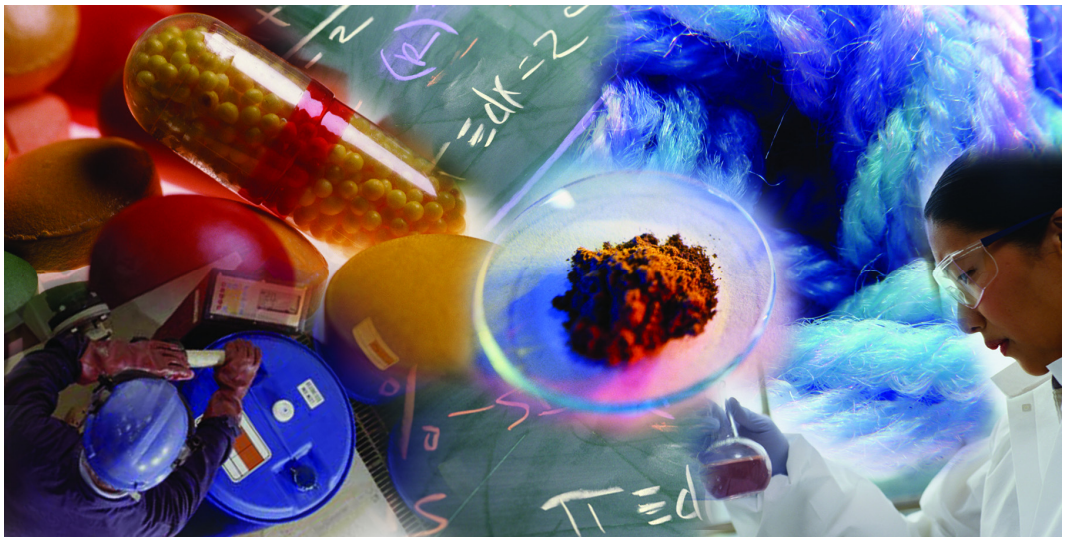
MOLECULAR SPECTROSCOPY

SPECTRUM 100 SERIES



User's Guide

PerkinElmer®
precisely.

Release History

Part Number	Release	Publication Date
L1050021	A	October 2005

Any comments about the documentation for this product should be addressed to:

User Assistance
PerkinElmer Ltd
Chalfont Road
Seer Green
Beaconsfield
Bucks HP9 2FX
United Kingdom

Or emailed to: info@perkinelmer.com

Notices
The information contained in this document is subject to change without notice.
Except as specifically set forth in its terms and conditions of sale, PerkinElmer makes no warranty of any kind with regard to this document, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.
PerkinElmer shall not be liable for errors contained herein for incidental consequential damages in connection with furnishing, performance or use of this material.

Trademarks
Registered names, trademarks, etc. used in this document, even when not specifically marked as such, are protected by law.

PerkinElmer is a registered trademark of PerkinElmer, Inc.
Spectrum, Spectrum 100, and Spectrum 100N are trademarks of PerkinElmer, Inc.

Contents

Introduction

About This Manual

This manual contains the following sections:

- Introduction;
- Warnings and Safety;
- An Overview of the Spectrum 100 Series Spectrometers;
- Unpacking and Installation;
- Using the Spectrum 100 Series Spectrometers;
- Routine Maintenance;
- Advanced Maintenance;
- Instrument Performance Validation;
- Appendices.

For further information on collecting, viewing and processing spectra using Spectrum software, see the on-screen HTML help file, which you can access from the Help menu, or by clicking **Help** on a dialog.

There is a multimedia introduction to the instruments, which you can access directly off the *Spectrum Multimedia CD*. This CD also includes multimedia tutorials for each of the main sampling accessories.

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.

The term 'instrument' refers to either the Spectrum 100 FT-IR or Spectrum 100N FT-NIR spectrometer, and any sampling accessory fitted.

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.*

Warning Signs on the Instrument

Caution, hot surface.

Caution, risk of electric shock.

Caution, laser radiation hazard.

Caution, risk of danger.

Refer to accompanying documents in all cases where this symbol is used to find out the nature of the potential hazard and any actions which have to be taken.

Warnings and Safety Information

Safety Summary

The Spectrum 100 FT-IR and Spectrum 100N FT-NIR spectrometers have been designed to comply with a wide variety of international standards governing the safety of laboratory equipment. In routine use, the instruments pose virtually no risk to you. If you take some simple, common-sense precautions, you can make sure that you maintain the continued safe operation of your instrument:

DO make sure that the instrument is properly connected to the electrical supply; in particular make sure that the ground (earth) is securely connected.

DO disconnect the electrical power cable before opening the main cover of the instrument.

DO keep the instrument dry. Avoid spilling liquid into the instrument. Clean all external spills immediately. If anything that is spilled enters the main body of the instrument, switch off the power and contact a PerkinElmer Service Engineer.

DO NOT stare into the internal laser beam under the instrument cover. The instrument contains a low power, visible (red) laser; momentary exposure to the beam is not dangerous, but deliberate, direct viewing of the beam along its axis could damage your eye.

DO NOT use a flammable gas to purge the instrument. The instrument contains a hot source, and a fire or explosion will result. Only use clean, dry, oil-free nitrogen or air to purge the instrument.

DO read the more detailed information on warnings and safety in the following pages to ensure the safe operation of the instrument.

General Safety

The Spectrum 100 FT-IR and Spectrum 100N FT-NIR spectrometers have been designed and tested in accordance with PerkinElmer specifications and in accordance with the safety requirements of the International Electrotechnical Commission (IEC). The instruments conform to IEC publication 61010-1 ('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 low voltage Directive 73/23/EEC, amended by 93/68/EEC.

If the instrument is used in a manner not specified by the manufacturer, the protection provided by the instrument may be impaired. Only use the instrument indoors and under the following conditions:

Temperature	15 °C to 35 °C
Relative Humidity	75% 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, operating instrument is necessary, this must only be done by a skilled person who is aware of the hazard involved.

Whenever it is likely that the instrument is unsafe, make it inoperative. The instrument 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.

WARNING

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

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

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

- Indoor use.
- Altitude up to 2000 m (above mean sea level).
- 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 supply fluctuations not exceeding ± 10 % of the nominal voltage.

Location and ventilation

To allow for adequate cooling, the instrument should not be sited near to room heating equipment, for example, central heating radiators.

During operation, there should be a minimum gap of:

- 15 cm (6 inches) between any surface and the cooling louvers at the rear of the instrument.
- 7 cm (3 inches) between the instrument and adjacent equipment.
- 45 cm (18 inches) between any surface and the top surface of the closed sample area lid (to allow for the lid to be opened fully).

WARNING

Make sure that the switch at the electrical supply inlet on the rear of the instrument is not obstructed.

Electrical safety

- Connect the instrument to a power supply line that includes a switch or other means of disconnection from the electricity supply.
- Only plug the instrument into an electricity-supply socket that is provided with a protective earth connection.
- When fuses need replacing, use only those with the required current rating and of the specified type. Do not use makeshift fuses and do not short-circuit fuse holders.
- When the instrument is connected to its electricity supply, terminals may be live and the removal of covers other than those which can be removed by hand 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.
- The instrument must be disconnected from all voltage sources before it is opened for any adjustment, replacement, maintenance or repair.

WARNING

Any interruption of the protective earth conductor inside or outside the instrument or disconnection of the protective earth terminal can make the instrument dangerous.

The instrument has:

- An IEC Pollution Degree 2 classification - usually only non–conductive atmospheric pollution of the equipment occurs; occasionally, however, a temporary conductivity caused by condensation must be expected.

- An IEC Insulation class I rating for external circuits – only connect equipment that meets the requirements of IEC 61010-1, IEC 60950 or equivalent standards.

The instrument is designed to be safe under transient overvoltages typically present on the MAINS supply.

NOTE: The normal level of transient overvoltages is impulse withstand (Overvoltage) category II of IEC 60364-4-443.

Laser Safety Regulations

The Spectrum 100 FT-IR and Spectrum 100N FT-NIR spectrometers are CDRH Class I, BS EN 60825-1/IEC 60825-1 Class 1 laser products. The optical module contains a Class II/2 Helium Neon (HeNe) laser, which emits visible, continuous wave radiation at a wavelength of 633 nm and has a maximum output power of 1 mW.

Some of the HeNe laser radiation, with a maximum power level of less than 0.39 μW (Class I/Class 1), may be accessed in the sample compartment or a sampling accessory.

The laser is automatically shut down when the main cover of the instrument is raised.

The instrument complies with the following laser safety regulations:

1. 21 CFR Chapter 1, Subchapter J, "Radiological Health", Part 1040.10 - administered by the Center for Devices and Radiological Health, U.S. Department of Health and Human Services.

2. British Standard BS EN 60825-1 (1994) - "Radiation safety of laser products, equipment classification, requirements and user's guide". BS EN 60825-1 implements CENELEC European Normalization document EN 60825-1 (CENELEC is the European Committee for Electrotechnical Standardization).

3. IEC Publication 60825-1 (1993) and Amendment 1 – "Safety of laser products – Part 1: Equipment classification, requirements and user's guide". (IEC is the International Electrotechnical Commission. The IEC have renumbered their standards, IEC Publication 60825-1 was originally IEC Publication 825-1).

WARNING

Do not attempt to override or modify the interlock system.

Explanation of the laser radiation hazard and its classification

Indirect observation of the laser beam radiation in the optical path is not hazardous. Directly viewing the laser beam along its axis (allowing the laser beam radiation to pass into the eye) can be hazardous, depending upon the power of the beam, the length of time that the eye is exposed to the beam and the optical efficiency of the exposed eye. Direct viewing of a laser beam along its axis is termed *intrabeam viewing*.

Protection of the eye during accidental, momentary intrabeam viewing of a Class II/Class 2 laser beam is normally given by the eye's aversion response, including the blink reflex, which limits exposure of the eye to less than 0.25 seconds.

CDRH regulations state that Class IIa levels of laser radiation are not considered to be hazardous if directly viewed for any period of time less than or equal to 1000 seconds.

Class I/Class 1 levels of laser radiation are not considered to be hazardous.

The CDRH, BS EN 60825-1 and IEC 60825-1 laser radiation classification limits are described below:

CDRH Class limits

Classification	**For 633 nm Laser Radiation**
Class II	> 3.9 μW to 1000 μW
Class IIa	> 0.39 μW to 3.9 μW
Class I	< 0.39 μW

BS EN 60825-1 and IEC 60825-1 Class limits

Classification	**For 633 nm Laser Radiation**
Class 2	> 6.8 μW to 1000 μW
Class 1	< 6.8 μW

Laser Apertures

The accessible Class I/Class 1 laser radiation emerges from the aperture in the left hand side of the sample compartment; the radiation crosses the sample compartment and enters the detector aperture.

Class I/Class 1 laser radiation exits the external beam port when the port cover is removed and the external beam is selected. The laser radiation is not accessible at the port when an external beam accessory is attached. When an external beam accessory is removed from the instrument, the internal beam path must be selected, or the external beam port cover must be replaced.

WARNING

Do not stare into any laser beam. Staring into a laser beam (intrabeam viewing) can cause permanent damage to your eyes.

Radiation Emitted by the Spectrum 100N FT-NIR

The Spectrum 100N FT-NIR quartz halogen bulb, which produces the near infra-red beam, emits ultraviolet, visible and infrared radiation. The majority of this radiation is in the infrared region. Do not stare into the beam produced by this bulb.

Measurements of the infrared radiation emitted from the sample area show that exposure limits recommended by the American Conference of Governmental Industrial Hygienists (ACGIH) and International Commission on Non-Ionizing Radiation Protection (ICNIRP) will not be exceeded during normal operation.

Labels

When this label is attached to an instrument it means 'Caution, risk of danger'. Refer to the manual to find out the nature the potential hazard and any actions that have to be taken.

Spectrum 100 FT-IR and Spectrum 100N FT-NIR laser safety labels

Safety labels are fixed to the Spectrum 100 FT-IR and Spectrum 100N FT-NIR spectrometers in the locations shown in Figure 1 and Figure 2 on the following pages:

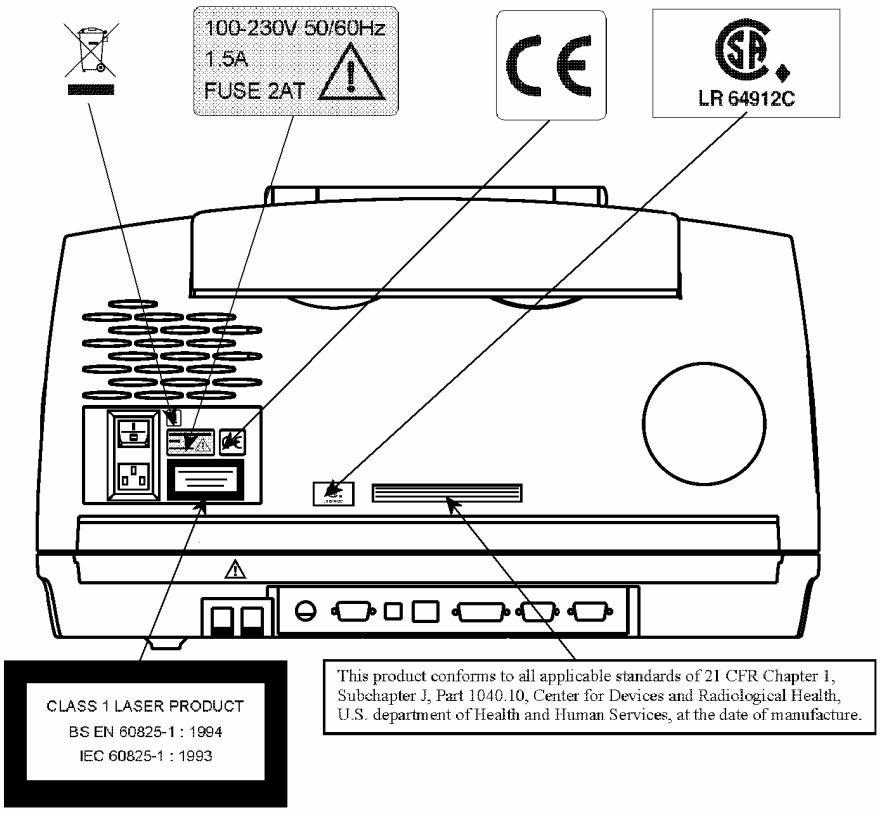
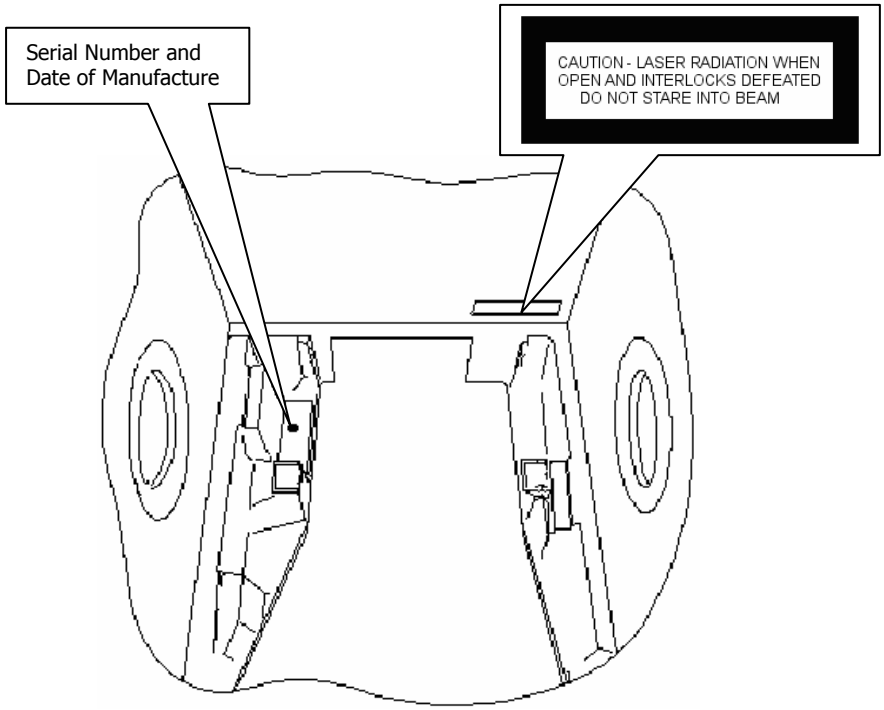


Figure 1 Labels (rear of instrument)

NOTE: The label with a crossed-out wheeled bin symbol and a rectangular bar indicates that the product is covered by the Waste Electrical and Electronic Equipment (WEEE) Directive. Refer to Appendix 3: WEEE Instructions for PerkinElmer Products.



NOTE: There is a second copy of the CAUTION label inside the cover.

Figure 2 Labels (sample area)

Product identification label

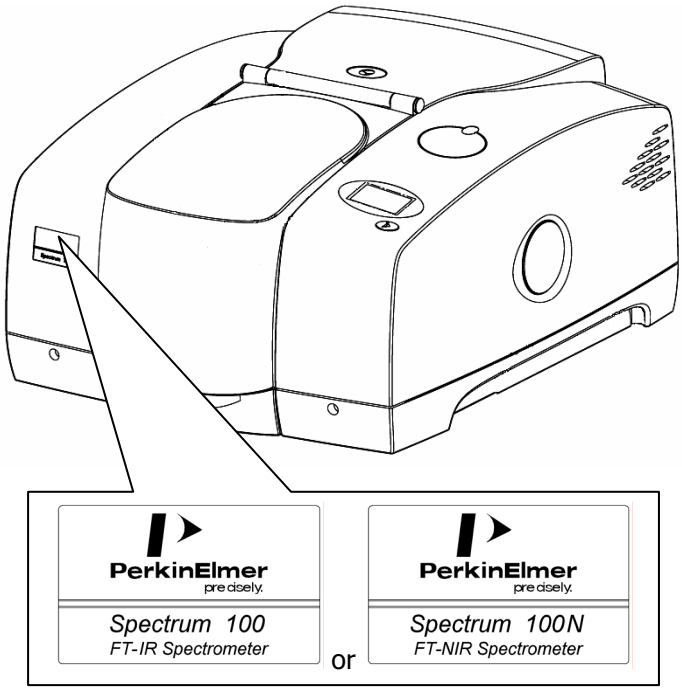


Figure 3 Product label (front of instrument)

EMC Compliance

EC directive

The Spectrum 100 FT-IR and Spectrum 100N FT-NIR spectrometers have been designed and tested to meet the requirements of the EC Directive 89/336/EEC. The instruments comply with the EMC standard EN 61326-1 (EMC standard for electrical equipment for measurement, control and laboratory use).

FCC rules and regulations

These products are classified as digital devices used exclusively as industrial, commercial, or medical test equipment. They are exempt from the technical standards specified in Part 15 of the FCC Rules and Regulations, based on Section 15.103 (c).

Use of Flammable Solvents and Samples

WARNING

The instrument contains a hot source and contact with flammable vapors may cause an explosion. When working with flammable solvents or samples, particularly during unattended operation with flow-cells, it is recommended that the instrument optics area should be continuously purged with dry air or nitrogen to maintain a positive pressure and prevent flammable vapor entering the instrument.

WARNING

If flammable solvents or samples are spilled on the instrument and there is any possibility that they have entered the interior (by coming into contact with cover gaskets for example) then the instrument must be switched off immediately and disconnected from the power supply. The optics area should then be thoroughly purged with dry air or nitrogen, or the main cover should be opened to thoroughly ventilate the optics area before proceeding.

WARNING

Flammable solvents or samples should not be stored on or near the instrument. Handling of such materials during preparation should be performed in a safe area away from the instrument such as a fume cabinet.

An Overview of the Spectrometers

A Guided Tour of the Spectrum 100 Series

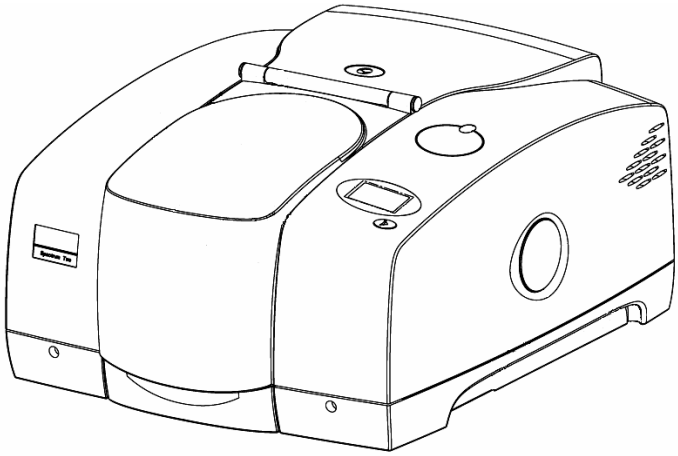


Figure 4 The Spectrum 100 Series spectrometers

The PerkinElmer Spectrum 100 Series spectrometers (Figure 4) are bench-top instruments that provides all the following in one self-contained unit:

- A large, purgeable, sample compartment. The instruments can operate in ratio, single-beam, or interferogram mode.
- For the Spectrum 100 FT-IR, an optical system that gives you data collection over a total range of 7800 to 370 cm^{-1} (220 cm^{-1} with CsI beamsplitter) with a best resolution of 0.5 cm^{-1}.
- For the Spectrum 100 FT-IR, a mid infrared detector - either DTGS (deuterated triglycine sulphate) or $LiTaO_3$ (lithium tantalate) - as standard, and the option of using MCT (Mercury Cadmium Telluride) or PAS (a photoacoustic detector).
- For the Spectrum 100N FT-NIR, an optical system that gives you data collection over a total range of 14000 to 2100 cm^{-1} with a best resolution of 0.5 cm^{-1}.
- For the Spectrum 100N FT-NIR, a near infrared detector - NIR DTGS (deuterated triglycine sulphate) as standard.
- An electronics system based on the Motorola DSP56303 Digital Signal Processor and the Motorola 68340 Integrated Processor.

The instrument is connected to a PC, either point-to-point or over a network, which utilizes Spectrum software. This software enables you to control the instrument and manipulate the spectra that you collect.

Top Panel Controls

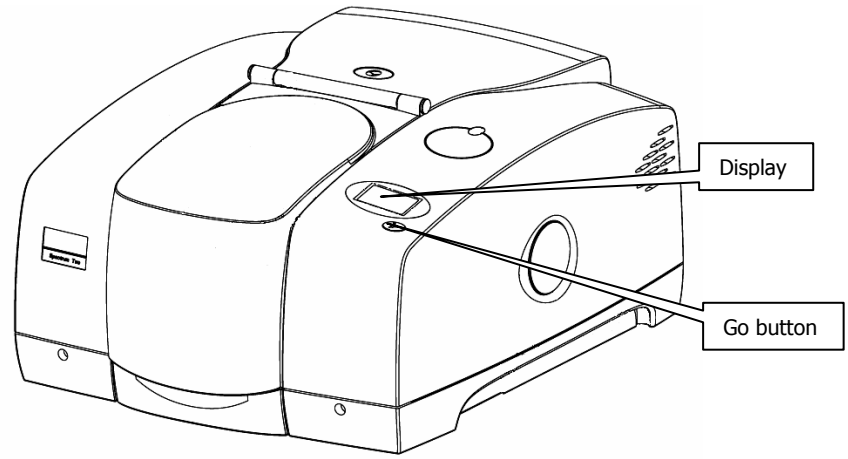


Figure 5 Top Panel Controls

The Display on the lower right of the top of your instrument has two purposes:

1. To display messages generated by the instrument's firmware, such as those that monitor initialization and diagnostics when the instrument is switched on.

2. To display prompts and other messages generated by the Spectrum software.

The instrument's Go button is used in concert with the displayed prompts and other messages generated by the Spectrum software. It allows you to Start and Halt data collection while you are away from your computer.

