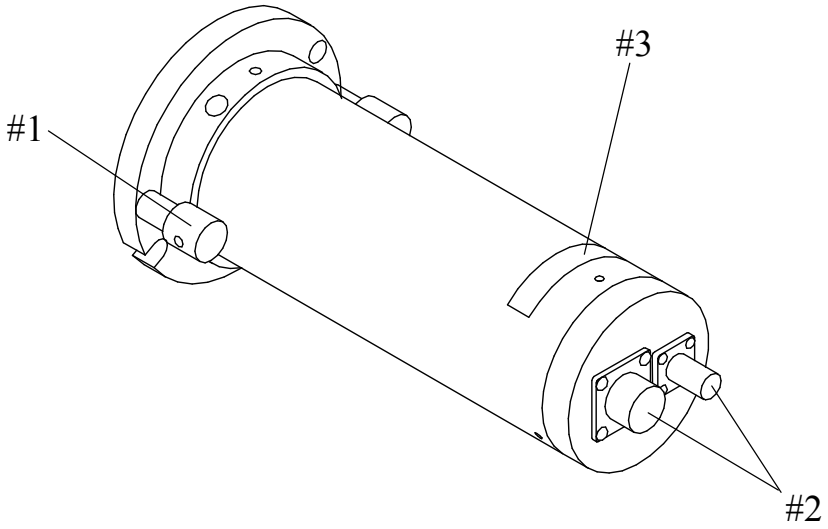


Figure. 3.7 Detector unit

Component	Function
#1 Lock screw	Secures the detector unit to the main unit.
#2 Connector	Connect to the ″CD In″ connector located on the rear panel of the amplifier unit.
#3 Label	Indicates the wavelength range. Install the detector unit on the main unit with this label facing upward.

4. MAINTENANCE

4.1 Light Source Check and Replacement

The service life of the xenon lamp is 300 to 500 hours, but it varies considerably from one lamp to another. It is therefore difficult to predict life expectancy from operating hours. It is generally predicted from the noise on the measured data. Compare the current data with the data obtained immediately after delivery (i.e. data obtained with a new lamp) to decide whether to replace the lamp or not.

***Note**: Noise may also appear if the line voltage fluctuates rapidly.*

Observe the following guidelines in order to maximize the service life of the xenon lamp.

. If the light source is not used for an extended period, turn it off. However, if the light source will be not be required for an hour or less, leave it on. Frequently turning the light source on and off will shorten its service life.

. Always supply cooling water to the light source (450 W light source[*1]).

<Procedure>

WARNING: Read carefully the ″Safety Cautions″ at the beginning of this manual.

(1) Turn OFF the ″Power″ switch located on the main unit.

(2) For the 150 W light source, remove the light source cover and then remove the anode holder and the light source. For the 450 W light source[*1], remove the anode holder, and then loosen the cathode fixing screw with a screwdriver through the hole on the side cover to remove the light source.

***Note**: The 150 W light source is attached to the anode holder.*

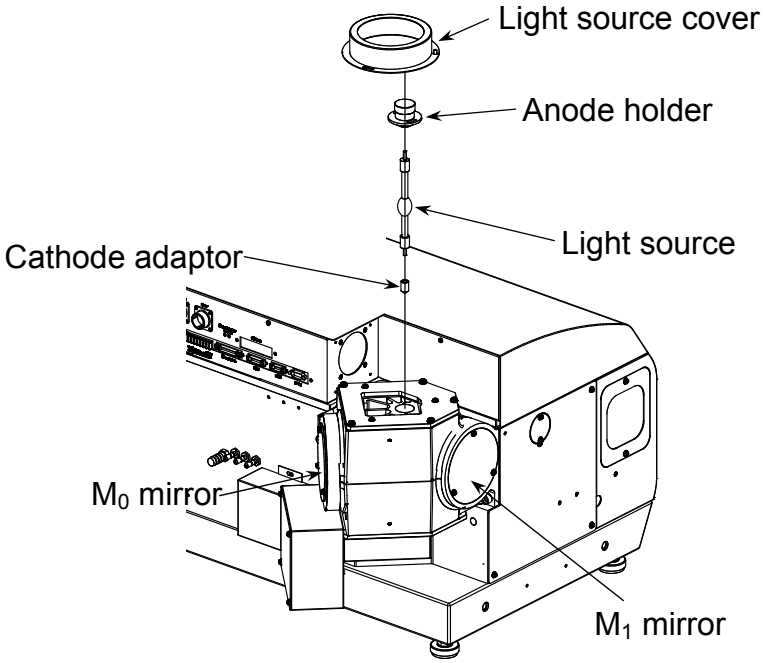
(3) For the 150 W light source, remove the anode holder and cathode adapter from the light source, and attach them to a new light source.

