

Spectrum RX I

Getting Started Guide

2 . Spectrum RX I Getting Started Guide

Release History

Part Number	Release	Publication Date
L1050045	A	January 2006

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Using this Manual

It is very important that you install your Spectrum RX I carefully, and follow the procedures described in this manual. If you require assistance, contact your local PerkinElmer service engineer.

This manual describes how to unpack and install your Spectrum RX I; how to align the interferometer; and gives a very brief tutorial to help you familiarize yourself with the instrument.

Part Numbers

All eight-digit numbers in this manual are PerkinElmer part numbers unless stated otherwise.

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 click two keys at the same time, for example, ALT+F.

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

Notes, cautions and warnings

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

<p>NOTE: A note indicates additional, significant information that is provided with some procedures.</p>

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.

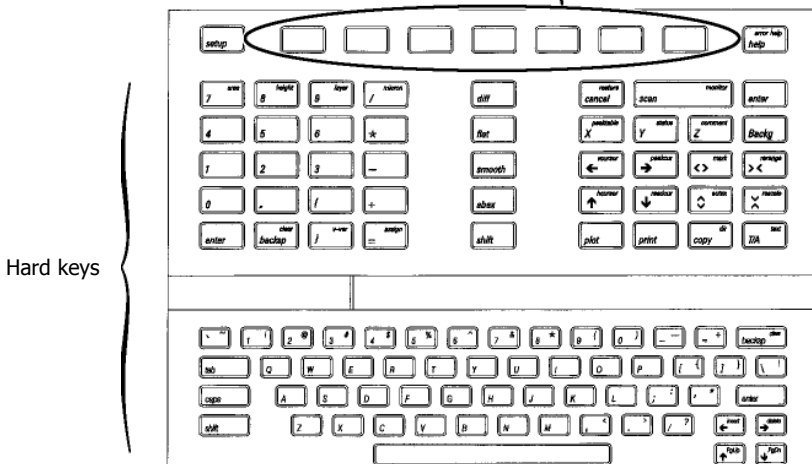
The use of these terms is defined by BS 4884 (1974) and the EPA (QA Requirements in Chapter 1 of SW-846, July 1991). An exception to this convention is the text on the labels on the instrument. The wording used on the laser labels is specified by laser safety regulations.

Documentation Conventions

The following conventions are used:

- Keypad keys (called hard keys) are represented by gray boxes. For example, **scan**.
- The top row of the keypad keys are called the soft keys. The function of the soft keys changes as you access different commands. Instead of permanent labels, soft keys have labels that appear on the screen. Soft keys are represented by white boxes: **setup**.
- Soft keys that execute their command immediately, without the entry having to be confirmed, are called *action keys*. Action keys are represented by black boxes: **EXECUTE**
- Entries that you type into the command line, and text displayed on the screen, are represented by **bold type**. For example, "Type **100** in the **#scans** field."

Soft keys and action keys



Warnings and Safety Information

Summary

The Spectrum RX I has been designed to comply with a wide variety of international standards governing the safety of laboratory equipment. In routine use, the Spectrum RX I poses 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 the instrument:

DO make sure that the Spectrum RX I 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 Spectrum RX I.

DO keep the Spectrum RX I dry. Avoid spilling liquid into the instrument, especially into the top of the display-screen housing, which contains a high-voltage supply. Clean all external spills immediately. If anything that is spilled enters the main body of the Spectrum RX I, switch off the power and call a PerkinElmer Service Engineer.

DO NOT stare into the laser beam. The Spectrum RX I 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 Spectrum RX I. The Spectrum RX I 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 take care if you need to open the main cover of the instrument. The screen is a separate unit and must be removed before opening the cover.

DO read the more detailed information on safety in the following pages.

General Safety

The Spectrum RX I FT-IR Spectrometer has been designed and tested in accordance with Perkin-Elmer specifications and in accordance with the safety requirements of the International Electrotechnical Commission (IEC). The spectrometer conforms 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 Directive 73/23/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 Spectrum RX I 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 Spectrum RX I is unsafe, make it inoperative. The Spectrum RX I 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.

The Spectrum RX I has been designed to be safe under the following environmental conditions:

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

Location and Ventilation

To allow for adequate cooling, the system should not be sited near to room heating equipment, for example, central-heating radiators. There should be a minimum gap of at least 15 cm (6 inches) from the top and side surfaces of the Spectrum RX I, to permit adequate cooling.



WARNING

Make sure that the switch at the electrical supply inlet on the right-hand side of the Spectrum RX I is not obstructed.

Electrical Safety

Connect the Spectrum RX I to a power supply line that includes a switch or other adequate means of disconnection from the electricity supply.

Only plug the Spectrum RX I 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 Spectrum RX I 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 Spectrum RX I may still be charged even if the instrument has been disconnected from all voltage sources.

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The Spectrum RX I 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 Spectrum RX I or disconnection of the protective earth terminal can make the instrument dangerous.