Sample compartment

The sample compartment (Figure 6) is located at the front of the instrument. You open the sample compartment by lifting the cover using the recess at the front.

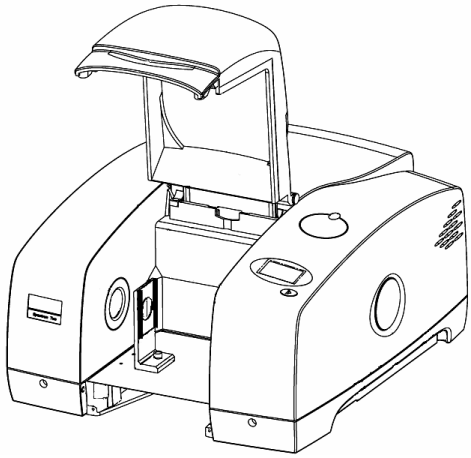


Figure 6 Sample compartment

- The infrared beam enters the compartment through an aperture on the left. After passing through the sample, it enters the detector area through an aperture on the right side of the sample compartment.
- Standard accessories are mounted on a baseplate that plugs into the connector on the rear wall of the sample compartment. There are other accessories that are mounted in the sample slide or on the sample shuttle.
- The standard baseplate has a sample holder located by a knurled screw.

CAUTION	*The Spectrum 100 FT-IR sample compartment windows are composed of KBr or CsI, which, although coated, can be damaged by high levels of humidity. If you spill a liquid in the sample compartment, wipe it up quickly. When working with water–based samples open to the air, either purge the sample compartment or leave the cover open.*

CAUTION	*For the Spectrum 100 FT-IR, a relative humidity higher than 75% (or 45% if your Spectrum100 FT-IR is fitted with CsI optics) can damage the windows of the sample compartment. If you expect the humidity to exceed 75% (or 45% if your instrument is fitted with CsI optics), continually purge or desiccate the sample compartment.* *The Spectrum 100N FT-NIR sample compartment windows are composed of CaF_2 , which is relatively resistant to humidity.*

Power switch and communications ports

The power switch, AC power cable connector, and communications ports are on the rear of the instrument. The power switch is marked I/O (on/off).

NOTE: It can take the Spectrum 100 FT-IR and Spectrum 100N FT-NIR spectrometers up to two hours to equilibrate when switched on after being switched off overnight. To save time, we suggest that you leave the spectrometer switched on at all times.

Optical system

Usually the main cover of the instrument is closed, but to perform most maintenance tasks, the cover has to be open. When you do this, a safety interlock automatically switches off the power. However, the instrument should be disconnected from the mains before opening the main cover for maintenance. Under the cover is the optical system of the instrument.

Consistent, reliable performance is achieved by having few moving or adjustable parts, and by extensive insulation of the optical system from the effects of humidity and vibration.

Stability of the optical system

The entire optical system is purged and sealed at the factory. A supply of desiccant placed within the system removes any water vapor and carbon dioxide that may enter. A humidity sensor is fitted, which warns you when the desiccant needs changing.

In the Spectrum 100 FT-IR, KBr or CsI windows separate the sample compartment from the purged optical system (In the Spectrum 100N FT-NIR, these windows are CaF_2). You can purge the sample compartment with dry air or nitrogen. Either one removes water vapor; however, nitrogen is preferable because it also removes atmospheric carbon dioxide.

WARNING

Do not use a flammable gas to purge the Spectrum 100 FT-IR or Spectrum 100N FT-NIR spectrometers. The instrument contains a hot source, and a fire or explosion will result. Only use clean, dry, oil–free nitrogen or air to purge the instrument.

The optics are kinematically mounted to ensure accurate positioning and to make them rugged. The interferometer is enclosed and mounted on anti-vibration mounts to guard against air and bench borne disruptions. The interferometer uses very low-friction point bearings and a frictionless electromagnetic drive to ensure long life.

Accessories for the Spectrum instrument

There is a range of specialized sampling accessories available for the Spectrum 100 FT-IR and Spectrum 100N FT-NIR spectrometers, including:

Accessory	Spectrum 100 FT-IR	Spectrum 100N FT-NIR
Sample Shuttle	Yes	Yes
HATR	Yes	n/a
Universal ATR	Yes	n/a
Diffuse Reflectance	Yes	n/a
NIRA	n/a	Yes
NIR Tablet Autosampler	n/a	Yes
NIR Fiber Optic Probe	n/a	Yes
Liquid Sipper	Yes	Yes

These accessories are easily installed (see *Changing the Sampling Accessory* on page 110) and will be automatically recognized and controlled by the software.

Further information about the use of these accessories can be found on the *Spectrum 100/100N Manuals CD* and on the *Spectrum Multimedia* CD.

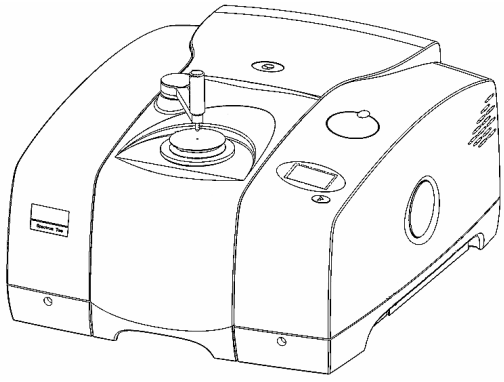


Figure 7 Spectrum 100 with Universal ATR accessory fitted

Unpacking and Installation

Requirements

NOTE: Read the warnings and safety information at the start of this manual before you install the instrument. They contain important information.

Electrical requirements

The Spectrum 100 FT-IR and Spectrum 100N FT-NIR spectrometers can operate on electricity supplies of 50 or 60 Hz and in the 100 to 230 V range without any adjustment.

The nominal power consumption of the instrument is 120 VA.

The line supply must be within 10% of the nominal voltage.

If possible, do not connect the instrument to circuits that have heavy duty equipment connected, such as large motors.

If possible, do not use photocopiers, discharge lamps, radio transmitters, and other equipment with large or frequent transient loads on the same supply circuit.

The primary fuse (2AT, 250 V) is in the drawer on the rear of the instrument next to the mains inlet: the spare fuse is in the same drawer. The primary fuse is connected in the live line.

Environment

To obtain the best performance from your instrument:

- Place the instrument in an environment that is relatively dust-free.
- Make sure that the bench top is free from vibration or mechanical shocks.
- Do not place the instrument or the PC near to room heating equipment, such as central-heating radiators.
- Do not position the instrument in direct sunlight as this may cause overheating.
- Leave at least 15 cm (6 inches) from any surface and the cooling louvers at the rear of the instrument.
- Leave at least 7 cm (3 inches) from any vertical obstacle to the sides of the instrument, to permit an adequate flow of cooling air.
- Make sure that there are no overhanging shelves, and no water pipes or faucets that could leak onto the instrument.
- The area near the PC must be free of strong magnetic fields, direct sunlight, and heating or cooling units or ducts.

The instrument has been designed for indoor use and operates correctly under the following conditions:

Ambient temperature	15 °C to 35 °C
Ambient relative humidity	75% maximum (non-condensing)

Unpacking the Spectrometer

WARNING

The spectrometer is a heavy precision instrument, so two people are required for safe handling.

The instrument weighs approximately 34 kg unpacked (40 kg packed) and has a lifting recess on either side. Consult the local codes of practice issued by safety advisors before attempting to lift it.

Take care not to injure yourself or others, or to drop the spectrometer.

CAUTION

Take great care when installing your Spectrum 100 FT-IR or Spectrum 100N FT-NIR spectrometer, and follow the procedures described in this manual. If you require assistance, contact your local PerkinElmer Service Engineer.

Opening the shipping container

Your spectrometer is packed inside the box in a silver bag that protects it from condensation.

1. First remove the manuals/software box, leads, and so on from the box, and check that all the following parts are present:

Part	Description	Spectrum 100	Spectrum 100N
L1202057	Polystyrene calibration film	1	-
L1180479	NIR Performance Validation Kit	-	1
L1185224	NIR Tutorial Samples	-	1
04974265	Quick release purge coupling	2	2
L1200466	Ethernet crossover cable	1	1
04790839	2A, 250V Time lag Fuse	2	2
09923433	8.0 mm hexagonal wrench	1	1
N0171159	Desiccant kit	3	3
L1050001 L1050002 L1050005	Software and manuals kit: Spectrum 100 Series Getting Started Guide Spectrum 100/100N Manuals CD Spectrum Multimedia CD.	1	1
L1242701	NIR Source	-	1
L1240055	Cuvette Holder Assembly	-	1
L1240056	Cell Holder Assembly and disposable cells (5).	-	1

If any items are missing or damaged, contact your local PerkinElmer office.

2. Carefully remove the instrument from the shipping container, but not from the bag in which it was shipped.

CAUTION	*The spectrometer must be allowed to reach the temperature of its surroundings before it is removed from the bag. This means leaving it overnight if it has been moved from a cold area, and at least 4 hours after removal from the shipping container.*

3. When the spectrometer has been allowed to warm to the temperature of its surroundings, remove it from the bag and place it on the bench where it is to be used.

   Ensure that you can reach the rear of the spectrometer to enable you to connect the cables.

NOTE: Any accessories will be shipped in separate boxes.

The Desiccant Indicator

The optical system of the spectrometer is purged at the factory. This protects the beamsplitter and the sample compartment windows from being damaged by humidity. Replaceable packs of desiccant keep the optics dry and free of CO_2.

The top panel of the instrument includes a Desiccant Indicator, whose sectors change sequentially from blue to pink as the desiccant packs are exhausted. Change the desiccant in the instrument when the sector marked 10 becomes pink, but while the sectors marked 15 and 20 are still blue. Refer to *Changing* the Desiccant on page 71

Refer to *The Desiccant Indicator in detail* on page 70 for more information about the appropriate action to take if the sectors marked 15 and 20 are pink.

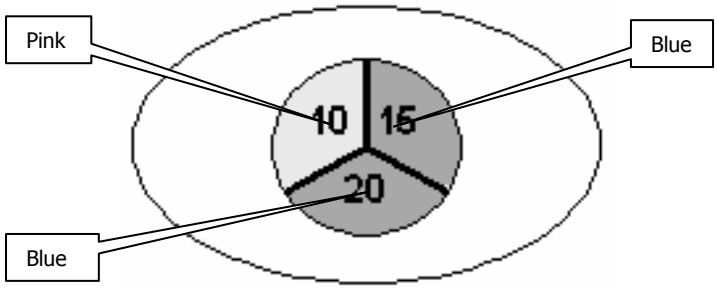


Figure 8 The Desiccant Indicator: When desiccant packs should be changed

CAUTION	*If all three sectors of the Desiccant Indicator are pink, then you must change the desiccant.* *The instrument optics may be fogged. Do not switch the instrument either ON or OFF until all sectors are blue.*

NOTE: We recommend that you change the desiccant in the spectrometer before using it for the first time. Refer to *Changing* the Desiccant on page 71.

Connecting up the Spectrometer

Connecting to the PC

NOTE: To control your instrument from a PC, use the crossover cable supplied.
To control your instrument over your network, use a standard Ethernet cable (not supplied).

1. Plug one end of the cable into the connector port labeled  on the back of the instrument (Figure 9).

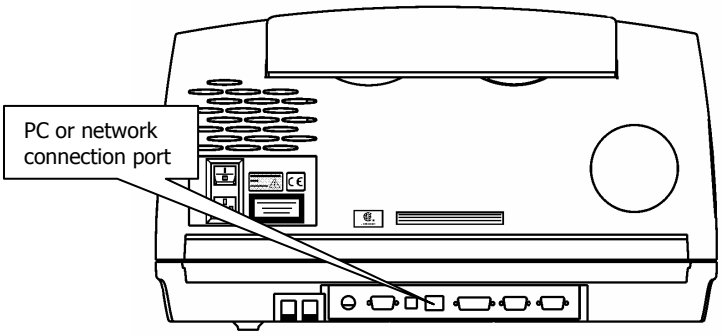


Figure 9 PC connection port

2. Plug the other end of the cable into the network connection on your PC (if you are using the crossover cable) or network hub (if you are using a standard Ethernet cable).

CAUTION	*Do not attempt to connect a monitor to the EXT.R and MICROSCOPE ports or you will cause serious damage to the instrument when it is switched on.*

Other connectors

The communications ports for peripheral devices are illustrated in Figure 10.

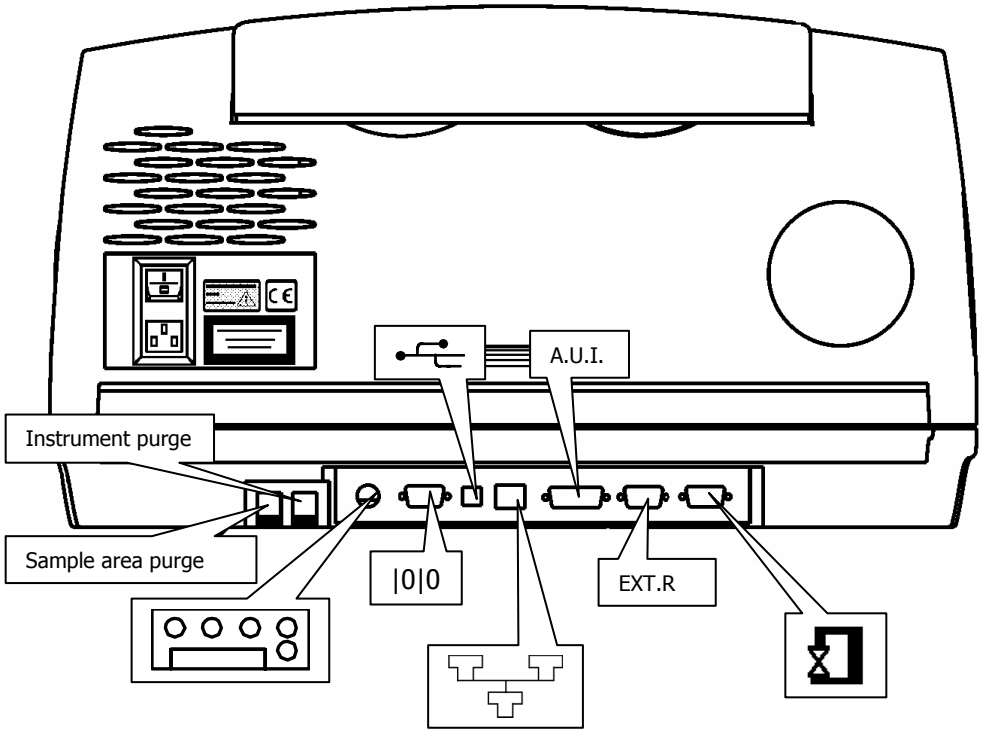
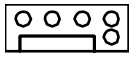
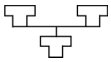


Figure 10 Communications ports

Icons which identify the function of each of the communications ports are printed on the hinge molding directly above the communications port.

Icon	Description	Connector Type	Voltages	Maximum Currents
	Keyboard. Connects a keyboard or barcode reader to the spectrometer.	Mini-DIN 6-way	+5 V	0.65 A
	Serial port. Connects a PC to the instrument using an RS232 interface cable. This connector is only used for service diagnostics.	9-way D-type	+12 V	< 100 mA
			- 12 V	< 100 mA
	Universal serial bus (USB). This connector is not used.	USB	< 5 V	< 100 mA
	10 Base-T Ethernet connector. This is the standard interface between the PC and the instrument, or between a Local Area Network (LAN) and the instrument. If connecting directly from the PC to the instrument use the Category 5 UTP Cross-Over cable supplied. If you are connecting to your network, use a standard Ethernet cable. DO NOT USE THE CROSS-OVER CABLE TO CONNECT TO YOUR NETWORK.	Ethernet	< 5 V	< 100 mA
A.U.I.	Attachment Unit Interface. Can be used to connect the instrument to a LAN.	11-way mixed D-type	+ 5 V	< 100 mA
			± 12 V	50 mA
EXT. R	Right external detector module. Connects to an external detector module. Usually the detector is placed in an accessory placed on the right of the instrument.	High density D: 15 way	+12 V	0.65 A
			-12 V	0.65 A
			+ 5 V	4 A
	Microscope external detector module. Connects to a PerkinElmer infrared microscope, placed on the left of the instrument.	High density D: 15 way	+12 V	0.65 A
			-12 V	0.65 A
			+5 V	4 A

Connecting the Spectrometer to the electrical supply

The power cable for the electrical supply plugs into the rear of the instrument.
It has a molded socket at one end. If it is necessary to fit a plug on the power cable, use the wire color code below:

Plug Pin	Wire Color (100-120 V)	Wire Color (220-240 V)
Ground (Earth)	Green or Green/Yellow	Green/Yellow
Live	Black	Brown
Neutral	White	Blue

WARNING

To ensure safe and satisfactory operation of the instrument, it is essential that the green or green/yellow ground (earth) wire of the power cord is connected to a ground that complies with the regulations of the local electricity supply authority (or equivalent body); ground circuit continuity is essential for safe operation of the equipment.

The Spectrum 100 FT-IR and Spectrum 100N FT-NIR spectrometers can operate on electricity supplies of 50 or 60 Hz and in the 100 to 230 V range without any adjustment.

1. Fit the molded socket of the power cable into the electrical supply inlet (Figure 11) of the instrument.

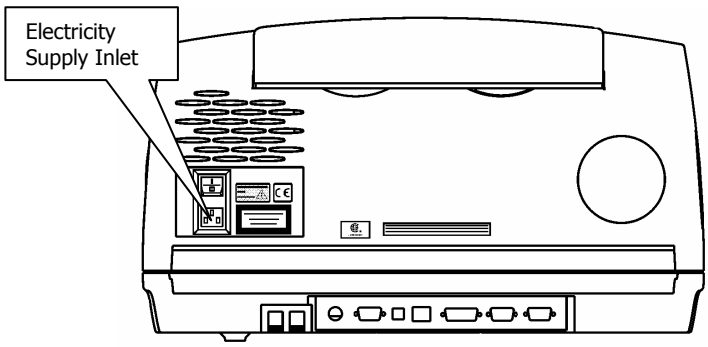


Figure 11 Electrical Supply Inlet

2. Switch on the power at the supply.

3. Switch on the instrument at the switch above the supply inlet.
   I is on and **O** is off.

After a short diagnostic check, described in *Appendix 2: Instrument Self-Checks* on page 113, your instrument will be ready to communicate with the PC.

Installing the Spectrum Software

Before setting up the instrument, set up your PC and install the Spectrum software.

Minimum PC requirements

If you are supplying your own computer, make sure that it meets the minimum requirements for hardware and software set out in the *PC Requirements* section of the *Spectrum Administrator's Guide (L1050020).*

Installing Spectrum software

Details of the installation program are given in the *Spectrum Administrator's Guide* (*L1050020).*

The Instrument Install Wizard

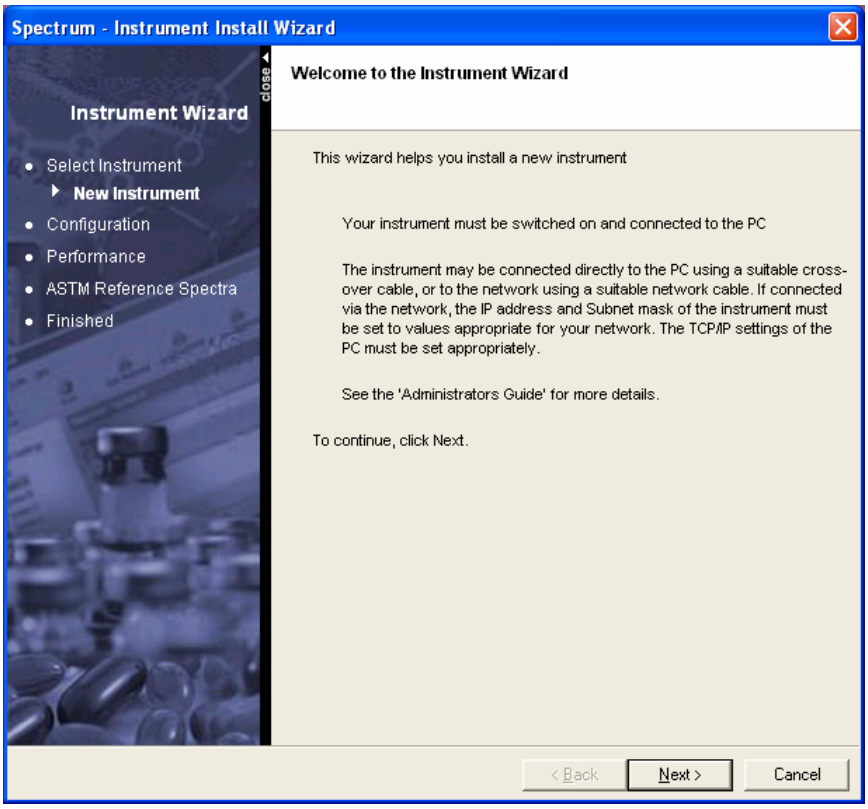
NOTE: Install your instrument with the standard sample slide fitted, rather than any additional accessory, such as a Universal ATR (for the Spectrum 100 FT-IR) or the NIR Tablet Autosampler (for the Spectrum 100N FT-NIR). Accessories are shipped in separate boxes and fitted later.

Make sure the sample area is clear, and there is nothing in the sample slide.

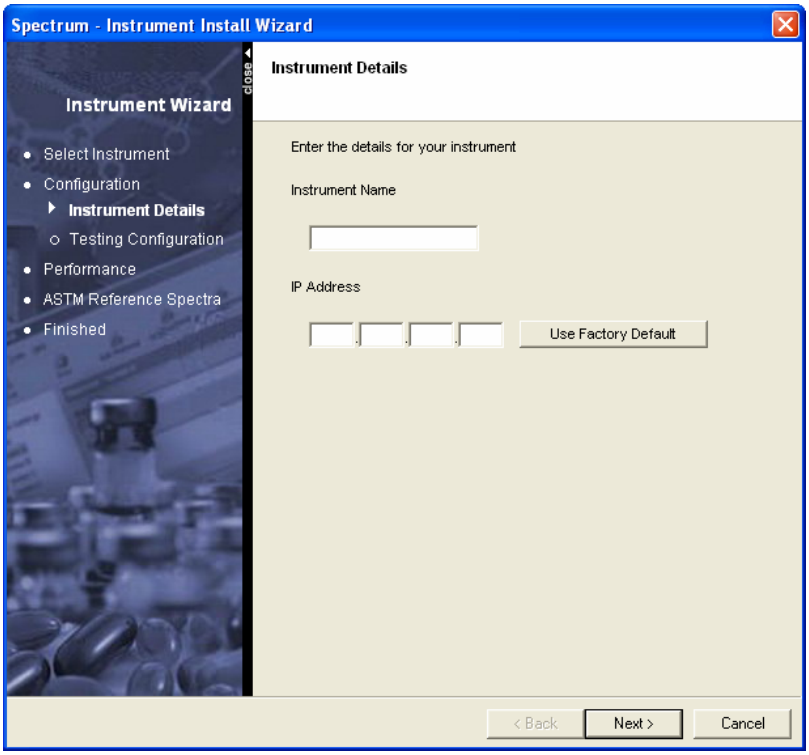
1. To install your instrument, Log In to the Spectrum software as an administrator and elect to work **Offline**.

2. From the Administration menu, select **Instrument and Accessory Configuration**, then select **Add Instrument** from its sub-menu.

   The **Instrument Install Wizard** starts with advice on how to connect your instrument to your PC or network.



