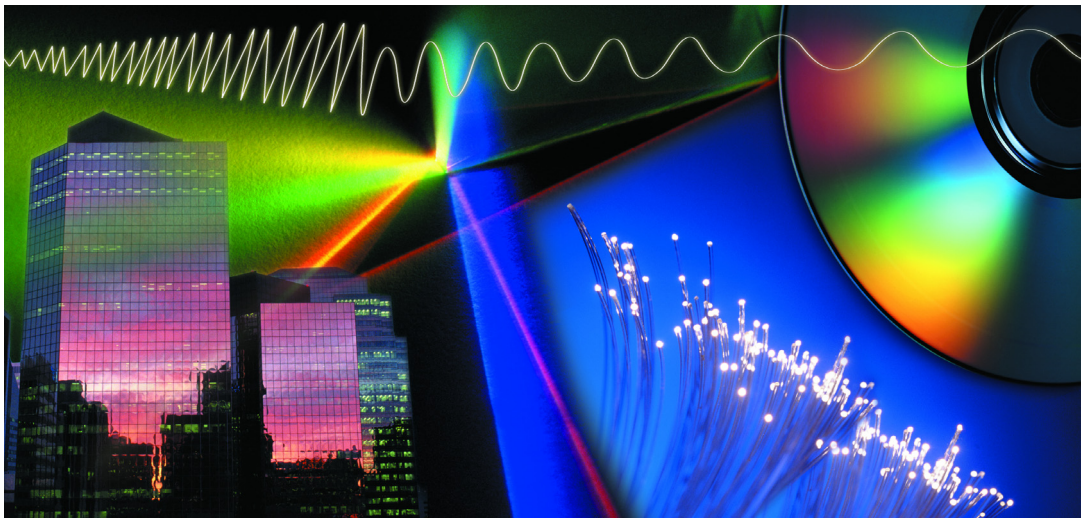
LAMBDA 650/850/950



Hardware Guide

PerkinElmer®
precisely.

Release History

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Table of Contents

Introduction

Overview

This hardware guide covers the operating instructions for the Lambda 650, Lambda 850 and Lambda 950 instruments plus those maintenance routines that do not necessarily require a PerkinElmer Service Engineer.

NOTE: *Responsible Body: Individual or body responsible for the use and maintenance of equipment and for ensuring that OPERATORS are adequately trained.*

There are separate manuals for the Sphere and Universal Reflectance accessories which can be found on the Lambda 650/850/950 Manuals CD.

This manual is divided into following chapters:

Chapter 1 Introduction

This chapter contains a brief introduction on the instrument, the conventions and warnings used in the manual.

Chapter 2 Safety Practices

Important safety information is provided in this chapter. It is the same information as given in the Lambda 650/850/950 Getting Started Guide that shipped with your instrument.

Chapter 4 System Description

This chapter contains information on the components of the instrument, how it works and instrument specifications.

Chapter 5 Lambda 650 Installation

Information on installing Lambda 650 instrument. Only the 650 should be customer installed, the 850 and 950 instruments should be installed a PerkinElmer Service representative. This is the same information given in the Lambda 650/850/950 Getting Started Guide that shipped with your instrument.

Chapter 6 Using the Instrument

Startup procedure and general instructions for using the instrument are provided.

Chapter 7 Maintenance

Maintenance and cleaning procedures for the various components of your instrument are provided.

Conventions Used in this Manual

Normal text is used to provide information and instructions.

Bold text refers to text that is displayed on the screen.

UPPERCASE text, for example ENTER or ALT, refers to keys on the PC keyboard. '+' is used to show that you have to press two keys at the same time, for example, ALT+F.

All eight digit numbers are PerkinElmer part numbers unless stated otherwise.

Notes, Cautions and Warnings

Three terms, in the following standard formats, are also used to highlight special circumstances and warnings.

NOTE: *A note indicates additional, significant information that is provided with some procedures.*

CAUTION	*We use the term CAUTION to inform you about situations that could result in **serious damage to the instrument** or other equipment. Details about these circumstances are in a box like this one.*
D	***Caution (Achtung)*** *Bedeutet, daß die genannte Anleitung genau befolgt werden muß, um einen **Geräteschaden** zu vermeiden.*
DK	***Caution (Bemærk)*** *Dette betyder, at den nævnte vejledning skal overholdes nøje for at undgå en **beskadigelse af apparatet**.*
E	***Caution (Advertencia)*** *Utilizamos el término **CAUTION** (ADVERTENCIA) para advertir sobre situaciones que pueden provocar **averías graves en este equipo** o en otros. En recuadros éste se proporciona información sobre este tipo de circunstancias.*
F	***Caution (Attention)*** *Nous utilisons le terme **CAUTION** (ATTENTION) pour signaler les situations susceptibles de provoquer de **graves détériorations de l'instrument** ou d'autre matériel. Les détails sur ces circonstances figurent dans un encadré semblable à celui-ci.*
I	***Caution (Attenzione)*** *Con il termine **CAUTION** (ATTENZIONE) vengono segnalate situazioni che potrebbero arrecare **gravi danni allo strumento** o ad altra apparecchiatura. Troverete informazioni su tali circostanze in un riquadro come questo.*
NL	***Caution (Opgelet)*** *Betekent dat de genoemde handleiding nauwkeurig moet worden opgevolgd, om **beschadiging van het instrument** te voorkomen.*
P	***Caution (Atenção)*** *Significa que a instrução referida tem de ser respeitada para evitar a **danificação do aparelho**.*

WARNING

*We use the term WARNING to inform you about situations that could result in **personal injury** to yourself or other persons. Details about these circumstances are in a box like this one.*

D

Warning (Warnung)
*Bedeutet, daß es bei Nichtbeachten der genannten Anweisung zu einer **Verletzung** des Benutzers kommen kann.*

DK

Warning (Advarsel)
*Betyder, at brugeren kan blive **kvæstet**, hvis anvisningen ikke overholdes.*

E

Warning (Peligro)
*Utilizamos el término **WARNING** (PELIGRO) para informarle sobre situaciones que pueden provocar **daños personales** a usted o a otras personas. En los recuadros como éste se proporciona información sobre este tipo de circunstancias.*

F

Warning (Danger)
*Nous utilisons la formule **WARNING** (DANGER) pour avertir des situations pouvant occasionner des **dommages corporels** à l'utilisateur ou à d'autres personnes. Les détails sur ces circonstances sont données dans un encadré semblable à celui-ci.*

I

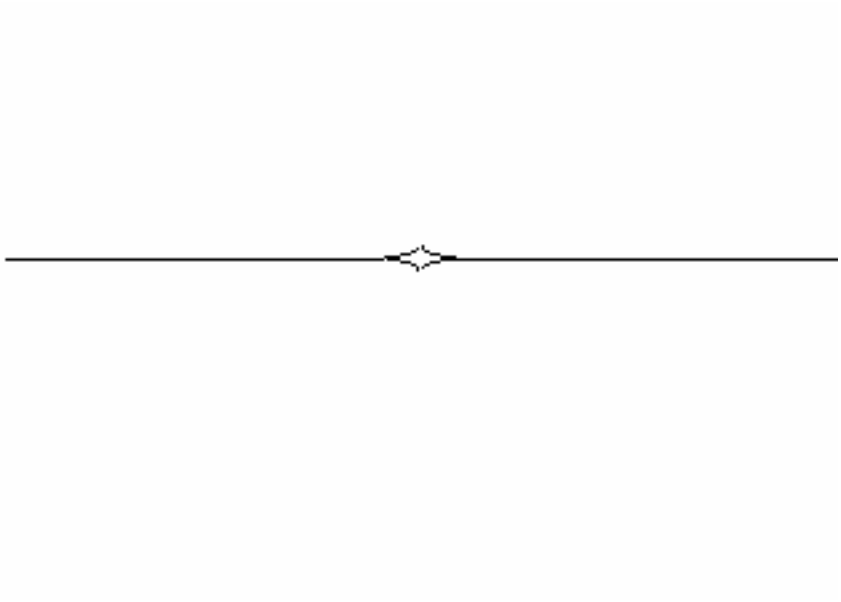
Warning (Pericolo)
*Con il termine **WARNING** (PERICOLO) vengono segnalate situazioni che potrebbero provocare **incidenti alle persone**. Troverete informazioni su tali circostanze in un riquadro come questo.*

NL

Warning (Waarschuwing)
*Betekent dat, wanneer de genoemde aanwijzing niet in acht wordt genomen, dit kan leiden tot **verwondingen** van de gebruiker.*

P

Warning (Aviso)
*Significa que a não observância da instrução referida poderá causar um **ferimento** ao usuário.*



Safety Practices

Overview

This chapter describes the general safety practices and precautions that must be observed when operating the Lambda 650/850/950.

This advice is intended to supplement, not supersede, the normal safety codes in the user's country. It is also a supplement to the PerkinElmer standard Safety and Health Policy. The information provided does not cover every safety procedure that should be practiced. Ultimately, maintenance of a safe laboratory environment is the responsibility of the analyst and the analyst's organization.

Please consult all manuals and CDs supplied with the Lambda 650/850/950 and accessories before you start working with the instrument. Carefully read the safety information in this chapter and in the other manuals supplied. When setting up the instrument or performing analyses or maintenance procedures, strictly follow the instructions provided.

Precautions

WARNING

Be sure that all instrument operators read and understand the precautions listed below. It is advisable to post a copy of the precautions near or on the instrument itself.

The following precautions must be observed when using the Lambda 650/850/950:

- Connect the instrument to a correctly installed line power outlet that has a protective conductor (earth/ground).
- Do not attempt to make internal adjustments or replacements except as directed in this handbook.
- Do not operate the instrument with any covers or parts removed.
- Servicing should be carried out only by a PerkinElmer service representative or similarly authorized and trained person.
- Disconnect the instrument from all voltage sources before opening it for any adjustment, replacement, maintenance, or repair. If, afterwards, the opened instrument must be operated for further adjustment, maintenance, or repair, this must only be done by a skilled person who is aware of the hazard involved.
- Use only fuses with the required current rating and of the specified type for replacement.
- Do not use makeshift fuses or short-circuit the fuse holders.

WARNING

If the equipment is used in a manner not specified herein the protection provided by the equipment may be impaired.

General Operating Conditions

The Lambda 650/850/950 has been designed and tested in accordance with PerkinElmer specifications and in accordance with the safety requirements of the International Electrotechnical Commission (IEC). The Lambda 650/850/950 conforms to IEC61010-1 (Safety Requirements for electrical equipment for measurement, control and laboratory use) as it applies to IEC Class 1 (earthed) appliances and therefore meets the requirements of EC directive 73/23/EEC.

This instrument meets the Canadian Standards Association (CSA) Standard CAN/CSA-C22.2 No. 1010.1-92: *Laboratory Equipment*.

Only use the Lambda 650/850/950 indoors and under the following conditions:

Temperature	15 ^{o}C to 35 ^{o}C
Relative Humidity	80% maximum (non-condensing)

If possible, avoid any adjustment, maintenance and repair of the opened, operating instrument. If any adjustment, maintenance and repair of the opened instrument is necessary, this must be done by a skilled person who is aware of the hazard involved.

Whenever it is likely that the Lambda 650/850/950 is unsafe, make it inoperative. The Lambda 650/850/950 may be unsafe if it:

- shows visible damage
- fails to perform the intended measurement
- has been subjected to prolonged storage in unfavorable conditions
- has been subjected to severe transport stresses.

NOTE: *The instrument must always be positioned so that it can easily be disconnected from the power supply.*

Environmental Conditions

The instrument has been designed to be safe under the following conditions:

- Indoor use
- Altitude up to 2000 m
- Ambient temperatures of 5 °C to 40 °C
- A maximum ambient relative humidity of 80% for temperatures up to 31 °C, decreasing linearly to 50% relative humidity at 40 °C
- Mains fluctuations not exceeding ± 10% of the nominal voltage.

WARNING

This instrument is not designed for operation in an explosive atmosphere.

Other Environmental Conditions

Chemicals

Use, store, and dispose of chemicals that you require for your analyses in accordance with the manufacturer's recommendations and local safety regulations.

WARNING

Hazardous Chemicals

Some chemicals used with this instrument may be hazardous or may become hazardous after completion of an analysis.

The responsible body (for example, Laboratory Manager) must take the necessary precautions to ensure that the surrounding workplace and instrument operators are not exposed to hazardous levels of toxic substances (chemical or biological) as defined in the applicable Material Safety Data Sheets (MSDS) or OSHA, ACGIH, or COSHH documents.

Venting for fumes and disposal of waste must be in accordance with all national, state and local health and safety regulations and laws.

OSHA: Occupational Safety and Health Administration (U.S.A.)
ACGIH: American Conference of Governmental Industrial Hygienists (U.S.A)
COSHH: Control of Substances Hazardous to Health (U.K.)

Toxic Fumes

If you are working with volatile solvents or toxic substances, you must provide an efficient laboratory ventilation system to remove vapors that may be produced when you are performing analyses.

Waste Disposal

Waste containers may contain corrosive or organic solutions and small amounts of the substances that were analyzed. If these materials are toxic, you may have to treat the collected effluent as hazardous waste. Refer to your local safety regulations for proper disposal procedures.

Deuterium lamps and other spectral lamps are maintained under reduced pressure. When you dispose of lamps that are defective or otherwise unusable, handle them correctly to minimize the implosion risk.

UV Radiation

You should be aware of the health hazards presented by ultraviolet radiation.

- When the deuterium (UV) lamp is illuminated, do not open the spectrophotometer covers unless specifically instructed to do so in the manual.
- Always wear UV-absorbing eye protection when the deuterium lamp is exposed.
- Never gaze into the deuterium lamp.

Compressed Gases

Handle cylinders of compressed gas with care, in accordance with local regulations.

We recommend that gas cylinders be located outside the laboratory and the gases led to the laboratory through approved gas supply lines.