The Spectrum RX I has:

- An IEC Installation Category (Overvoltage Category) II classification - suitable for connection to local level power supplies.
- 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.

The Spectrum RX I is able to withstand transient overvoltages typically present on the MAINS supply. The normal level of transient overvoltages is impulse withstand (overvoltage) category II of IEC 60364-4-443.

EMC Compliance

EC directive

The Spectrum RX I has been designed and tested to meet the requirements of the EC Directives 89/336/EEC and 93/68/EEC. The Spectrum RX I complies with the EMC standards EN 61326 (Electrical equipment for measurement, control and laboratory use) and EN 55011 (ISM) Class A (RF Emissions).

FCC rules and regulations

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

Laser Safety Regulations

The Spectrum RX I 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 (1992) - "Radiation safety of laser products, equipment classification, requirements and user's guide". BS EN 60825 implements CENELEC European Normalization document EN 60825 (CENELEC is the European Committee for Electrotechnical Standardization).
3. IEC Publication 825 (1984) - "Radiation safety of laser products, equipment classification, requirements and user's guide" and "Amendment 1 to Publication 825" (August 1990).

Spectrum RX I Laser Product Classification

The Spectrum RX I contains a CDRH Class II (BS EN 60825 and IEC 825 Class 2) Helium Neon (HeNe) laser, which emits visible, continuous wave radiation at a wavelength of 633 nm and has a maximum output power of less than 1 mW. A portion of the laser radiation with a maximum power level of less than 0.4 mW may be accessed in the sample compartment, which classifies the instrument as a CDRH Class II, BS EN 60825 Class 2, and IEC 825 Class 2 laser product. The laser is switched on when the main cover is closed and the Spectrum RX I's power switch is switched on. The laser is automatically switched off when the main cover of the Spectrum RX I is raised or the power switch is switched off.



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*.

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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 s.

C.D.R.H. classifies a 633 nm laser radiation beam as Class II when it has a power level in the range $>3.9 \text{ mW}$ to 1000 mW . BS EN 60825 and I.E.C. 825 classify a 633 nm laser radiation beam as Class 2 when it has a power level in the range $>6.8 \text{ mW}$ to 1000 mW .

The typical level of 633 nm laser radiation that a user can access in the sample compartment of the Spectrum RX I is 35 mW .

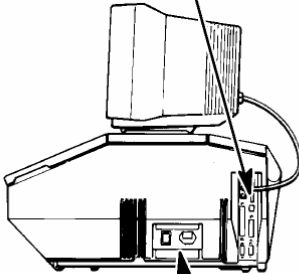
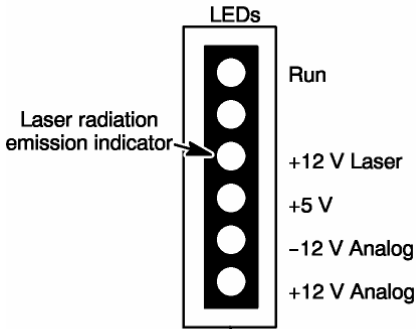


WARNING

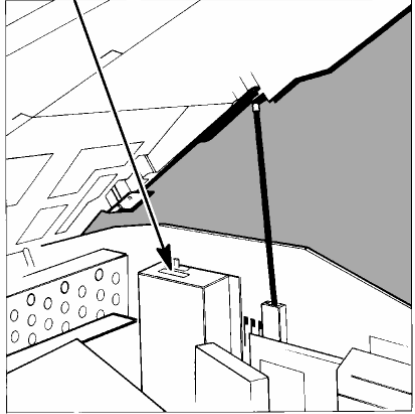
Do not stare into the laser beam. Staring into the laser beam can cause permanent damage to your eyes.

Laser Labels and Laser Apertures

This manual contains information and warnings that you must follow to make sure that you use the Spectrum RX I safely. Warning labels are fixed to the Spectrum RX I in the locations shown on the following pages.



CAUTION-LASER RADIATION WHEN OPEN AND INTERLOCKS DEFEATED DO NOT STARE INTO BEAM



Inside the main cover


PERKIN-ELMER LIMITED
BEACONSFIELD BUCKS ENGLAND

DATE OF MANUFACTURE
PART NO.