3. Click **Next**.
   The **Instrument Details** page is displayed.

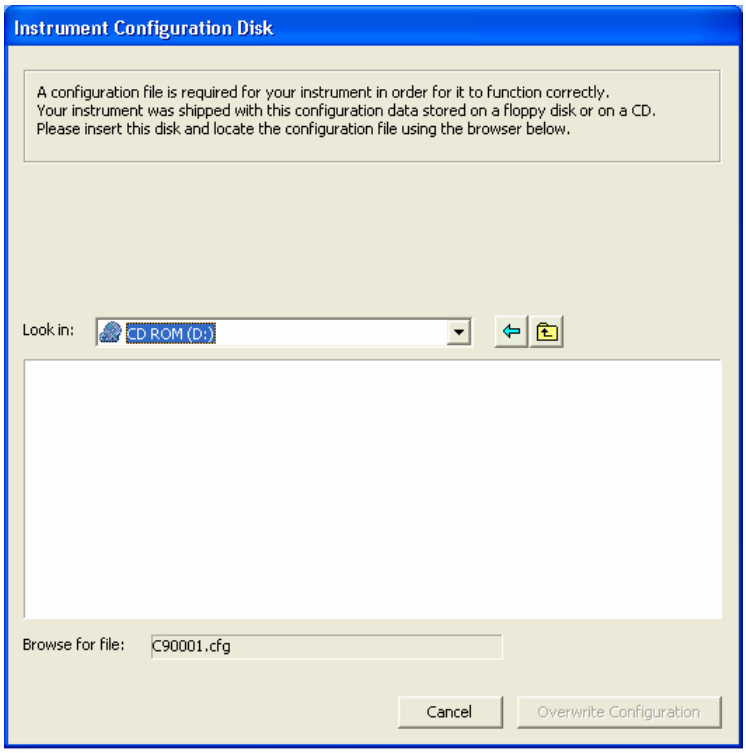


4. Enter an **Instrument Name,** which will be used by the Spectrum software to identify your instrument.

5. If the instrument is connected to your network enter a suitable **IP Address,** which can be provided by your network administrator.
   If the instrument is connected directly to your PC using the supplied cross-over cable, click **Use Factory Default**.

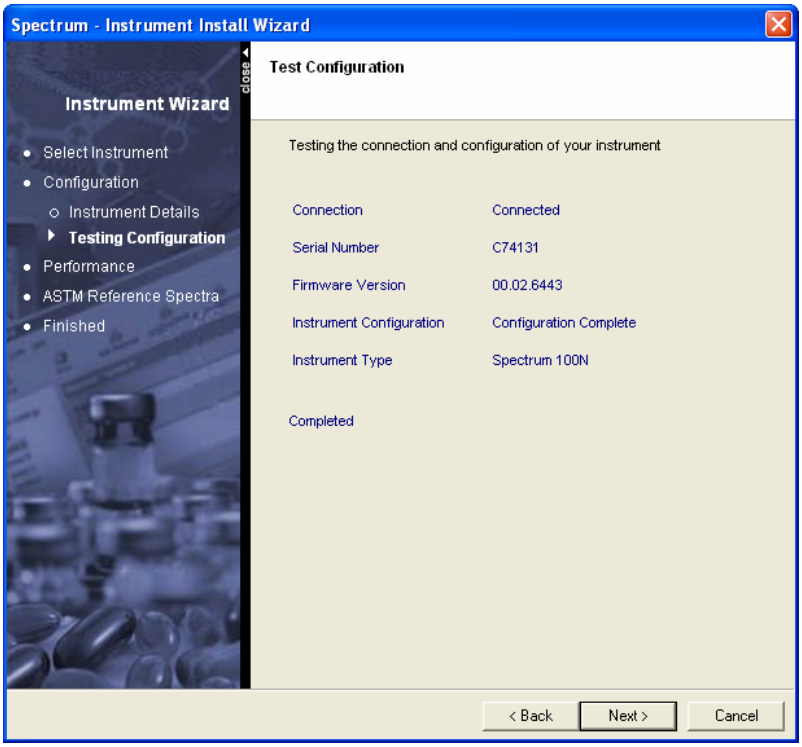
6. Click **Next**.

   The **Instrument Configuration Disk** page is displayed, which prompts for the <name>.cfg of the configuration file required by your instrument. This file is shipped on a CD with your instrument.



   If a suitable configuration file has been has been installed on your PC on a previous occasion, this dialog is amended to enable you either to **Use Existing Configuration**, or to **Overwrite Configuration**.

7. Browse to the configuration file, then click **Copy Configuration**.
   The Test Configuration page is displayed.



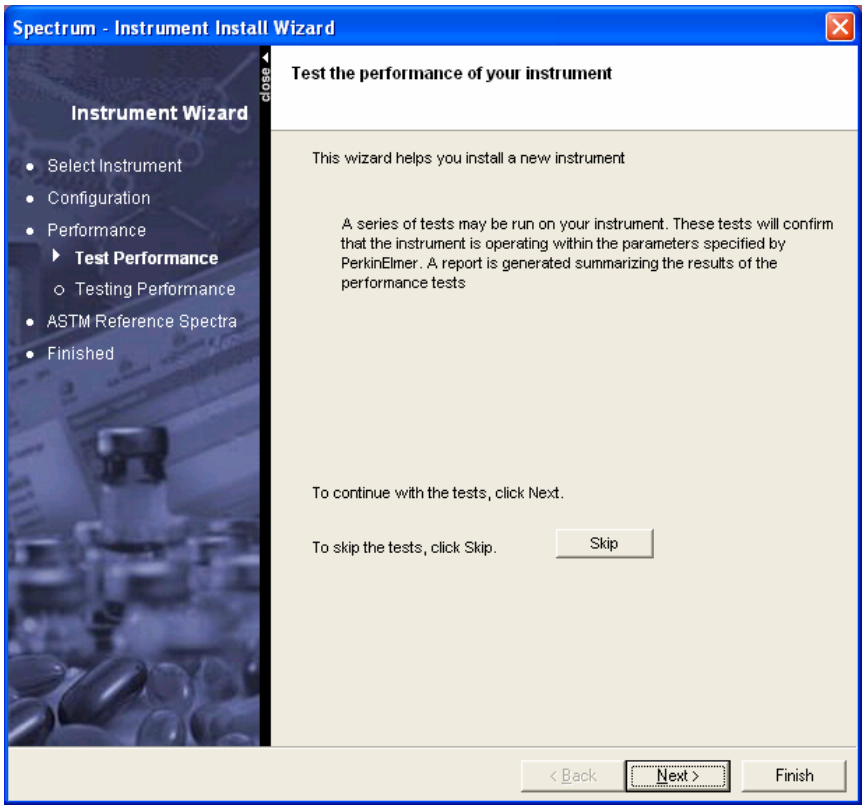
   This test automatically checks whether your PC and instrument can communicate with each other.

   Assuming this **Connection** is working, the page then displays the **Serial Number** and **Firmware Version** reported by your instrument, confirms that the installation of the **Instrument Configuration** is complete, and displays the **Instrument Type** recognized by the Spectrum software.

8. When this page is **Completed**, check that the information displayed is as expected.
   Likely causes of any discrepancies include out-of-date firmware or configuration data. Ask your PerkinElmer Service representative for advice.

9. Remove the configuration CD and click **Next.**

   The wizard now offers the opportunity to **Test the performance of your instrument.**

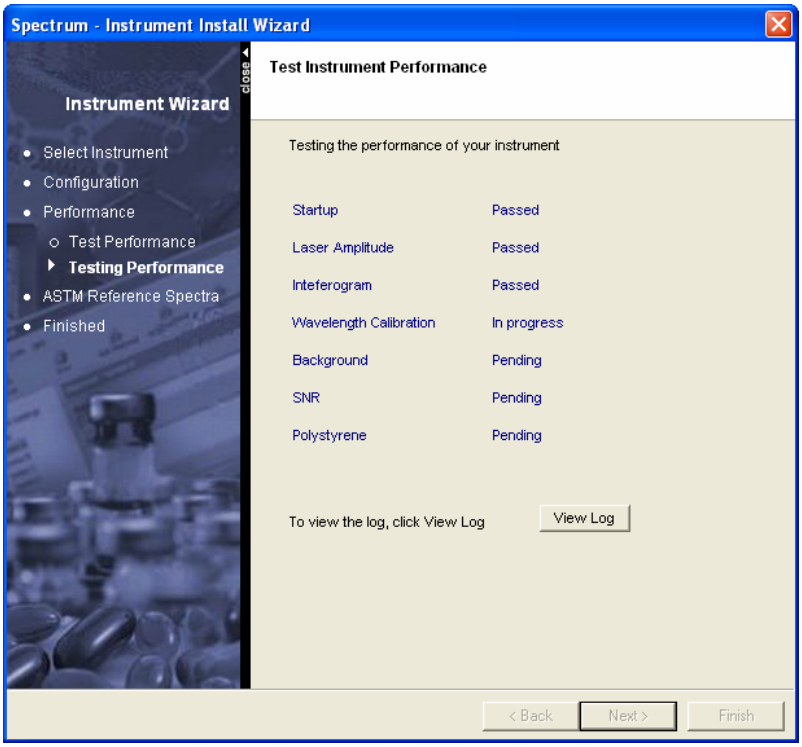


10. If you want to continue with the performance tests, click **Next**. Otherwise, click **Skip**.

    - If your instrument is an FT-IR spectrometer, and you elect to skip performance tests, the wizard continues with the collection of **ASTM Reference Spectra**.

    - If your instrument is an FT-NIR spectrometer, and you elect to skip performance tests, the Finish page is displayed, where you can view the Log for this installation.

The Spectrum Software works through a series of instrument performance tests:

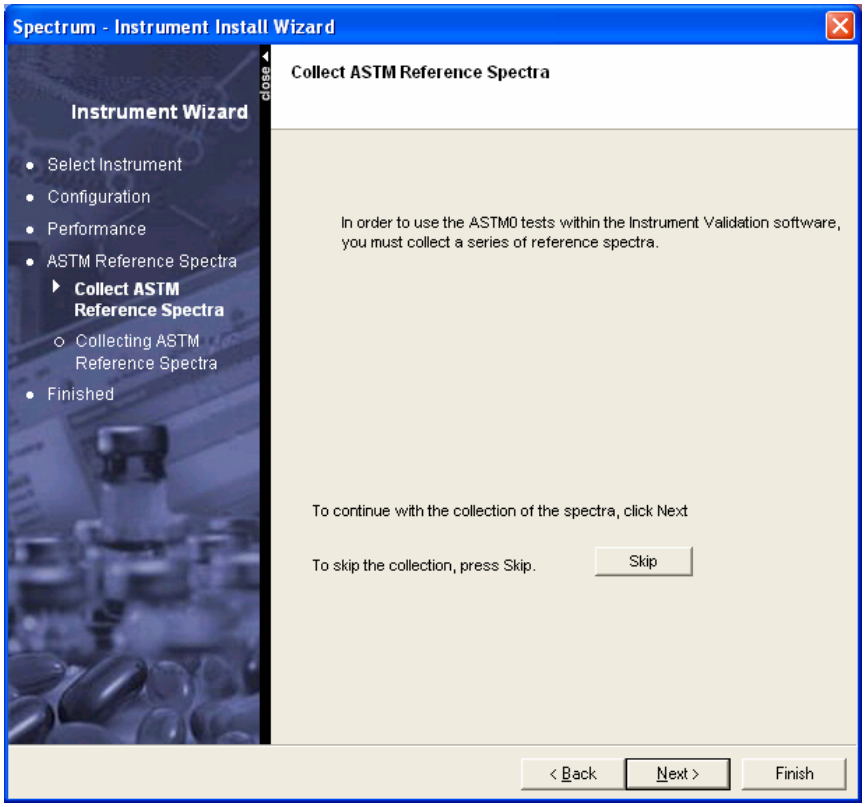


- **Start-up** – Reviews the power-up diagnostics to make sure no problems were found when the Spectrum instrument was switched on.
- **Laser Amplitude** – Checks the amplitude of the laser
- **Interferogram** – Checks the amplitude of the interferogram.
- **Wavelength Calibration** – Performs a wavelength calibration by checking and correcting against the position of a reference peak in a polystyrene spectrum, which is collected either from the internal polystyrene filter, or if not fitted, then by asking you to place the polystyrene test card supplied with the instrument in the sample slide.
- **Background** – Collects a background spectrum and checks the beamsplitter cut-off and the energy levels.
- **SNR** – Collects spectra and performs a signal-to-noise ratio test checked against a set limit.
- **Polystyrene** – If an internal polystyrene filter is not available you will be asked to insert the test card shipped with the instrument, so that a spectrum can be collected and the position of five standard peaks checked.

11. When the tests are complete, click **View Log**. A new window allows you to see the results of the instrument performance tests in more detail.

12. Click **Next**.

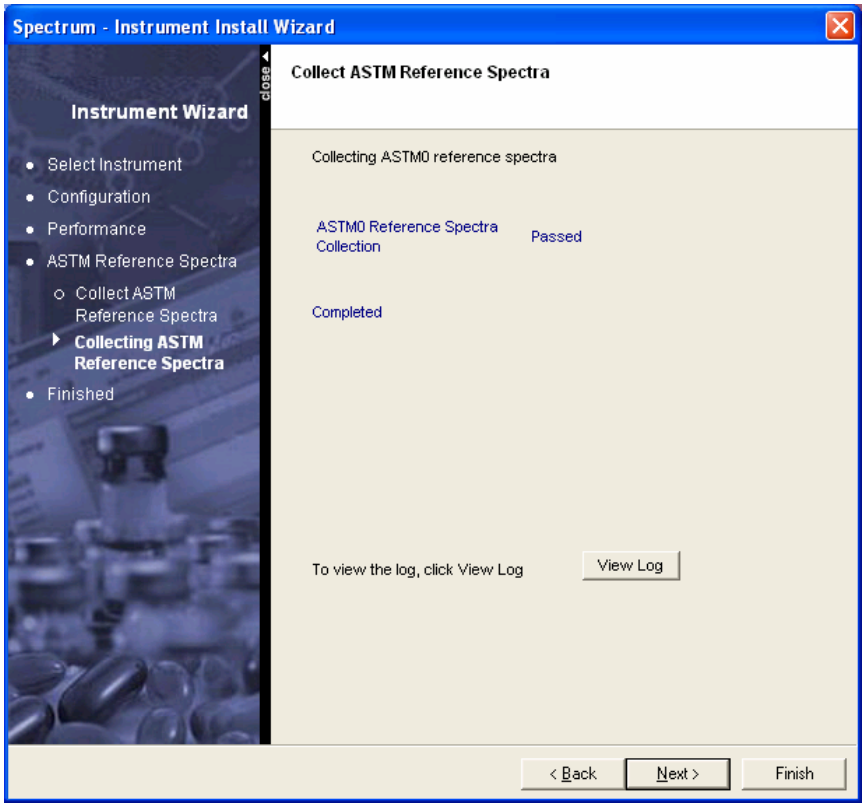
    If your instrument is an FT-IR Spectrometer, the wizard now offers the opportunity to **Collect ASTM Reference Spectra**, which are used when ASTM validation tests are performed. For more information about ASTM level 0 tests, see the HTML Help for the Spectrum software.



- If you do not want to collect ASTM Reference Spectra, click **Skip** to move to the **Finish** page.

- If your instrument is an FT-NIR spectrometer, the **Finish** page is displayed.

13. To collect ASTM Reference Spectra, click **Next**.

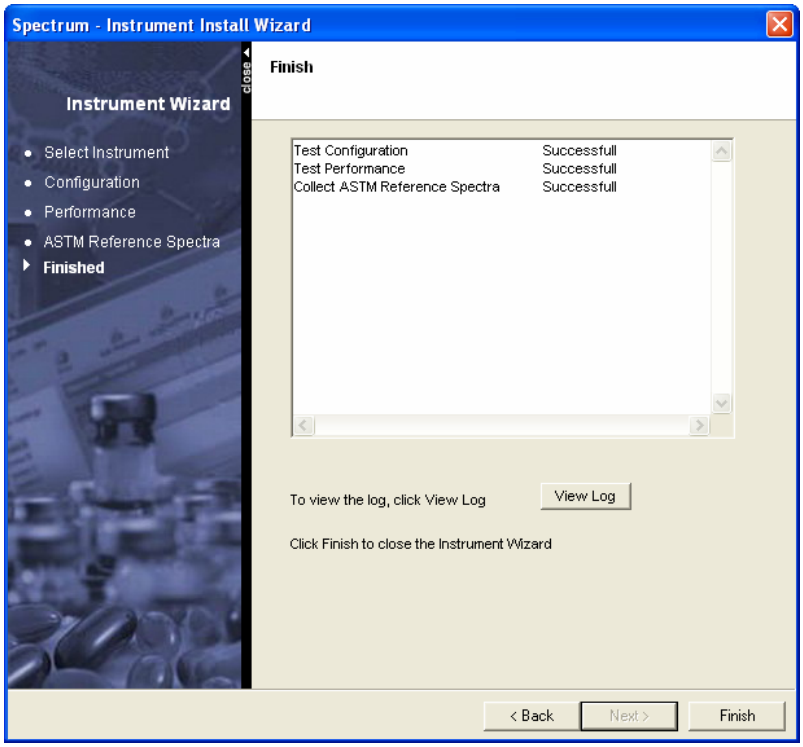


14. When the ASTM0 Reference Spectra collection is complete, click **View Log**.

    A new window allows you to see the results in more detail.

    If you want to view the results later, the log is stored at C:\Program Files\PerkinElmer\ServiceIR\<Instrument Serial Number>\PerformanceTests xxx\PerformanceTests.log (where xxx is an incremented number).

15. Click **Next**.
    The **Finish** page is displayed.



    This page of Instrument install wizard offers a summary of the Configuration and Performance Tests.

    You can also click **View Log** to see the results of the configuration and performance tests in more detail.

16. Click **Finish** to complete the installation and close the Instrument Wizard.

Using the Instrument Install Wizard to install an Accessory

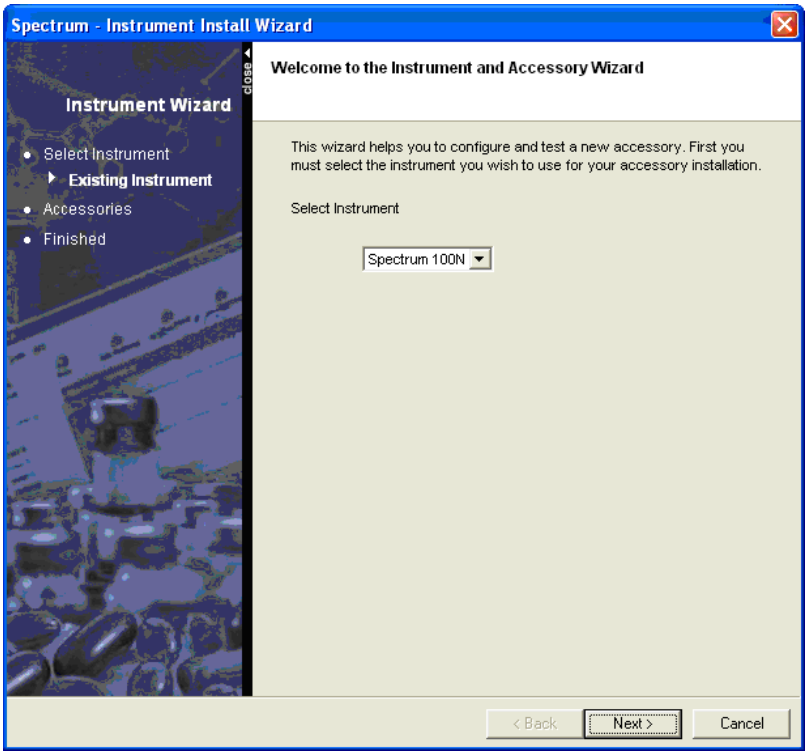
The Instrument Install Wizard tests your accessory (against, for example, any shipping damage) and makes sure that any data necessary for its operation is present on your system.

NOTE: If you want to test an Accessory after it has been installed, there is no need to re-run these accessory installation tests. Validate your instrument by running System Suitability checks instead.

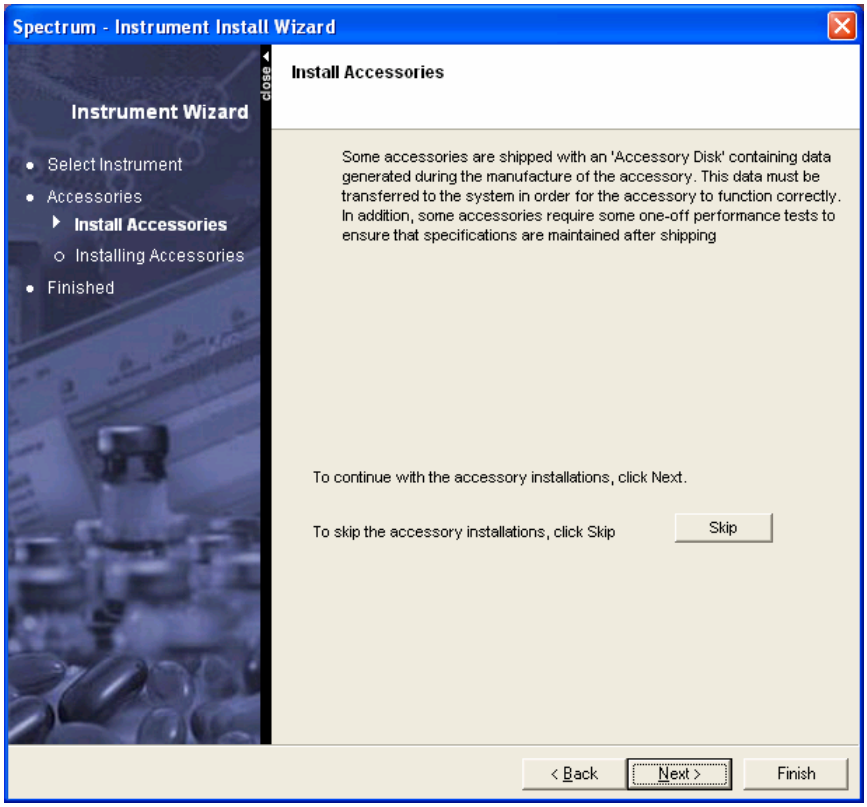
1. To install an instrument accessory, Login to the Spectrum software as an Administrator.

2. From the Administration menu, select **Instrument and Accessory Configuration**, then select **Add Accessories** from its sub-menu.

   The **Instrument Install Wizard** starts.



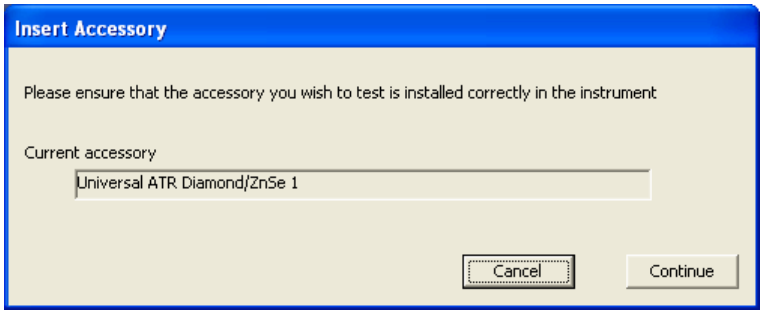
3. Select the instrument on which the accessory will be installed, then click **Next**.
   The **Install Accessories** page is displayed.



Some accessories (such as the Universal ATR), but not all, are shipped with a disk containing, for example, reference spectra generated during manufacture. If required, you will need this 'Accessory Disk' at step 6.

4. Click **Next**.

   The **Insert Accessory** dialog is displayed.