Use only approved tubing, connectors, and regulators for gas supply lines.

Electrical Safety

The instrument has been designed to protect the operator from potential electrical hazards. This section describes some recommended electrical safety practices.

WARNING

Electrical Hazard
Any interruption of the protective conductor inside or outside the instrument or disconnection of the protective conductor (earth/ground) terminal is likely to make the instrument dangerous.
Intentional interruption is prohibited.

Lethal voltages are present in the instrument

- *Even with the power switch OFF, line power voltages can still be present within the instrument.*
- *When the instrument is connected to line power, terminals may be live, and opening covers or removing parts (except those to which access can be gained without the use of a tool) is likely to expose live parts.*
- *Capacitors inside the instrument may still be charged even if the instrument has been disconnected from all voltage sources.*

Electrical Protection

Insulation: Class I as defined in IEC 61010-1.

Installation Category: The instruments are able to withstand transient overvoltage according to Installation Category II as defined in IEC 61010-1 and IEC 664.

Pollution Degree: The equipment will operate safely in environments that contain non-conductive foreign matter and condensation up to Pollution Degree 2 as defined in IEC 61010-1 and IEC 664.

Electrical Safety Issues

To ensure satisfactory and safe operation of the instrument, it is essential that the green/yellow lead of the line power cord is connected to true electrical earth (ground).

If any part of the instrument is not installed by a PerkinElmer service representative, make sure that the line power plug is wired correctly:

Terminal	**Cord Lead Colors**	
	International	**USA**
Live	Brown	Black
Neutral	Blue	White
Protective Conductor (earth/ground)	Green/Yellow	Green

EMC Compliance

EC directive

This product complies with the minimum immunity requirements of IEC 61326 and has been tested to the relevant parts of the following standards:

IEC 61000-4-2

IEC 61000-4-3

IEC 61000-4-4

IEC 61000-4-5

IEC 61000-4-6

IEC 61000-4-11

This product complies with EN 55011 Group 1 Class A and with IEC 61000-3-2 and 61000-3-3.

FCC rules and regulations

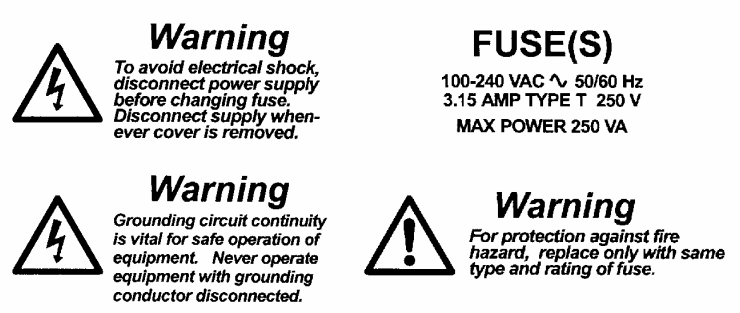
This product is classified as a digital device used exclusively as industrial, commercial, or medical test equipment. It is exempt from the technical standards specified in Part 15 of the FCC Rules and Regulations based on Section 15.103 (c).

Warning Labels

WARNING

When this label is attached to an instrument it means refer to the manual.

The following electrical warnings are shown on the rear of the instrument, as identified in Figure 1:



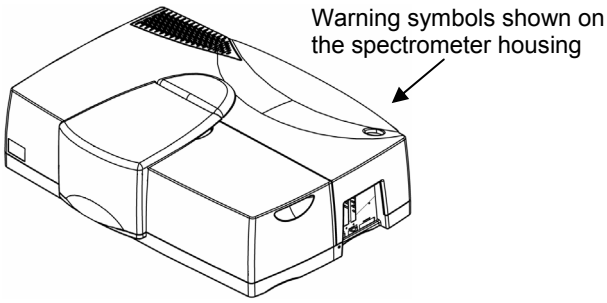


Figure 1 Lambda 650/850/950 Spectrometer

The following warnings are shown on the inside of the lamp compartment, as identified in Figure 2:

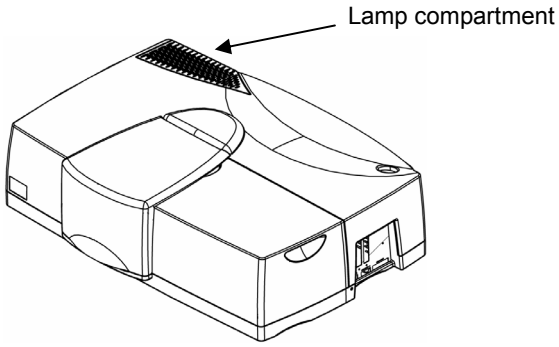


Figure 2 Position of the lamp compartment

Fuses

WARNING

Electrical hazard
To prevent potential injury to yourself and damage to the instrument, switch OFF all instruments in the system and disconnect them from the line power supply before you alter, or make any new, electrical connections.

The fuses are located in a fuse holder at the rear of the instrument, as shown in Figure 3.

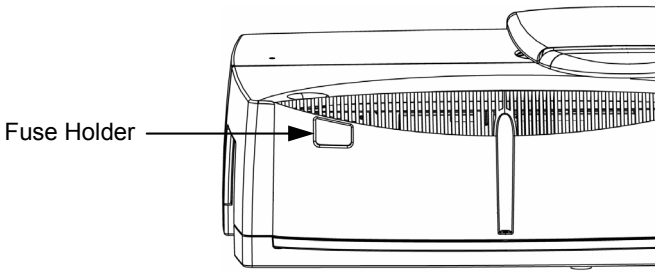


Figure 3 Rear view, fuse holder

1. Switch off the instrument and remove the line power cord from the electrical supply.
2. Squeeze in and lever out the two lugs at each side of the fuse holder one at a time using a flat-headed screwdriver
3. Gently pull out the fuse holder.

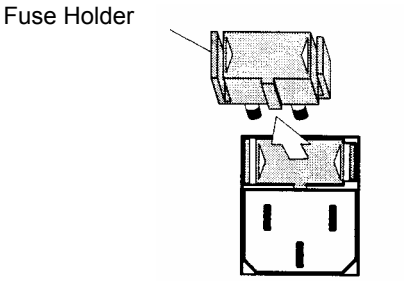


Figure 4 Removing the fuse holder

4. Replace the fuses with new ones of the same type and rating (3.15 A time delay).

NOTE: *The module has two fuses and you should always replace both at the same time, even if only one blew, as the other may have been weakened.*

5. Replace the fuse holder by aligning the lug at the bottom of the fuse holder with the slot in the socket and then pushing the holder into place.
   A click is heard as each lug snaps into place.

NOTE: *If you use the correct fuses but the instrument still does not work correctly, or the fuses blow repeatedly, contact your PerkinElmer office or representative.*

Moving the Instrument

WARNING

The instrument weighs about 76 kg. Four people are needed to lift the instrument.

CAUTION

If you must move the instrument any great distance, especially if the instrument may be subject to vibrations or jolts, contact your local PerkinElmer service representative for guidance or help.

If you are only moving the instrument within the laboratory or to a nearby laboratory then use four people and lift the instrument using the handholds, as shown in Figure 5.

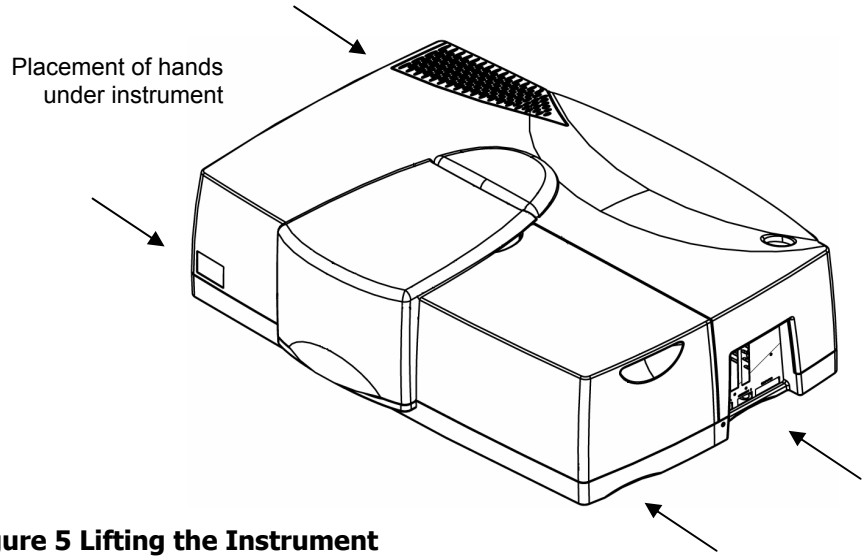


Figure 5 Lifting the Instrument

System Description

Overview

The Lambda 650, 850 and 950 are versatile spectrometers operating in the ultraviolet visible (UV/Vis) spectral ranges. Additionally, the Lambda 950 operates in the near infrared region. The spectrometer features a double-beam, double monochromator, ratio recording optical system.

These instruments are usable in a wide range of applications as indicated by their performance specifications.

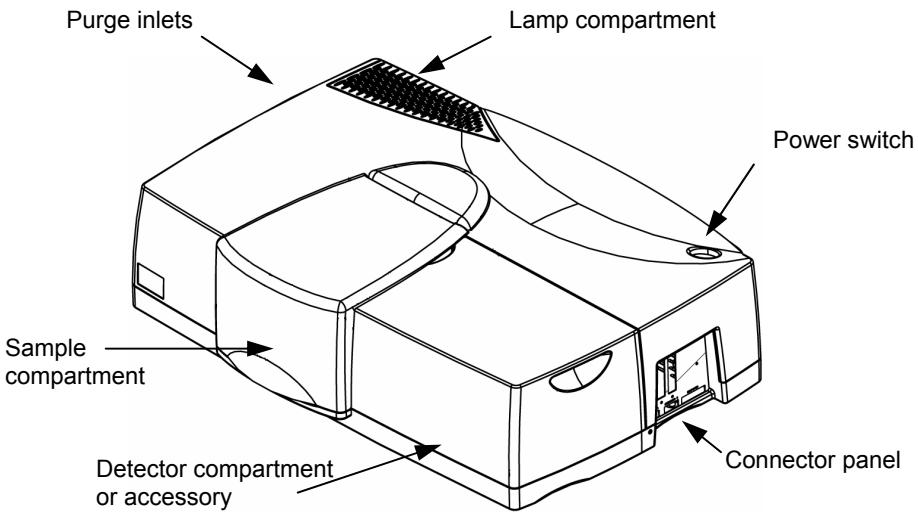


Figure 6 Lambda 650/850/950 spectrometer features

Optical System

The Lambda 650/850/950 Spectrometer features an all-reflecting, double-monochromator optical system. The optical components are coated with silica for durability. Holographic gratings are used in each monochromator for the UV/Vis range and the NIR range.

The optical system is depicted schematically in Figure 7.

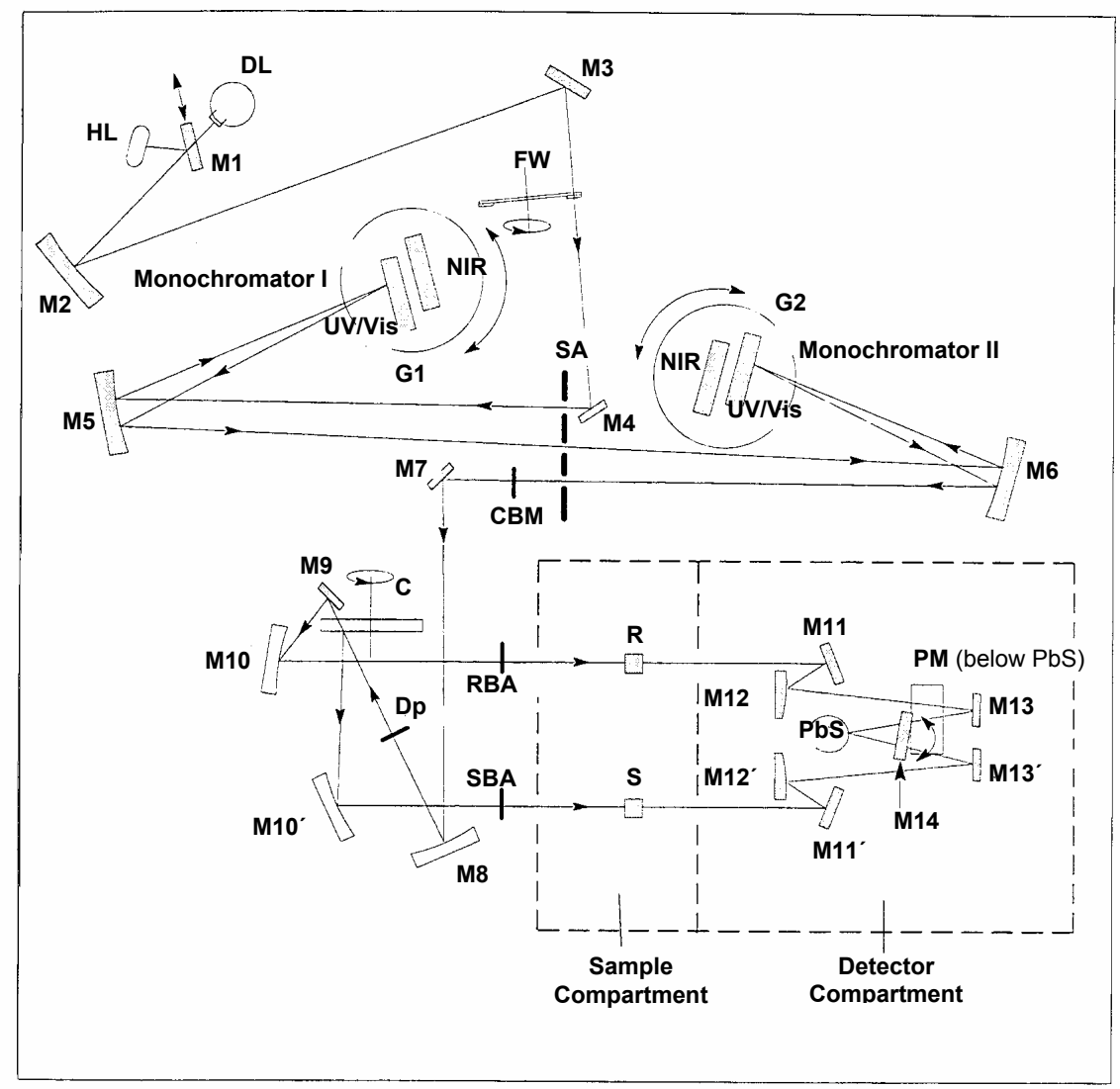


Figure 7 Schematic of Optical System

Two radiation sources, a deuterium lamp (DL) and a halogen lamp (HL), cover the working wavelength range of the spectrometer.