(4) Mount a new light source in the position of the old light source.

CAUTION: Confirm that the glass protrusion of the Xe lamp does not face the M_0 and M_1 mirrors.

CAUTION: Do not mistake the polarity of the Xe lamp.

150 W Light Source



450 W Light Source

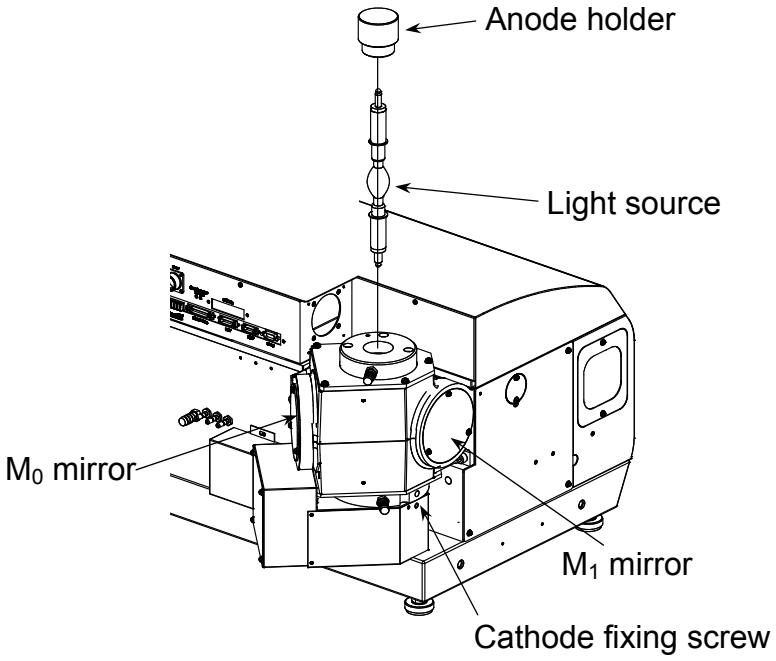


Figure. 4.1

(5) Tighten the cathode fixing screw (for the 450 W light source[*1])

(6) Mount the anode holder (for the 450 W light source[*1]).

(7) Start up the instrument.

(8) Start up [Spectrum measurement] program (see Software operation manual).

(9) Select the [Parameters]/[General] command from the [Measure] menu and set the [Photometric mode], [Sensitivity] and [D.I.T.] settings as follows.

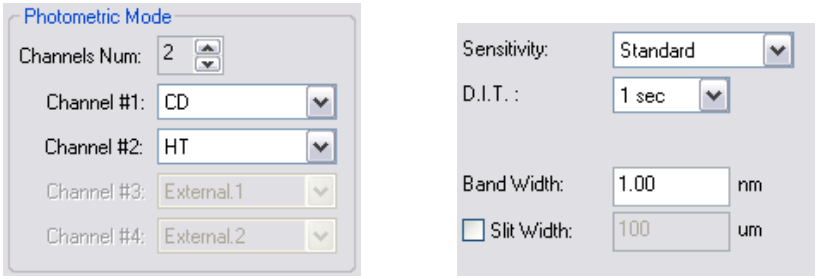


Figure. 4.2 Setting parameters (replacement of light source)

(10) Select the [Move Wavelength...] command from the [Control] menu and set the wavelength to ″546.1 nm″.

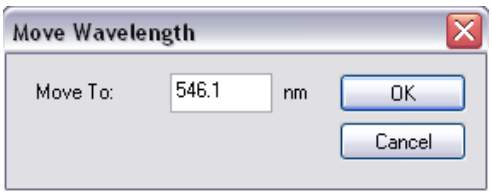


Figure. 4.3 Setting wavelength (replacement of light source)

(11) Remove the cover from the M0 and M1 mirrors. The adjustment screw shown in Fig. 4.4 will be visible.