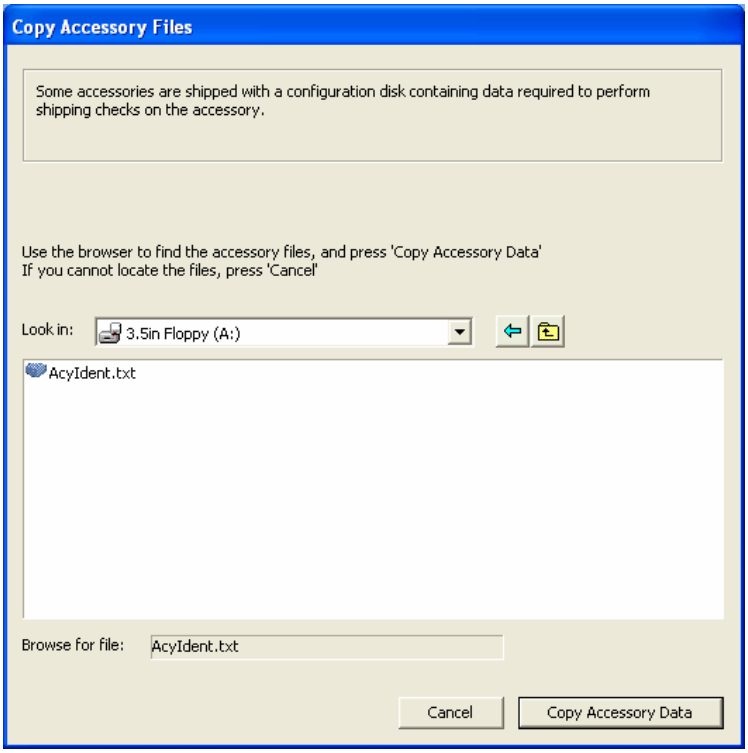


5. Fit the accessory to be installed in the instrument as described in its User's Guide, which is provided on the *Spectrum 100/100N Manuals CD (L1050002)*.

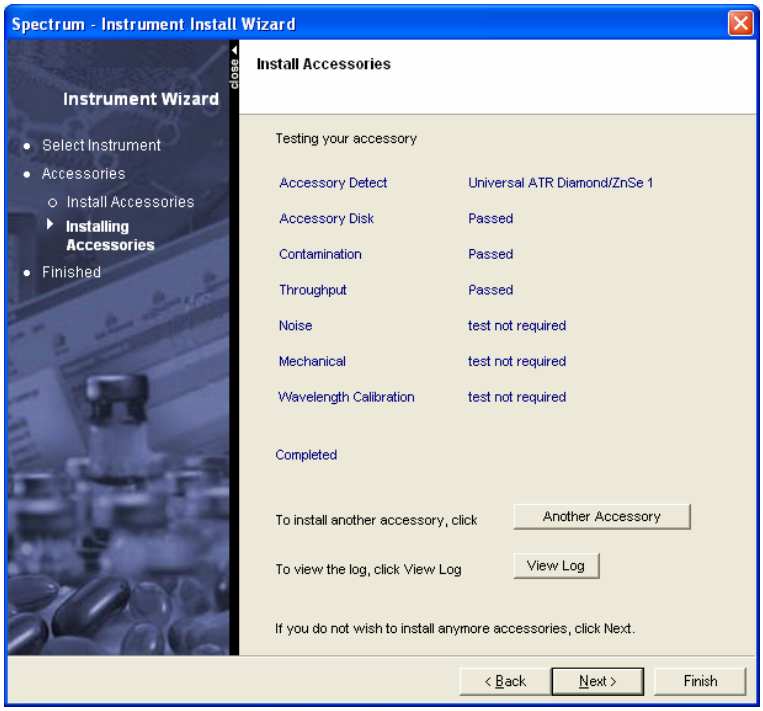
   Typically, you remove the sample slide and sample cover from the instrument, then slide in the accessory module, making sure that it is properly latched and, if appropriate, that its top plate is in place. See *Appendix 1: Changing* the Sampling Accessory on page 110.

6. Click **Continue**.

   If required, the **Copy Accessory Files** page is displayed, which prompts for the <serial number>.cfg of the configuration file required for your accessory. This file is shipped on a disk with your accessory.



7. Browse to the configuration file, select it, then click **Copy Accessory Data**.
   The software performs a series of appropriate accessory performance tests:

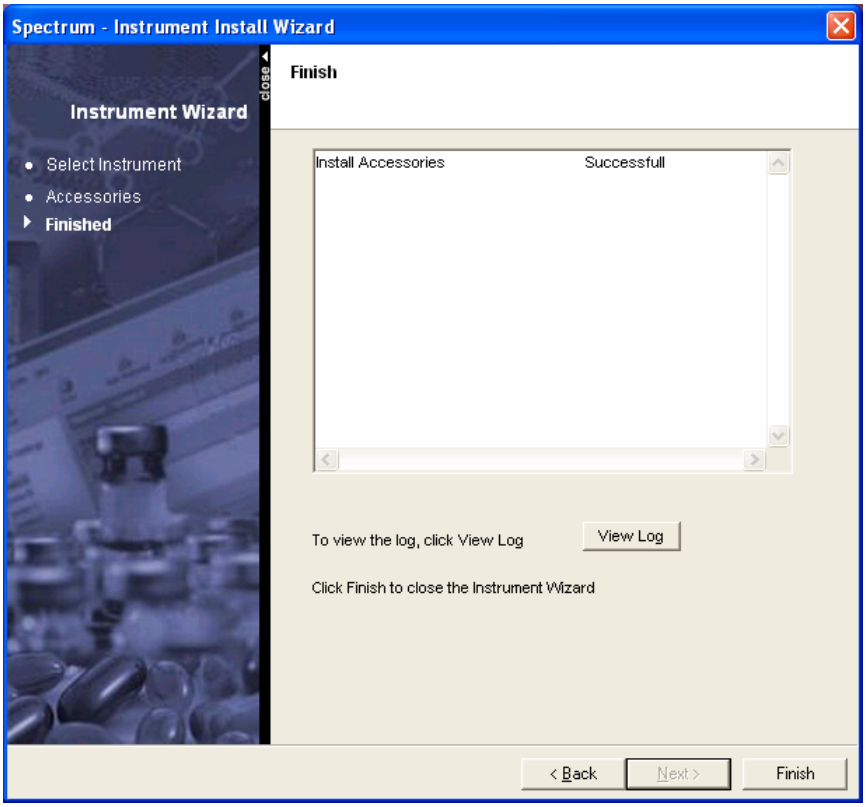


   You may be prompted to remove the accessory briefly (to clear the beam path whilst a background spectrum is collected), then replace it.

8. Once installed, an accessory is recognized by the Spectrum software automatically whenever it is fitted to the instrument. You may decide to install, and test, all the accessories shipped. To install another accessory, click **Another Accessory**
   You are returned to step 4.

9. When any necessary accessory tests and calibrations tests are complete, click **View Log.** A new window allows you to see the results in more detail.
   If you want to view the results of the accessories tests later, the log is stored at C:\Program Files\PerkinElmer\ServiceIR\<Instrument Serial Number>\PerformanceTests xxx\PerformanceTests.Log (where xxx is an incremented number).

10. Click **Next**.
    The **Finish** page is displayed.



11. Click **Finish** to close the Instrument Install Wizard.

Using the Spectrometer

Basics of Software Control

Switching on the Spectrometer

NOTE: It can take the Spectrum 100 FT-IR and Spectrum 100N FT-NIR spectrometers up to two hours to equilibrate when switched on after being switched off overnight. To save time, we suggest that you leave the spectrometer switched on at all times.

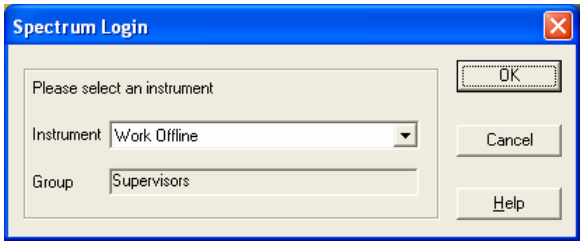
1. Switch on the power to the instrument, using the switch above the power cable.

2. From the Start menu select **Programs**; the **PerkinElmer Applications** group; the **Spectrum** sub-group and then the **Spectrum** application.

   After the Spectrum start-up splash-screen a dialog is displayed; this may require login details:

   Enter your **User name** and **Password**, if necessary, then click **OK**.

3. Select the **Instrument** you want to use; or select **Work Offline** if you just want to work with data that has been collected previously, without attaching to an instrument.



4. If you are using Spectrum (not Spectrum ES), choose whether to **Activate IR Assistant**.

   IR Assistant is a simplified, wizard-driven interface for Spectrum spectrometers. IR Assistant is included in the Spectrum application sub group, and is an item on the Spectrum Help menu. On its start page, you can elect to **Always show Assistant when Spectrum starts**.

5. Click **OK**.

   Spectrum starts.

Controlling the Instrument

You start scans and make adjustments to the instrument using commands in the Spectrum software.

NOTE: The level of control you have (and the complexity of the dialogs you see) is determined by your user level as set on the Instrument tab of the Options dialog, available from the Setup menu. The information that follows shows the dialogs available to the Advanced User.

1. To collect data from your spectrometer, select **Scan** on the Instrument menu, where you can:

   - Enter the details to be saved with the spectra on the **Multiple Sample** tab.

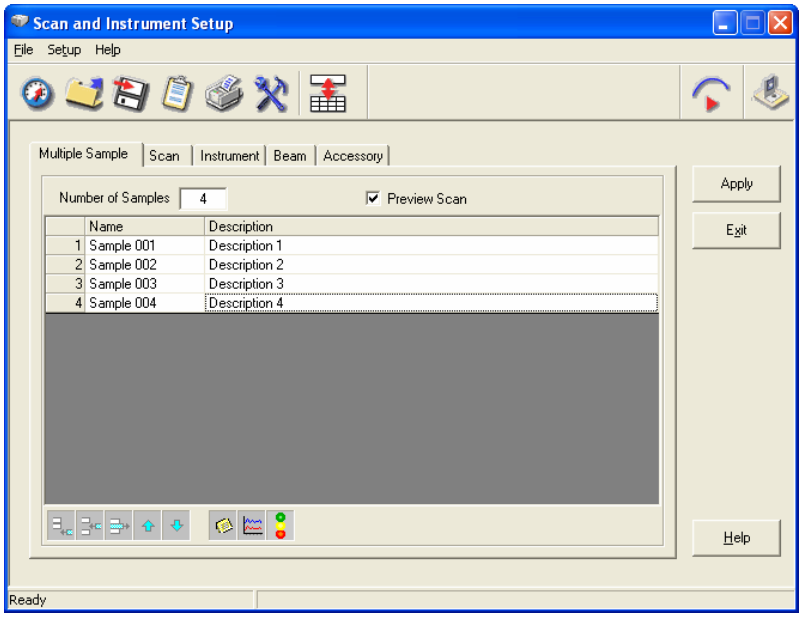
NOTE: Click the  icon to toggle between the **Multiple Sample** tab and the **Sample** tab interface, which may be familiar from earlier versions of the Spectrum software.

The **Multiple Sample** table is shown below with rows for four spectra.

For the **Name** fields, Data Collection has been set up to prefix each sample name with the word **Sample**, and to Auto-increment (**001**, **002**, **003** and so on).

To add a **Description** for each row, select the appropriate cell.

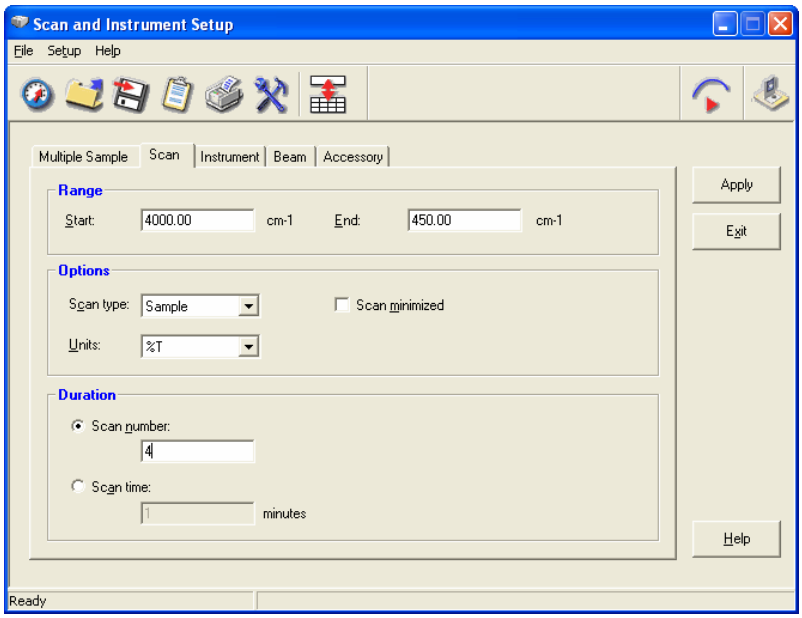
To append a comment to one or more rows click the  icon.



NOTE: When you fit certain accessories, such as the NIR Tablet Autosampler, the format of the Multiple Sample table is amended.

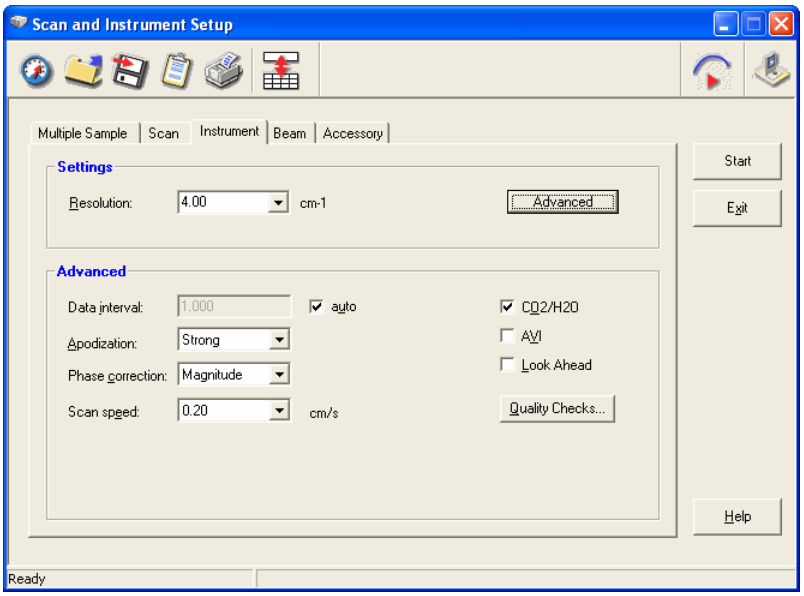
For further details refer to the Spectrum HTML Help system.

- Select the **Range**, **Scan type**, **Units** and **Scan number** (number of scans) on the **Scan** tab.



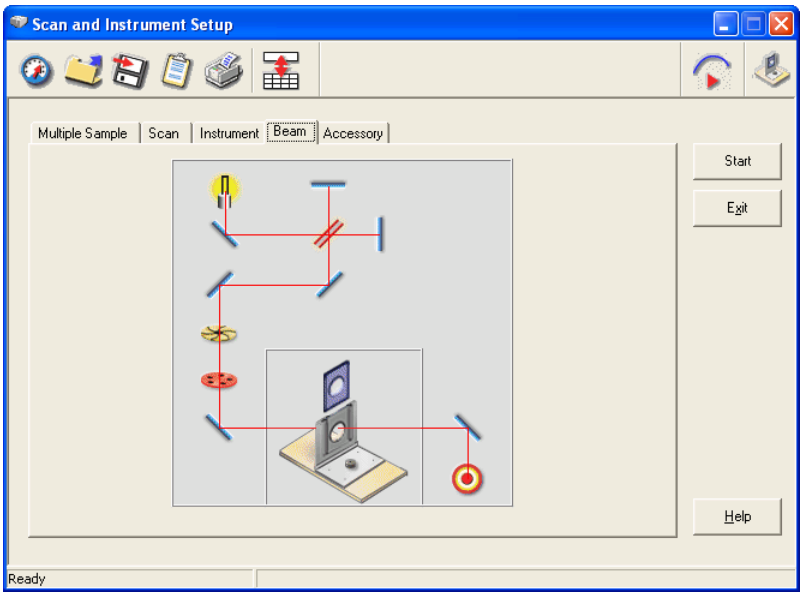
- Select the instrument settings required on the **Instrument** tab.

  The **Advanced** options of **CO2/H2O** suppression, **AVI** correction, **Look Ahead** and **Quality Checks** are discussed between pages 61 and 65.

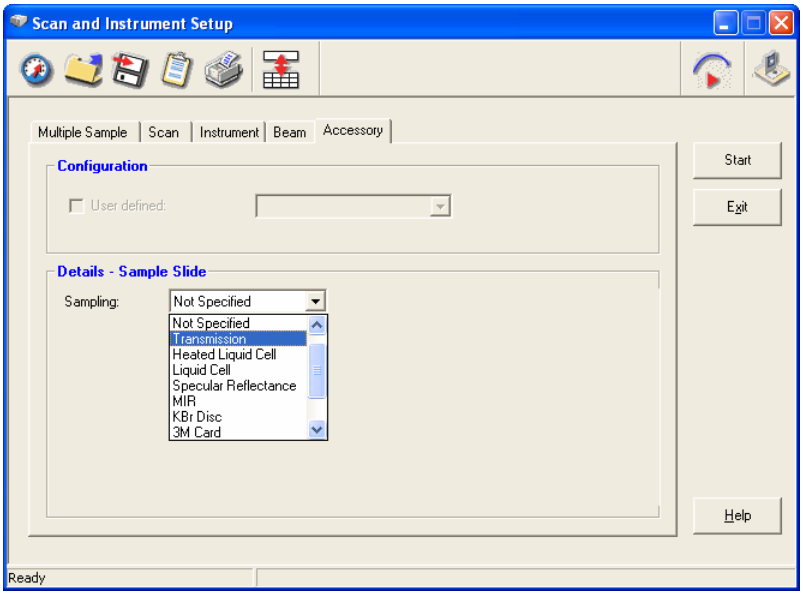


- Set up items on the beampath on the **Beam** tab.

  The **Beam** tab utilizes an interactive graphic. Hover over its icons to identify elements in the instrument beam path. Where appropriate, right-click for further detail about, or an options dialog for, the element.

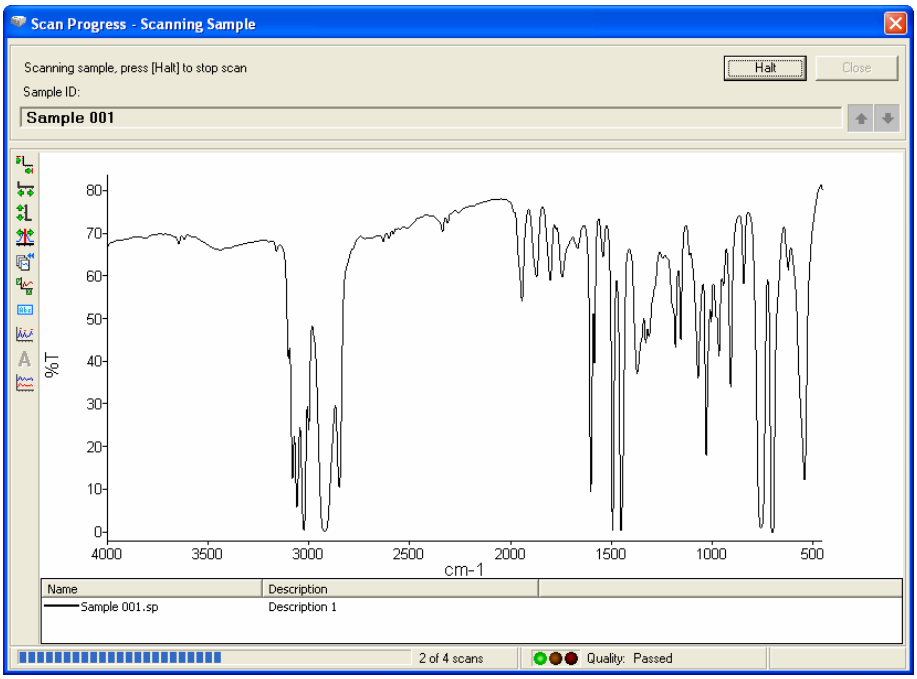


- Set up accessory specific conditions, or call up specific pre-set configurations on the **Accessory** tab.



2. When you are satisfied with the entries on the **Scan and Instrument Setup** dialog tabs, click **Start**.

   The **Scan Progress** dialog opens.



   If, for example, the instrument resolution setting has been increased, a valid background spectrum may not be available. The Scan Progress dialog prompts you to ensure the beampath is clear so that a background spectrum can be collected.

   Click **Scan** to begin.

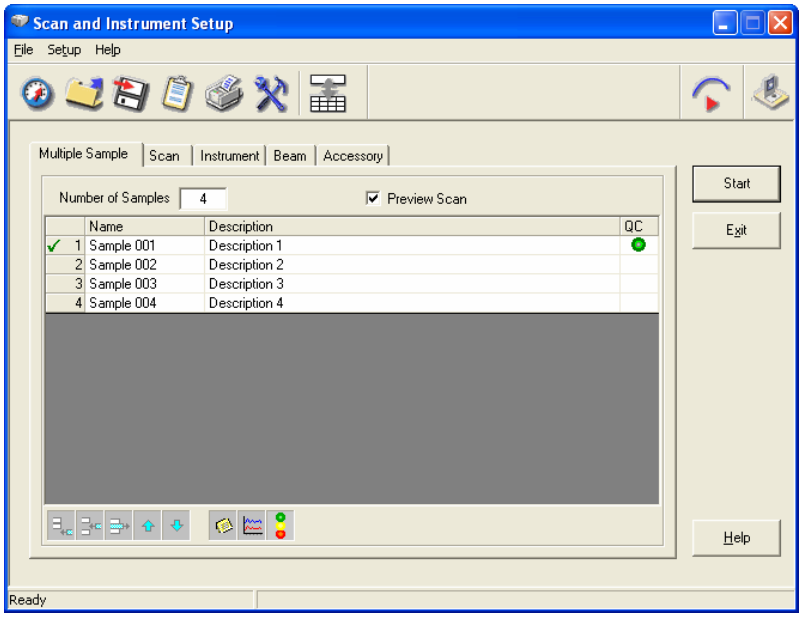
   The **Scan** button changes to **Halt** while the data is being collected.

3. If a valid background spectrum is available, or after a background spectrum has been collected, the Scan Progress dialog prompts you prepare your sample.

4. Click **Scan** to begin collecting your sample spectrum.

   The **Scan** button changes to **Halt** while the data is being collected.

   As each spectrum is collected, it is checked off on the Multiple Sample table.



5. If Quality Checks have been set, the selected tests are performed as each spectrum is collected, and a signal light (green , amber , or red) is placed in the **QC** column to indicate its status.

   To examine Quality Check results in more detail, select the appropriate scan then click the button.

Working with the Instrument Display and Go button

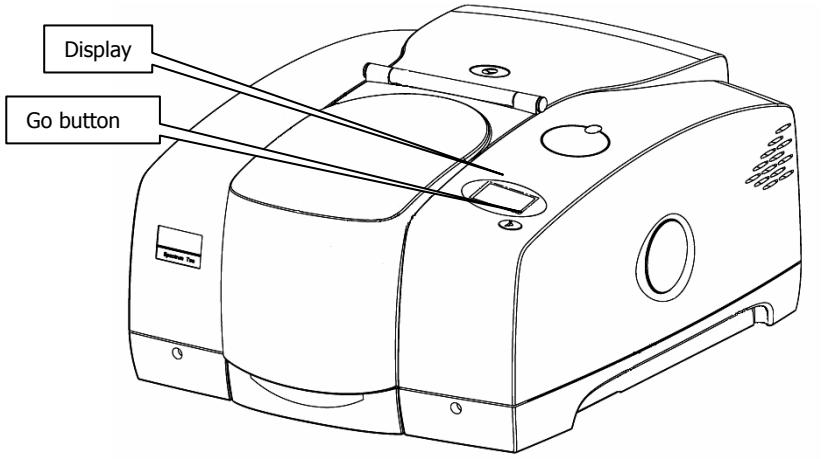


Figure 12 Instrument Display and Go button

The Display on the lower right of the top of your instrument is used to display prompts and other messages generated by the Spectrum software.