For operation in the near infrared (NIR) and visible (Vis) ranges, source mirror M1 reflects the radiation from the halogen lamp onto mirror M2. At the same time it blocks the radiation from the deuterium lamp.

For operation in the ultraviolet (UV) range, mirror M1 is raised to permit radiation from the deuterium lamp to strike source mirror M2. Source change is automatic during monochromator slewing.

Radiation from the respective source lamp is reflected from mirror M2 via mirror M3 through an optical filter on the filter wheel assembly (FW) to mirror M4.

The filter wheel is driven by a stepping motor to be in synchronization with the monochromators. Depending on the wavelength being produced, the appropriate optical filter is located in the beam path to prefilter the radiation before it enters the monochromator. Filter change is automatic during monochromator slewing.

From mirror M4 the radiation is reflected through the entrance slit of Monochromator I. All slits are located on the slit assembly (SA). The radiation is collimated at mirror M5 and reflected to the grating table G1. Depending on the current wavelength range, the collimated radiation beam strikes either the UV/Vis grating or the NIR grating (NIR version only).

The radiation is dispersed at the grating to produce a spectrum. The rotational position of the grating effectively selects a segment of the spectrum, reflecting this segment to mirror M5 and then through the exit slit. The exit slit restricts the spectrum segment to a near-monochromatic radiation beam. Grating change is automatic during monochromator slewing.

The exit slit of Monochromator I serves as the entrance slit of Monochromator II. The radiation is reflected via mirror M6 to the appropriate grating on grating table G2 and then back via mirror M6 through the exit slit to Mirror M7. The rotational position of grating table G2 is synchronized to that of G1. The radiation emerging from the exit slit exhibits high spectral purity with an extremely low stray radiation content.

In the UV/Vis and NIR range a choice is provided between a fixed slit width, a servo slit, and a slit program. When the servo slit is selected, the slit widths change automatically during scanning to maintain constant energy at the detector.

From mirror M7 the radiation beam is reflected via toroid mirror M8 to the chopper assembly (C). As the chopper rotates, a mirror segment, a window segment and two dark segments are brought alternately into the radiation beam.

When a window segment enters the beam, radiation passes through to mirror M9 and is then reflected via mirror M10 to create the reference beam (R).

When a mirror segment enters the beam the radiation is reflected via mirror M10' to form the sample beam (S).

When a dark segment is in the beam path, no radiation reaches the detector, permitting the detector to create the dark signal.

The radiation passing alternately through the sample and reference beams is reflected by mirrors M11, M12, M13, and M11', M12', M13', respectively of the optics in the detector assembly onto the appropriate detector. Mirror M14 is rotated to select the required detector. A photomultiplier (PM) is used in the UV/Vis range while a lead sulfide (PbS) detector is used in the NIR range. Detector change is automatic during monochromator slewing.

At the cell plane, each radiation beam is approximately 12 mm high. The width of the radiation beams is dependent on the slit width. At a slit width of 5 nm each radiation beam is approximately 4.5 mm wide.

To permit minimum sample volumes to be measured in micro cells, the height of the radiation beam must be reduced in the active cell area.

A common beam mask (CBM) is mounted between the slit assembly (SA) and mirror M7. This mask restricts the cross-section of both the sample beam and the reference beam in the respective cell area. The radiation beam can be reduced from the maximum height of 11.7 mm to 0.0 mm in 50 steps.

During all scanning operations, the monochromators stop slewing while a filter, source, or detector change is in progress.

NOTE: *You can select the source or detector change wavelength within a defined wavelength range. This facility is useful if a feature of special spectral interest is located at one of the default change wavelengths.*

The spectrometer scans from higher toward lower wavelengths.

There is an optional depolarizing filter (D_P) accessory, which can be swung into the beam.

There are internal attenuators for the Lambda 850 and 950 which can be swung individually into the sample beam (SBA) and the reference beam (RBA). The attenuators have the values: 0%, 1%, 10% and 100%. The Lambda 650 requires manual attenuators to be placed as required (L6020277 – 10% attenuator, L6020276 – 1% attenuator).

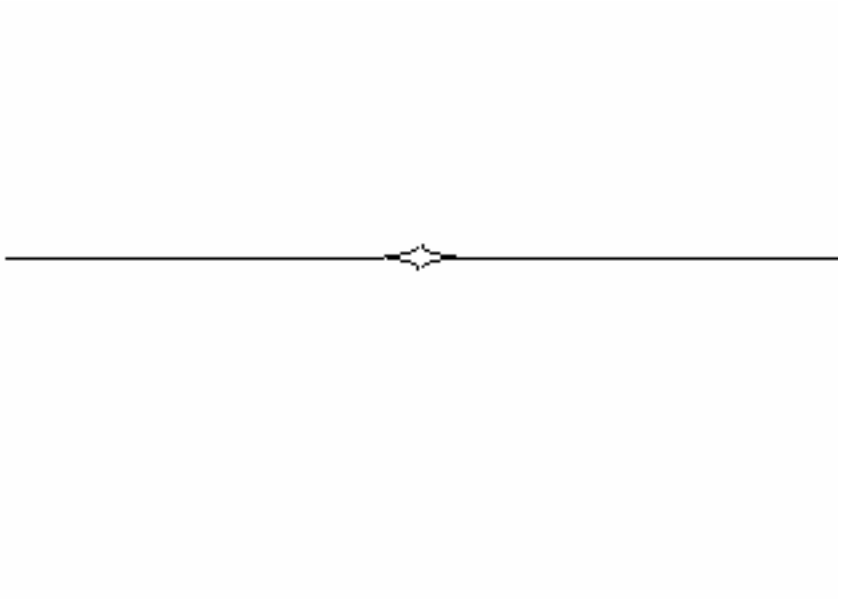
Minimum Performance Specifications

Specification	Lambda 950	Lambda 850	Lambda 650
Principle	Double beam, double monochromator, ratio recording UV/Vis/NIR spectrophotometer with microcomputer electronics, controlled by DELL PC or compatible personal computer.	Double beam, double monochromator, ratio recording UV/Vis spectrophotometer with microcomputer electronics, controlled by DELL PC or compatible personal computer.	Double beam, double monochromator, ratio recording UV/Vis spectrophotometer with microcomputer electronics, controlled by DELL PC or compatible personal computer.
Optical system	All reflecting optical system (SiO_2 coated) with holographic grating monochromator with 1440 Lines/mm UV/Vis blazed at 240 nm and 360 Lines/mm NIR blazed at 1100 nm, Littrow mounting, sample thickness compensated detector.	All reflecting optical system (SiO_2 coated) with holographic grating monochromator with 1440 Lines/mm UV/Vis blazed at 240 nm, Littrow mounting, sample thickness compensated detector optics.	All reflecting optical system (SiO2 coated) with holographic grating monochromator with 1440 Lines/mm UV/Vis blazed at 240 nm, Littrow mounting, sample thickness compensated detector optics.
Beam Splitting System	Chopper (46+ Hz, Cycle: Dark/Sample/Dark/ Reference, Chopper Segment Signal Correction CSSC).	Chopper (46+ Hz, Cycle: Dark/Sample/Dark/ Reference, Chopper Segment Signal Correction CSSC).	Chopper (46+ Hz, Cycle: Dark/Sample/Dark/ Reference, Chopper Segment Signal Correction CSSC).
Detector	Photomultiplier R6872 for high energy in the whole UV/Vis wavelength range. Peltier cooled PbS detector for NIR.	Photomultiplier R6872 for high energy in the whole UV/Vis wavelength range.	R955 Photomultiplier, giving high energy throughout the whole UV/Vis range.
Source	Pre-aligned tungsten-halogen and deuterium.	Pre-aligned tungsten-halogen and deuterium	Pre-aligned tungsten-halogen and deuterium.
Wavelength Range (N_2 purge required below 185 nm)	175 nm–3300 nm	175 nm–900 nm	190 nm– 900 nm
UV/Vis Resolution	≤0.05 nm	≤0.05 nm	≤0.17 nm
NIR Resolution	≤0.20 nm	N/A	N/A

Specification	Lambda 950	Lambda 850	Lambda 650
Stray Light			
At 200 nm (12 g/l KCl USP/DAP method)	> 2 A	> 2 A	> 2 A
At 220 nm (10 g/l NaI ASTM method)	≤0.00007 %T	≤0.00007 %T	≤0.0001 %T
At 340 nm (50 mg/l $NaNO_2$ ASTM method)	≤0.00007 %T	≤0.00007 %T	≤0.0001 %T
At 370 nm (50 mg/l $NaNO_2$ ASTM method)	≤0.00007 %T	≤0.00007 %T	≤0.0001 %T
At 1420 nm (H_20 1 cm pathlength)	≤0.00040%T	N/A	N/A
At 1690 nm ($CHCl_3$ 4 cm pathlength)	≤0.0015 %T	N/A	N/A
At 2365 nm ($CHCl_3$ 1 cm pathlength)	≤0.0005 %T	N/A	N/A
Wavelength Accuracy	+/- 0.08 nm UV/Vis +/- 0.30 nm NIR	+/- 0.08 nm	+/- 0.15 nm
Wavelength Reproducibility			
UV/Vis (Deuterium Lamp Lines)	≤0.020 nm	≤0.020 nm	≤0.06 nm
NIR (Deuterium Lamp Lines)	≤0.080 nm	N/A	N/A
Standard deviation of 10 measurements UV/Vis	≤0.005 nm	≤0.005 nm	
Standard deviation of 10 measurements NIR	≤0.020 nm	N/A	
Photometric Accuracy			
Double Aperture Method 1 A	+/- 0.0006 A	+/- 0.0006 A	+/- 0.0012 A
Double Aperture Method 0.5 A	+/- 0.0003 A	+/- 0.0003 A	+/- 0.0006 A
NIST 1930D Filters 2 A	+/- 0.003 A	+/- 0.003 A	+/- 0.003 A
NIST 930D Filters 1 A	+/- 0.003 A	+/- 0.003 A	+/- 0.003 A
NIST 930D Filters 0.5 A	+/- 0.002 A	+/- 0.002 A	+/- 0.002 A
$K_2Cr_2O_7$ Solution USP/DAP method	+/- 0.010 A	+/- 0.010 A	+/- 0.010 A

Specification	Lambda 950	Lambda 850	Lambda 650
Photometric Linearity (Addition of filters UV/Vis at 546.1 nm, Slit 2 nm, 1-sec. integration time) At 1.0 A At 2.0 A At 3.0A	 +/- 0.006 A +/- 0.017 A +/- 0.020 A	 +/- 0.006 A +/- 0.017 A +/- 0.020 A	 +/- 0.02 A
Photometric Reproducibility 1 A with NIST 930D Filter at 546.1 nm Standard Deviation for 10 measurements 0.5 A with NIST 930D Filter at 546.1 nm Standard Deviation for 10 measurements 0.3 A with NIST 930D Filter at 546.1 nm Standard Deviation for 10 measurements (2 nm Slit, 1 sec. integration time)	 ≤0.00016 A ≤0.00008 A ≤0.00008 A	 ≤0.00016 A ≤0.00008 A ≤0.00008 A	 ≤0.0008 A ≤0.0004 A
Photometric Range	8 A	8 A	6 A
Photometric Display	Unlimited	Unlimited	Unlimited
Bandpass	0.05 nm–5.00 nm in 0.01 nm increments UV/Vis range 0.20 nm–20.00 nm in 0.04 nm increments NIR range Fixed resolution, constant energy or slit programming.	0.05 nm–5.00 nm in 0.01 nm increments UV/Vis range Fixed resolution, constant energy or slit programming.	0.17 nm–5.00 nm in 0.01 nm increments UV/Vis range Fix resolution, constant energy or slit programming.
Photometric Stability (After warm-up at 500 nm, 0 A, 2-nm Slit, 2-sec. integration time, Peak to Peak)	≤0.0002 A/h	≤0.0002 A/h	≤0.0003 A/h
Baseline Flatness	+/- 0.0008 A (190 nm–3100 nm, 2 nm Slit, Gain 1 NIR, 0.20 sec. UV/Vis–0.24 sec. NIR integration time, no smoothing applied)	+/- 0.0008 A (190 nm–860 nm, 2 nm Slit, 0.20 sec. integration time, no smoothing applied)	+/- 0.0008 A (200 nm – 850 nm, 2 nm slit, 0.20 sec integration time, best-fit line)