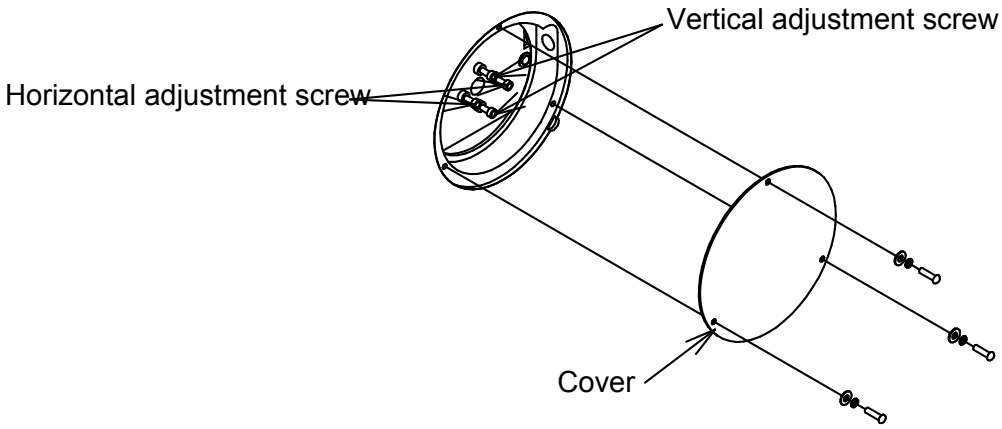


Figure. 4.4 Mirror adjustment screw

(12) Adjust the adjustment screws for the M_1 mirror so as to minimize the value of channel 2 (HT voltage) when the sample compartment is empty.

(13) Adjust the adjustment screws for the M_0 mirror so as to minimize the value of channel 2 (HT voltage) when the sample compartment is empty.

***Note**: Normally, the minimum value for HT is 200 to 300 volts.*

(14) Re-install the covers for the M_0 and M_1 mirrors.

4.2 Energy Check

The energy of the instrument will decrease over time due to the deterioration in the performance of the mirrors and other optical components. This decrease in energy is most apparent in the shorter wavelength region (250 nm and less). Check the energy of the instrument about once a year. The M_0 and M_1 mirrors should be replaced every two years, and the M_2 to M_5 mirrors should be replaced every five years.

***Note**: If an energy decrease is observed in the long wavelength region, improper optical alignment or some other problem is a more likely cause.*

<Procedure>

(1) Start up the [Data Monitor] program.

(2) Select the [Parameters…]/[General] command from the [Measure] menu and set the [Photometric mode], [Sensitivity] and [D.I.T.] settings as follows.

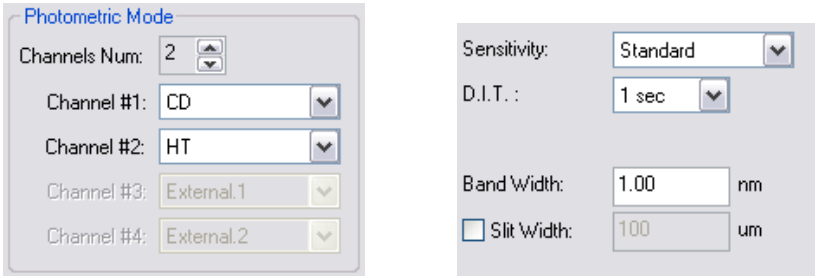


Figure. 4.5 Setting measurement parameters (energy check)

(3) Select the [Move Wavelength...] command from the [Control] menu and set to ″300 nm″

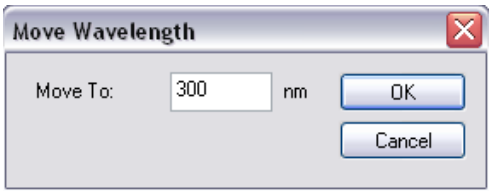


Figure. 4.6 Setting wavelength (energy check at 300 nm)

(4) Confirm that the value of channel 2 (HT voltage) is 180 to 260 volts when the sample compartment is empty.

(5) Set the wavelength to ″200 nm″.

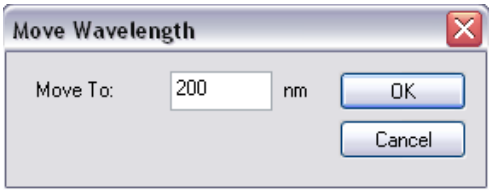


Figure. 4.7 Setting wavelength (energy check at 200 nm)

(6) Confirm that the value of channel 2 (HT voltage) is 500 volts or less when the sample compartment is empty.

4.3 Wavelength Accuracy Check and Adjustment

***Note**: Before checking wavelength accuracy, warm up the instrument for about one hour after turning the light source ON.*

***Note**: Use neodymium glass as the sample.*

<Procedure>

(1) Start up the Spectrum Measurement program.

