MOLECULAR SPECTROSCOPY

SPECTRUM 100 SERIES

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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

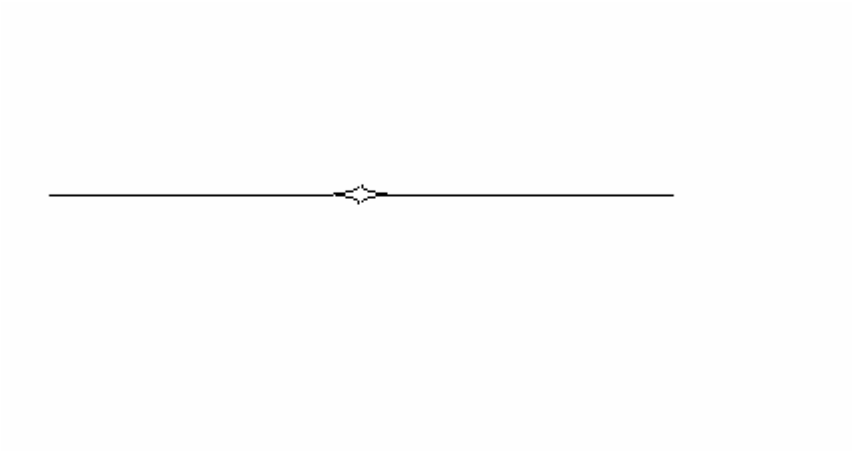
Three terms, in the following standard formats, are also used to highlight special circumstances and warnings.

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.*

Warning Signs on the Instrument

Caution, hot surface.



Warnings and Safety Information

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

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:

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:

Laser Apertures

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:

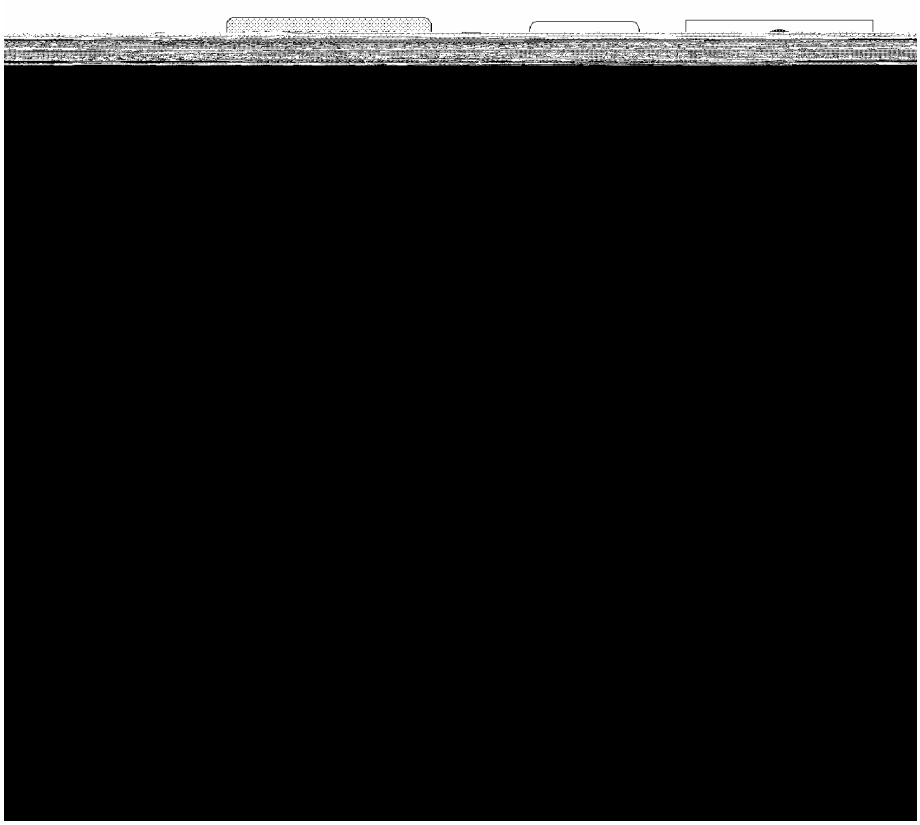
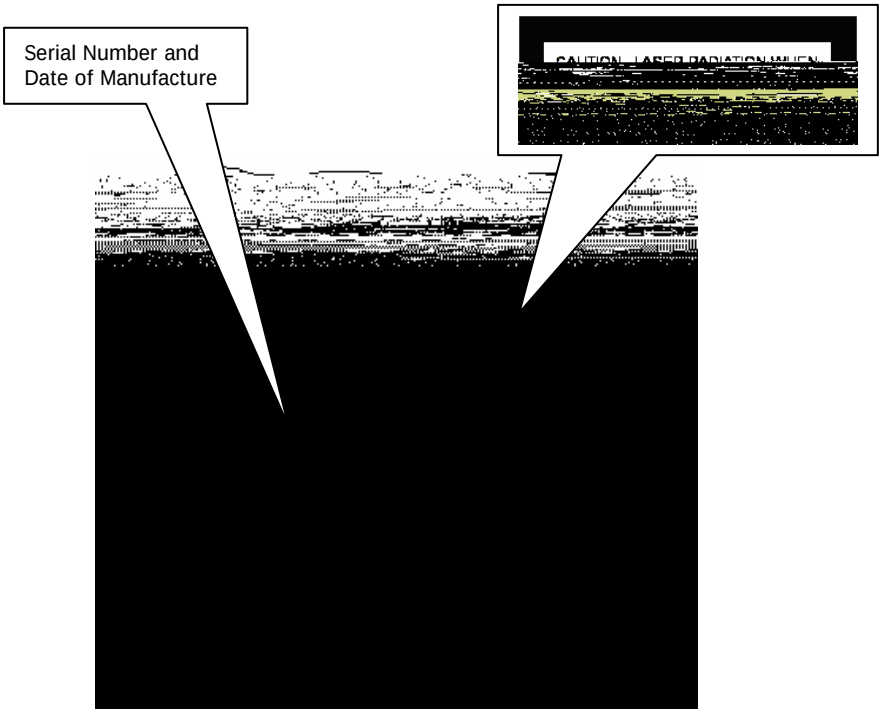


Figure 1 Labels (rear of instrument)

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

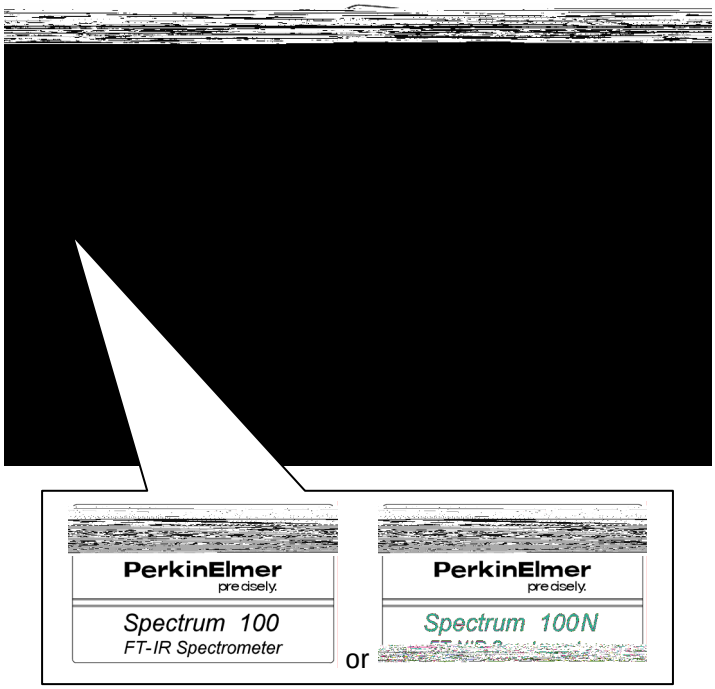


Figure 3 Product label (front of instrument)