Specification	Lambda 950	Lambda 850	Lambda 650
Photometric Noise RMS			
0 A and 190 nm	≤0.00010 A	≤0.00010 A	≤0.00010 A
0 A and 500 nm	≤0.00005 A	≤0.00005 A	≤0.00005 A
2 A and 500 nm	≤0.00020 A	≤0.00020 A	≤0.00020 A
4 A and 500 nm	≤0.00100 A	≤0.00100 A	≤0.00200 A
6 A and 500 nm	≤0.00500 A	≤0.00500 A	
0 A and 1500 nm	≤0.00004 A		
2 A and 1500 nm	≤0.00100 A		
3 A and 1500 nm	≤0.00300 A		
(2 nm Slit, 1-sec. integration time, Gain 1 NIR)			
Sample Compartment Instrument (WxDxH)	200 mm x 300 mm x 220 mm	200 mm x 300 mm x 220 mm	200 mm x 300 mm x 220 mm
Purging			
Optics	YES	YES	NO
Sample Compartment	YES	YES	NO
Instrument Dimensions (W x D x H)	1020 mm x 630 mm x 300 mm	1020 mm x 630 mm x 300 mm	1020 mm x 630 mm x 300 mm
Instrument Weight	76 kg	76 kg	76 kg
Digital I/O	RS 232 C	RS 232 C	RS 232 C
Light Beam	90 mm above the base plate 120 mm beam separation 3 mm–12 mm beam height	90 mm above the base plate 120 mm beam separation 3 mm–12 mm beam height	90 mm above the base plate 120 mm beam separation 3 mm–12 mm beam height
Instrument Requirements			
Power	90 VAC–250 VAC, 50/60 Hz; 250 VA	90 VAC–250 VAC, 50/60 Hz; 250 VA	90 VAC–250 VAC, 50/60 Hz; 250 VA
Temperature	10 °C–35 °C	10 °C–35 °C	10 °C–35 °C
Recommended Humidity	10–70% relative humidity, non-condensing	10–70% relative humidity, non-condensing	10–70% relative humidity, non-condensing



Lambda 650 Installation

Overview

CAUTION	*Only the Lambda 650 is designed to be customer installed.* *For the Lambda 850 or 950 please arrange for installation with your local PerkinElmer Service Representative.*

Requirements

For maximum stability and minimum maintenance, observe the following requirements when choosing where to site the instrument:

- A firm base free from vibration.
- Enough space around and underneath the instrument for efficient air circulation, as shown in Figure 8.
- A constant temperature between 15 ºC and 35 ºC.
- Constant humidity between 20% and 80% relative humidity.
- An atmosphere free from dust and corrosive fumes.
- Keep out of direct sunlight. Illumination with diffuse lighting is ideal.
- A suitable source of electrical power should be located in the vicinity of the instrument, in this case a proper earth-grounded 3-wire electrical outlet.
- The standard sample compartment baseplates have drain holes in them to run off spilled liquids to the benchtop underneath the instrument. If required, place a sheet of thick filter paper under the instrument.

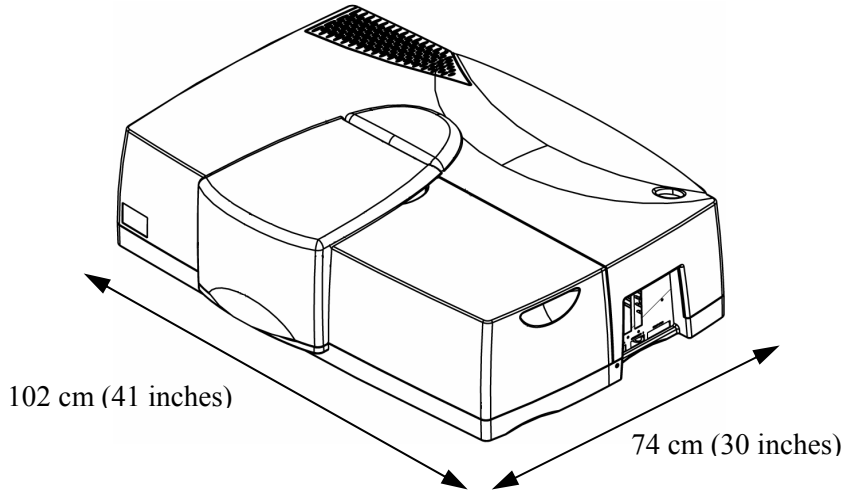


Figure 8 Space Requirements

Unpacking

CAUTION	*Take great care when installing your Lambda 650, and follow the procedures described in this manual. If you require assistance, contact your local PerkinElmer Service Representative.*

WARNING

The instrument weighs about 76 kg. Four people are needed to lift the instrument.

1. Unpack the components carefully, using four people to lift the instrument itself. Keep the packing materials for possible future storage or reshipment.

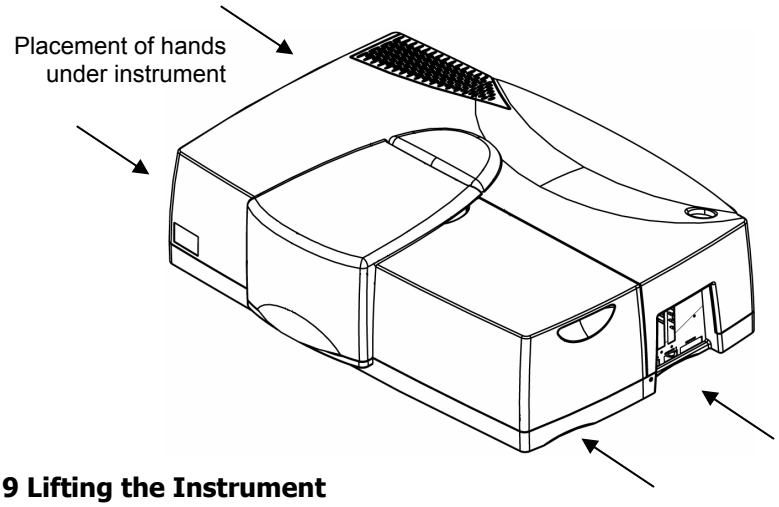


Figure 9 Lifting the Instrument

2. Check that you have the following items:

Part No.	**Description**
	UV WinLab Software Kit (ES or Standard)
09300004	Lambda 650/850/950 Getting Started Guide
09300005	Lambda 650/850/950 User Manuals CD
B0505071	2 Single-cell holders
B0142227	Screwdriver 5.5 mm
B0126972	Screwdriver 4.0 mm

Part No.	Description
B0859227	Long crosshead screwdriver
B0180242	Connecting cable, Spectrometer to PC
	Country specific power lead
B0155573	Spare fuse drawer
B0508454	Ferrite choke
L6020235	Hinge cover plate
B0155573	Spare fuses (ten 3.15 A T)
L6020277	2 10% manual attenuators
L6020276	2 1% manual attenuators

NOTE: *The two manual attenuators are only supplied with a Lambda 650.*

3. Examine the components for any signs of damage in shipment:

    - Check the entire outer cabinet of the spectrometer for damage, and make sure that terminals, fuse holders, etc. are not damaged.

    - Open and close the sample compartment cover, checking that it moves freely without binding.

    - Make sure that the compartment is free of dust or other foreign matter.

NOTE: *In the event of damage or missing parts, file an immediate claim with the authorized carrier, and inform your PerkinElmer office or representative.*

Connecting to the Line Power Supply

WARNING

Electrical Hazard

To prevent potential injury to yourself and damage to the instrument, first make any electrical connections in the system before connecting to the line power supply.

The spectrometer automatically adjusts to the correct operating voltage. Before starting the instrument for the first time, make sure that the correct fuse is fitted to your line power supply.

- *If you have a different fuse, change it for the correct one.*
- *Do not connect the spectrometer to the line power supply if the wrong fuse is fitted.*

4. Make sure that the correct fuses are fitted in the holder at the rear of the spectrometer (see *Fuses* on page 21).

NOTE: *The module has two fuses.*

5. Make sure that the plug fitted to the line power cord provided with the spectrometer is suitable for your local electrical outlets.

   If it is not, remove it and fit a plug conforming to the local regulations.

6. After all connections have been made between the various components of the system, make certain that all Power switches are set to off, then connect the line cords to the electrical power supply.

   The Power switch is located at the top right-hand rear of the spectrometer.

NOTE: *To prevent interferences caused by earth loops when operating with ancillary instruments (for example, printers), connect all components of the system to the same phase of the electrical supply via a multisocket distributor.*

Connecting the System Components

WARNING

Electrical Hazard

*To prevent potential injury to yourself and damage to the instrument, switch **OFF** all instruments in the system and disconnect them from the line power supply before you alter, or make any new electrical connections.*

- The PC and the printer may be placed either side of the spectrometer, but must not be placed on top of the spectrometer.
  When placing instruments side by side, always leave a small gap between them.
- Make sure that air can circulate freely over and under the system as well as behind it.
- Do not place anything on or under any of the components that could hinder free air circulation.

Connecting to the PC

➢ The PC is connected using the connection marked COMPUTER on the right side of the instrument, as shown in Figure 10.

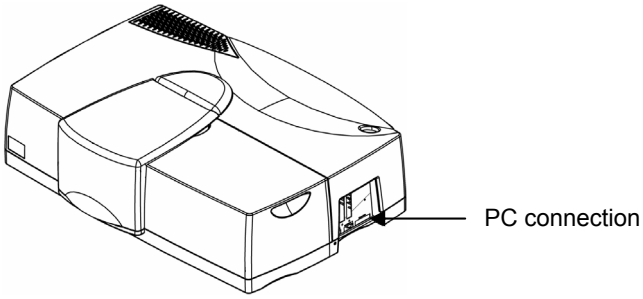


Figure 10 PC Connection

NOTE: *We suggest that you place the ferrite choke supplied with the instrument around the lead.*

NOTE: *You can use an external printer for hard-copy printouts of the analytical results. The printer is connected via the PC.*

To install the software, refer to the instructions that shipped with your software package.

Setting up the Instrument in the Software

Before you can use your instrument with UV WinLab software, you must set up the instrument in the UV WinLab Explorer.

NOTE: *If your instrument is Service installed you should not need to do this.*

1. With the instrument switched on, in the Main pane of the UV WinLab Explorer select Instruments.

   The Instruments page is displayed.

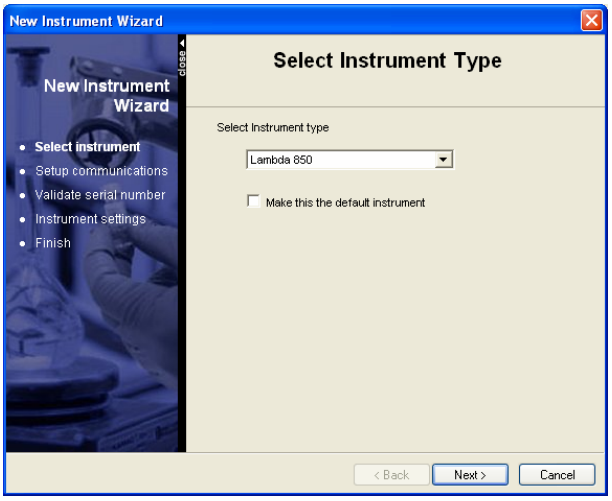
2. Double-click **Add New Instrument**,  .

   The New Instrument Wizard starts.

3. Select the **type of instrument** from the drop-down list.

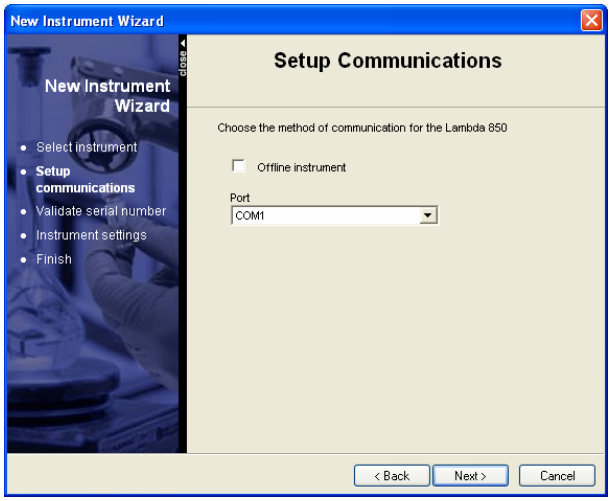
   The **Description** below the drop-down list details the available instruments for the selected type.

4. Click **Next**.



5. Select the **instrument type** to add from the drop-down list, and if required, select **Make this the default instrument**.

6. Click **Next**.

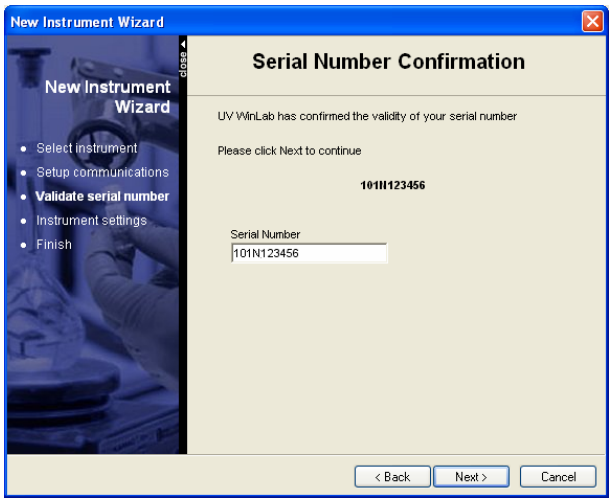


7. From the drop-down list, select the **Port** the instrument is connected to.

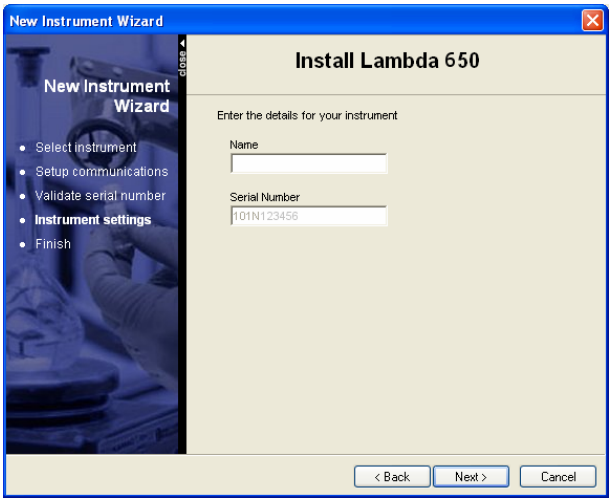
8. Click **Next**.