The messages and prompts provided by the **Scan Progress** dialog, and the actions of the **Scan**/**Halt** button are mirrored by similar messages and prompts on the Instrument Display, and the actions of the instrument's Go button.

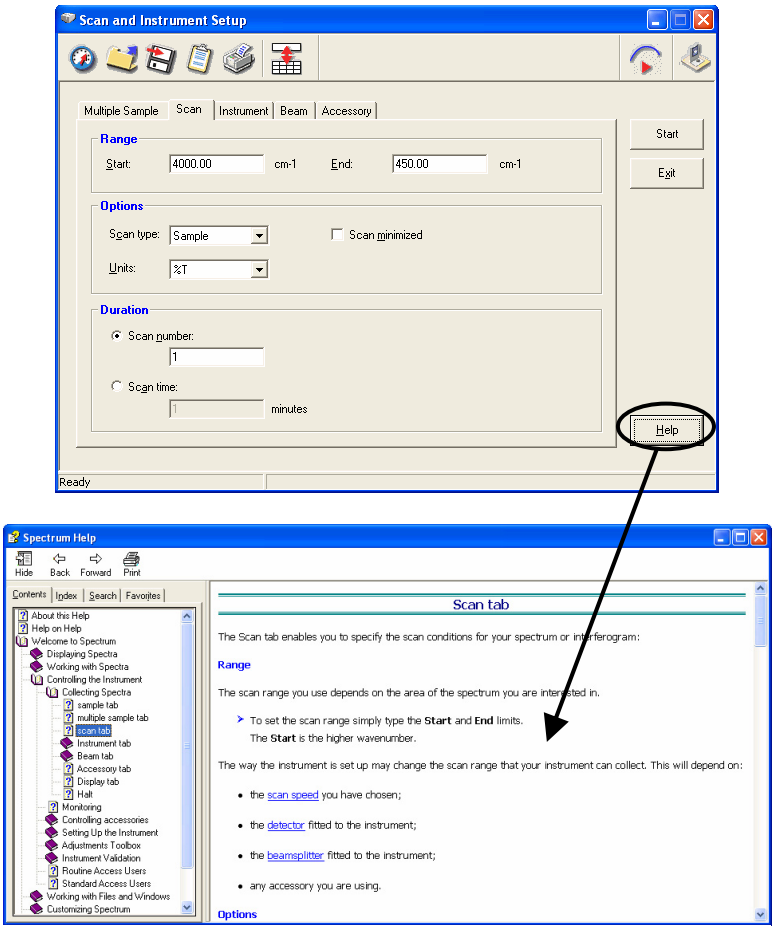
When used in conjunction with the Multiple Sample table in the Spectrum software, you can complete a series of sample scans using the Display and Go button.

Using the Spectrum on-screen help system

Use the Spectrum HTML Help system to find further information about using Spectrum software to control, set up and adjust your instrument.

To open the Help file, select **Contents and Index** from the **Help** menu. This menu also includes links to on-screen tutorials (**Learning Spectrum**), a simplified interface (**IR Assistant**), and information about the software (**About**).

To open the Help file at the most relevant topic, press the **F1** key, or click the **Help** button (sometimes the **?** button), in the window where you are working. For example:



Atmospheric (CO_2/H_2O) Suppression

Atmospheric suppression can be set in the Advanced section on the Instrument tab of the Scan and Instrument Setup dialog.

What is atmospheric suppression?

This is an atmospheric correction routine. This routine is more powerful than simple subtraction, overcoming the following issues:

- Non-linearity due to resolution,
- The measured spectrum is temperature dependent,
- Lineshape and calibration are affected by J-stop and sample or accessory.

What does atmospheric suppression do?

When **CO2/H2O** is switched on, the software uses a single reference spectrum derived from high resolution data and our understanding of the instrument to model the lineshape, then finds the current real instrument parameters by least squares fitting to the measured spectrum.

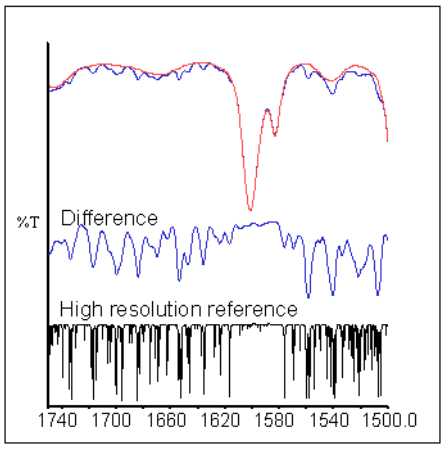


Figure 13 Correction of a mid infrared spectrum at 4 cm^{-1} resolution

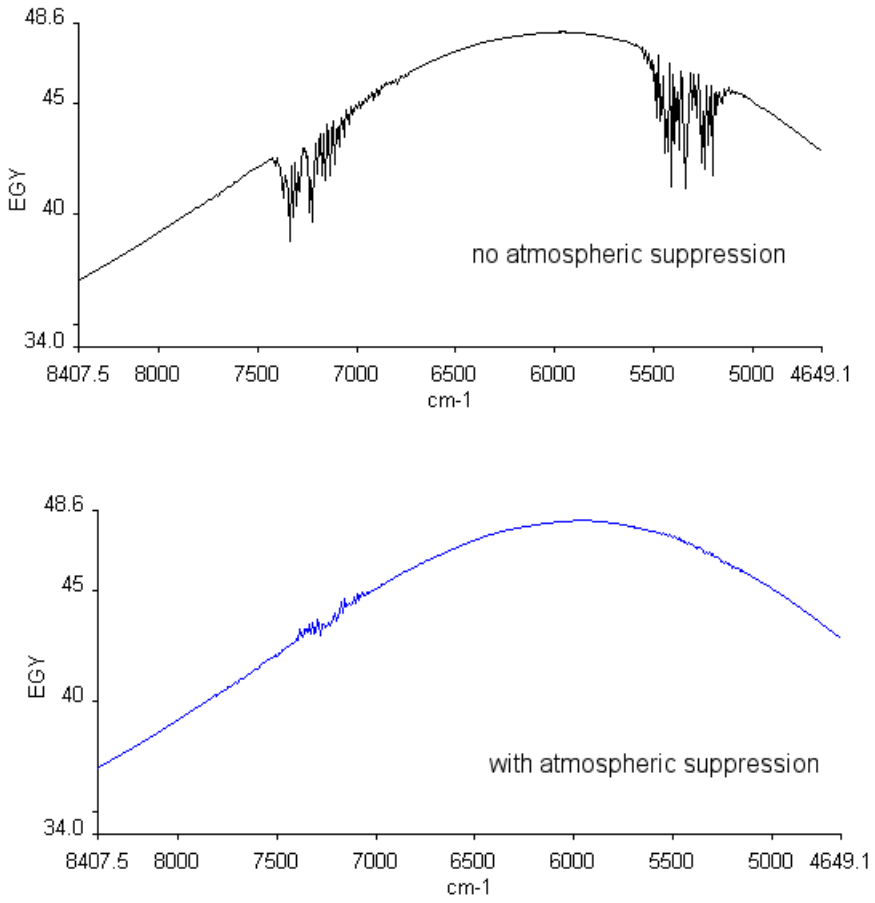


Figure 14 Atmospheric suppression

AVI Correction

AVI correction can be set in the Advanced section on the Instrument tab of the Scan and Instrument Setup dialog.

NOTE: AVI correction uses a methane gas cell installed in the filterwheel. AVI correction is only available on the Instrument tab if this cell has been fitted.

What is AVI correction?

The objectives of Absolute Virtual Instrument (AVI) correction are:

- Consistent performance over time and between instruments;
- Traceability for all measurements.

Although FT-IR and FT-NIR spectrometers use a reference laser, the wavenumber calibration and lineshape are affected by differences in beam divergence and uniformity. This is true for all FT-IR and FT-NIR spectrometers. Differences can occur between instruments, when using different sampling accessories and when components are changed. AVI allows calibration and lineshape to be maintained.

The Absolute Virtual Instrument is an instrument with theoretical performance, such that the result of measuring a known sample on such an instrument can be predicted. So, if we measure with a real instrument and calculate the software transform to match the theoretical result, we can apply this transform to future measurements.

The Absolute Instrument is defined by wavenumber calibration, instrument lineshape and ordinate accuracy.

What does AVI correction do?

When **AVI** is switched on, the software measures the current instrument profile relative to an absolute standard (the methane cell in the filterwheel) and an ideal lineshape function, and applies a correction. The use of an on-board methane cell means that it also provides correction for any sampling configuration.

NOTE: AVI correction can only be performed if an AVI Calibration has been set up for the current sampling configuration.

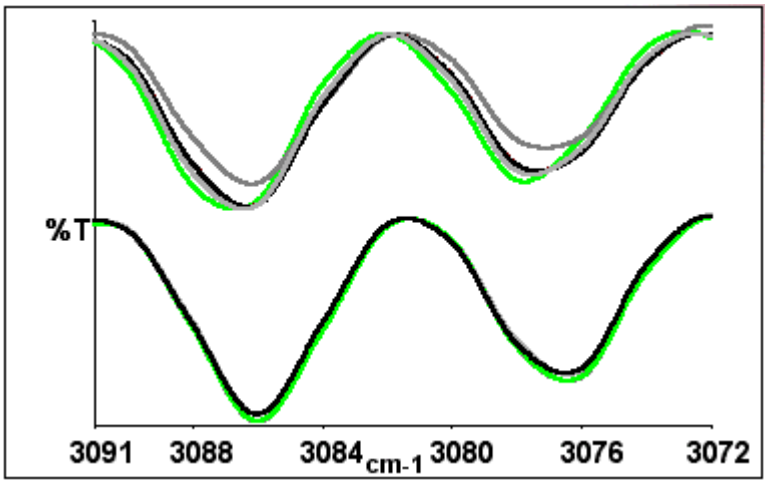


Figure 15 Spectra of methane at 4 cm^{-1} resolution as measured (top) and with AVI (bottom).

Look Ahead

Look Ahead can be set in the Advanced section on the Instrument tab of the Scan and Instrument Setup dialog.

What is Look Ahead?

Look Ahead is a novel system where the spectrometer scans continuously and uses the properties of the measured spectrum to identify changes corresponding to sample removal, sample insertion, or sample change, automatically.

This information is used to identify the scans that are being collected, and to accumulate sample scans. This can decrease the overall scanning time required for those samples that require scan accumulation.

What does Look Ahead do?

If **Look Ahead** has been enabled, the spectrometer scans continuously. When you request a sample scan, the scan collected is compared to the scans that have already been collected. If identical scans are found, the number of scans requested is decreased by the number of scans found, so decreasing the overall scanning time.

Quality Checks

Quality Checks can be set in the Advanced section on the Instrument tab of the Scan and Instrument Setup dialog.

What are Quality Checks?

Quality checking is a tool for less experienced IR users that identifies possible problems in the spectrum being collected and suggests ways of improving the measurement.

What do Quality Checks do?

Choosing **Quality Checks** displays a dialog that enables you to select the quality checks you want to perform.

NOTE: For more information about each individual test, double click on the test in the dialog.

When you collect your spectrum, the selected tests are performed as the data is collected and the signal lights at the bottom of the Display tab,  , show the current status.

There are two levels of alert from the Quality Checks:

Caution () - IR Expert has identified a problem that you may want to investigate in order to improve the quality of the spectra you are collecting.

Warning () - IR Expert has identified a serious problem that you should attempt to cure before collecting further spectra.

If a problem is identified a dialog will be displayed that not only alerts you to the problem, but also explains what the problem means, how it may of occurred and gives some suggestions on how to stop the problem occurring again.

Quality Checks and the Multiple Sample tab

If Quality Checks have been set, the selected tests are performed as each spectrum is collected, and a signal light (green  , amber , or red ) is placed in the Multiple Sample tabs QC column to indicate its status.

- To examine Quality Check results in more detail, select the appropriate scan then click the  button.

Routine Maintenance

Cleaning the Spectrometer

Clean the outside of the instrument using a damp cloth. If necessary, a mild detergent may be used. Before you clean the entire instrument, always perform a patch test on an inconspicuous area.

Avoid spilling liquid into the instrument. Clean all external spills immediately. If anything that is spilled enters the main body of the spectrometer, switch off the power and contact a PerkinElmer Service Engineer.

CAUTION	*Do not touch or attempt to clean any optical surface in the instrument, because this will impair its performance and may easily damage the component.*

Cleaning the Display

Clean grease and dirt off the Display using a soft damp cloth and a mild detergent.

Moving the Spectrometer

WARNING

The spectrometer is a heavy precision instrument, so two people are required for safe handling.

Consult the local codes of practice issued by safety advisors before attempting to lift it.

Take care not to injure yourself or others, or to drop the spectrometer.

WARNING

Before moving the spectrometer, switch off the power supply, wait 60 seconds, and disconnect the power cable.

The spectrometer can be lifted using the shaped handholds on its sides, as shown in Figure 16. Two people are needed to lift it because its basic weight is approximately 34 kg.

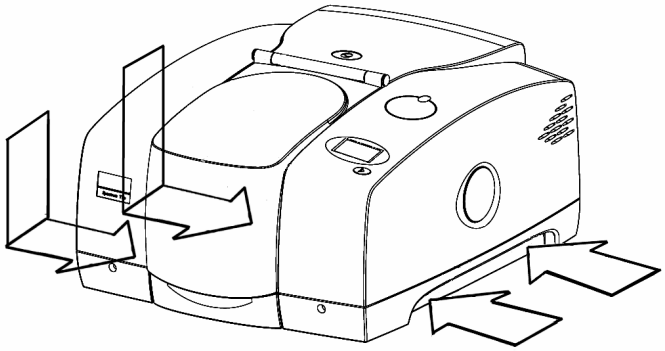


Figure 16 Spectrum 100 Series lifting points

Condensation

Be aware that condensation caused by moving your spectrometer from a cooler environment to a warmer one can damage the windows of the sample compartment. To prevent this damage from occurring:

- Make sure that the windows are protected by placing fresh bags of desiccant in the sample compartment;
- Leave the spectrometer to reach the temperature of the surroundings before removing the desiccant.

The Desiccant Indicator in detail

The optical system of the spectrometer is purged at the factory. This protects the KBr (Spectrum 100) or CaF_2 (Spectrum 100N) beamsplitters and the sample compartment windows from being damaged by humidity. Replaceable packs of desiccant maintain the purge.

The top panel of the instrument includes a Desiccant Indicator, whose sectors change sequentially from blue to pink as the desiccant becomes exhausted. Change the desiccant packs in the instrument when the sector marked 10 becomes pink, but while the sectors marked 15 and 20 are still blue. These numbers correspond to the approximate % Relative Humidity in the optical compartment.

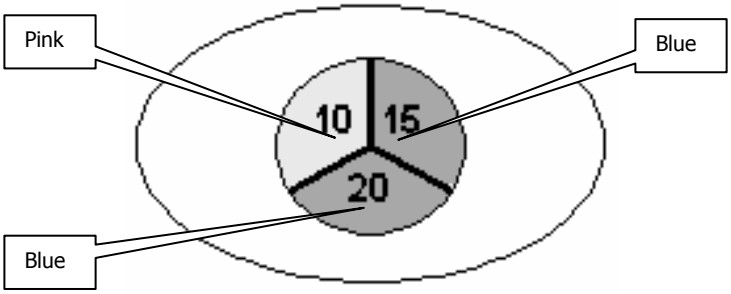


Figure 17 The Desiccant Indicator: When desiccant packs should be changed

CAUTION	*If all three sectors of the Desiccant Indicator are pink, then you must change the desiccant.* *The instrument optics may be fogged. Do not switch the instrument either ON or OFF until all sectors are blue.*

Sector	**Action Required**
All sectors blue	None. The humidity levels in the instrument are below approximately 10% Relative Humidity.
Sector 10 pink	Change the desiccant. If the instrument has been switched OFF for an extended period, do not switch ON until you have changed the desiccant and all sectors are blue.
Sector 10 & 15 pink	You should have changed the desiccant already. Do not switch the instrument ON or OFF until you have changed the desiccant and all sectors are blue.

Changing the Desiccant

NOTE: We recommend that you change the desiccant in the spectrometer before using it for the first time.

CAUTION

Expect to change the desiccant in the spectrometer every six months. Old, used desiccant releases moisture.

In regions experiencing high humidity levels we recommend you change the desiccant more often.

At intervals set in the Maintenance section of the instrument control software the following message will be displayed to warn you that the desiccant in your instrument needs changing (Figure 18):

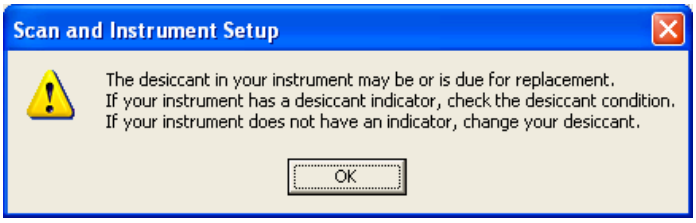


Figure 18 Desiccant Replacement Warning Dialog

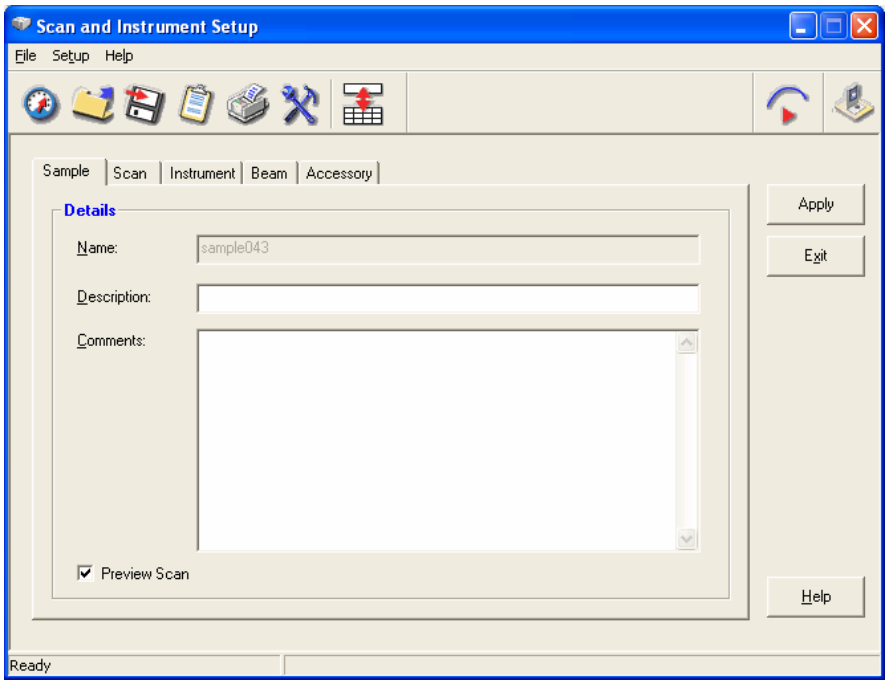
When the message appears, you should check the Desiccant Indicator. The message will continue to appear until you tell the software that the desiccant has been changed.

NOTE: The following operations can only be performed by a user who has ***Advanced*** level instrument access as set on the Instrument tab of the Options dialog.

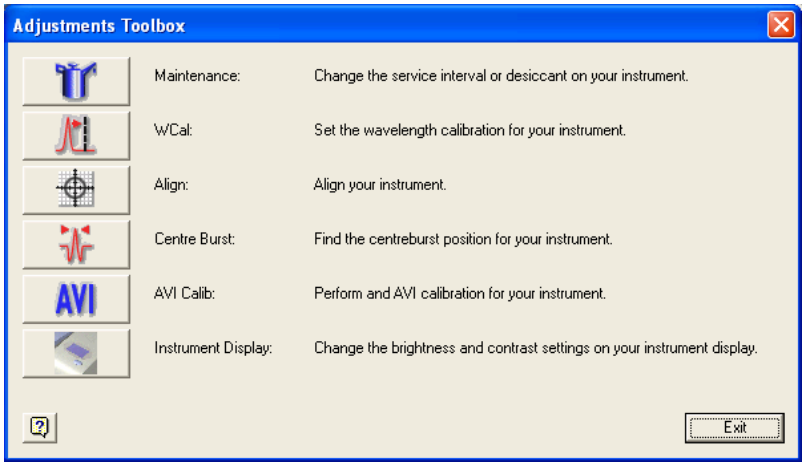
Resetting the desiccant change interval

The message displayed to warn you that the desiccant in your instrument needs changing (Figure 18) is displayed until the Desiccant options are reset using the Maintenance tool in the Adjustment Toolbox.

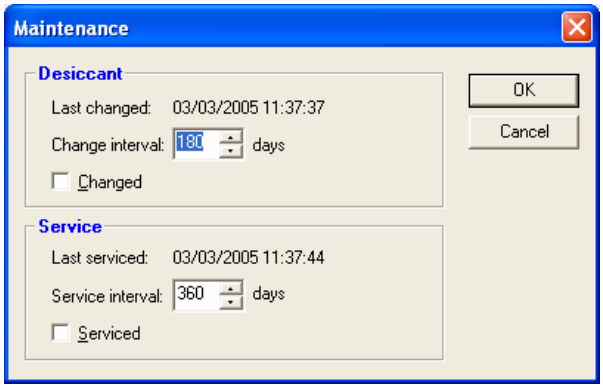
1. Display the Setup menu and choose **Instrument**.
   The Scan and Instrument Setup dialog is displayed.



2. Click  .
   The Adjustments Toolbox is displayed.



3. Click **Maintenance**.
   The Maintenance dialog is displayed.



4. The date of the last desiccant change is reported in the **Desiccant** panel. Select the **Changed** checkbox and, if required, reset the **Change interval**.
   The message displayed to warn you that the desiccant in your instrument needs changing will reappear after the specified number of days.

5. If appropriate, update the **Service** panel.

6. Click **OK**.

Renewing the disposable desiccant

CAUTION	*Old, used desiccant releases moisture and can cause catastrophic failure of KBr optics.* *Do not use damaged packs of desiccant. Make sure that the packs you use have not been left in contact with the air.*

You can purchase disposable desiccant kits from PerkinElmer (Part Number N017 1159). A kit contains two packs of desiccant, and three kits are required.

1. Inspect the humidity indicator card in the plastic bags in which the spare desiccant packs are packed. If the card indicates humidity in the bag, discard the desiccant pack.

2. Remove the sample area cover, if fitted, by opening the cover, pressing the clip and pulling the cover vertically to remove.