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

An Overview of the Spectrometers

Top Panel Controls

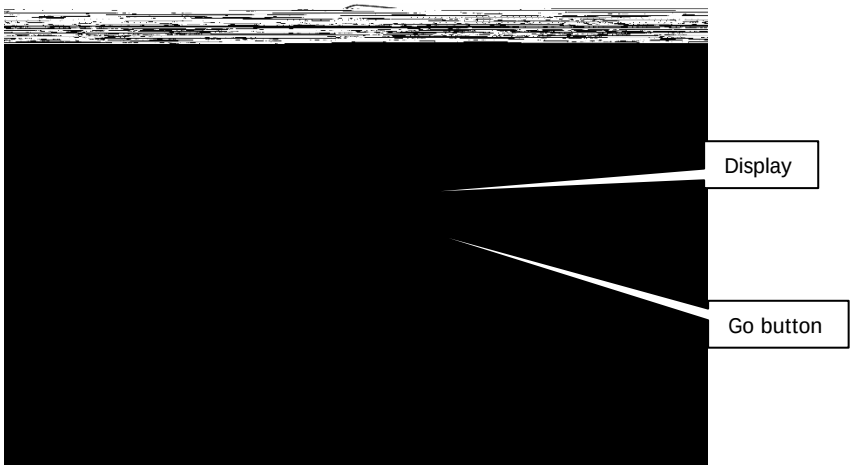


Figure 5 Top Panel Controls

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.

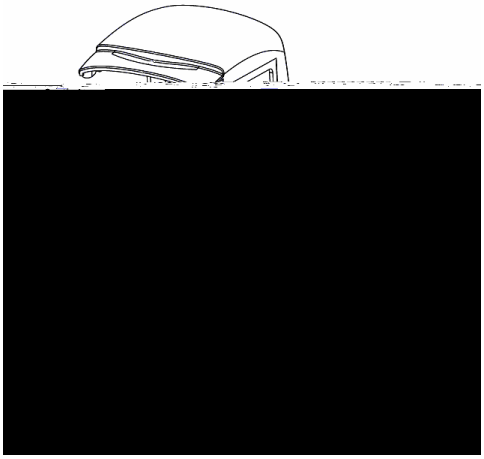


Figure 6 Sample compartment

- 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

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.

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

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.

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).

Other connectors

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

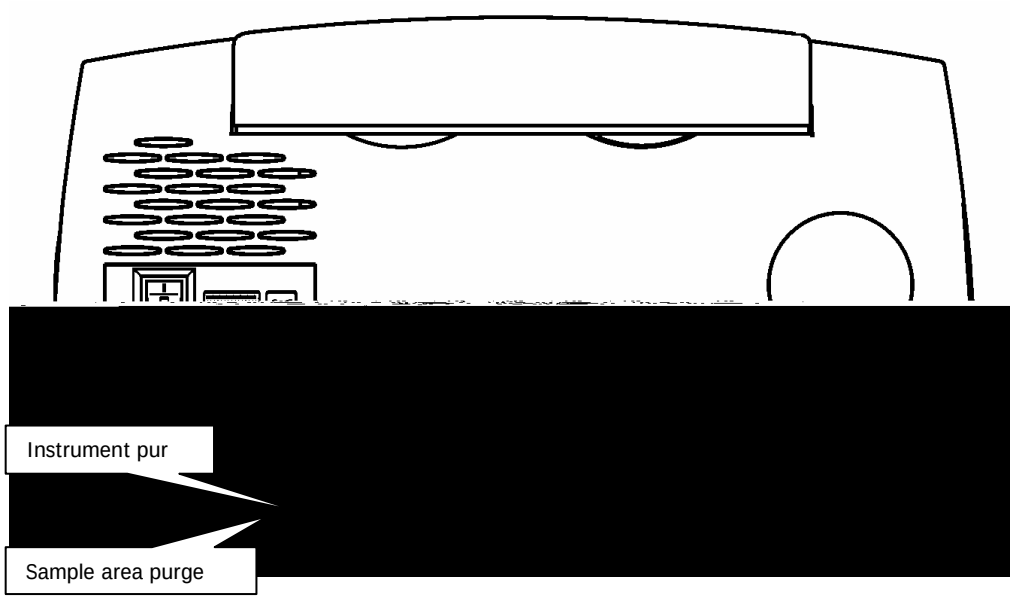
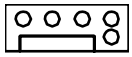
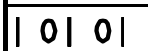
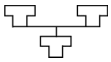


Figure 10 Communications ports

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
			+12 V	0.65 A
			-12 V	0.65 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.

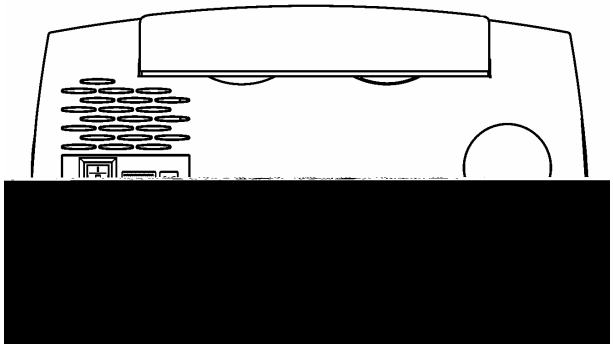


Figure 11 Electrical Supply Inlet

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 Appendix 20 9l 0 3Dity de

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.

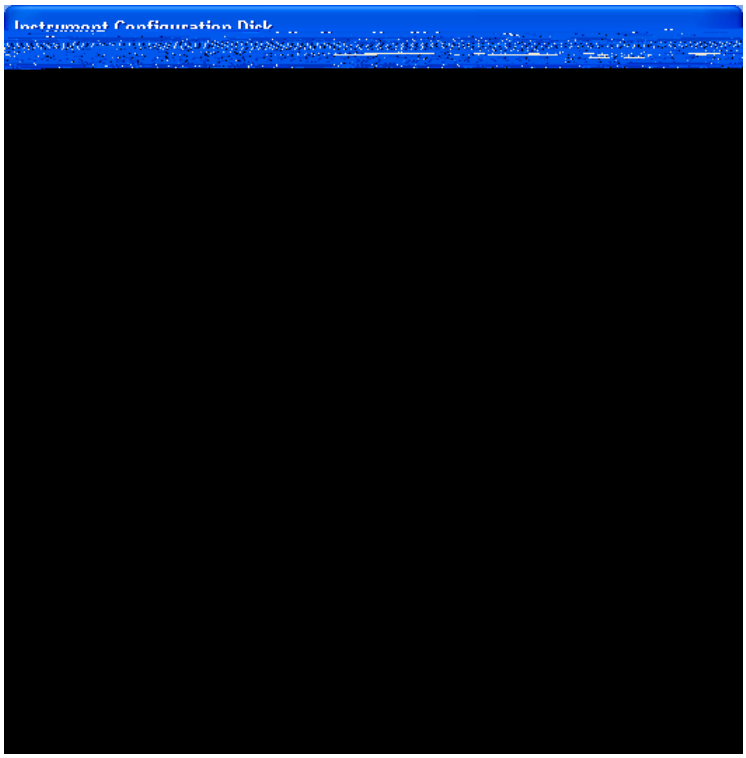
4. Enter an **Instrument Name**, which will be used by the Spectrum software to identify your instrument.

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.