(2) Select the [Parameters…]/[General] command from the [Measure] menu, and set the measurement parameters as shown in Fig. 4.8.

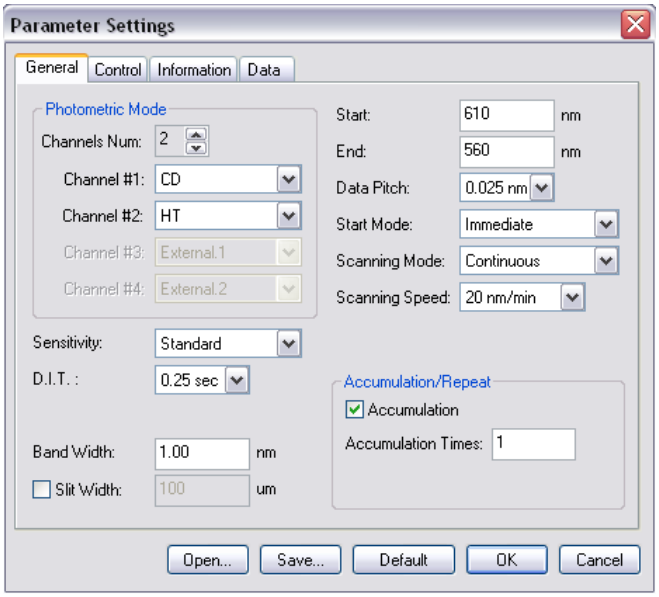


Figure. 4.8 Measurement parameters (wavelength accuracy check)

(3) Mount the neodymium glass sample in the sample compartment.

(4) Select the [Measure]/[Sample] command from the [Measurement] menu in order to perform a measurement (it is not always necessary to perform a baseline measurement).

(5) Using the spectrum analysis program, verify that the peak wavelength of Channel 2 (Fig. 4.8) of the measurement data is 586 ±0.8 nm. If the peak wavelength does not fall within this range, adjust the instrument according to the following procedure.

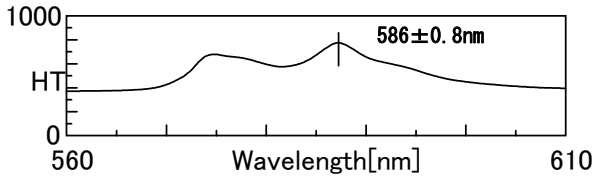


Figure. 4.9 HT data for neodymium glass

<Adjustment procedure>

Adjust the adjustment screws on the wavelength lever located at the bottom of the main unit.

(1) If the main unit is mounted in the optional cabinet, the wavelength cam and wavelength lever will be visible from below, as shown in Fig. 4.9. If the main unit is mounted on a table or bench, lay the instrument across two tables or benches to permit access to the adjustment screws.

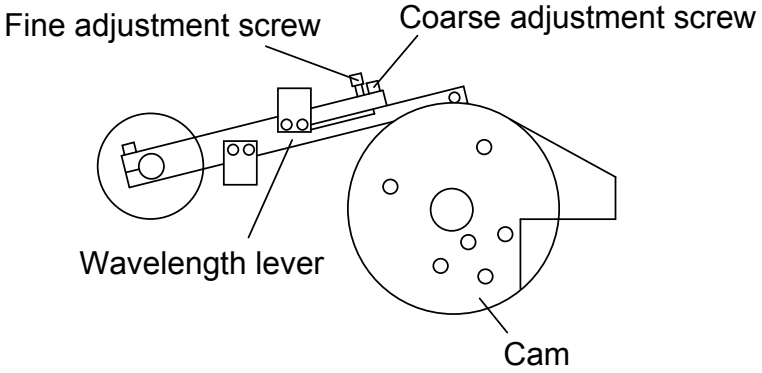


Figure. 4.10 Adjustment screws

(2) Correct the wavelength by adjusting the fine and coarse adjustment screws located on the wavelength lever. Turning the screw clockwise shifts the HT data to shorter wavelengths, and turning the screw counterclockwise shifts the data to longer wavelengths.

(3) Measure the HT data for the neodymium glass sample to check the wavelength setting.

***Note**: If the instrument is moved, gently move it back to its original position, and check wavelength accuracy again.*

4.4 CD Scale Check and Adjustment

***Note**: Before checking the CD scale, warm up the instrument for about one hour after turning the light source ON.*

***Note**: Use a 0.06% (w/v) aqueous solution of ammonium d-10-camphor sulfonate as the sample.*

<Procedure>

(1) Start up the [Spectrum Measurement] program.