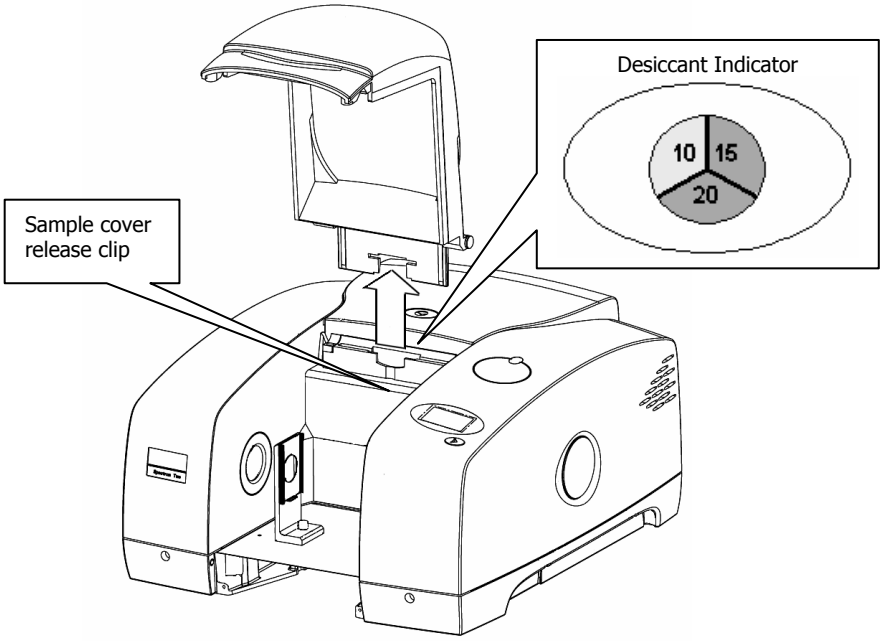


Figure 19 Removing the sample area cover

3. Undo the two captive screws securing the desiccant cover (Figure 20).

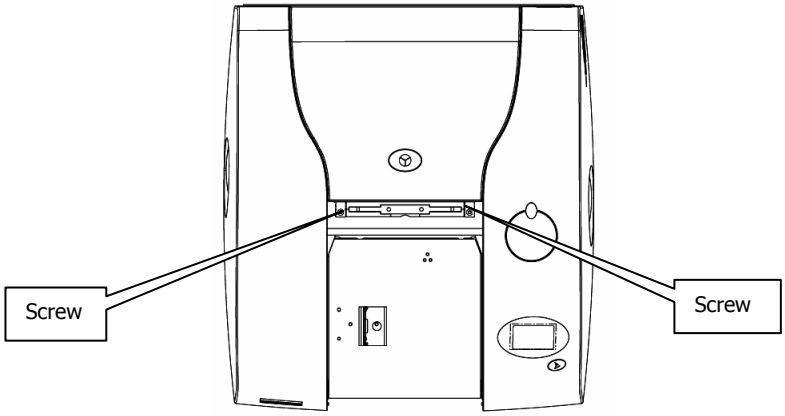


Figure 20 Captive screws securing desiccant cover

4. Open the cover and remove all the exhausted desiccant packs (Figure 21), noting how they are installed.

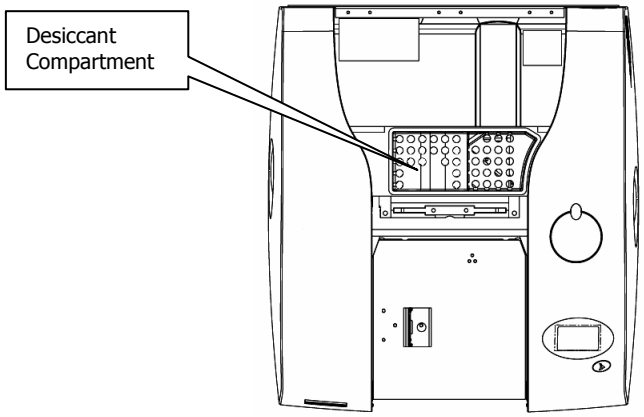


Figure 21 Desiccant removed

5. Place the first three packs of desiccant upright in the recess on the right of the desiccant holder then, one at a time, lay the three remaining packs flat in the upper part of the holder (Figure 22).

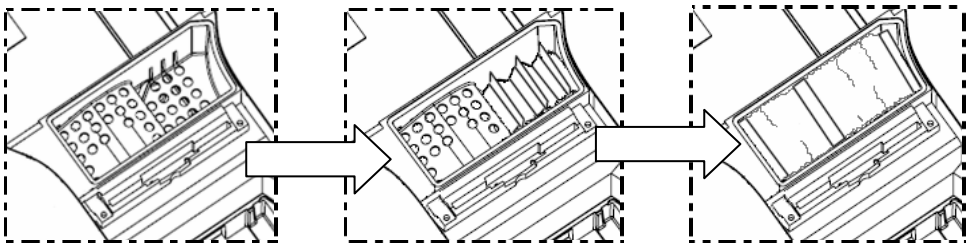


Figure 22 Stowing the desiccant packs

Ensure that when the packs have been installed they do not rise above the level of the black rubber purge seal.

6. Close the cover and tighten the screws.

7. Refit the sample area cover.

Installing rechargeable desiccant

There is also a rechargeable desiccant kit available (L1250261).

To install rechargeable desiccant packs follow the *Renewing the disposable desiccant* procedure starting on page 73.

The instrument requires two rechargeable desiccant packs; the packs are sized to fit into the left (70 mm x 78 mm x 33 mm) or right (102 mm x 78 mm x 84mm) of the desiccant container.

The standard kit contains two pairs of rechargeable desiccant packs. This is so you can immediately replace the desiccant in the instrument with re-activated packs.

The desiccant packs can be re-activated by baking them in an oven at 250 °C for approximately 8 hours. They should be cooled in a dry atmosphere. For optimum results, re-activate the packs immediately before re-use.

Purging the Spectrometer

Under most circumstances, you do not need to purge the optical system. However, after performing any maintenance tasks that involved opening the main cover, you may purge the optical system to remove water vapor and CO_2 that entered while the system was open.

Purge the sample compartment if you need to make sure that no residual water vapor or CO_2 peaks are visible in the spectrum.

There are two separate sets of connectors for purge gas lines, one for the sample compartment and one for the optical system. You can purge with either dry air or nitrogen. Both remove water vapor; however, nitrogen is preferable because it also removes atmospheric carbon dioxide.

A typical cylinder of dry nitrogen (or dry air) stores 220 ft^3 at 2200 lbf/in^2 (6.26 m^3 at 1.4 x 104 kPa). Make sure that the gas is free of oil, water, or dirt particles larger than 25 μm (0.001 inch).

WARNING

Do not use a flammable gas to purge the instrument. The spectrometer contains a hot source, and a fire or explosion will result. Only use clean, dry, oil–free nitrogen or air to purge the instrument.

WARNING

Never connect the purge tubing directly to a gas cylinder or other high pressure supply; always use a pressure regulator and set the pressure to a maximum of 1 lbf/in^2 (6.9 kPa) before you start the flow.

A length of clear plastic tubing (4 mm internal diameter) will be required to transfer the gas from the gas bottle to the instrument purge connectors.

1. The tubing is connected to the instrument by a universal pipe fitting which is secured to the tubing with a nut. Two sets of fittings are supplied with the instrument. Assemble the fittings to the tubing as illustrated in Figure 23.

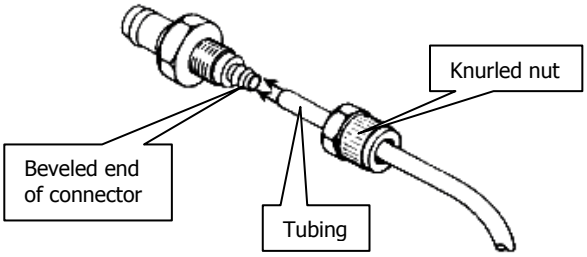


Figure 23 Purge fittings

2. Tighten the nut, ensuring it is not over tightened.

3. Push the connector on the end of the tubing into the purge connector of the compartment to be purged (Figure 24).

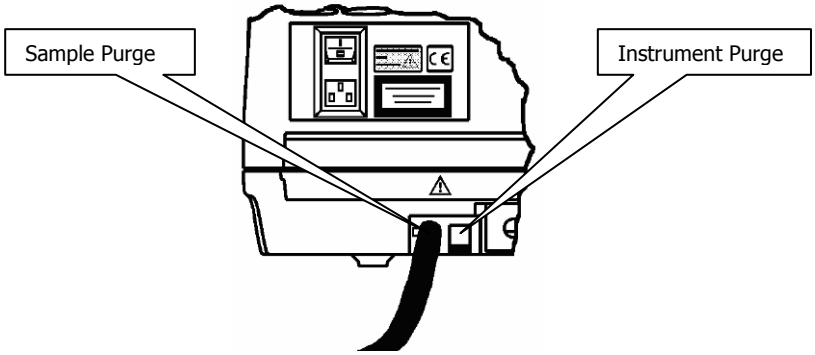


Figure 24 Connector fitted to purge port

4. Connect the free end of the tubing to the gas regulator.

NOTE: Ensure the regulator is set to a pressure not greater than 6.9 kPa (1 lbf/in^2).

5. Open the gas flow valve on the regulator until a flow rate of 28 L/minute (1 ft^3/minute) is achieved.

   The instrument compartment is purged in 10 minutes. The sample compartment is purged in 2 minutes.

6. Once purging is complete turn off the gas supply.

7. Disconnect the fitting from the instrument by pushing the locking clip located on the side of the purging port (Figure 25).

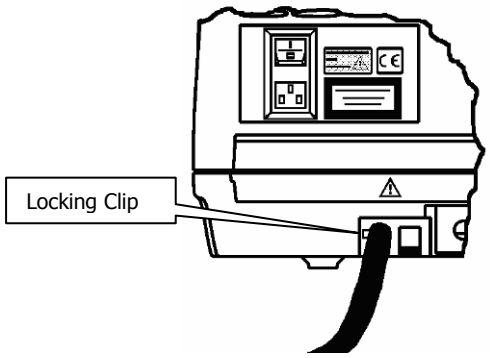


Figure 25 Disconnect the locking clip

Changing the External Fuse

Very occasionally, a fuse may fail with age and will need to be changed.

NOTE: If fuses fail repeatedly, there is an electrical fault: disconnect the power supply and contact your PerkinElmer Service Department.

There is one spare fuse in the fuse drawer. If you need more, order 2A, 250V Time Lag fuses (0497 0839) from PerkinElmer. You must only replace the fuse with one of this type and rating. Do not use makeshift fuses and do not short-circuit fuse holders.

WARNING

Before you begin this procedure, switch off the power to the spectrometer, wait for 60 seconds, and disconnect the power cable.

This will protect you from electrical shock.

The external fuse drawer is located at the rear of the instrument between the power switch and the power socket (Figure 26).

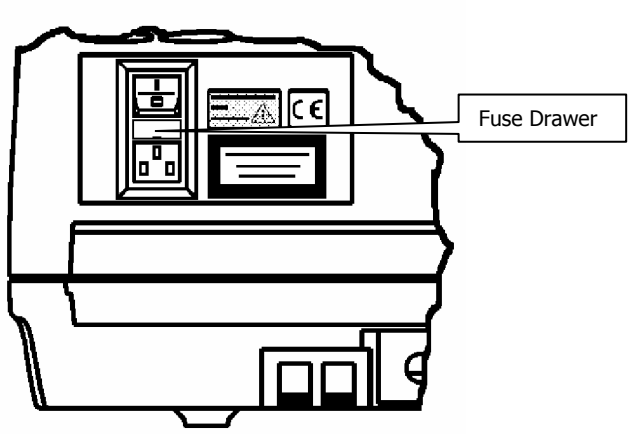


Figure 26 Fuse drawer closed

1. Lever out the fuse drawer so that it swings down over the power socket. The fuse is in the right hand slot.
2. Remove the old fuse and discard it.

3. Fit the new fuse into the slot (Figure 27).

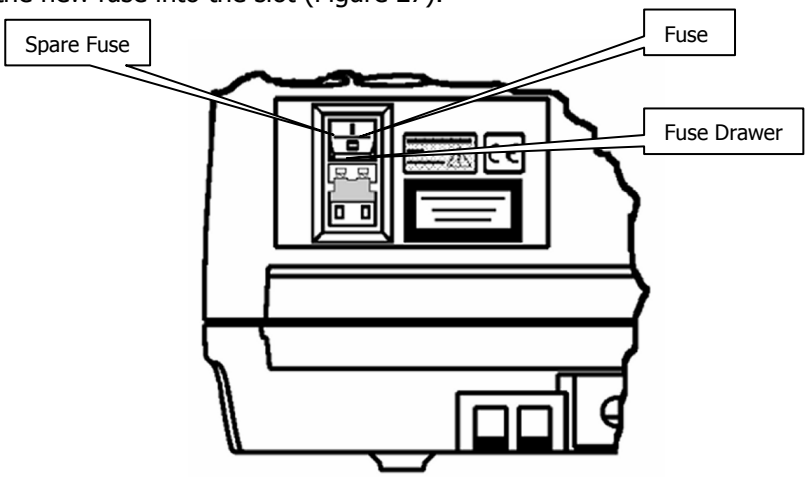


Figure 27 Fuse fitted; drawer open

4. Close the drawer.
   The new fuse is now installed.

5. Reconnect the power cable and switch on the instrument.

Cooling the MCT Detector (Spectrum 100)

Optionally, the Spectrum 100 may be fitted with an MCT (mercury cadmium telluride) detector. When it is fitted in the instrument it must be cooled to 77 K before you collect spectra. The detector is mounted in a dewar that can be filled with liquid nitrogen. The detector is not enabled until it has been sufficiently cooled.

WARNING

The extremely low temperature of liquid nitrogen can burn skin and eyes. Avoid exposure by wearing protective gloves and safety goggles whenever you work with it.

WARNING

As liquid nitrogen cools the detector it evaporates so rapidly that the resulting pressures can send a funnel or detector cap suddenly and forcefully shooting upward from the top of the dewar.

WARNING

Be sure to wait the specified time when filling the funnel and before replacing the plug. This enables the bubbling nitrogen to settle down and the pressure to dissipate. In addition to wearing safety goggles at all times, stand back from the instrument after each time you fill the funnel.

1. Remove the MCT coolant cover (Figure 28).

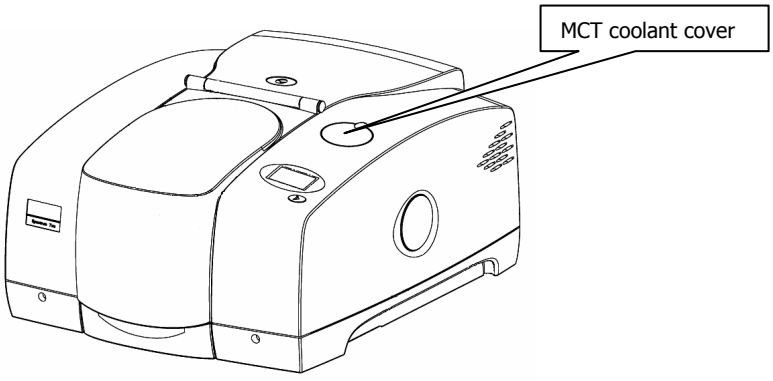


Figure 28 Location of MCT Coolant Cover

2. Remove the plug from the dewar.

3. Ensure that the funnel guide, which helps prevent overspill entering the instrument body rather than the dewar, is in place.

4. Make sure the supplied plastic funnel is dry.

CAUTION	*Stand where you can see the inside of the funnel as you pour the nitrogen in. Pour slowly, so that neither the funnel nor the dewar overflows. Take care not to overfill the funnel and splash liquid nitrogen onto the instrument covers.*

5. Insert the plastic funnel into the funnel guide and slowly fill the detector dewar with liquid nitrogen.

NOTE: Make sure that the detector dewar is filled to the top with liquid nitrogen before selecting the detector. Prevent radiation from reaching the detector by obstructing the beam path in the sample area during filling.

6. Stand back and wait two minutes.

   This nitrogen also vaporizes as the dewar continues to cool. The two-minute wait allows the bubbling to settle down and the pressure of the vaporizing nitrogen to dissipate.

7. Continue to pour liquid nitrogen into the funnel, adding a little more each time the funnel empties.

   The funnel takes longer to empty as the dewar fills. This happens after two or three more funnels of liquid nitrogen. Because the dewar has now cooled, the liquid nitrogen does not vaporize, but instead fills the dewar.

8. Remove the funnel and wait two minutes.

   The liquid nitrogen settles down and bubbling slows.

9. When the nitrogen stops bubbling, refit the plug.

   When the detector dewar has been filled, it will remain at its operating temperature for approximately eight hours.

NOTE: Cooled detector dewars require pumping down after approximately 12 months operation. When the boil-off rate of liquid nitrogen becomes excessive (that is the liquid nitrogen level is low after 3-4 hours' operation), consult the nearest PerkinElmer Service Department or Agent.

Advanced Maintenance

Opening the Main Cover

To perform most maintenance tasks, you have to open the main cover of the spectrometer.

WARNING

Switch off the mains power supply to the spectrometer, wait 60 seconds and disconnect the power cable before you open the cover of the spectrometer. This makes sure that you are safe from electrical shock and laser radiation.

CAUTION

Do not open the main cover if the humidity is:

>75% relative humidity for an instrument fitted with KBr optics.
>45% relative humidity for an instrument fitted with CsI optics.

The humidity sensitive optics will be damaged if subjected to a relative humidity in excess of the specified levels.

The main cover is hinged at the back of the instrument and opens from the front. Figure 29 identifies the locking bolts, which are on the front of the instrument.

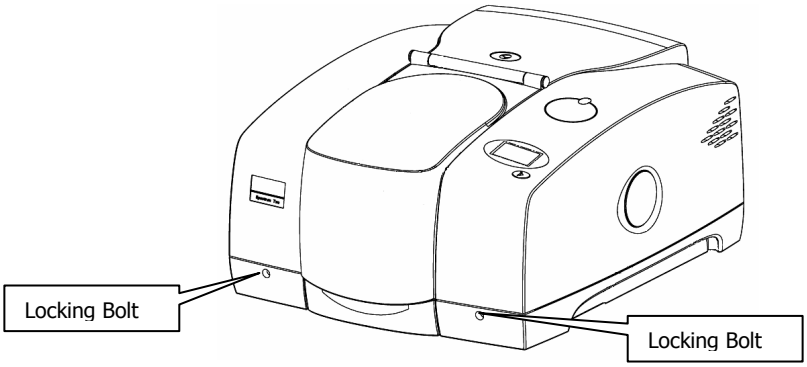


Figure 29 Main cover locking bolts

1. Switch off the power supply to the spectrometer.
2. Wait for 60 seconds.
3. Disconnect the power cable.
4. Remove the sample area cover, if fitted; open the cover, press on the cover retaining clip and pull the cover vertically to remove it (Figure 30).

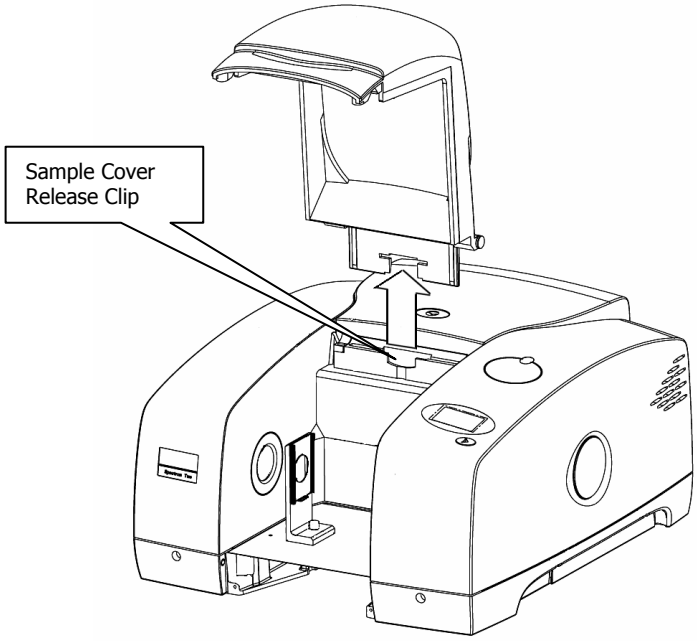


Figure 30 Removing the sample area cover

5. Remove the fitted sampling accessory, by pulling the blue release handle towards you and sliding the accessory towards you (Figure 31).

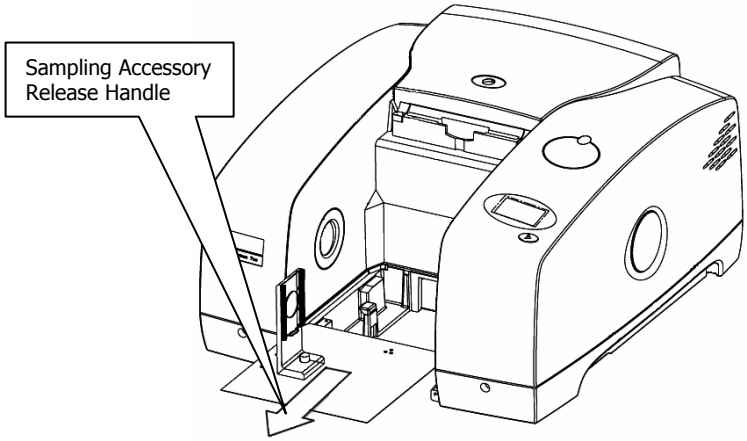


Figure 31 Removing the sampling accessory

6. Undo the two locking bolts (Figure 32) on the front of the instrument using the hexagonal wrench supplied; insert the wrench, so that the free end is pointing horizontally away from the instrument and rotate the wrench 180° in the direction indicated by the arrows in the figure.

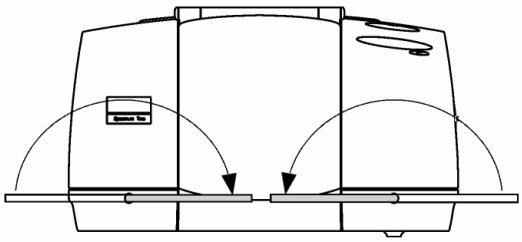


Figure 32 Undoing the locking bolts

7. Lift the main cover from the front.
8. Ensure the cover is fully open and retained by the stay.
9. Perform the necessary maintenance inside the instrument.

Figure 33 illustrates the primary component parts of a Spectrum 100 Series spectrometer.

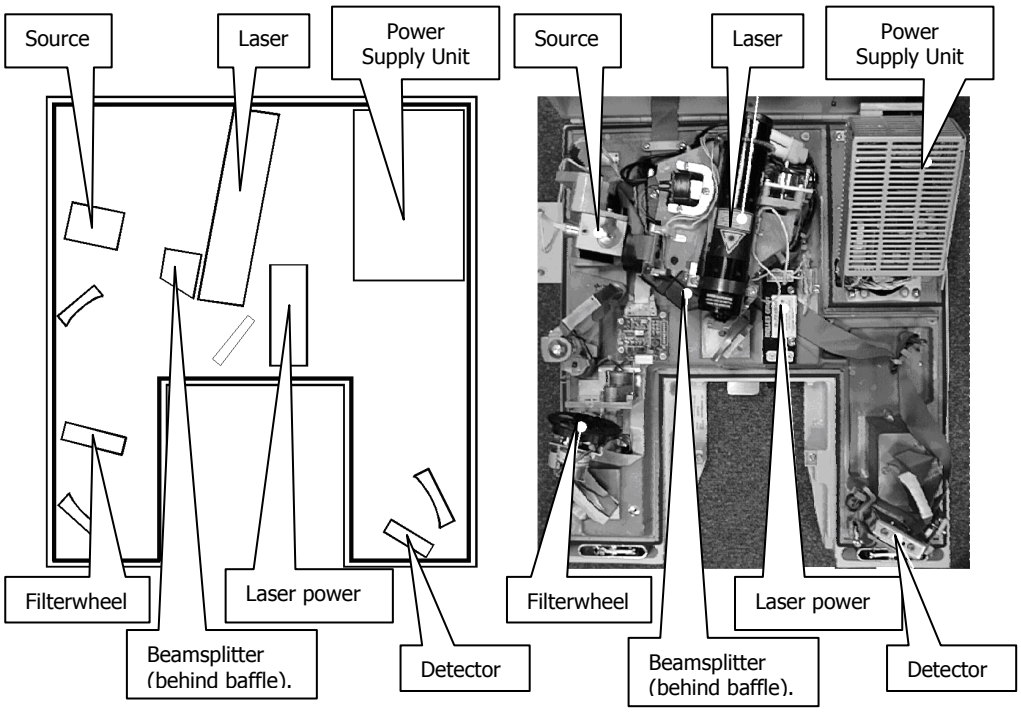


Figure 33 Spectrum 100 and 100N component parts

10. Close the cover.
11. Lock the two locking bolts by inserting the wrench into each bolt in turn and rotating it opposite to the direction indicated by the arrows, in Figure 32.
12. If required, reinstall the sampling accessory by sliding it on the ledge and pushing it into the sample compartment until it engages with the connector.
13. If required, refit the sample cover by inserting the hinge into the grooves and pushing the cover downwards until the clip engages.
14. Reconnect the power cable and switch the power back on.
15. If required change the desiccant (see page 70), and/or purge the instrument (see page 76).