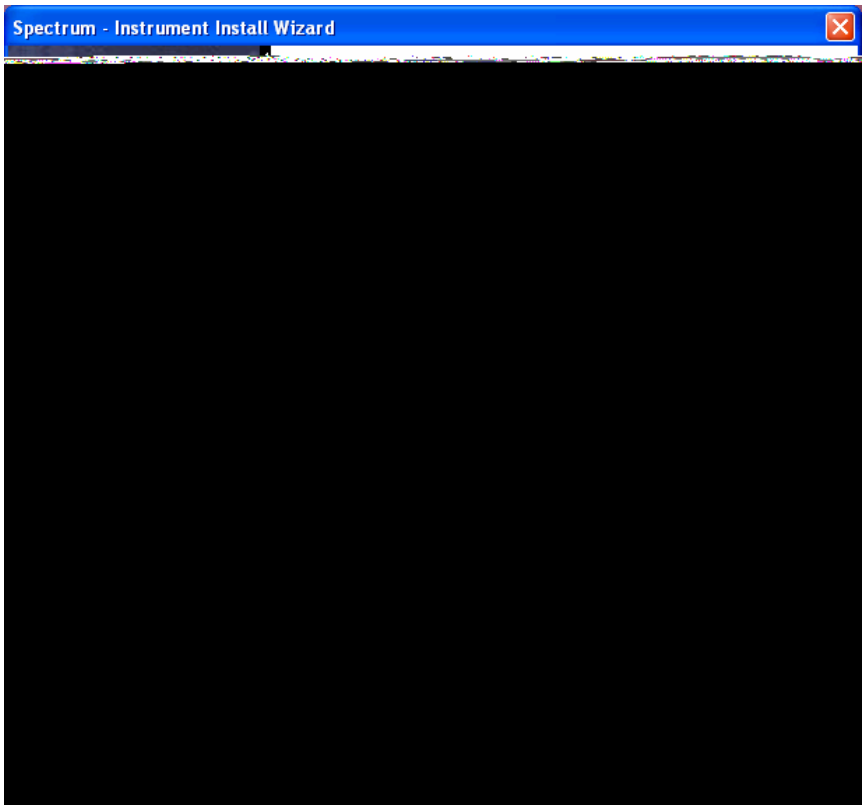
   This test automatically checks whether your PC and instrument can communicate with each other.

   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.

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

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

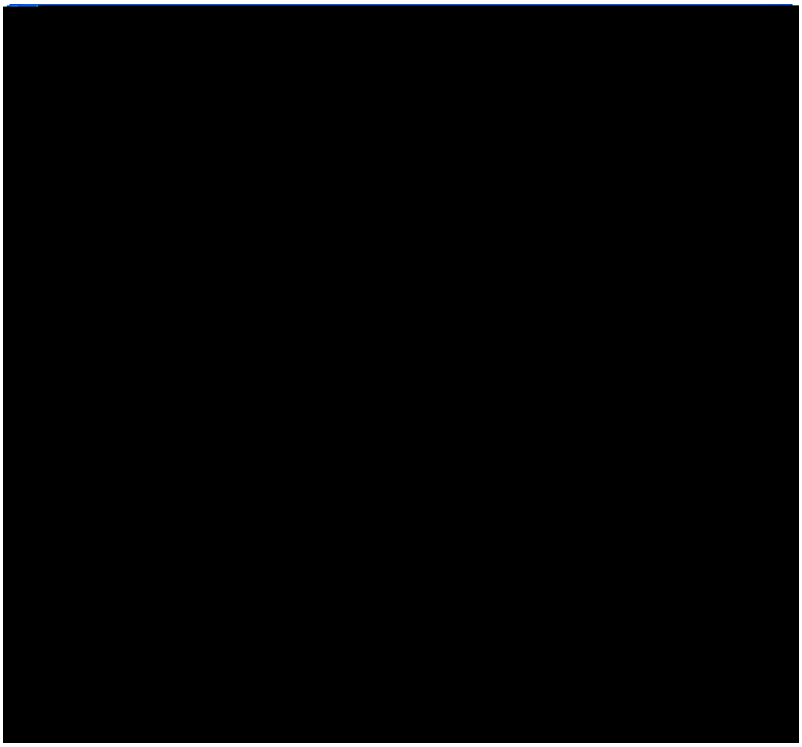


10. If you want to continue with the performance tests, click **Next**. Otherwise, click **Skip**.

    - 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.

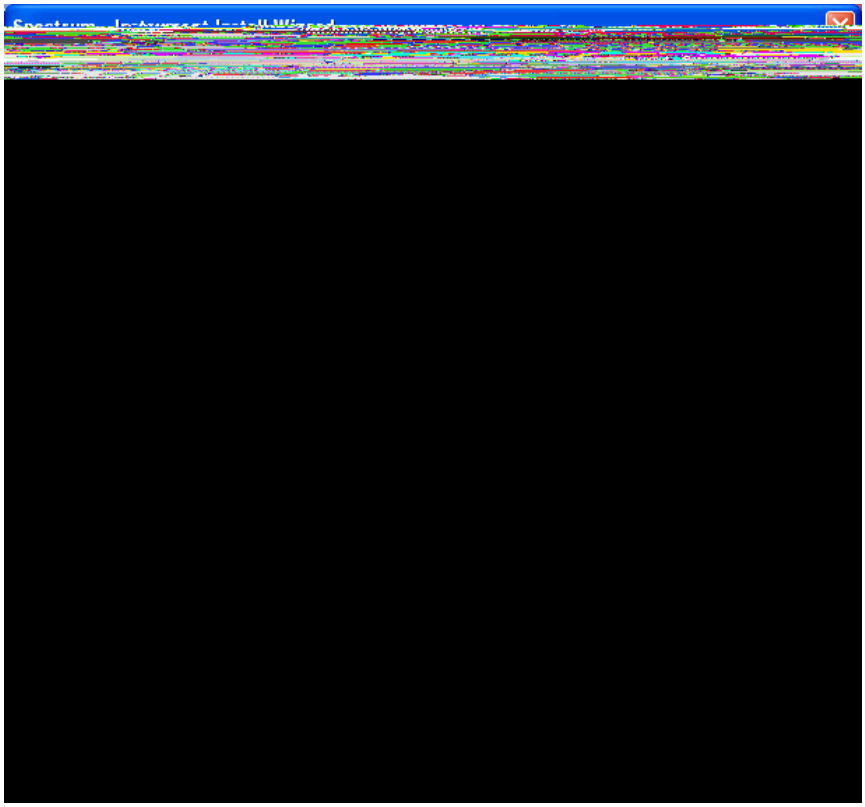
The Spectrum Software works through a series of instrument performance tests:



- **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**

12. Click **Next**.

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.

Using the Instrument Inst

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.

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 wam0008 6Qi15ts in more detail.

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

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

Using the Spectrometer

Basics of Software Control

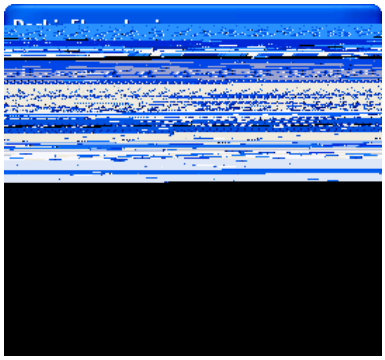
Switching on the Spectrometer

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.

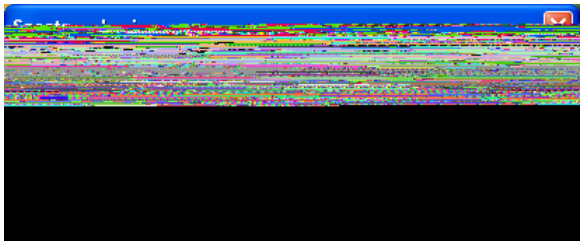
2. From the Start menu select **Programs**; the **PerkinElmer Applications** group; the **Spectrum** sub-group and then the **Spectrum** application.

   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**.

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.