(2) Select the [Parameters...]/[General] command from the [Measure] menu, and set the measurement parameters as shown in Fig. 4.11.

Figure. 4.11 Measurement parameters (CD scale check)

(3) Fill the 10 mm light path cell with 0.06% aqueous solution of ammonium d-10-camphor sulfonate (solvent: distilled water), and mount the cell in the sample compartment.

(4) Select the [Sample] command from the [Measure] menu to make a measurement.

(5) Using the spectrum analysis program, confirm that the peak value of Channel 1 (Fig. 4.12) is 190.4 ±1 mdeg (291.0 nm). If the peak value does not fall within this range, adjust the instrument according to the following procedure.

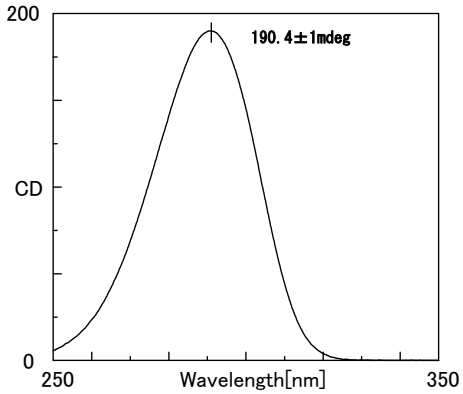


Figure. 4.12 CD spectrum of 0.06% ammonium d-10-camphor sulfonate

<Adjustment procedure>

Use the ″Scale Correction CD″ knob located on the rear panel of the amplifier unit (Fig. 3.4).

(1) Select the [Move Wavelength...] command from the [Control] menu and set to ″291.0 nm″

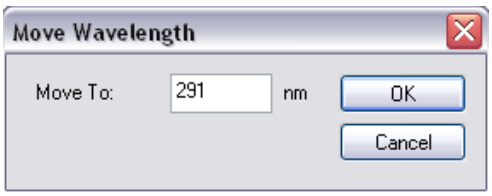


Figure. 4.13 Setting wavelength (CD scale adjustment)

(2) Turn the ″Scale Correction CD″ knob located on the rear panel of the amplifier unit (Fig. 3.4) until the CD value comes within the reference range.

(3) Measure the CD spectrum to check the CD scale.

4.5 Test Signal Check

The test signal is used to check if the electrical system is operating normally. A test signal can be generated by setting the photometric mode to ″Test Signal″.

<Procedure>

(1) Select the [Parameters...]/ [General] command from the [Measure] menu, and designate the measurement parameters as shown in Fig. 4.14.

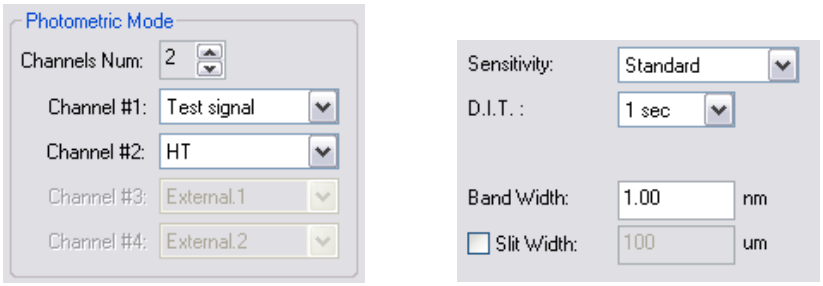


Figure. 4.14 Setting measurement parameters (test signal check)

(2) Verify that the measurement value of Channel 1 falls within 18 (±10%) mdeg.

(3) After that, set the ″Photometric mode″ to ″CD″.

5. TROUBLESHOOTING

If the instrument does not operate properly, the one of the following is likely to be the cause:

. Erroneous operation
. Deterioration of consumable components
. Failure of instrument

The following table describes basic corrective actions to be taken for specific symptoms. If the difficulty cannot be corrected by performing these actions, failure of the instrument is suspected. In this case, contact your local JASCO distributor with detailed information about your difficulty, including the model name, serial number, and date of manufacture of your instrument.