   The software will automatically perform a check to see if the correct instrument is attached to the selected port and switched on, and will display a Warning message if not.

   You may then be asked to confirm the serial number of the instrument.



9. Check the serial number on the right-hand side of the instrument, where the PC connects to the instrument, correct it if necessary, and click **Next**.



10. Enter a **Name** for the instrument.

    The **Name** you enter will be displayed in the Explorer beneath the instrument icon. It can be edited in future if required.

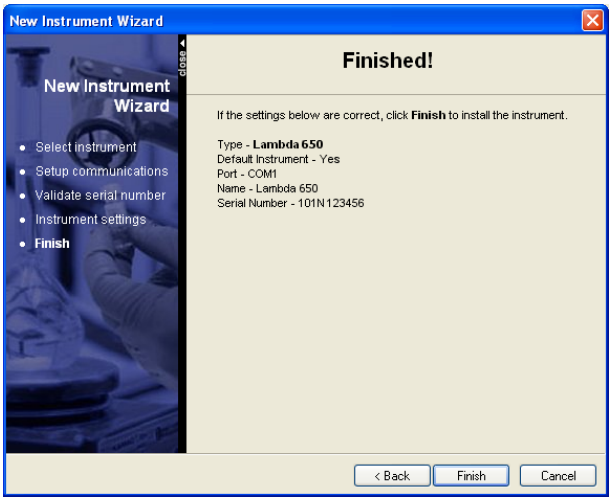
11. Select whether a **Common Beam Depolarizer**, **Double Polarizer / Depolarizer**, and/or manual **Attenuators** are installed.

    These can be selected if you are going to use them, even if they are not currently installed.

NOTE: *Manual Attenuators are only available for the Lambda 650, the Lambda 850 and 950 have automatic attenuators. The Common Beam Depolarizer requires a firmware command to be enabled.*

12. Click **Next**.

    The Finished page displays all the selected settings.



13. If all the settings are correct, click **Finish** to close the wizard and add the instrument.

    The Wizard closes, a confirmation message that the instrument has been successfully installed is displayed, and the instrument is displayed in the Explorer.

    OR

    Click **Back** to return to the previous page(s) and amend the settings as required.

Calibrating the Instrument

Once the instrument is set up in the software you will need to calibrate it.

NOTE: *Make sure that the instrument has been switched on for at least an hour before calibrating it.*

14. From the Instruments page of the Explorer, right-click on the new instrument and select **Calibrate**.
    The Calibration Utility dialog is displayed.
    The dialog displays the names of the routines, a description, the last calibration date of the routine, and whether the test is enabled.

15. To view (and change) the settings for a particular routine, highlight the routine in the table and then click **Settings**.
    The settings dialog for the selected routine is displayed.

NOTE: *Settings is not available for Slit Calibration.*

16. Select the routines to be performed by the calibration.
    There are three calibration routines available - **UV/Vis Two Peak** (see page 42 for details), **Slit Calibration**, and **0%T** (see page 43 for details). All of these routines should be performed.
    A check mark indicates the routine is selected and will be performed.

17. Click **Calibrate**.
    The calibrations are performed in the order listed in the table. Messages below the table show the progress of the calibration.
    When a calibration has passed, a green check mark is displayed in the first column of the table. If the test fails, a red cross is displayed. In such an event please contact your local PerkinElmer Service Representative.

18. When the calibration has finished, click **Close** to close the dialog.
    The date and time of the calibration is recorded in the instrument event log.

NOTE: *It is not possible to print the calibration results.*

Your instrument is now ready to be used.

UV/Vis Two Peak Calibration

This calibrates the UV/Vis wavelength range.

- Select **Manual set**, **Manual set 1 peak**, **Manual set 2 peaks**, **Auto search 1 peak**, or **Auto search 2 peaks**.

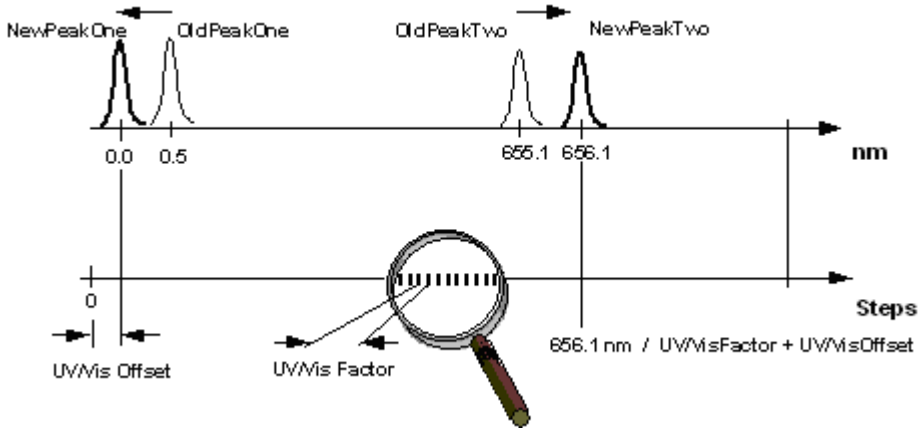
  - **Manual set** enables you to enter the **offset** and **factor** (without the need to determine the values in advance).

  - **Manual set 1 peak** enables you to change the offset. A well known peak can be shifted to an exact wavelength by entering values of **Old Peak 1** and **New Peak 1**.

- **Manual set 2 peaks** enables you to change the offset and factor by specifying the old and new values of 2 well known peaks by entering values of **Old Peak 1**, **New Peak 1**, **Old Peak 2** and **New Peak 2**.

- **Auto search 1 peak** enables you to change the offset. The software performs an automatic search for the D_2 peak at 656.1 nm. The measured peak is then shifted to the exact wavelength.

- **Auto search 2 peaks** enables you to change the offset and factor. The software performs an automatic search for the D_2 peak at 656.1 nm and the peak at 0.0 nm. The measured peaks are then shifted to the exact wavelengths.



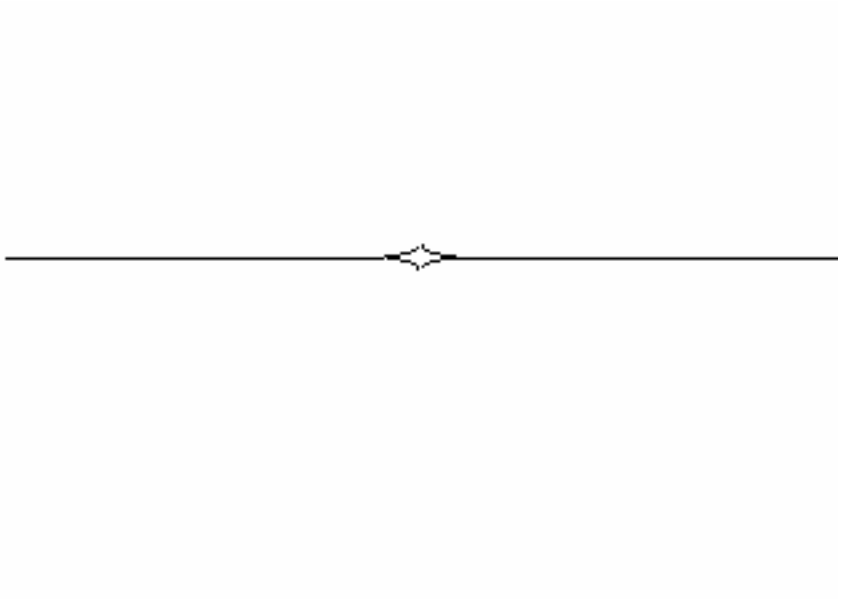
0%T

This calibrates the electronic offsets.

➢ Select **Auto** to enable the software to determine the required offset.

OR

Enter the required **Calibration offset** value to be used.



Using the Instrument

Startup procedure

NOTE: *If you have purchased accessories you may want to install these first before commencing with the Startup procedure. An overview of accessories is available on page 70, see also the specific documentation for the accessory.*

CAUTION	*Do not turn power to the instrument on and off quickly as this may damage the power supply.* *Wait at least 30 seconds before re-starting.*

1. Open the sample compartment cover.
2. Make sure that the beam paths are free from obstruction.
   This means that no objects (for example, cables) project into the beam paths, no samples are in the sample compartment, and any accessories are properly installed.

NOTE: *If the sample compartment is obstructed during the startup procedure, the spectrometer will not initialize correctly.*

3. Close the sample compartment.
4. Switch on the power switch located at the top right hand corner of the instrument as shown in Figure 11.
   The switch will light up when there is power to the instrument.

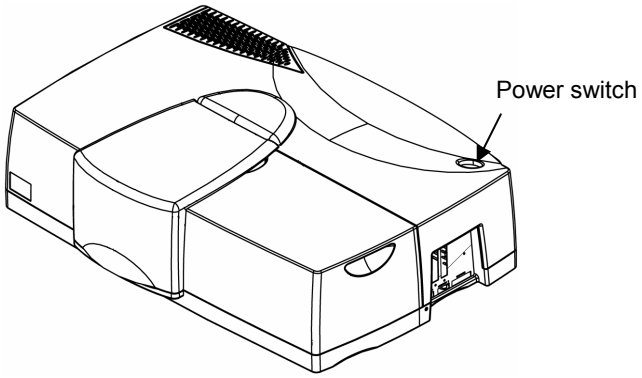


Figure 11 Power Switch

5. Switch on any accessories.
6. Wait until all instrument initialization is complete before starting the UV WinLab software.
   This will take approximately three minutes from switching the power on.

NOTE: *We recommend that for optimal performance of the instrument you should leave the spectrometer switched on for approximately one hour to allow the lamps to warm up and stabilize before starting analysis.*

The Single Cell Holder

Description

There are two single-cell holders provided with the instrument, one for the sample beam and one for the reference beam. The single-cell holders are mounted on a plinth to bring them in line with the radiation beam.

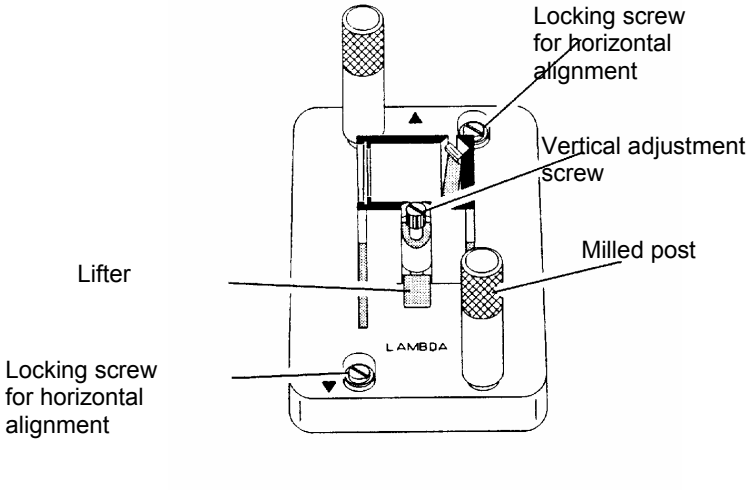


Figure 12 Single Cell Holder B0505071

Installing the Cell Holder

Install the plinth in the sample compartment as follows:

1. Lower the plinth so that the two locating holes slip onto the two locating pins on the baseplate in the sample compartment, as shown in Figure 13.
   The plinth only fits one way round.

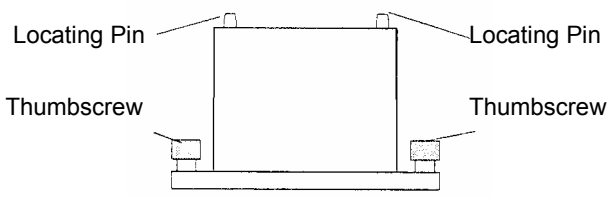


Figure 13 Fitting the plinth to the baseplate in the sample compartment

2. Screw the two thumbscrews by hand into the baseplate.

Install the single-cell holder in the sample compartment as follows:

3. Orientate the holder so that the word **LAMBDA** is toward the front of the sample compartment (see Figure 14 below).

4. Lower the holder so that the two locating holes slip onto the two studs on the two locating pins on the plinth in the sample compartment.

The cell holder only fits one way round.

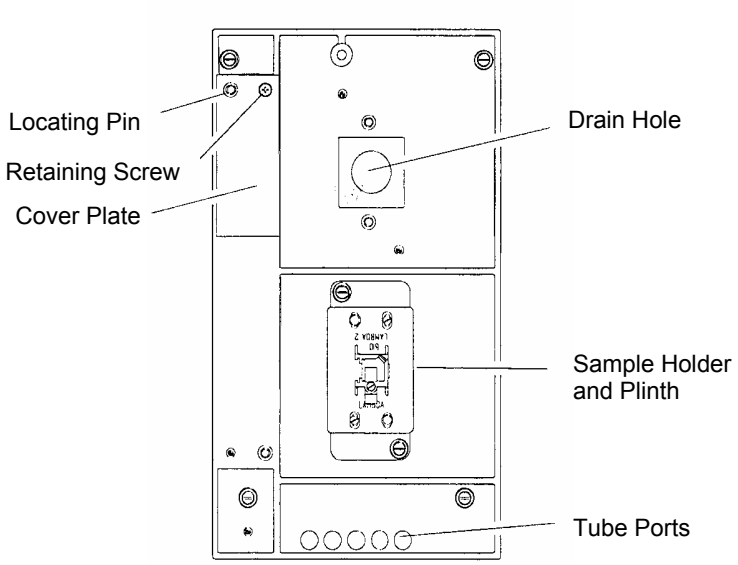


Figure 14 Lambda 650/850/950 Sample Compartment Baseplate

5. Move the milled posts a little to locate the threaded holes in the baseplate, and then tighten the milled posts.

   You can lead tubes and connecting cables for accessories into the sample compartment through either the tube ports, located at the front of the sample compartment, or the opening located at the left rear of the sample compartment under the cover plate.