    If the cover is left open for more than 1 hour, the desiccant should be replaced.

Replacing the Source

WARNING

Switch off the mains power supply to the spectrometer, wait 60 seconds and disconnect the power cable before you open the cover of the spectrometer. This makes sure that you are safe from electrical shock and laser radiation.

WARNING

Due to its high operating temperature allow sufficient time for the source to cool before attempting to remove it.

1. Open the main cover of the instrument as detailed on page 84 and identify the Source (Figure 34).

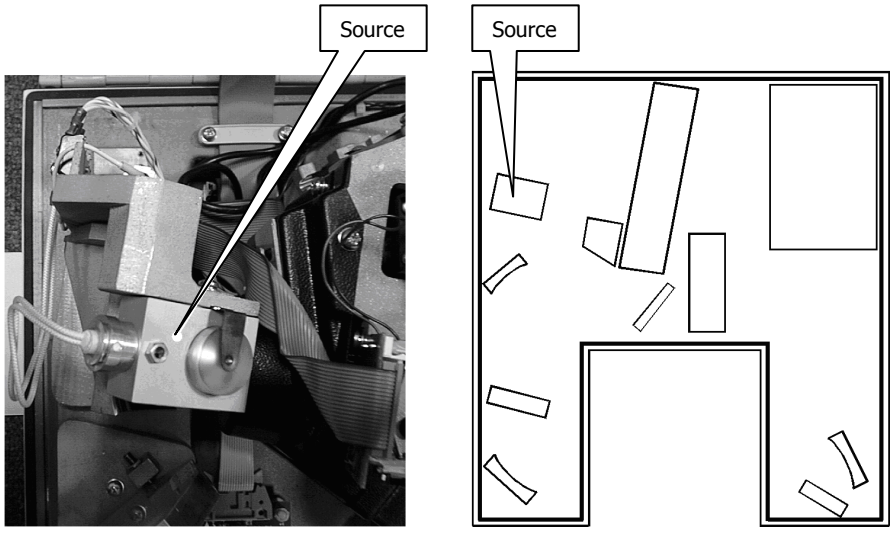


Figure 34 Source location

Caution, hot surface.

The source housing and source itself will be hot if recently switched on. Allow to cool before performing the following procedure.

CAUTION

The source element is brittle and can be broken if not handled properly. Be careful when removing and installing the source.

Do not touch the glass bulb as this will degrade the performance of the bulb and shorten its life.

2. Slacken the two terminal screws (Figure 35) securing the wires leading to the source. Disconnect the wires from the connectors.

3. By grasping the round metal source body NOT the wires, remove the source from its housing by pulling, noting its installed position.

4. Install the new source in its housing, by pushing in until it clicks into place.

5. Reconnect the two wires to the terminals and secure by tightening the two terminal screws.

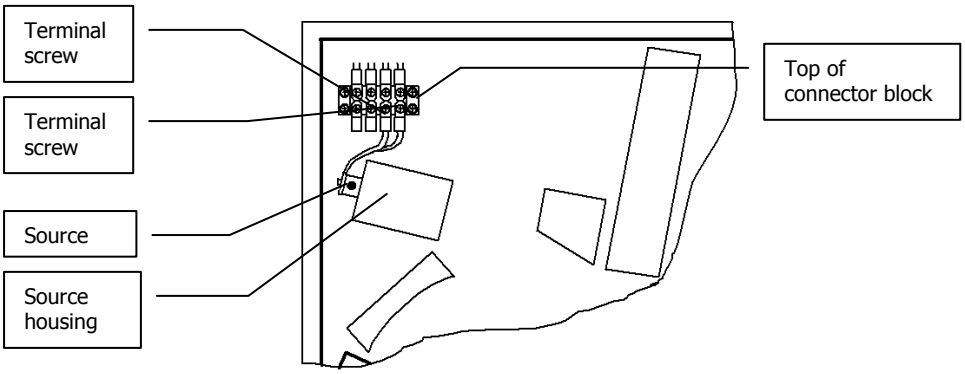


Figure 35 Terminal screws

6. Close and secure the Main Cover (steps 10 to 15 on page 86).

7. Plug in and switch on the instrument.

8. Allow the source temperature to stabilize for approximately 2 hours before using the instrument.

Replacing the Beamsplitter

WARNING

Switch off the mains power supply to the spectrometer, wait 60 seconds, and disconnect the power cable before you open the cover of the spectrometer. This makes sure that you are safe from electrical shock and laser radiation.

1. Open the main cover of the instrument, as detailed on page 84 and identify the Beamsplitter, which is behind the laser baffle (Figure 36).

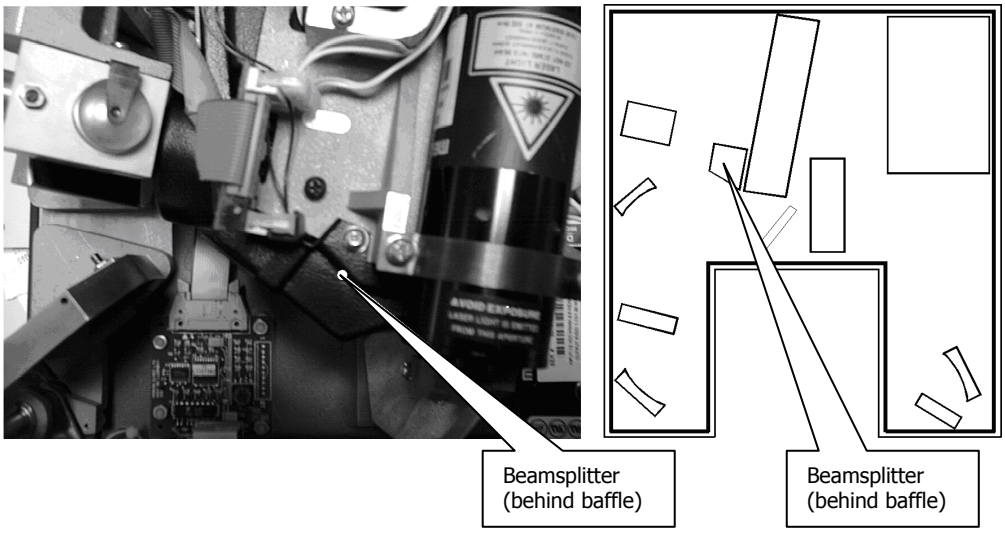


Figure 36 Beamsplitter location

2. Unscrew the laser baffle retaining screws and remove the laser baffle, as shown in Figure 37.

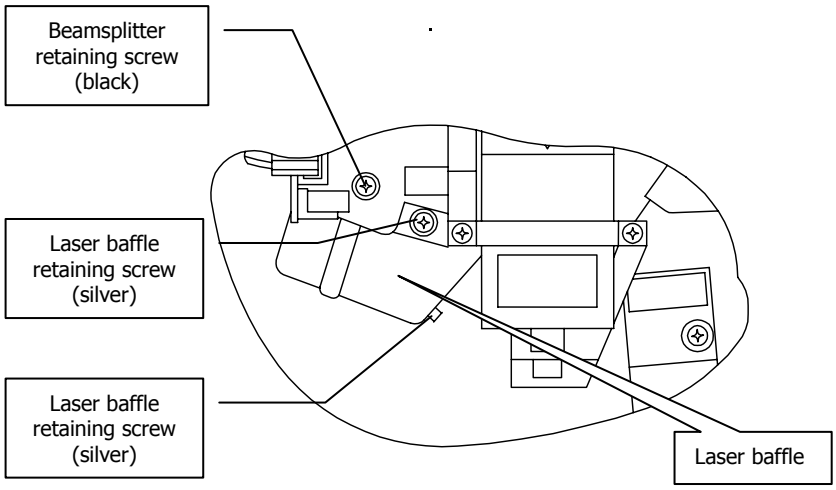


Figure 37 Laser Baffle

3. Remove the beamsplitter retaining screw.
4. Noting its installed position, pull out the beamsplitter.
5. Install the new beamsplitter and secure with the retaining screw.
6. Refit the laser baffle and secure with retaining screws.
7. Close and secure the Main Cover (steps 10 to 15 on page 86).
8. Plug in and switch on the instrument.

Installing/Replacing Windows

The following procedure describes how to install a window in one of the external beam ports. The details apply equally to windows in the sample compartment.

WARNING

Switch off the mains power supply to the spectrometer, wait 60 seconds, and disconnect the power cable before you open the cover of the spectrometer. This makes sure that you are safe from electrical shock and laser radiation.

1. Open the main cover of the instrument, as detailed on page 84.
   - Using the hexagonal wrench supplied with the new window kit, slacken and remove the screws securing the beam port cover or current window to the main cover.
   - Remove the beam port cover or current window and seal. Retain for further use.

CAUTION

Be careful not to get moisture on the optical surface of the window. Do not touch or breathe on the optical surface of the window.

2. Ensure the seal is fitted to the window and is correctly seated (Figure 38).

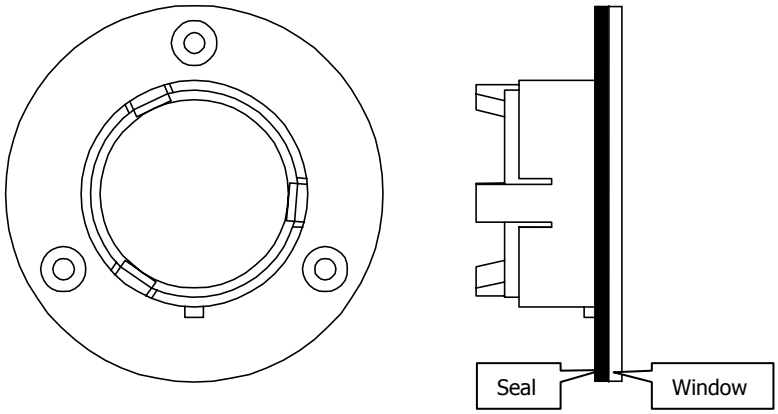


Figure 38 Seal fitted to window

3. Fit the window to the main cover from the outside in.

   Ensure the seal is fully seated and the key on the window lines up with the notch in the main cover.

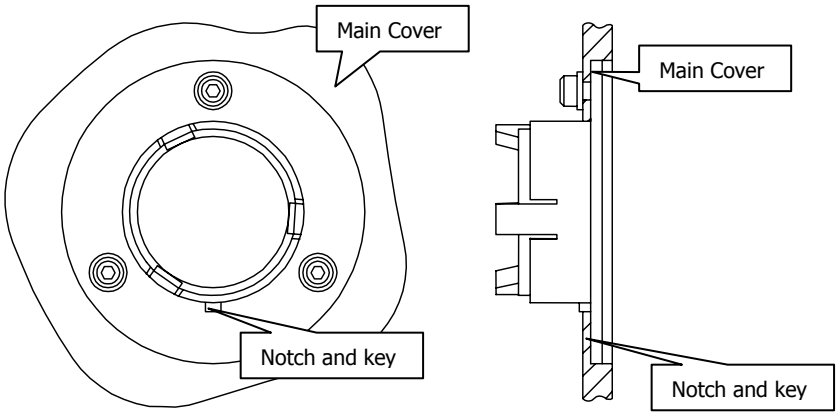


Figure 39 Window installed in Main Cover

4. Secure the window to the main cover by fitting the screws and washers and tightening the screws using the hexagonal wrench (Figure 39).

5. Close and secure the Main Cover (steps 10 to 15 on page 86).

6. Plug in and switch on the instrument.

Installing Filters in the Filterwheel

The following procedure describes how to install a filter in the filterwheel. The same procedure should be followed when replacing a filter.

Due to the restricted cabling, the filterwheel assembly is removed from its mounting and placed on the sample compartment baseplate. It therefore may be necessary to remove the sample slide.

WARNING

Switch off the mains power supply to the spectrometer, wait 60 seconds, and disconnect the power cable before you open the cover of the spectrometer. This makes sure that you are safe from electrical shock and laser radiation.

1. Open the main cover of the instrument as detailed on page 84 and identify the Filterwheel (Figure 40).

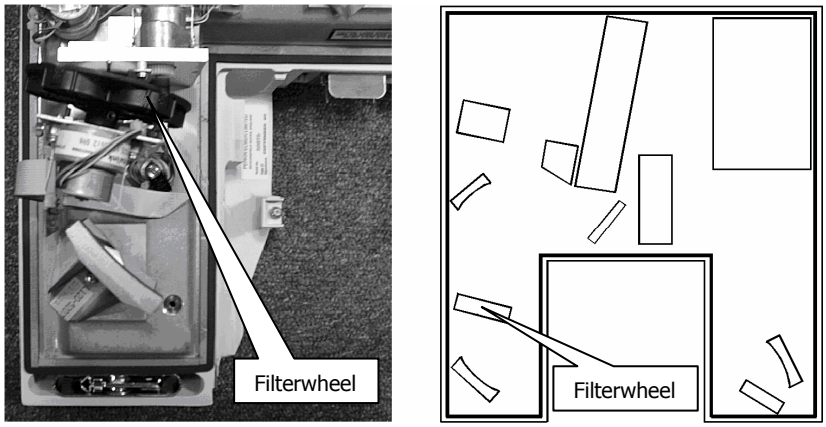


Figure 40 Filterwheel location

2. You need the standard sample holder baseplate installed for this procedure, but remove the sample holder itself by unscrewing the knurled screw (Figure 41).

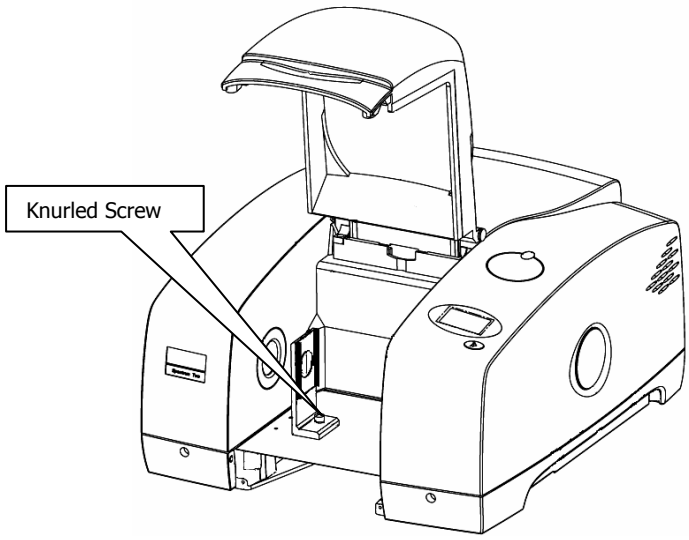


Figure 41 Knurled screw

3. Remove the filterwheel assembly from its mounting by undoing and removing the two securing screws (Figure 42).

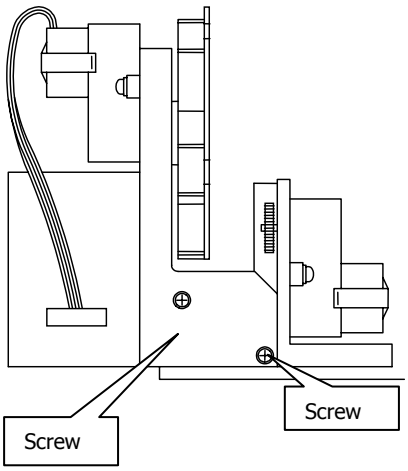


Figure 42 Filterwheel assembly securing screws

4. Place the assembly on the sample accessory baseplate (Figure 43).

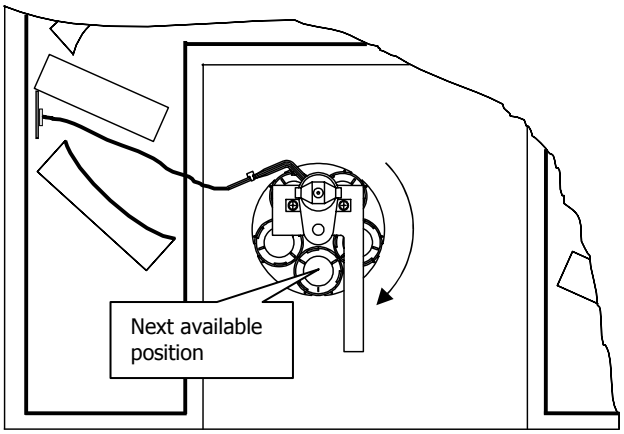


Figure 43 Filterwheel assembly on accessory baseplate

5. Identify the next available filter position, remove the foam and filter holder, place the filter in the hole and place the foam spacer on top of it. Figure 44 illustrates the assembly sequence.

   The next available filter position is the next empty position working clockwise, as shown in Figure 43. Make sure there is at least one open beam position if possible.

6.

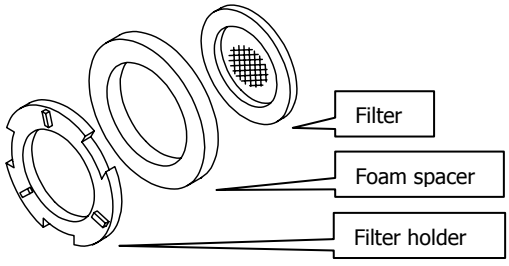


Figure 44 Filter, foam spacer and filter holder

7. Secure the filter to the filterwheel by clipping the holder into place (Figure 45).

   Align the notches of the holder with the indents in the filterwheel, then twist the holder clockwise to lock it.

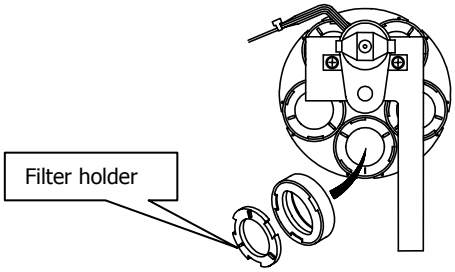


Figure 45 Installing the filter holder

8. Refit the filterwheel to its mounting and secure it in place with the two screws.
9. Refit the sample slide.
10. Close the main cover (see page 86, steps 10 to 15).
11. Plug in and switch on the instrument.
12. Update your Spectrum configuration so that the software is aware of the new filter. Refer to *Filterwheel* in the on-screen help system.

Installing an AVI Cell in the Filterwheel Assembly

WARNING

Switch off the mains power supply to the spectrometer, wait 60 seconds and disconnect the power cable before you open the cover of the spectrometer. This makes sure that you are safe from electrical shock and laser radiation.

1. Remove the filterwheel assembly as described in *Installing Filters in the Filterwheel* on page 93.

2. Place the cell in the next available filter position, orientated as shown in Figure 46 and Figure 47, and place the spacer on top of it.

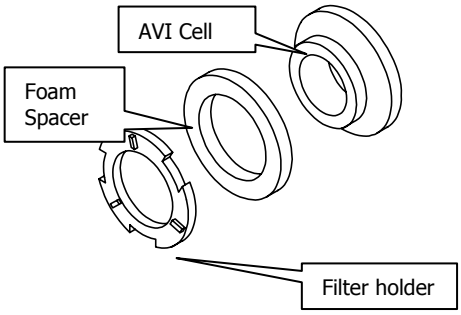


Figure 46 AVI Cell orientation

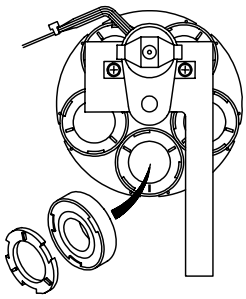


Figure 47 AVI Cell installation

3. Secure the cell and refit the filterwheel.
   Refer to page 95, steps 8 to 11.

4. Update your Spectrum configuration so that the software is aware of the new filter.
   Refer to *Filterwheel* in the on-screen help system.

Replacing the Laser and Power Supply

WARNING

Switch off the main power supply to the spectrometer, wait 60 seconds and disconnect the power cable before you open the cover of the spectrometer. This makes sure that you are safe from electrical shock and laser radiation.

WARNING

Do not attempt to separate the Laser from the power supply. The Laser retains an electrical charge even when the main power is switched off.

1. Open the Main Cover of the instrument as detailed on page 84 and identify the Laser and Power Supply (Figure 48).

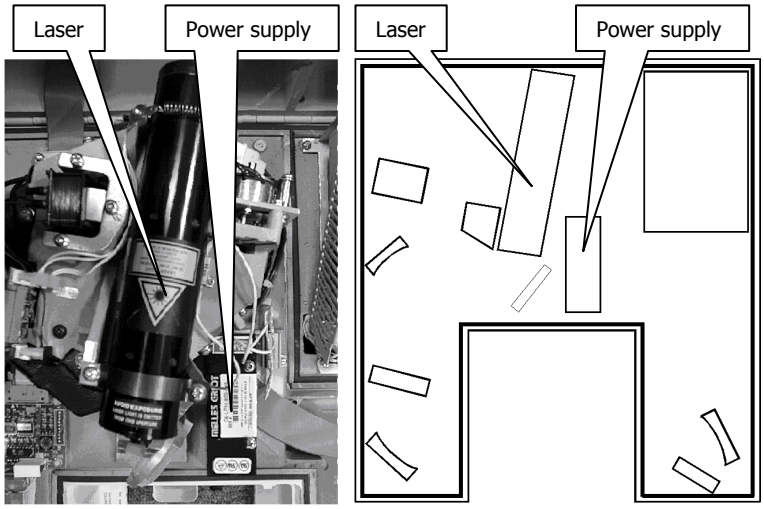


Figure 48 Laser and power supply

2. Slacken the two screws securing the laser power supply.

3. Disconnect the thin black and red cables, marked Laser, from the board connector which is located under the rear of the laser assembly.

WARNING

Be careful, the nearby source housing may be hot.

4. Unhook the spring and remove the two screws on the retaining bracket, as shown in Figure 49.

5. Remove the laser and power supply; noting the way the cabling is routed.

6. Install the new laser and power supply. Ensure the laser is pushed fully home to the stop at the front of the housing.

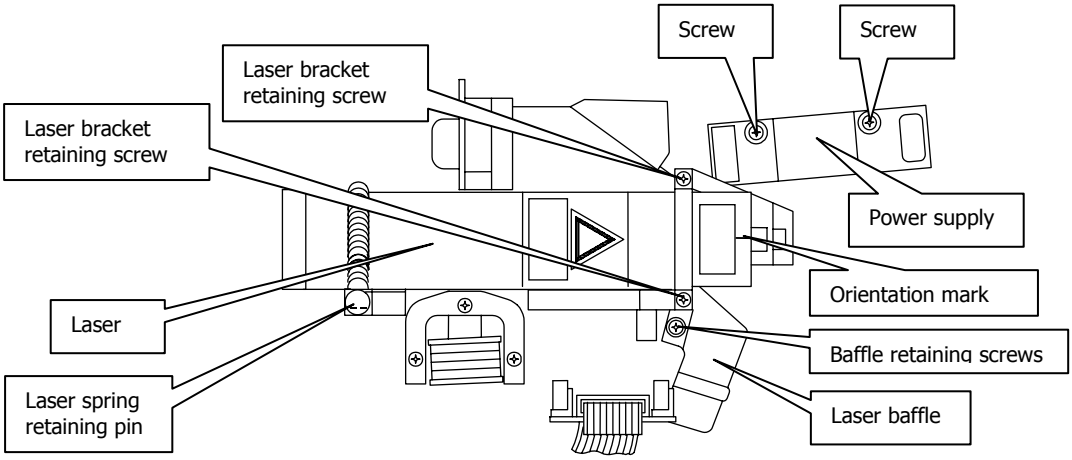


Figure 49 Laser and power supply installation

7. The laser must be installed so that the small orientation mark (a single engraved line) is facing directly upwards.
   This should be the same orientation as the end of the triangular warning label.