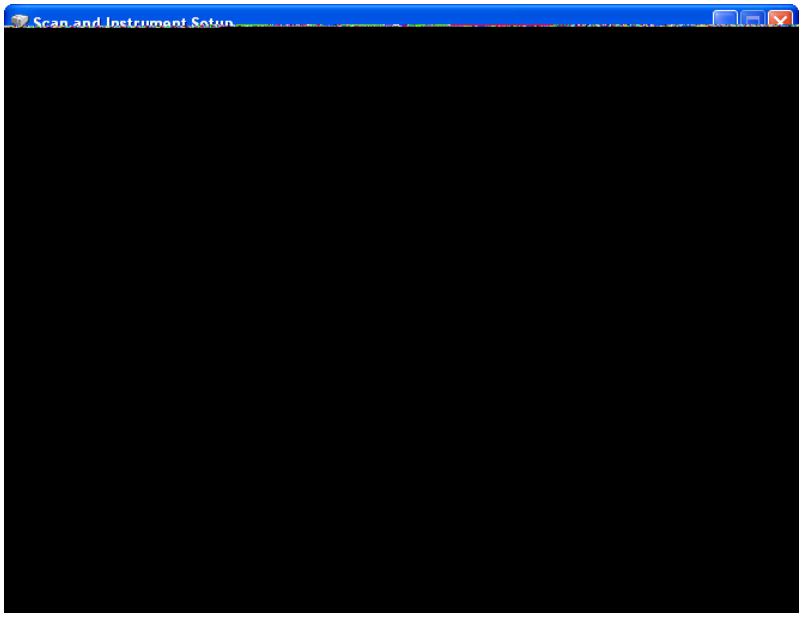
NOTE: Click the icon to toggle between the **Multiple Sample** tab and the **Sample** tab interface, which may be familiar from earlier versions of the Spectrum software.

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.

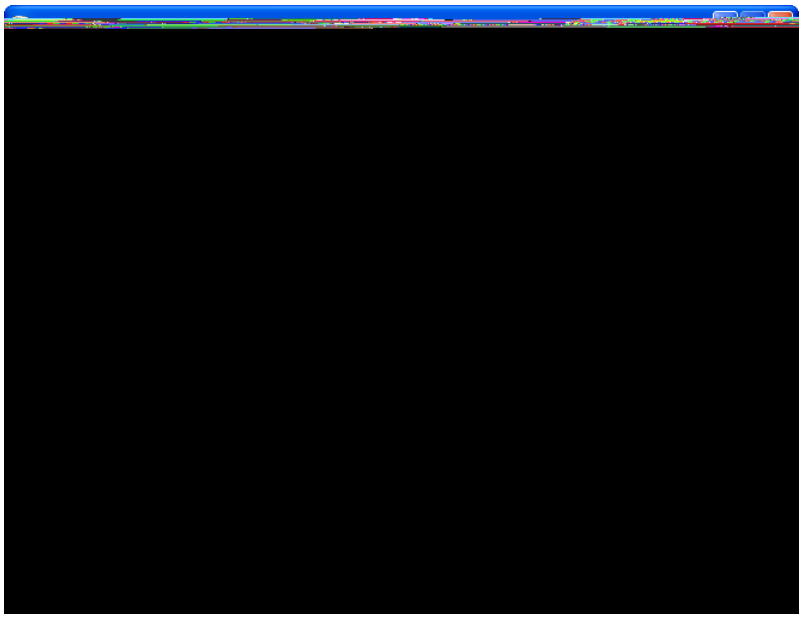
To append a comment to one or more rows click the icon.



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

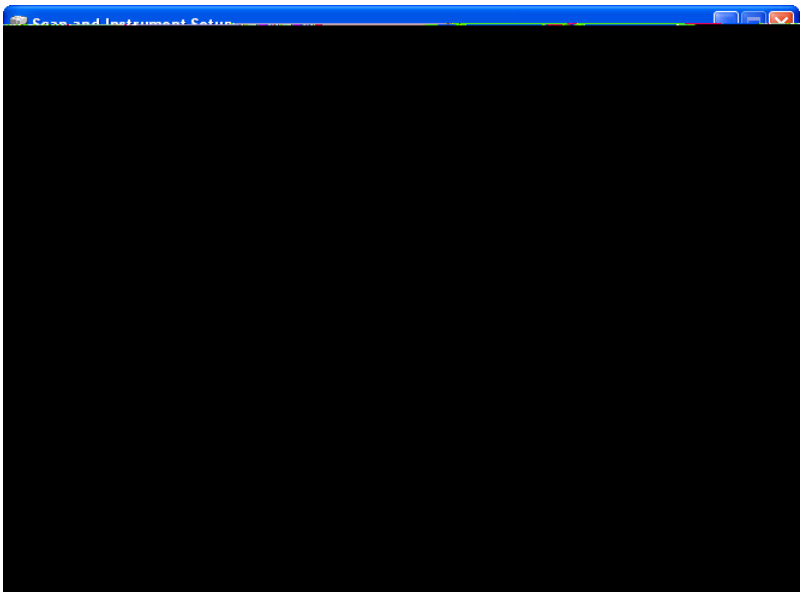
For further details refer to the Spectrum HTML Help system.

- 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.

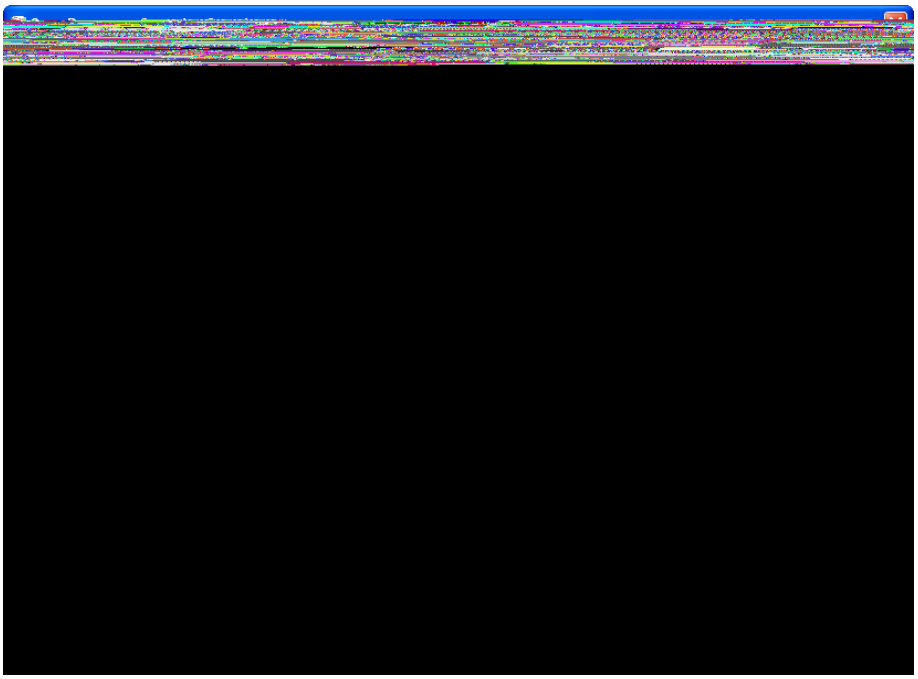
  The **Advanced** options of **CO2/H2O** suppression, **AVI** correction, **Look Ahead** and **Quality Checks** are discussed between pages 61 and 65.



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

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.

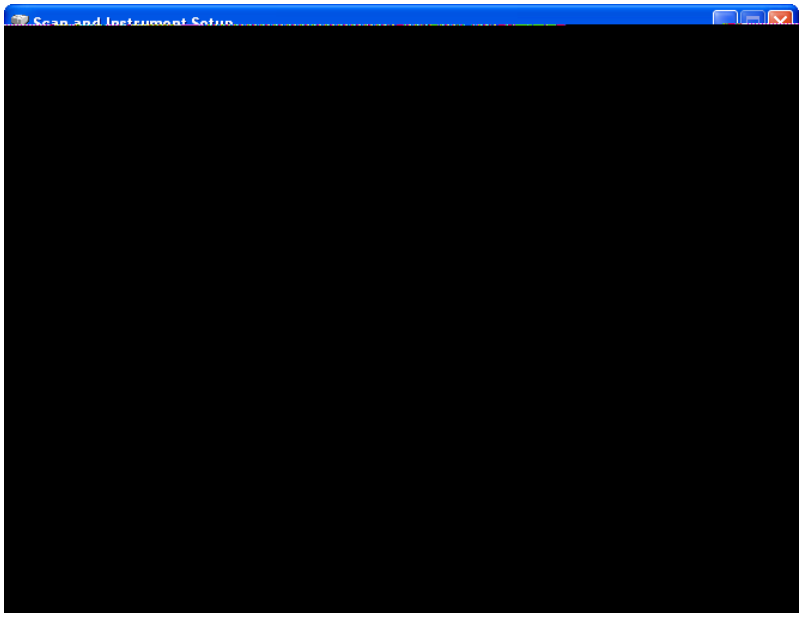
   The **Scan** button changes to **Halt** while the data is being collected.