Symptom	Check	Corrective action
Power cannot be turned ON	Is the power cable plugged into the outlet?	Correctly plug in the cable.
	Is the fuse for the power supply unit intact?	Replace the fuse.
The light source does not come on.	Is the check box ″Turn ON light source at start″ in the ″System Setting″ dialog box checked?	Turn ON the light source in the ″Light source control″ dialog box.
	Is the flow rate of cooling water supplied to the 450 W light source[*1] sufficiently high?	Increase the cooling water flow rate.
	Is the cathode fixing screw tightened, (450 W light source[*1]) and are the anode holder and the lamp in contact with each other?	Tighten the cathode fixing screw. Adjust the contact plate of the anode holder.
	Can a sparking sound be heard?	Replace the lamp.
HT voltage does not increase.	Is the shutter open?	Open the shutter in the ″Shutter control″ dialog box.
	Is the photometric mode set correctly?	Set the measurement mode to ″CD″ (not ″Test signal″).
	Is the ″HT voltage setting″ in the ″Detector sensitivity″ dialog box set correctly?	Set it to ″Auto″ (not ″Manual″).
	Is the sample compartment lid completely closed?	Completely close the lid.
HT voltage has risen and will not decrease.	Is there a sample in the sample compartment?	Remove the sample.
	Is the spectral bandwidth setting too small?	Increase the spectral bandwidth.
	Is the cable correctly connected to the detector unit and to the connector located on the back panel of the amplifier unit?	Correctly connect the cable.
	Is the wavelength set to a value at which the detector is not sensitive?	Set the wavelength to a value at which the detector is sensitive.

	Is the nitrogen gas flow rate high enough when the wavelength is set below 180 nm?	Increase the nitrogen gas flow rate.
	Is the ″HT″ switch on the sub-panel of the amplifier unit in the ″Auto″ position?	Set the ″HT″ switch to ″Auto″.
The noise level is high	Is the spectra bandwidth setting too small?	Increase the spectra bandwidth.
	Does the sample have high light absorption?	Reduce the sample concentration, or shorten the light path of the cell.
	Is noise detected in the HT voltage?	Replace the Xe lamp.
	Is the HT voltage at below 250 nm too high?	Adjust the M_0 and M_1 mirrors.
	Is there any noise source that generates electromagnetic waves nearby?	Remove the noise source from the vicinity of the instrument.
	Is there any source of mechanical vibration nearby?	Remove the source of vibration.
	Does the line voltage vary abruptly.	Use stabilized line voltage.
The baseline curves strongly.	Is the curvature of the baseline within ±10 mdeg when the baseline is not corrected?	Perform baseline correction.
A CD value is displayed even though the sample is not optically active.	Is the sample fluorescent?	Decrease sample absorbance to 2 or less.
	Is the sample a film or liquid crystal?	A spurious CD signal from the sample is probable.
	Does the cell contain any optically active residue?	Prepare a new sample.
The displayed CD value is smaller than normal, or no display appears.	Is the ″HT voltage setting″ in the ″Detector sensitivity″ dialog box set correctly?	Set it to ″Auto″ (not ″Manual″).
	Is the photometric value 18±2 mdeg when the photometric mode is ″Test signal″?	Failure of the electrical system or modulator element is probable.
Repeatability of CD values is low.	Has the instrument warmed up sufficiently?	Before performing Cd measurement, warm up the instrument for approximately one hour after turning on the light source.
	Has the sample deteriorated due to irradiation by the light from the light source?	Use the shutter function or narrow the spectrum bandwidth.

	Is the variation in the peak value of aqueous solution of ammonium d-10-camphor sulfonate (distilled water, 10 mm cell) at 291.0 nm within 2 mdeg/hr?	Normal.
	Are the room temperature and humidity variations within the prescribed limits?	Maintain the room temperature within 20 ±5°C, and the humidity below 70%.
	Is air being blown on the instrument from an air conditioner or another source?	Install the instrument in a location away from the direct path of air currents.
	Is the scanning speed too high?	Slightly lower the scanning speed.
	Is the noise level too high?	Increase D.I.T. Or, refer to the ″The noise level is high″ symptom.
Wavelength repeatability is low.	Has the instrument warmed up sufficiently?	Measure the wavelength repeatability after warming up the instrument for approximately one hour after the light source is turned on.
	Is the variation in the room temperature and humidity variations too high?	Maintain the room temperature within 20 ±5°C, and the humidity below 70%.
No communication with the computer.	Is the RS-232C cable connected properly?	Reconnect the cable correctly.
	Is the communication port setting in agreement with the wiring?	Correctly set the communication ports.

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

Printed in Japan