8. Refit the laser retaining bracket and secure with the two securing screws.

9. Secure the spring on the retaining pin.

10. Reconnect the PSU Laser cable to the board connector.

11. Secure the laser power supply with the two securing screws.
    Make sure that the laser cabling is secured so that it does not get trapped in the cover.

12. Close and secure the main cover (steps 10 to 15 on page 86).

13. Plug in and switch on the instrument.

Instrument Performance Validation

Performance Validation Kits

The Spectrum 100N is supplied with Performance Validation kit L1180479, which contains a 35 µm polystyrene reference sample and an NG11 Schott Glass reference sample.

For the Spectrum 100, Performance Validation kit L1365335 is available. This kit contains a 1.2 mm polystyrene reference sample. The Performance Validation procedure is similar to that described here, but the kit includes IPV Kit User's Guide 09934028.

Principles of Use

The Food and Drug Administration (FDA), the United Kingdom Accreditation Service (UKAS) and the Good Laboratory Practice (GLP) regulations, all require that calibration of instrument accuracy can be traced to a certified reference material (CRM).

Instrument Performance Validation (IPV) enables you to routinely generate a record of wavenumber calibration that is traceable to a National Physical Laboratory (NPL) CRM. Using the NIR IPV certificate printing utility, you produce a certificate comparing the result for a polystyrene Traceable Reference Material (TRM), and your internal polystyrene Automatic Precision Validator (APV) against a certified polystyrene standard (serial number: JR95), measured by the NPL, Teddington, TW1 0LW, UK.

The NPL certificate of measurement provides wavenumber values for two peaks, 5669.3 cm^{-1} and 4571.6 cm^{-1}, for resolutions of 4 cm^{-1} or better. The polystyrene TRM supplied with your instrument has been calibrated against this CRM, and a Certificate of Calibration printed at the factory is included with it. This certificate provides a record of calibration and traceability for the TRM to the NPL CRM.

The polystyrene in the APV is calibrated by the procedure described in the following pages. A certificate of Performance Validation will be printed which details the calibration of the polystyrene in the APV against the TRM.

The certification procedure also validates the internal APV used by Spectrum 100N for Ready-for-Work checks. For more information see the Spectrum on-screen help which can be accessed by selecting **Contents and Index** from the Help menu in Spectrum.

Limitations of traceable wavenumber calibration

Certified values for the peak positions used have quoted uncertainties of ± 1.5 cm^{-1} for the peak at 5669.3 cm^{-1} and ± 1.0 cm^{-1} for the peak at 4571.6 cm^{-1}. We suggest that the uncertainty associated with routine measurement of the two recommended peaks, in the spectrum of a traceable polystyrene sample, is realistically set at these limits. This level of precision is satisfactory for general analytical applications involving solid and liquid samples.

Validating Instrument Calibration

In order to validate instrument calibration, tests must be performed under the same measurement conditions as those used to calibrate the Traceable Reference Material (TRM) at the factory.

We also recommend that before starting the calibration, you make sure that the instrument is optimally aligned. Refer to the *Aligning the Instrument* topic in the Spectrum on-screen help.

NOTE: The NIR IPV Certificate Printing Utility validates the basic instrument, and cannot be used with an accessory. For information on how to validate accessories and how to perform %T and noise tests, see the *Validation* section of the Spectrum on-screen help.

Collecting the Reference Spectra

NOTE: For information on collecting spectra, see the Spectrum on-screen help.

1. Set up the instrument with the settings shown below:

Resolution	4 cm^{-1}
Apodization	Strong
Detector	DTGS

   Refer to *Controlling the Instrument* on page 55.

2. Collect a background spectrum of the empty sample compartment, using 16 scans.
3. Put the TRM in the sample slide in the sample compartment.
4. Collect a sample spectrum of the TRM, using 16 scans.
5. Save the spectrum on a disk as **trmpic.sp**.
   You may use another name for the spectrum.
6. Replace the TRM in its plastic box and store it in a safe place.
7. Move the internal polystyrene APV filter into the beam path.
8. Select **Instrument** from the Setup menu in Spectrum.
9. Select the Beam tab and then click on the Filterwheel.
10. Select **polystyrene** and click **OK**.
11. Collect a ratio spectrum of the polystyrene, using 16 scans.
12. Save the spectrum as **ipvpic.sp**, on the same disk.
    You may use another name for the spectrum.

Printing the Certificate of Performance Validation

Hardware and software requirements

To print a certificate you will need a PC running Microsoft Windows, connected to a printer with the correct print drivers installed. The PC does not have to be the one connected to your instrument.

➢Put the disk labelled *NIR IPV Certificate Printing* in drive a:\.

1. From the Start menu choose **Run**.

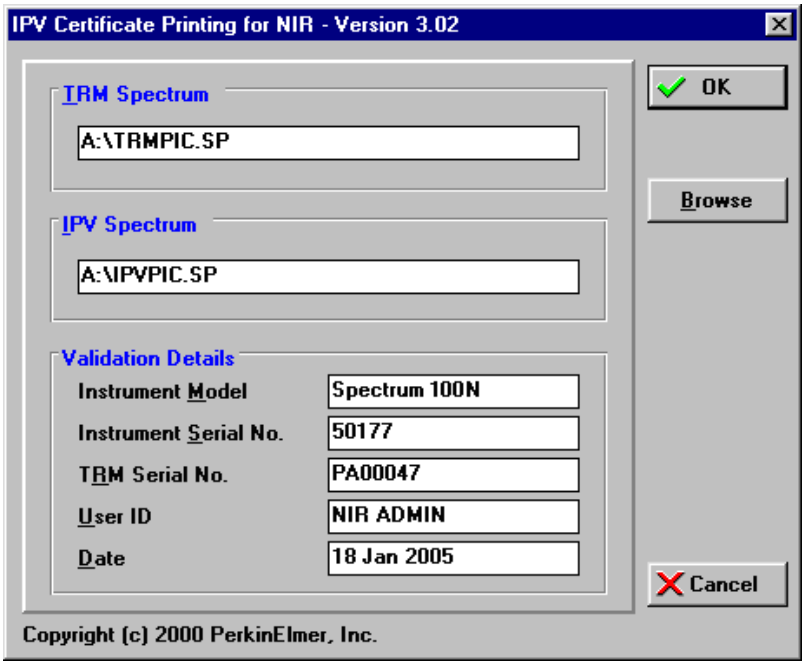
2. To install the program, type **a:\ipv** followed by the drive you want to install the program on, for example **a:\ipv c**, then click **OK**.

   The IPV certificate printing utility is installed in a directory named ipvalid on your selected hard drive.

3. Copy the file **ipvc_ic.ini** from the *ipvalid* directory to your *Windows* or *WINNT* directory.

4. To run the program, open Explorer and double-click on **ipvc_ic.exe** in the *ipvalid* directory.

   The IPV Certificate Printing dialog is displayed.



5. Put the disk on which you stored the reference spectra trmpic.sp and ipvpic.sp in drive a:\.

6. If necessary, enter the name of the **TRM Spectrum** as **trmpic.sp** and the **APV Spectrum** as **ipvpic.sp**.

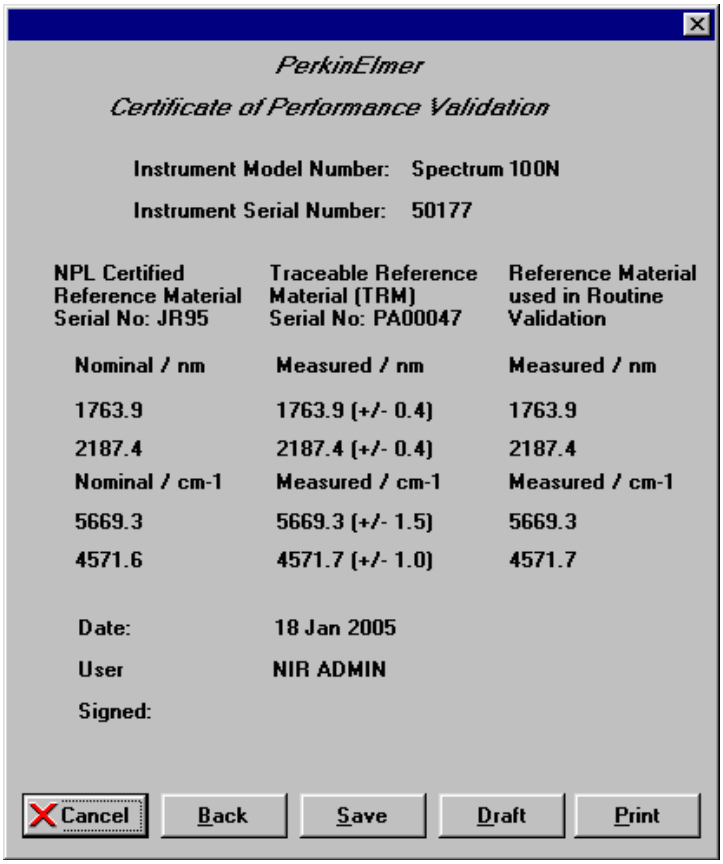
   Browse enables you to search for pathnames and files if you use different spectra than those suggested above.

7. Make sure that the **Validation Details** are correct, and add any missing information.

NOTE: The serial number of your instrument is usually printed on a silver label in the lower sample compartment area. The serial number of the TRM is on the TRM sample holder.

8. Click **OK**.

   The information that will be printed on your Certificate of Performance Validation is displayed.



NOTE: There are two peaks, with details given in both nm and cm^{-1}.

9. Make sure that all the details are correct.

   Peaks found outside the tolerance of the nominal value are displayed in red. If a peak is not found within 10 cm^{-1} of the nominal value, **No Peak** is displayed in red (see *Possible Reasons for Validation Failure* on page 104).

10. To save the information on the certificate, click **Save**.

    The Specify IPV Result File dialog is displayed.

11. Choose the **Drive**, **Folder** and **File Name**.

12. Click **OK**.

    The file is saved as an .ipv file. The Specify IPV Result File dialog closes and the certificate information is redisplayed.

    To print the certificate, see page 104.

Possible Reasons for Validation Failure

If the peaks were not found or lie outside the tolerance, the failure may be because:

- the wrong spectra were used;
- the wrong reference material was used to collect one of the spectra;
- the instrument was not aligned correctly;
- the noise level is too high;
- the beam was obstructed during validation, for example by an accessory in the beampath. This effect is most often seen at high wavenumbers;
- the instrument is not set up correctly:

  The instrument setup is not correct;

  The incorrect J-stop aperture was used (most often seen at high wavenumbers);

  The resolution used for collecting the two spectra was not the same.

If you need more help, contact your nearest PerkinElmer agent or office.

Printing the Certificate

Testing for paper orientation

Before you print the certificate, you must find the correct orientation for the certificate.

1. Write **Top** on a sheet of plain paper and put it into the paper tray of your printer, with the writing visible and towards you (this will depend on your printer type).
2. Click **Draft**.
   The test sheet is printed.
3. If the orientation is not correct, write **Top** on another sheet of paper, use a different orientation and repeat step 2.
   Continue doing this until you have found the correct orientation.

Printing the certificate

1. Put the certificate in the paper tray in the correct orientation.
2. Click **Print**.
   The certificate is printed (see the example on the next page).

PerkinElmer
precisely.

Certificate of Performance Validation

Instrument Model Number: Spectrum 100N

Instrument Serial Number: 50177

NPL Certified Reference Material Serial No: JR95	Traceable Reference Material (TRM) Serial No: PA00047	Reference Material Used in Routine Validation
Nominal / nm	Measured / nm	Measured / nm
1763.9	1763.9 (+/- 0.4)	1763.9
2187.4	2187.4 (+/- 0.4)	2187.4
Nominal / cm-1	Measured / cm-1	Measured / cm-1
5669.3	5669.3 (+/- 1.5)	5669.3
4571.6	4571.7 (+/- 1.0)	4571.7

Date: 18 Jan 2005

User Identification: NIR ADMIN

Signed:

*NPL: National Physics Laboratory, Teddington, England
**APV: Automatic Precision Validator

All analytical instruments and systems manufactured by PerkinElmer Ltd are certified under the quality requirements of ISO9001.

Certificate number FM11397

L118 8353

3. Sign the certificate.
   Keep the spectra trmpic.sp and ipvpic.sp as a record of the original data for future reference.

NOTE: The values on the certificate above are for illustration only. Do not use these values for validation of your instrument.

Re-printing the Information on a Certificate

Opening a .ipv file

1. Open Windows Explorer.
2. Choose the .ipv file you want to open.
3. Display the File menu and choose **Open with**.
   The Open with dialog is displayed.
4. Select **Other**.
5. Select **ipvc_ic.exe** from the ipvalid directory.
6. Ensure that the **Always use this program to open this file** box is selected.
7. Click **OK**.
   The IPV Certificate printing dialog is displayed with the data from the .ipv file.

NOTE: You are now able to open the .ipv file by double-clicking on the file name in Windows Explorer.

Printing the certificate

1. Double-click on the .ipv file you want to print.
   The IPV Certificate Printing dialog containing the data you saved is displayed.
2. Click **Print**.
   The certificate is printed.

NOTE: The data saved in a .ipv file cannot be changed.

When Should I Recalibrate My Instrument ?

When using a Fourier Transform spectrometer, the error in the peak positions will be proportional to the wavenumber. The calibration can be adjusted by changing the effective wavenumber of the HeNe laser. If the peak positions in a spectrum collected from your TRM are not within ± 0.3 cm^{-1} of those given in the column labelled TRM on the Certificate of Performance Validation, you should recalibrate your instrument as described in *Wavenumber Calibration* in the Spectrum on-screen help

NOTE: The reference laser controls the wavenumber scale of the instrument and the scale is calibrated by measuring the effective wavenumber of the laser. This differs from the absolute value because the infrared radiation in the interferometer is not all exactly parallel to the laser beam. A different calibration is required for the Near Infrared Reflectance Accessory (NIRA) and remote accessories. Any calibration error will be proportional to the wavenumber value.

You must check the calibration of your instrument if a new source, detector or power supply has been fitted to your instrument, and recalibrate if necessary.

For recalibration purposes, we recommend that you use the peak at nominally 5669.3 cm^{-1} in the column labeled Traceable Reference Material on your Certificate of Performance Validation.

Appendices

Appendix 1: Changing the Sampling Accessory

1. Remove the sample area cover if fitted by opening the cover, pressing the clip and pulling the cover vertically to remove (Figure 50).

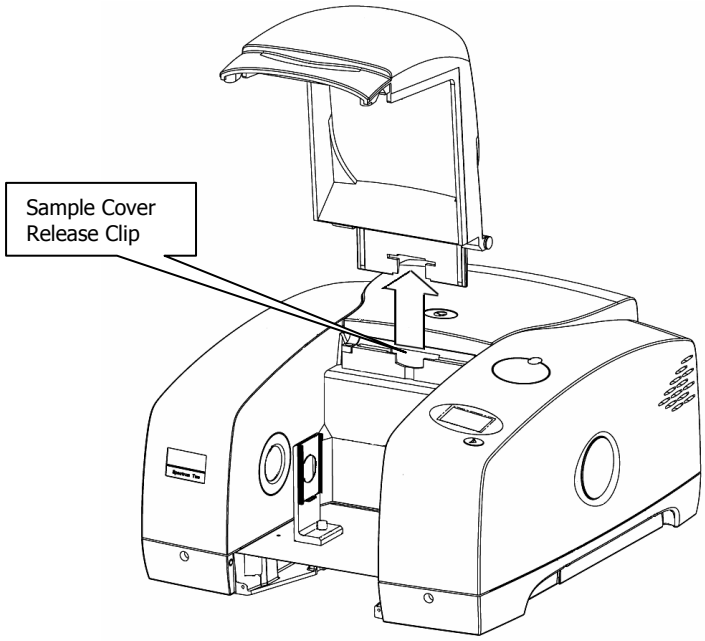


Figure 50 Removing the sample area cover

2. Remove the current sampling accessory by pulling the blue release handle (under the baseplate of the accessory) towards you and then sliding the accessory towards you (Figure 51).

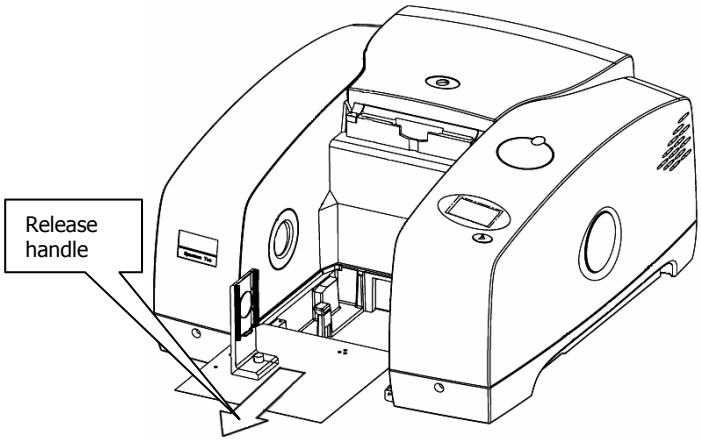


Figure 51 Removing the sampling accessory

3. Install the new accessory (Figure 52) by sliding it onto the ledge and pushing it into the sample compartment until it engages with the connector.

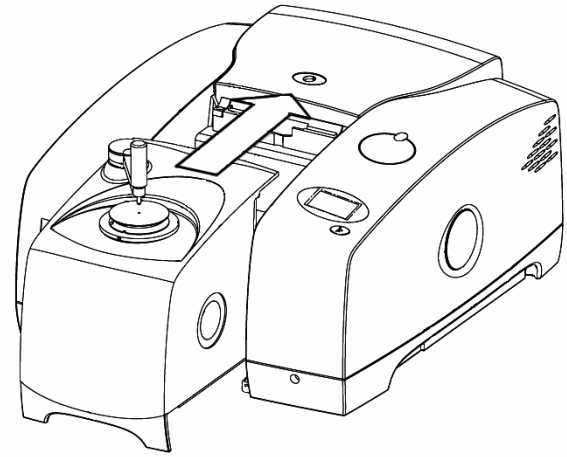


Figure 52 Installing the new sampling accessory

4. The Scan and Instrument Setup dialog automatically recognizes which accessory is installed.

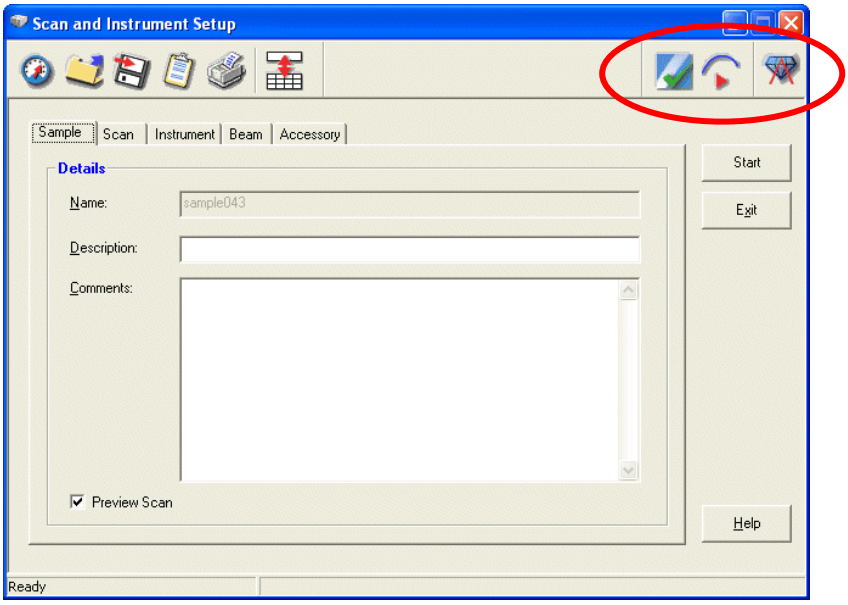


Figure 53 UATR Accessory icons

Appendix 2: Instrument Self-Checks

NOTE: It can take the Spectrum 100 FT-IR and Spectrum 100N FT-NIR spectrometers up to 2 hours to equilibrate when switched on after being switched off overnight. To save time, we suggest that you leave the spectrometer switched on at all times.

- When you switch on the instrument, the Instrument Display provides this sequence of messages:

  >*Initializing*
  Initializing
  Checking Program Integrity
  Checking Instrument Configuration
  Checking Source
  Checking Laser
  Checking Scan
  Checking Calibration
  Initialization Complete.

- When initialization is complete the last message fades, leaving the instrument identity message:

  PerkinElmer Spectrum 100 Series

  When connected to a PC, the Instrument Display adds *Ready*.

- When collecting data, the Instrument Display provides prompts generated by the PerkinElmer application software.

Initialization Errors

If your instrument generates one of the following error messages, switch off the instrument, then switch the instrument on again. Consult your PerkinElmer service representative if the problem persists.

Error message	**Action**
Program Integrity Failed	The instrument's firmware may be corrupt, so must be reinstalled.
Instrument Configuration Failed	Suggests that one or more internal devices is failing. If the problem persists, note any associated error messages and consult your PerkinElmer service representative.
Scan Failed	If the problem persists, note any associated error messages and consult your PerkinElmer service representative.
Laser Failed Replace Laser	Refer to *Replacing the Laser and Power Supply* on page 97.
Source Failed Replace Source	Refer to *Replacing the Source* on page 87.
Calibration Failed	Too little energy may be reaching the detector. Make sure the sample compartment is clear.

Appendix 3: WEEE Instructions for PerkinElmer Products


or


A label with a crossed-out wheeled bin symbol and a rectangular bar indicates that the product is covered by the Waste Electrical and Electronic Equipment (WEEE) Directive and is not to be disposed of as unsorted municipal waste. Any products marked with this symbol must be collected separately, and in accordance with the regulatory guidelines in your area.

The objectives of this program are to preserve, protect and improve the quality of the environment, protect human health, and utilize natural resources prudently and rationally. Specific treatment of WEEE is indispensable in order to avoid the dispersion of pollutants into the recycled material or waste stream. Such treatment is the most effective means of protecting the customer's environment.

Requirements for waste collection, reuse, recycling, and recovery programs are set by the regulatory authority at your location. Contact your local responsible person (such as your laboratory manager) or authorized representative for information regarding applicable disposal regulations. Contact PerkinElmer at the web site listed below for information specific to PerkinElmer products.

Web address:

http://las.perkinelmer.com/OneSource/Environmental-directives.htm

Customer Care USA:	1-800-762-4000	(inside the USA)
	(+1) 203-925-4602	(outside the USA)
Customer Care EU:	0800 40 858	(Brussels)
	0800 90 66 42	(Monza)

Products from other manufacturers may also form a part of your PerkinElmer system. These other manufacturers are directly responsible for the collection and processing of their own waste products under the terms of the WEEE Directive. Please contact these manufacturers directly before discarding any of their products.

Consult the PerkinElmer web site (above) for manufacturer's names and web addresses.

Index