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

Using the Spectrum on-screen help system

Use the Spectrum HTML Help system to find further information about using Spectrum

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.

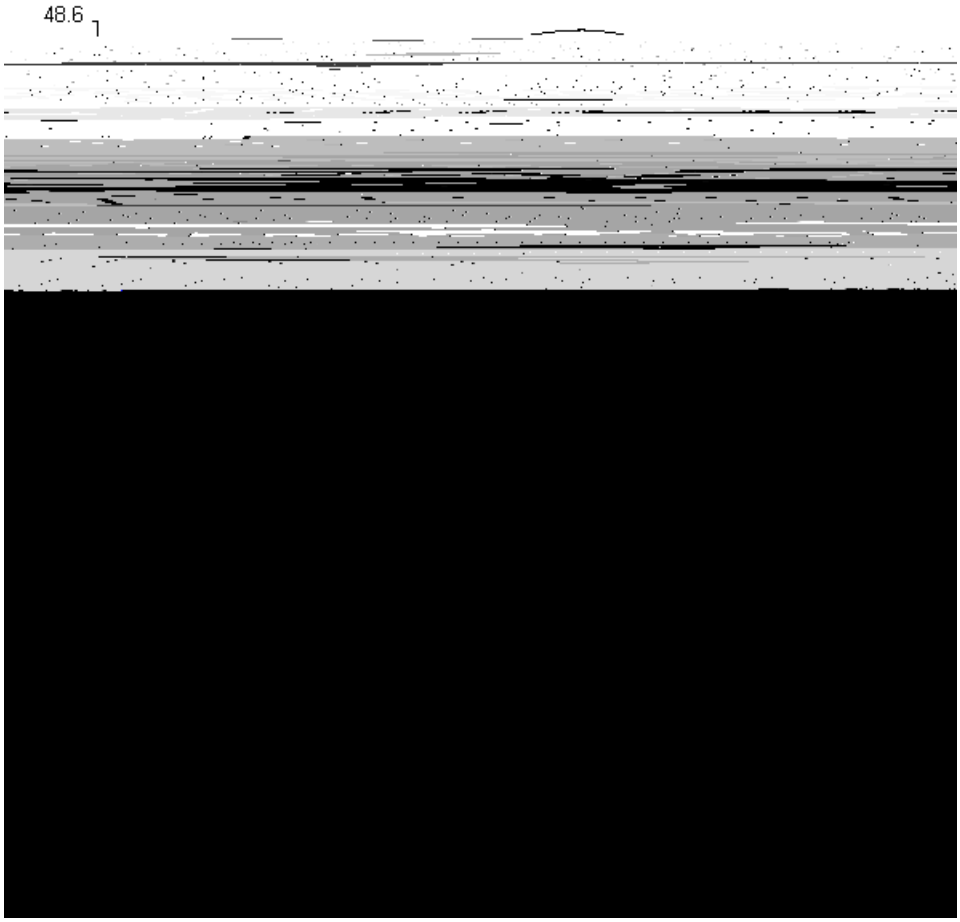


Figure 14 Atmospheric suppression

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.

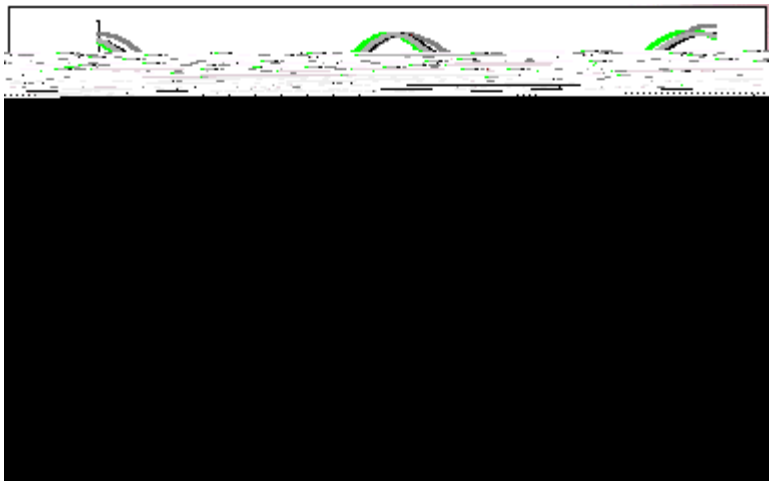


Figure 15 Spectra of methane at 4 cm^{-1} resolution as measured (top) and with AVI (bottom).

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

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.

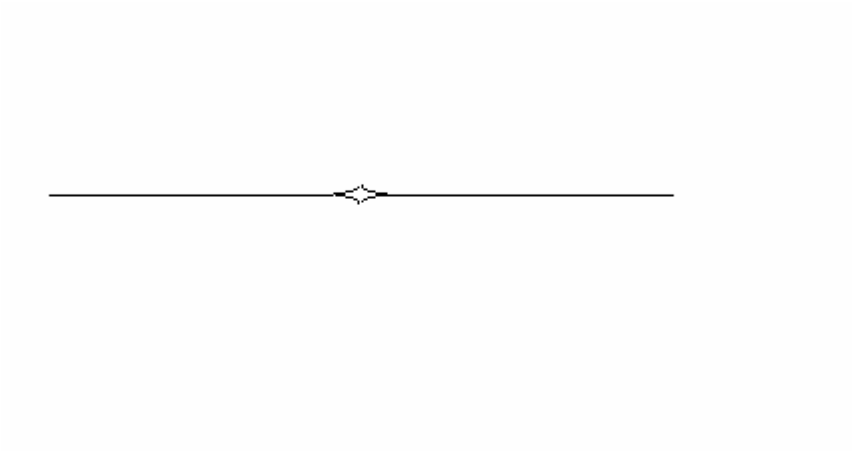
Warning ( ) - IR Expert has identified a serious problem that you should attempt to cure before collecting further spectra.

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.

ü 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.

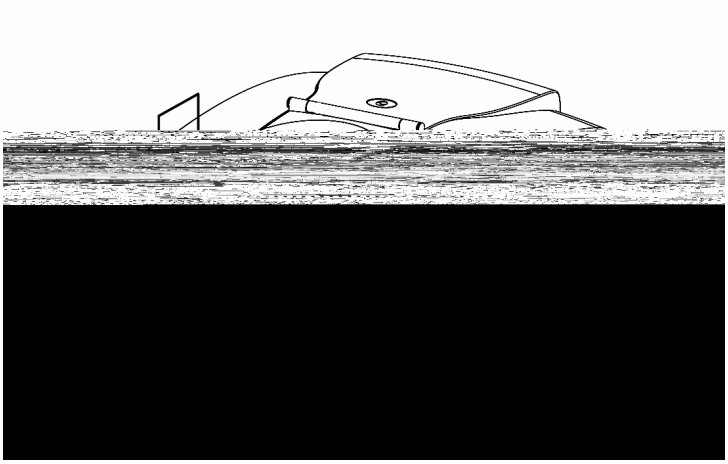


Figure 16 Spectrum 100 Series lifting points

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

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):

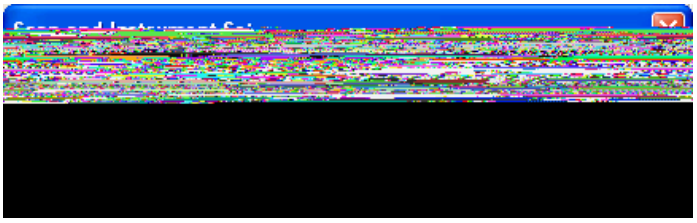


Figure 18 Desiccant Replacement Warning Dialog

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

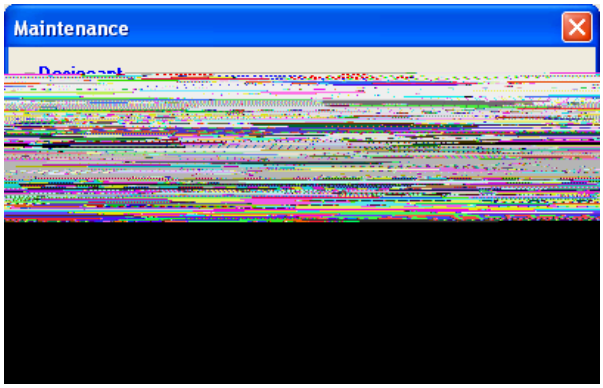
The message displayed to warn you that the desiccant in your instrument needs changing (Figure 18) is displayed until the Desiccant options are reset using the Maintenance tool in the Adjustment Toolbox.