   When not in use, you should always insert the caps into the tube ports and keep the cover plate fixed in place.

   The cover plate is fixed in place by a retaining screw.

Aligning the Single-cell Holder

Coarse alignment of the single cell holder is carried out as follows:

1. Open the sample compartment cover.

2. Fill cells with a low-absorbing solvent (deionized water or ethanol).

3. Insert one cell into the sample cell holder and one into the reference cell holder.

   Make certain that the cell is pushed down fully.

NOTE: *The alignment procedure is for a given cell in a given holder. After alignment, the cell should always be used in the same holder.*

4. From The UV WinLab Explorer, select the instrument you are using and select **Manual Control** from the Tools menu.

5. From the Manual Control window, select **Data Collection** in the treelist and then select **Alignment Mode** on the page.

6. Block the sample and reference beam windows on the right side of the sample compartment with a card to prevent white light from saturating the detector.

7. By holding a piece of matt white paper behind each cell holder, visually examine the light spot to see that the radiation beam is passing through the cell sample area.
   Diffraction patterns become apparent if the radiation beam impinges on the cell wall.

8. If the radiation beam is not centered exactly, loosen the two locking screws and the two milled posts on the relevant cell holder and shift the cell holder plate to center the radiation beam.
   Then retighten the two milled posts and the two locking screws.

9. Visually check the vertical alignment of the radiation beam in the cell sample area.
   Alignment is correct when the radiation beam is just above the floor of the cell sample area (minimum 2 mm) or covers the cell window.

NOTE: *The center of the window for micro flowcells should be ideally approximately 15 mm above the base of the cell.*

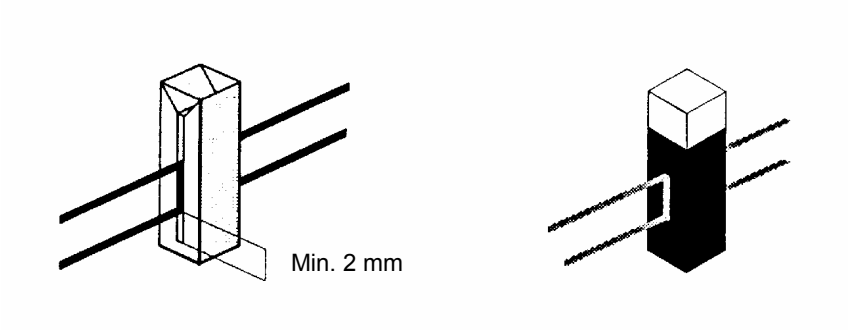


Figure 15 Correct alignment of the radiation beam in the cell sample area

10. If alignment is required, turn the vertical adjustment screw on the lifter either clockwise to raise the cell, or counterclockwise to lower the cell.

11. Recheck the horizontal alignment of the radiation beam through the cell and correct if necessary.

12. Slew the monochromator to any value above 200 nm.

13. Remove the card blocking the sample beam window and close the sample compartment cover.
    This completes the coarse alignment of the cell holders. If necessary, proceed with the fine alignment as described below.

Fine Alignment

If fine alignment is necessary, proceed as follows:

1. Slew the monochromator to your measurement wavelength or to 460 nm.

2. Call up a method that uses transmission (%T) as the ordinate.

3. If necessary change the ordinate mode to transmission.

4. Remove the reference cell from the sample compartment.

5. Make horizontal fine alignment to the sample cell holder (locking screws and milled posts loosened) to obtain the highest possible transmittance reading on the display.
   Close sample compartment cover while measuring transmittance.

6. Make fine alignment using the vertical adjustment screw again to obtain the highest possible reading.
   Close sample compartment cover while measuring transmittance.

7. When you are satisfied with the alignment, tighten the milled posts and the locking screws on the cell holder.

8. Reinstall the reference cell in the reference cell holder.

9. The sample cell remains in its holder.

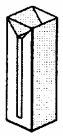
10. Repeat steps 4 to 6 with the reference cell holder, but this time obtain the lowest possible transmittance reading on the display.
    This completes the fine alignment procedure.

NOTE: *When the cell holder has been aligned once, you can take it out and reinstall it without aligning it again.*

Minimum Volume Applications

To measure minimum sample volumes, use microcells (offered by PerkinElmer).

The minimum sample volume required is a function of the cell internal width or volume and is specified below.

Cell Type		Cell Internal Width	Pathlength	Minimum Volume Required	Part Number
	Height of liquid slightly more than height of beam	2 mm	1 cm	150 µL	B0079404 (pair)
		4 mm	1 cm	300 µL	B0079402 (pair)
		Cell Volume	**Pathlength**	**Minimum Volume Required**	**Part Number**
	Cell window completely filled with liquid	0.5 µL	0.01 cm	2 µL	B0510076
		2.5 µL	0.5 cm	5 µL	B0510077
		5 µL	0.1 cm	10 µL	B0510078
		5 µL	1.0 cm	10 µL	B0505823
		30 µL	1.0 cm	50 µL	B0190608

NOTE: *You should align microcells very carefully in the radiation beam by following the procedures in* Aligning the Single-cell Holder *on page 48. When aligning microcells, fill each cell with the minimum volume of liquid specified in the above table to make sure that the liquid meniscus is not in the radiation beam.*

Instrument Purging (Lambda 850 and 950 only)

WARNING

Always purge the instrument with an inert gas such as Nitrogen. Never use a flammable gas such as Hydrogen.

Oxygen absorbs radiation in the UV range below 190 nm, while water vapor absorbs radiation in the NIR range between 1350 nm and 1450 nm, 1850 nm and 1950 nm, and also between 2520 nm and 3000 nm. Best accuracy for measurements in these spectral regions can only be obtained when the spectrometer is purged with nitrogen.

The entire optical compartment of the spectrometer is sealed. Radiation from the source lamps enters the optical compartments through a window. The sample compartment is also sealed from the optical compartment by windows. Thus the entire optical radiation path from virtually the source lamp to the detector can be purged largely free of water vapor and oxygen.

Fittings are provided on the left side of the spectrometer for connection of a supply of nitrogen, as shown in Figure 16. The inlet nearest the rear of the instrument is for the sample compartment and the one nearest the front of the instrument is for the main optical compartment. After purging these compartments the nitrogen escapes to atmosphere.

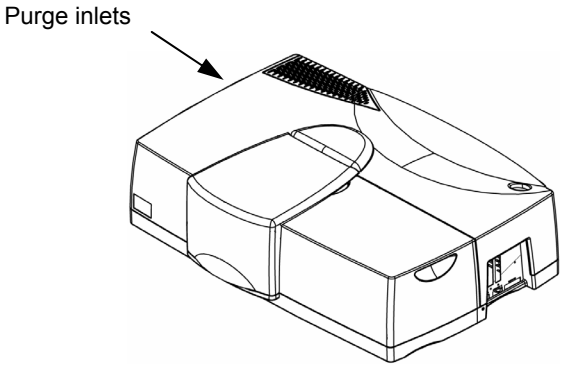


Figure 16 Connectors for the purge gas supply

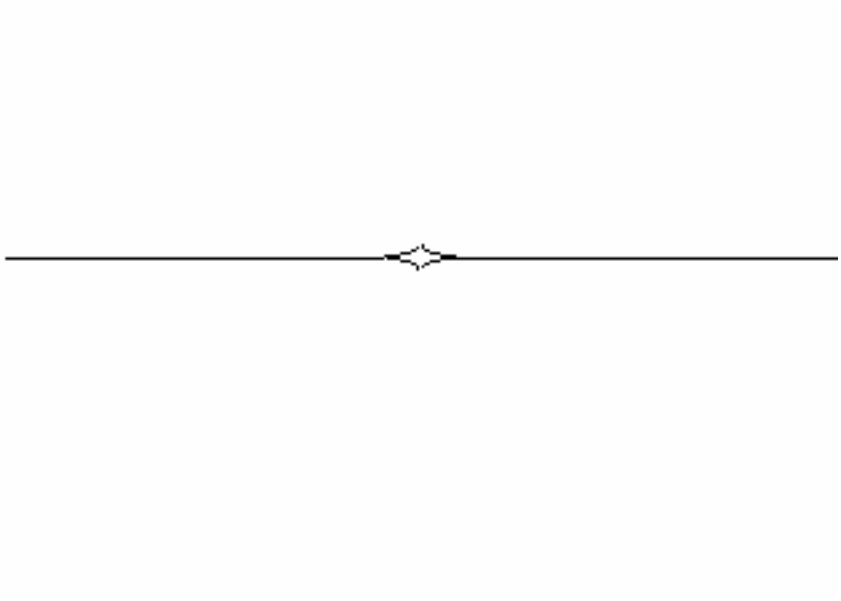
You should keep the sample compartment closed during routine operation to prevent the ingress of water vapor and oxygen. Do not leave the sample compartment cover open for longer than is necessary to perform operations within the sample compartment. After closing the sample compartment purge for several minutes before starting the measurement.

When the spectrometer has been standing for some time unpurged, an initial flow of 20 L/min is recommended. After the spectrometer has been thoroughly purged, the flow can be reduced to between 6 L/min to 7 L/min.

When you have a good deal of work in a spectral region where water vapor or oxygen absorb the radiation, we recommend that you purge the spectrometer more or less continuously. This has the advantage that startup times are markedly shorter. This advantage is somewhat offset by the increased consumption of nitrogen.

NOTE: *A Nitrogen Purge Accessory Kit, comprising of a filter and a flow controller with flowmeter, is offered as an option. With this kit you can control the gas flow more accurately.*

NOTE: *The Lambda 650 does not have this purge facility.*



Maintenance

Overview

WARNING

Unauthorized Adjustments and Servicing

Do not attempt to make adjustments, replacements or repairs to this instrument except as described here. Only a PerkinElmer service representative or similarly trained and authorized person should be permitted to service the instrument. Please contact your local PerkinElmer sales or service office.

This chapter describes the routine maintenance procedures required to keep your instrument in proper working condition and to ensure the highest possible level of performance. It includes maintenance checks that should be done on a daily basis and maintenance procedures that should be done periodically depending on instrument use. This chapter is divided into several sections, each section covering maintenance procedures for a particular component of the system.

You should perform only the maintenance procedures described in this chapter. If additional maintenance is required, contact a PerkinElmer Service Engineer.

CAUTION

Before using any cleaning or decontamination methods except those specified here, users should check with PerkinElmer that the proposed method will not damage the equipment.

Daily Checks

The instrument is constructed with high quality components and requires little maintenance other than to keep it clean and free of dust.

To protect the optical system from dust and fumes, you should keep the sample compartment cover closed except for when you are carrying out work in the compartment.

The sample compartment windows should always be installed.

You should observe the following care routine to maintain your instrument in good condition:

- Immediately clean all spilled materials from the affected area and wipe it dry with lint free paper or cloth.

  If you have to wipe the sample compartment windows, make sure you do not introduce scratches. The windows are optical components and you should handle them in the sampe way as high quality cells.

- Do not leave samples, particularly those given to fuming or evaporation, in the sample compartment for longer than necessary.

- If any type of sample handling system is installed and portions of it are left in the sample compartment (such as a sipper and flowcell), make certain that the system is cleaned at the end of the working day.

  Generally, such systems should be filled with deionized water when left overnight.

CAUTION	***Spills*** *Take care not to spill liquids onto the spectrometer.* *Expensive damage can result to the optics or electronics if liquids are spilled and run inside the instrument.*

Cleaning the Instrument Covers

You can clean the outside of the instrument using a damp cloth. Mild detergent may be used, if necessary. Always perform a patch test on an inconspicuous area of the instrument, before you clean the entire instrument.

Cleaning the Sample Compartment

You must clean the sample compartment every time anything is spilled into it. This preserves the matt black finish, and prevents corrosion and contamination.

The standard sample compartment baseplates have drain holes, as shown in Figure 17, in them to run off spilled liquids to the benchtop underneath the instrument. If required, place a sheet of thick filter paper under the instrument.

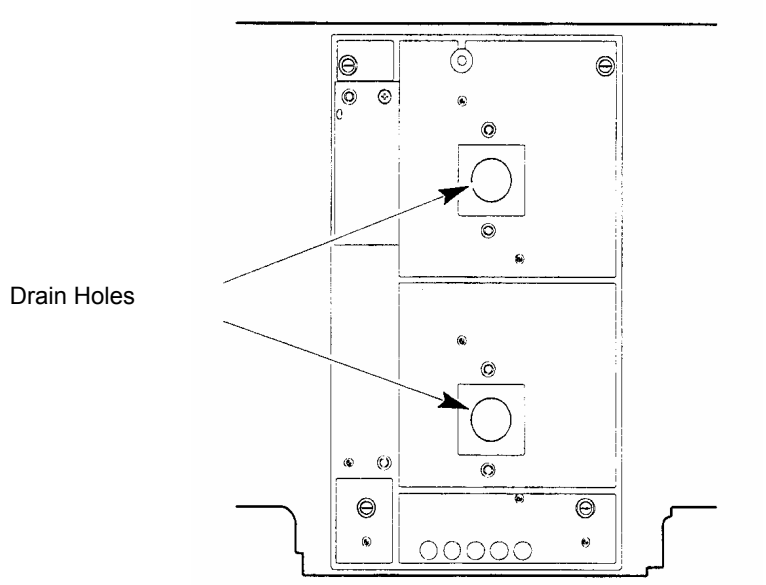


Figure 17 Drain holes in standard sample compartment baseplate

1. First remove the cell holder or other sample handling accessory from the sample compartment.
2. Using a soft cloth and mild laboratory detergent solution, lightly scrub away all foreign material.
3. Using a clean cloth dampened with water, rinse the cleaned surfaces thoroughly.
4. Dry with lint free cloth or tissue.

Sample Compartment Windows

Four windows are provided with the spectrometer. The windows are made of silica and may be used in the entire spectral range of the spectrometer.