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**.

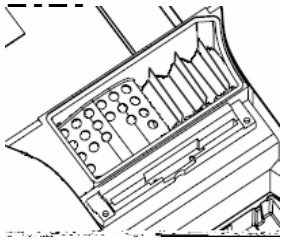
   The Maintenance dialog is displayed.



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**.

   .

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).



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 σ

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).

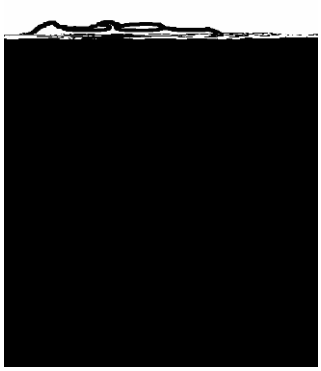


Figure 24 Connector fitted to purge port

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

NOTE:

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

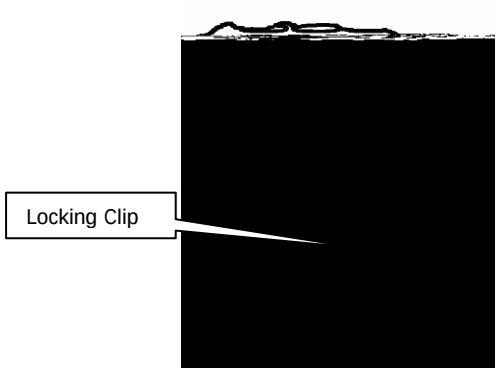


Figure 25 Disconnect the locking clip

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

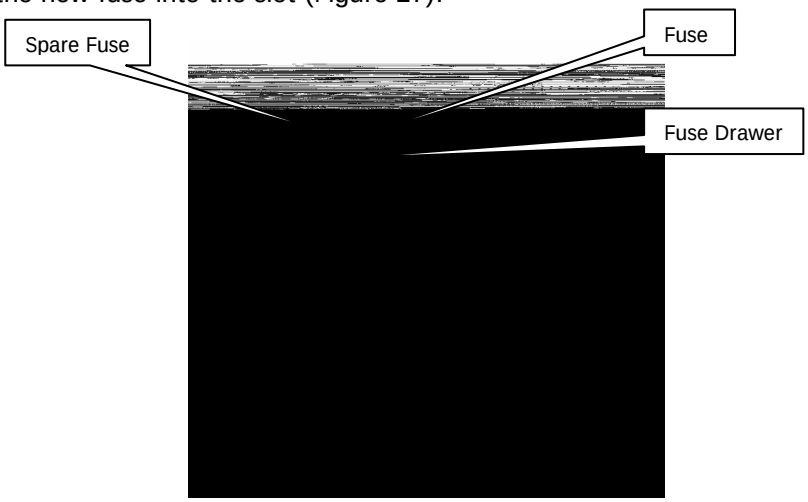


Figure 27 Fuse fitted; drawer open

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).

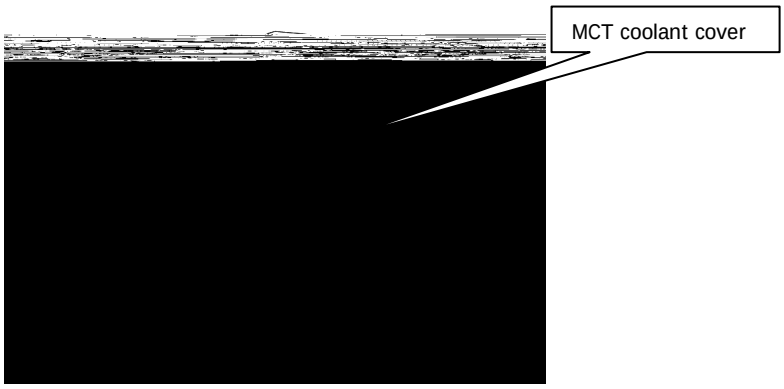


Figure 28 Location of MCT Coolant Cover

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.

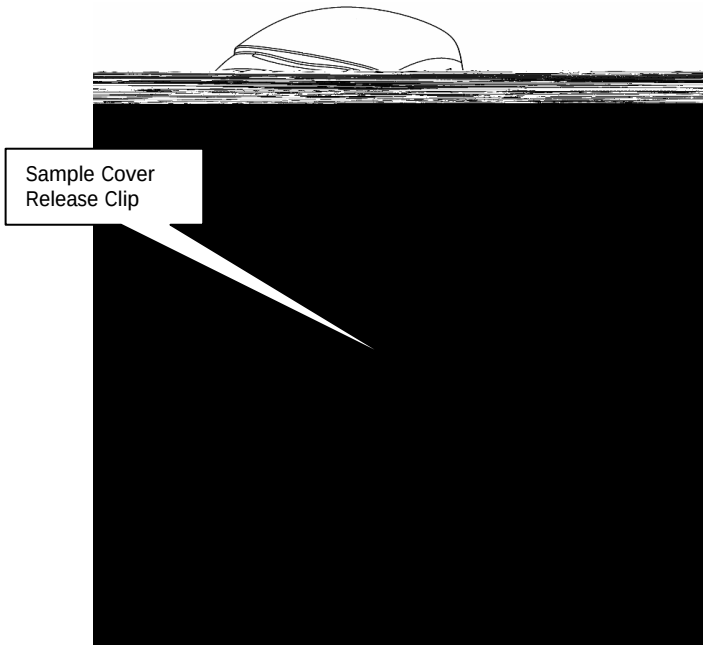


Figure 30 Removing the sample area cover

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

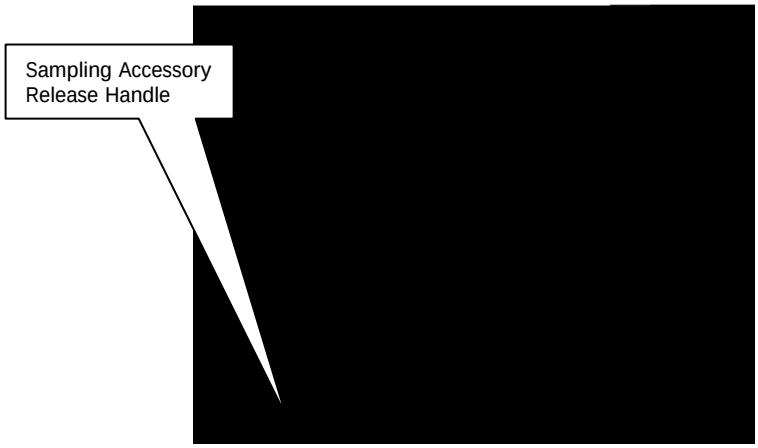


Figure 31 Removing the sampling accessory

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^{o} in the direction indicated by the arrows in the figure.

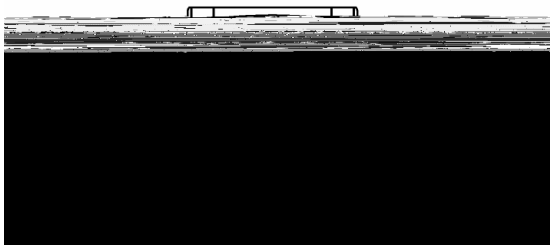


Figure 32 Undoing the locking bolts

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).

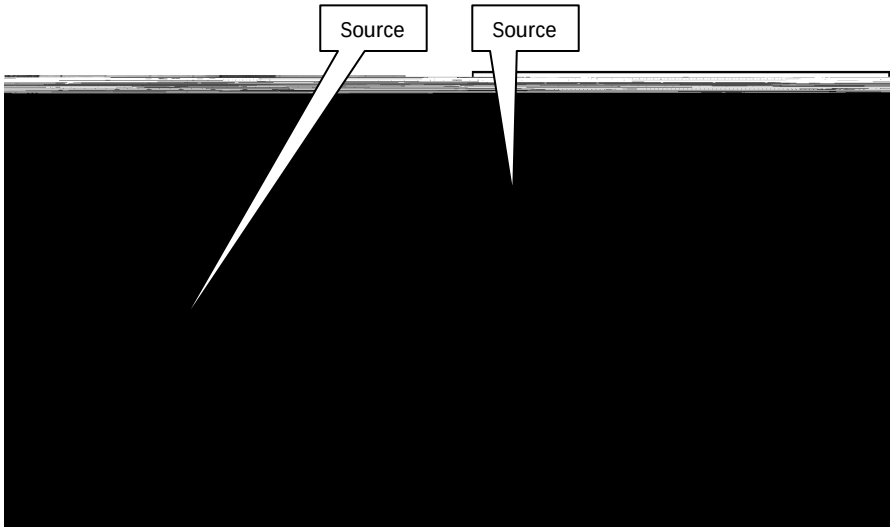


Figure 34 Source location

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.

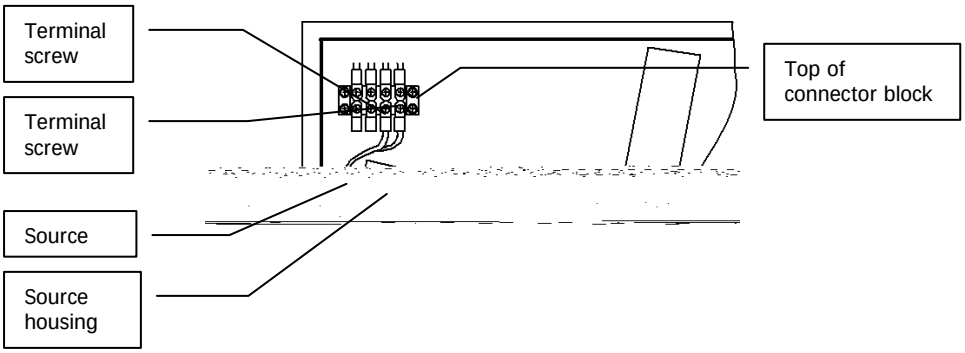


Figure 35 Terminal screws

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.

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

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.

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

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

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

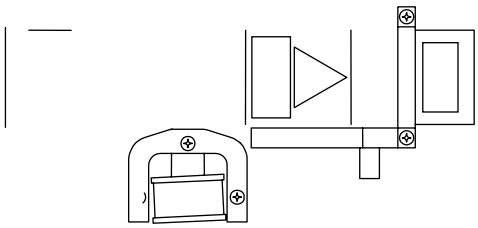


Figure 49 Laser and power supply installation

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

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

Printing the Certificate of Performance Validation

Hardware and software requirements

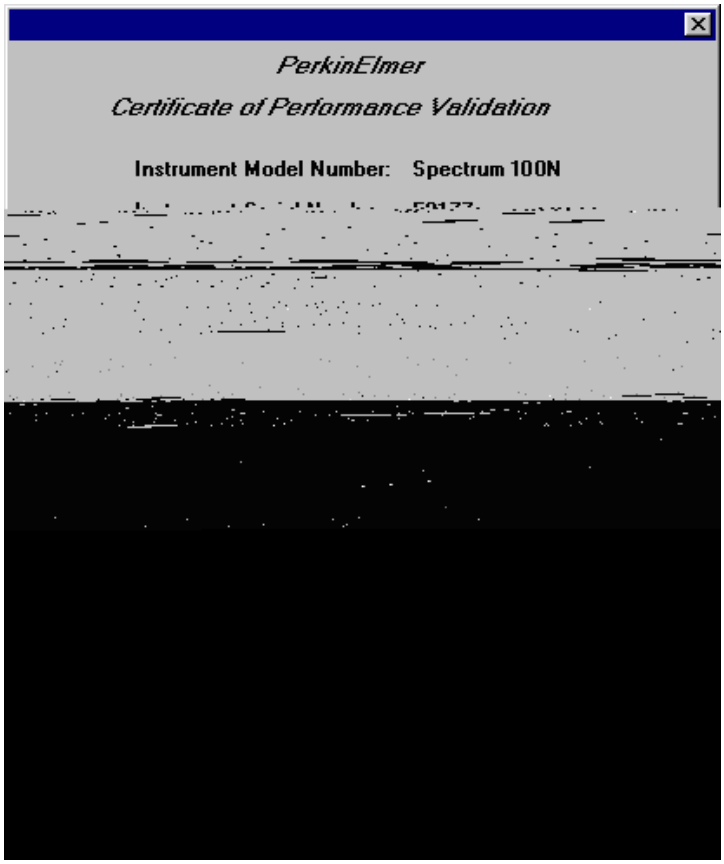
To print a certificate you will need a PC running Microsoft Windows, connected to a printer with the correct print drivers insta

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

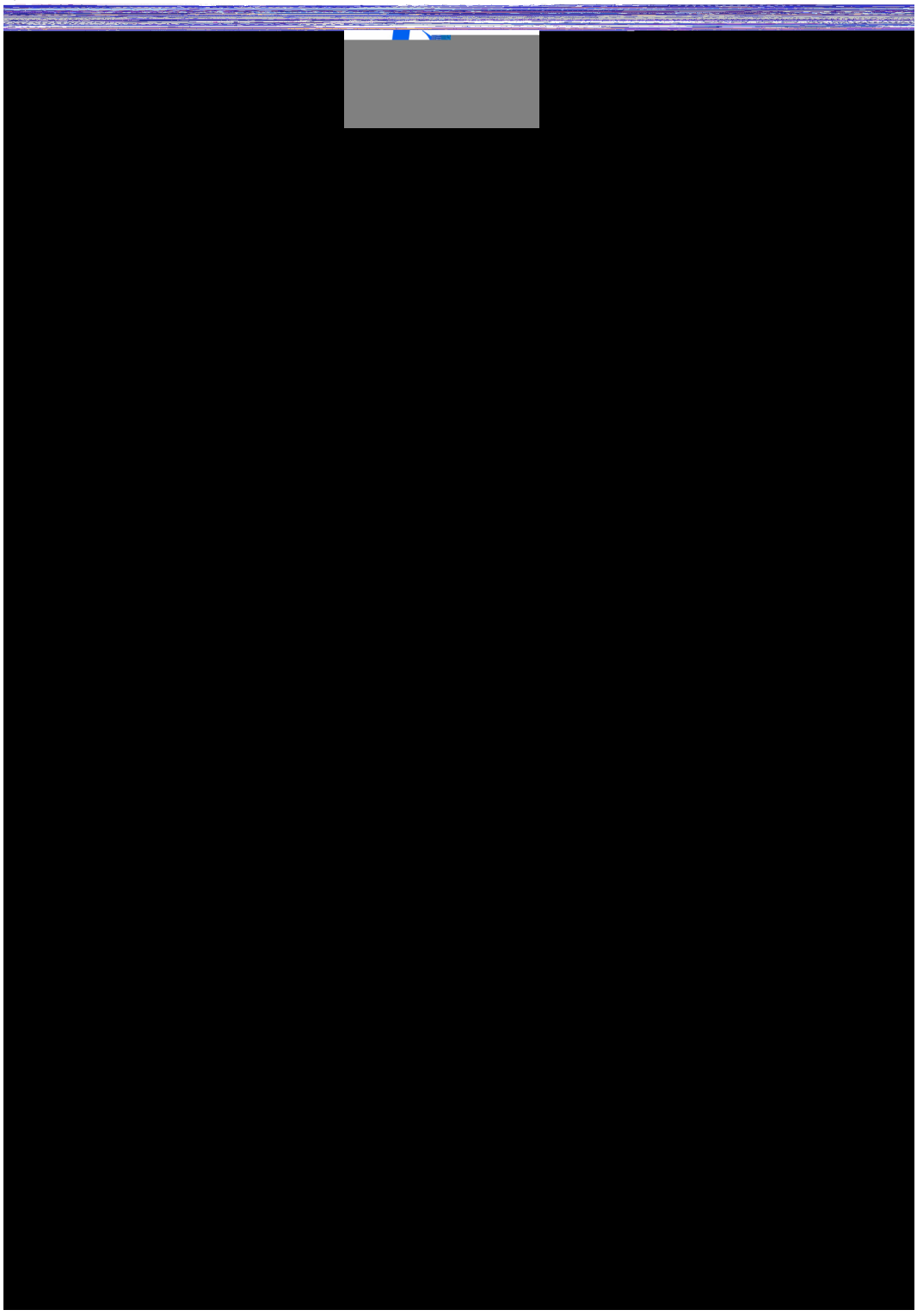
NOTE: The serial number of your instrument is usually printed on a silver label in the lower sample compartment area. The serial number of the TRM is on the TRM sample holder.