The windows seal the sample compartment and thus protect the instrument's optics from dust and fuming or aggressive samples.

- Generally, the windows should be installed at all times.
- The windows are an optical component and require the same care and handling as cells.
- The windows can be removed to clean them. Each window has a magnetic frame and can be carefully removed by hand.

  Windows are most suitably cleaned by wiping them with a soft cloth moistened with ethanol.

  Replace the window in its original position after cleaning.

Use and Care of Cells

A good spectrometer cell is an optical device, forming a part of the optical system of the instrument with which it is used. It must be accorded the same careful treatment applied to

any optical component. Optical faults of a minor nature, scratches, lint, finger marks, etc. on the optical surfaces can easily introduce substantial analytical errors.

You should observe the following list of cell handling rules to prevent analytical errors and to achieve utmost precision:

- Only hold cells by non-optical surfaces, such as the matt finish surfaces.
- Protect cells from scratches, and never permit them to rub against one another or against other hard surfaces.
- Avoid abrasive, corrosive or stain-producing cleaning agents, and make certain that the exposed surfaces of cells are optically clean.
- Always wipe the optical surfaces of cells dry and free of finger marks, using a soft cloth or cleaning tissue, just before placing them in the cell holder.
- When measuring cold solutions, always bear in mind that condensation can form on the optical surfaces.
- Make certain no bubbles cling to the inner surfaces of the cell, particularly when handling cold solutions.

For maximum precision and accuracy, calibrate and test with cells of the same type, and always insert cells into the holders with the same orientation.

Replacing a Lamp

If a lamp failure warning message is displayed, or you are seeing excessive noise on the baseline, you can replace the lamps as follows.

WARNING

Electrical Hazard
High voltages are present at the lamp connectors in the lamp compartment – severe electric shock hazard.
Never unplug or plug in a lamp cable while power is ON.
Switch off the spectrometer and remove the plug from the electrical supply before starting with the replacement.

High Temperatures - Risk of Burns
Lamps soon become very hot, make sure that the lamps and the lamp compartment have cooled to room temperature before you touch them.

UV Radiation
The lamps emit intense UV radiation which can damage your eyes.
Do not open the lamp compartment when the lamps are on.
Do not gaze into a lighted lamp.

The source lamps are located in the lamp compartment at the top left rear of the spectrometer, as shown in Figure 18.

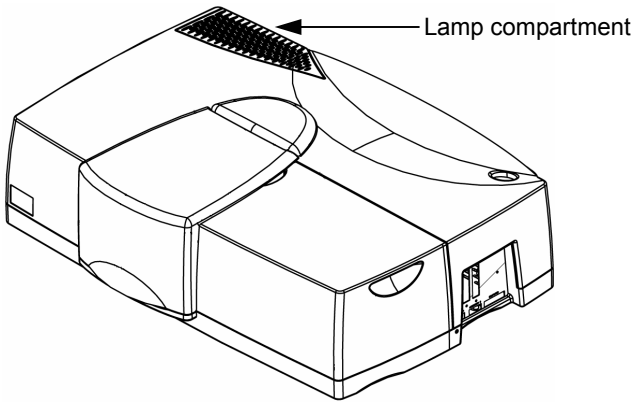


Figure 18 Lamp compartment

Halogen Lamp Replacement

If the lamp burns out, or if the bulb becomes blackened after prolonged use, you should replace the lamp. Replacement lamp assemblies (B0114620) are provided complete with pre-aligned mounts.

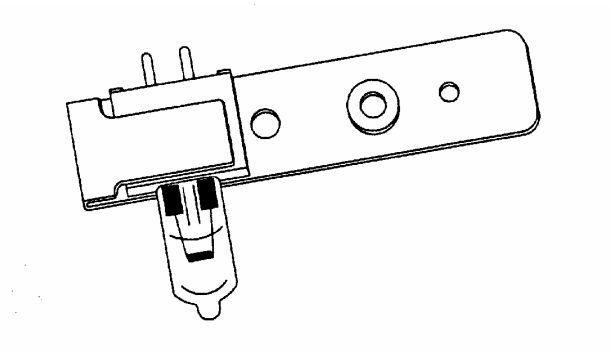


Figure 19 Pre-aligned Halogen Lamp

1. Switch off the spectrometer and disconnect the line power cord, if necessary wait until the lamps and lamp compartment have cooled to room temperature.

2. Remove the lamp compartment cover by lifting vertically from the handhold on the rear of the instrument.

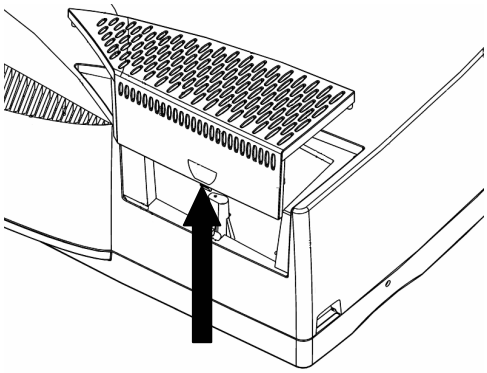


Figure 20 Removing the lamp cover

3. Remove the lamp cover by undoing the two screws and lifting vertically.

4. Carefully pull the halogen lamp connector from the rear of the halogen lamp, as shown in Figure 21.

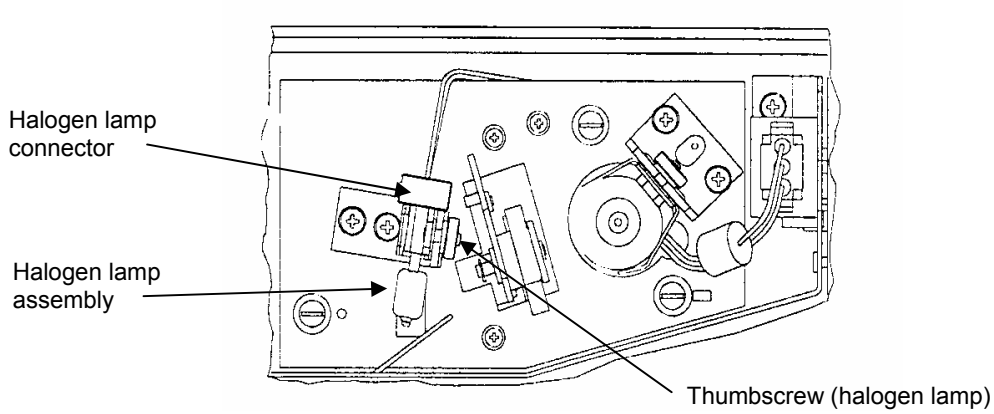


Figure 21 Removing the halogen lamp connector

5. Remove the halogen lamp assembly from the bracket by slackening the thumbscrew and pulling the lamp mount vertically upward.
   Save the thumbscrew for use with the new lamp assembly.

6. Unpack the new lamp assembly, taking care to hold it only by the metal mount to prevent finger marks on the bulb.

7. Slip the slot at the base of the lamp mount over the stud on the bracket in the lamp compartment and then secure with the thumbscrew.

8. Carefully push the halogen lamp connector firmly onto the pins on the base of the halogen lamp.

9. Wipe the halogen lamp bulb with a soft cloth moistened with alcohol to remove dirt, since this would otherwise be burned in when the lamp is hot.

10. Replace the lamp compartment cover by lowering it into position.
    This completes the halogen lamp replacement procedure.

NOTE: *Due to the pre-aligned mounts, the alignment of lamps after installation is generally so good that further alignment is not required.*

Deuterium Lamp Replacement

If the lamp burns out, or indicates falling energy after prolonged use, you should replace the lamp. Replacement lamp assemblies (B0160917) are provided complete with pre-aligned mounts.

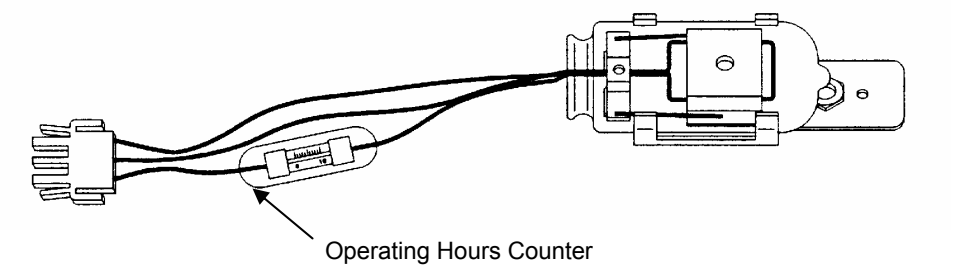


Figure 22 Pre-aligned Deuterium Lamp Assembly (B0160917)

NOTE: *An operating hours counter is incorporated in the red deuterium lamp lead. By means of a gap between the two display bars it is possible to read off the number of hours that the lamp has been in operation. One scale division corresponds to approximately 100 hours.*

1. Switch off the spectrometer and disconnect the line power cord, if necessary wait until the lamps and lamp compartment have cooled to room temperature.

2. Remove the lamp compartment cover by lifting vertically from the handhold on the rear of the instrument.

3. Remove the lamp cover by undoing the two screws and lifting vertically.

4. Unplug the deuterium lamp connector by squeezing in the two lugs at each side of the connector and carefully pulling the connector vertically upward.

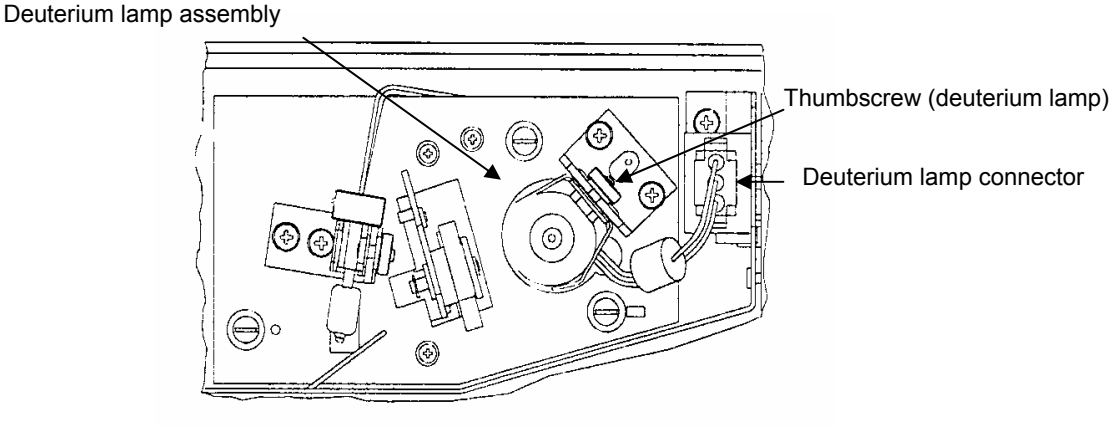


Figure 23 Removing the deuterium lamp connector

5. Remove the lamp assembly from the bracket by slackening the thumbscrew and pulling the lamp mount vertically upward.
   Save the thumbscrew for use with the new lamp assembly.

6. Unpack the new lamp assembly, taking care to hold it only by the metal mount to prevent finger marks on the lamp window.

7. Slip the slot at the base of the lamp mount over the stud on the bracket in the lamp compartment and then secure with the thumbscrew.

8. Plug the deuterium lamp connector into the socket.

NOTE: *The socket in the lamp compartment is asymmetric; the deuterium lamp connector can be inserted in one direction only. Make certain that the connector is the right way round before inserting it. Never attempt to insert the connector by force.*

9. Wipe the lamp window with a soft cloth moistened with alcohol to remove dirt, since this would otherwise be burned in when the lamp is hot.

10. Replace the lamp compartment cover by lowering into place.
    This completes the deuterium lamp replacement procedure.

NOTE: *Due to the pre-aligned mounts, the alignment of lamps after installation is generally so good that further alignment is not required.*

Replacement Parts

Supplies, accessories, and replacement parts can be ordered directly from PerkinElmer. e-ssentials, PerkinElmer's catalog service, offers a full selection of high-quality ultraviolet supplies, see *essentials.perkinelmer.com*.

Quantity	Item	Part Number
1	Pack of 10 fuses 3.15 A time delay	B0155573
1	RS 232 printer cable	B0166569
1	Deuterium Lamp, pre-aligned	B0160917
1	Halogen Lamp, pre-aligned	B0114620
1	Thumbscrew for lamp mount	B0119371
1	Set of Sample Compartment Windows for Lambda 950	B0505982
1	Set of Sample Compartment Windows for Lambda 850 or 650	L6020417
1	Single Cell Holder	B0505071

Accessory Installation

WARNING

Electrical Hazard
To prevent potential injury to yourself and damage to the instrument, switch **OFF** *all instruments in the system and disconnect them from the line power supply before you alter, or make any new, electrical connections.*

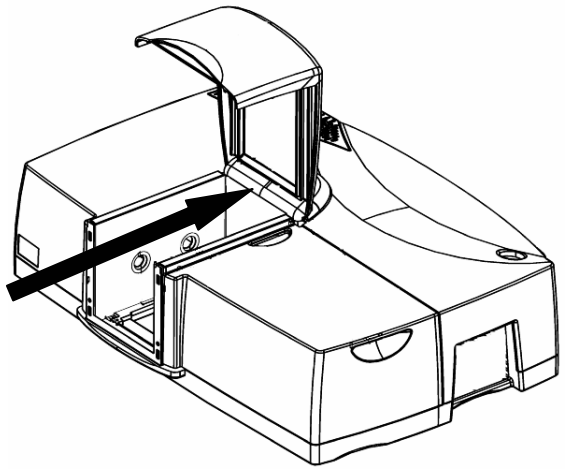
NOTE: *To operate the spectrometer with some accessories, for example Peltier cell changers, you need an accessory printed circuit board (PCB) fitted in the connector panel. The accessory PCB will be installed by a PerkinElmer service engineer.*

This section of the manual details changes that may need to be made to the basic spectrometer before installing an accessory and an overview of the installation required for some of the specific accessories. Full procedures for installing the accessories in the spectrometer are described in the directions provided with the respective accessories.