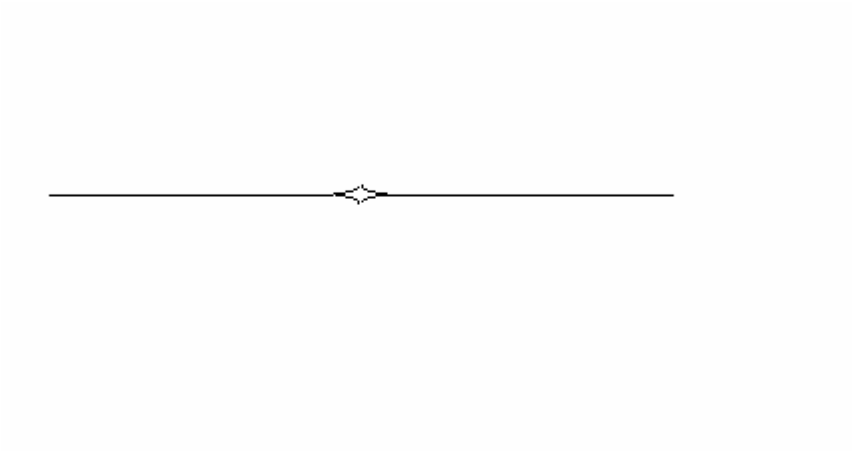
8. Click **OK**.

   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





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).

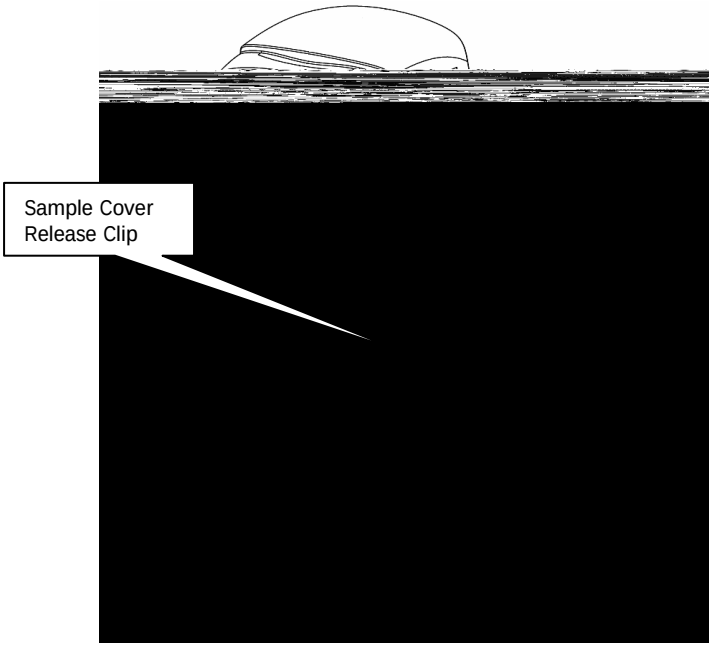


Figure 50 Removing the sample area cover

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

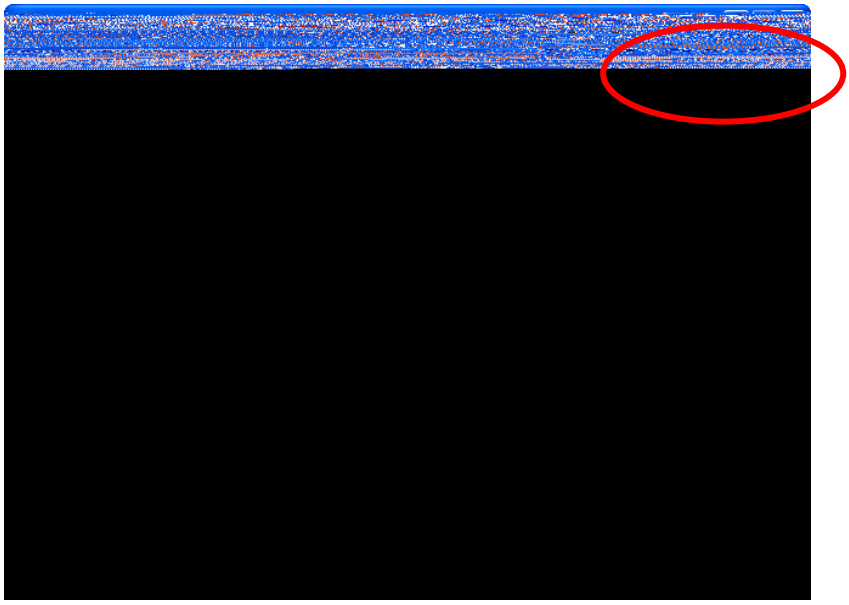


Figure 53 UATR Accessory icons

Appendix 2: Instrument Self-Checks

NOTE: It can take the Spectrum 100 FT-IR and Spectrum 100N FT-NIR spectrometers up

Initialization Errors

If your instrument generates one of the following error messages, switch off the

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.

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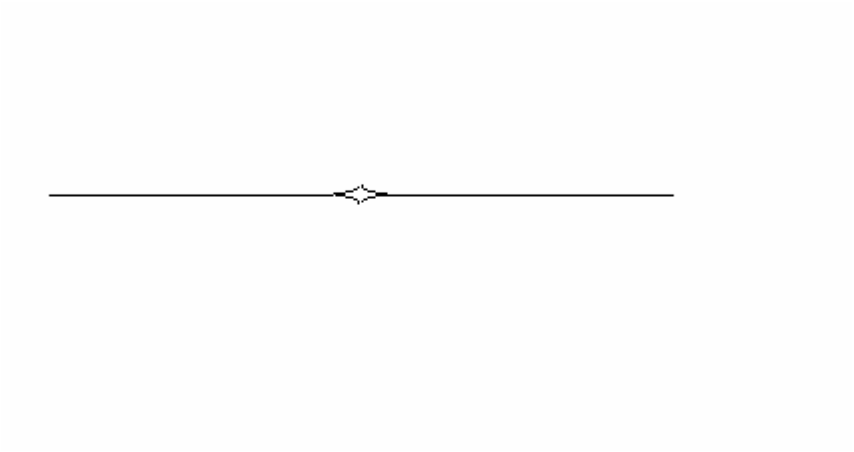
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