Removing the parts of the Sample Compartment

Removing the Sample Compartment Cover

1. Open the sample compartment cover so that the lid is at 90 degrees.
2. Push back on the base of the lid to release the three lugs holding it in place.



3. Lift the whole lid vertically to remove.

NOTE: *To re-fit the lid, make sure the lugs are properly inserted into the holes and then holding the lid vertically, pull it towards the front the instrument making sure the lugs are fully locked into place.*

Removing the Sample Compartment Windows

- Each window has a magnetic frame and can be carefully removed by hand.
  Replace the window in its original position.

Removing the Sample Compartment Baseplate

1. With the sample compartment cover open or removed, undo the four thumbscrews shown in Figure 24.

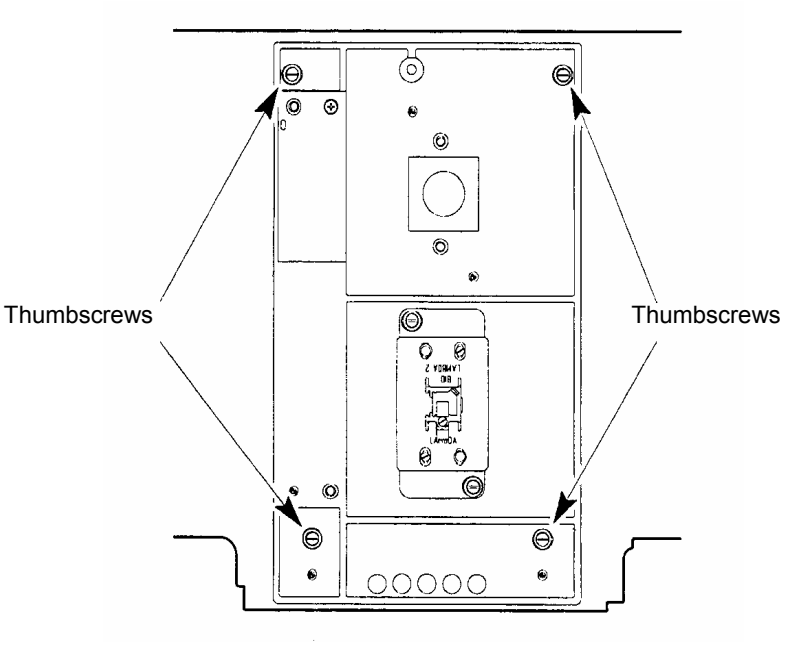


Figure 24 Four thumbscrews on the sample compartment baseplate

2. Lift the baseplate up off the locating pins and remove it from the sample compartment.

Removing the Sample Compartment

1. After removing the sample compartment cover and baseplate as described above, undo the four retaining screws shown in Figure 25.

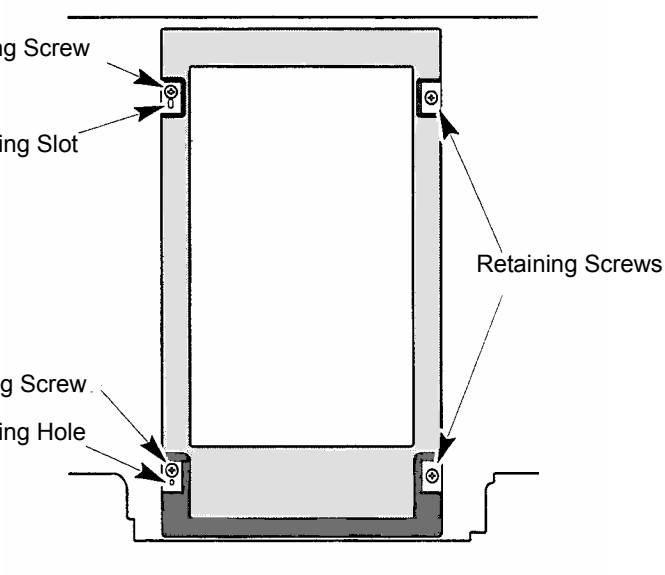


Figure 25 Four retaining screws in the sample compartment

2. Lift up the sample compartment off the locating pins and remove it from the spectrometer.

Removing the Detector Unit

WARNING

Electrical Hazard
The connector for the detector unit carries high voltage (130 V dc). Switch off and disconnect the instrument before removing or fitting a detector/accessory unit.

1. Switch off the spectrometer and disconnect the line power cord.

2. Open the sample compartment cover.

3. Undo the two retaining screws located under the blanking caps on the top of the detector (Figure 26) and are accessible using the long posidrive screwdriver supplied with the instrument.

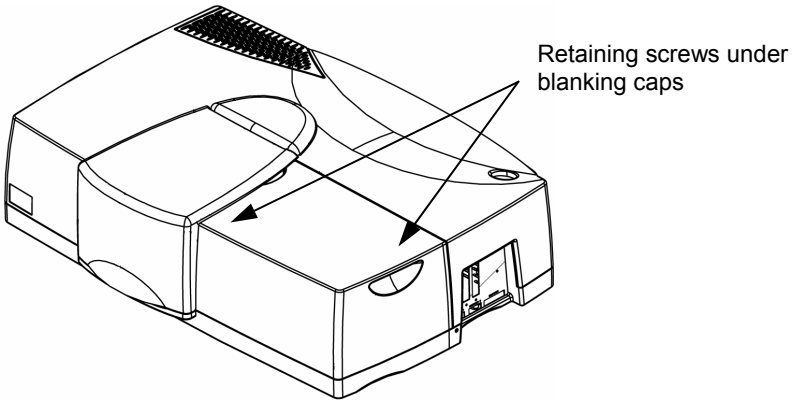


Figure 26 Undoing the retaining screws

4. Remove the detector compartment cover by carefully lifting vertically using the two hand holds, as shown in Figure 27.

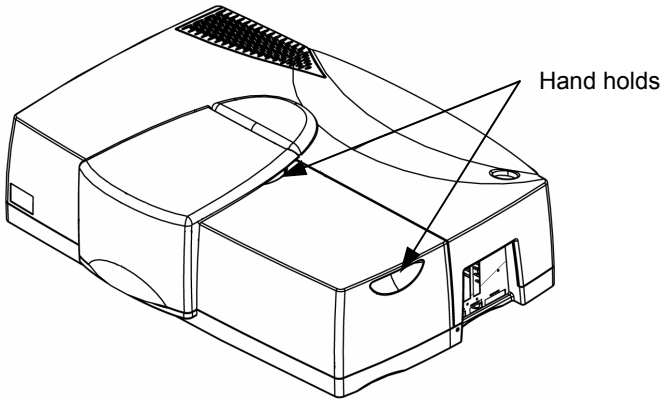


Figure 27 Removing the detector compartment cover

5. Move the detector unit carefully to the right and remove from the spectrometer.
   The detector unit is installed by performing this procedure in reverse, tightening the retaining screws and making sure the blanking caps are in place.

WARNING

Make sure you screw down the detector unit as this creates the earth bonding for elctrical safety.

Details of the installation procedure for a sphere or Universal Reflectance Accessory (URA) are given in the relevant manual on the *Lambda 650/850/950 User Manuals* CD.

Accessory Connector Panel

The accessory panel is fitted with an RS 232 interface and two 15-pin connector sockets. There are also three slots for the accessory printed circuit boards (PCB) for those accessories that require them.

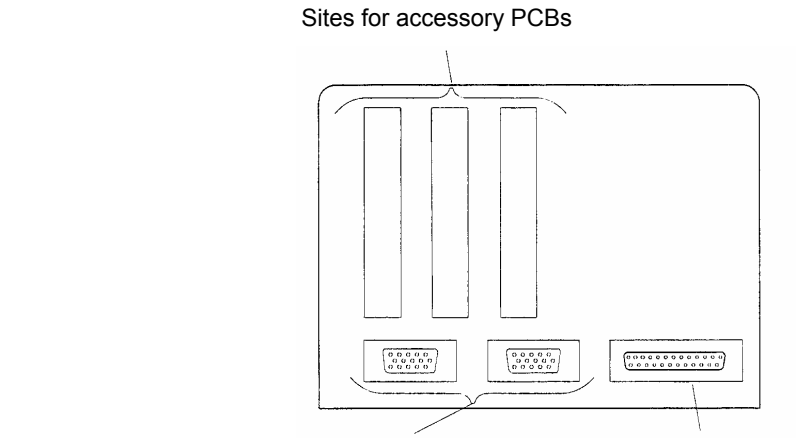


Figure 28 Connector Panel for Accessories

NOTE: *The insulation of externally connected accessories should meet the requirements of IEC 61010-1 or IEC 60950.*

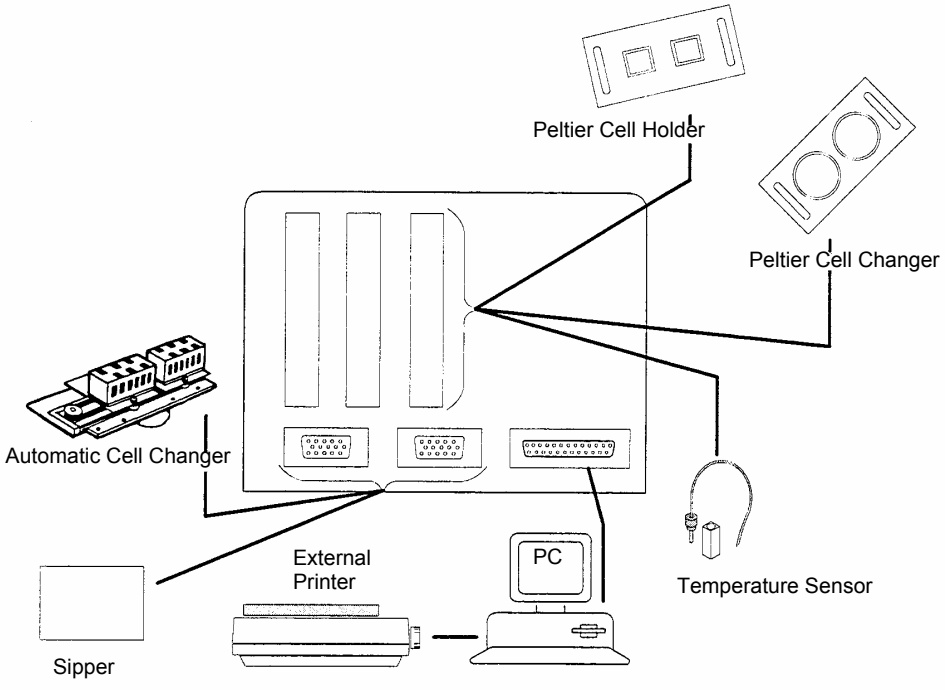


Figure 29 Possible accessories for a Lambda 650/850/950

Specific Accessory Installation Overviews

NOTE: *The Sphere and URA accessories are covered in separate manuals on the* Lambda 650/850/950 User Manuals *CD.*

Automatic Cell Changers

Connector on Spectrometer:	15-pin connector
Installation:	See cell changer manual
Cables:	Lead through bottom of spectrometer housing
Tubes:	Lead through bottom of spectrometer housing
Sample Compartment Cover:	Unchanged
Alignment:	See cell changer manual

Temperature Sensor

Connector on Spectrometer:	Slot in accessory board
Installation:	See temperature sensor description
Cables:	Lead through the tube ports
Sample Compartment Cover:	Unchanged

NOTE: *When connecting the temperature sensor, align the red mark on the plug with the red mark on the socket. Pull back the collar on the plug to connect/disconnect the plug. Release the collar to secure the plug.*

Sippers

Connector on Spectrometer:	15-pin connector
Installation:	See sipper manual
Cables:	See sipper manual
Tubes:	See sipper manual
Sample Compartment Cover:	Install special sipper sample compartment front plate and cover

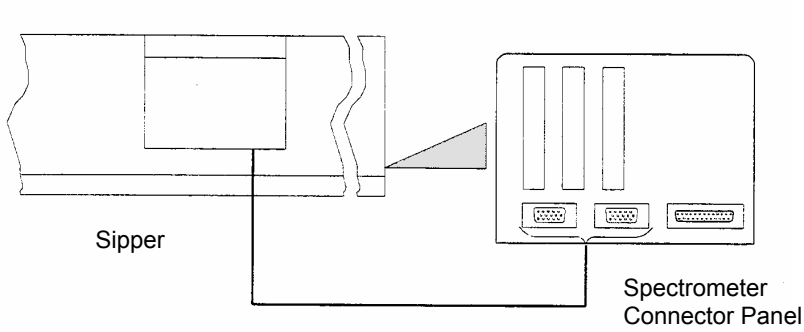


Figure 30 Sipper, electrical connection

Pin Configuration

There are two 15-pin connectors fitted to the connector panel of the Lambda 650/850/950 spectrometer to connect accessories. The connectors are identically configured so that the accessories can be connected to any of them. The pin numbering is shown in Figure 31, and the configuration is given in the following table.

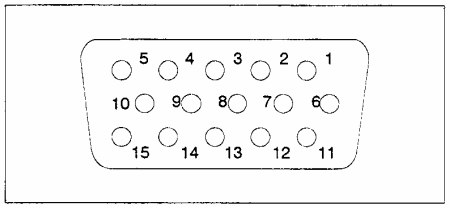


Figure 31 Pin configuration of 15-pin connector

Pin	Configuration	Description	Pin	Configuration	Description
1	GND D	Ground (Digital) logic	9	Not used	
2	+5 V	Logic power supply	10	Not used	
3	Not used		11	+12 V	Analog power supply
4	GND P	Ground Power	12	GND A	Ground Analog
5	+24 V	Power Supply	13	-12 V	Analog power supply
6	Not used		14	SCL	Serial clock
7	Not used		15	SDA	Serial data
8	Not used