50 / 60 Hz
FUSE

⚠

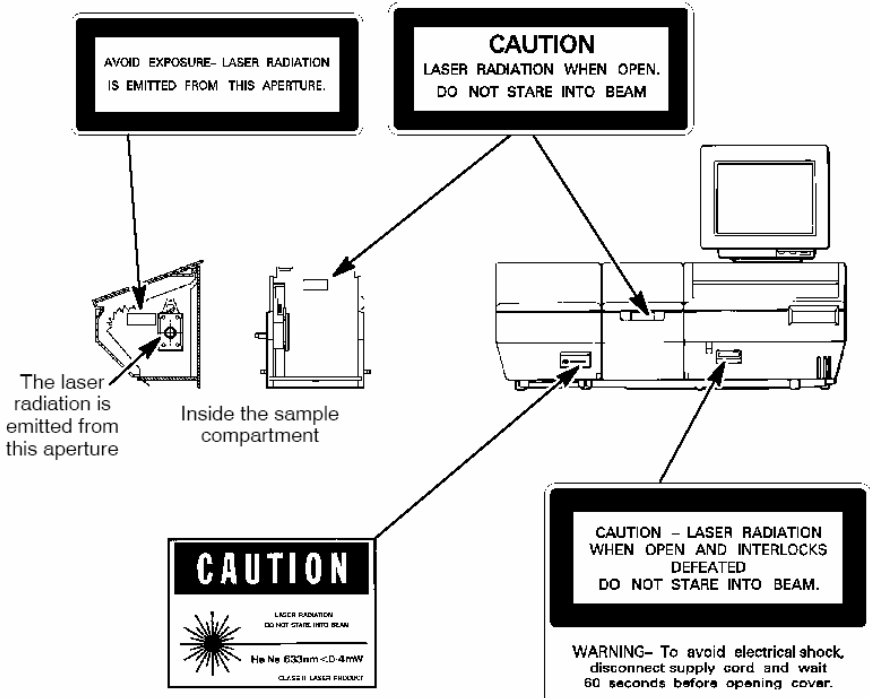
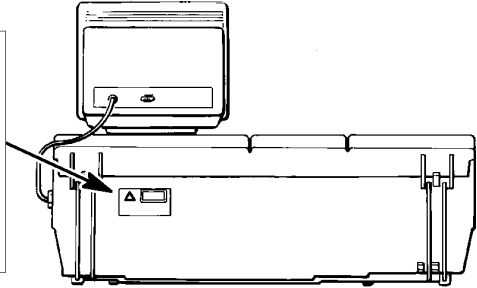
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LASER RADIATION
DO NOT STARE INTO BEAM
CLASS 2 LASER PRODUCT
HeNe 633nm < 0,4mW

I.E.C. 825 : 1984 AND AMENDMENT 1 : 1990
BS EN 60825 : 1992

This product conforms to all applicable standards of 21 CFR Chapter 1, Subchapter J, Part 1040.10, Center for Devices and Radiological Health, U.S.Department of Health and Human Services, at the date of manufacture.



AVOID EXPOSURE- LASER RADIATION IS EMITTED FROM THIS APERTURE.

CAUTION
LASER RADIATION WHEN OPEN.
DO NOT STARE INTO BEAM

The laser radiation is emitted from this aperture

Inside the sample compartment

CAUTION
LASER RADIATION
DO NOT STARE INTO BEAM
He Ne 633nm <D>0.4mW
CLASS II LASER PRODUCT

CAUTION - LASER RADIATION WHEN OPEN AND INTERLOCKS DEFEATED DO NOT STARE INTO BEAM.

WARNING- To avoid electrical shock, disconnect supply cord and wait 60 seconds before opening cover.

System Requirements

NOTE: Read the safety precautions at the start of this manual before you use the Spectrum RX I. They contain important information.

Give attention to the following points before installing the Spectrum RX I.

Electrical Requirements

The Spectrum RX I can operate on an electricity supply at 50 or 60 Hz, and in either of the ranges 100 to 120 V or 220 to 240 V, without any adjustment.

The Spectrum RX I requires two power sockets, one for the instrument and one for the screen.

The power consumption for all versions of the Spectrum RX I is almost the same, not exceeding 200 W.

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

If possible, do not connect the Spectrum RX I to supply circuits that have heavy-duty equipment, such as large motors, connected.

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

Site Requirements

Minimum bench dimensions of 110 x 80 cm to accommodate the Spectrum RX I.

To obtain the best performance from your Spectrum RX I:

- Place the Spectrum RX I in an environment that is relatively dust-free.
- Make sure that the benchtop is free from vibrations or mechanical shocks.
- Do not place the Spectrum RX I close to room heating equipment, for example, central-heating radiators.
- Leave at least 15 cm (6 inches) from any vertical obstacle to the sides of the Spectrum RX I, 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 Spectrum RX I.
- If your Spectrum RX I has a disk drive, the work area must be free of strong magnetic fields, direct sunlight, and heating or cooling units or ducts.

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The Spectrum RX I 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)

CAUTION

Relative humidity higher than 75% can damage the windows of the sample compartment. If you expect the humidity to exceed 75%, continually purge or desiccate the sample compartment.

Unpacking the Spectrum RX I

CAUTION *Take great care when installing your Spectrum RX I, and follow the procedures described in this manual. If you require assistance, contact your local PerkinElmer Service Engineer.*

This section describes how to unpack the Spectrum RX I.

Moving the Spectrum RX I

If you move your Spectrum RX I, be aware that condensation caused by moving the Spectrum RX I 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 Spectrum RX I to reach the temperature of the surroundings before removing the protective packaging.

Although this is particularly important when first unpacking your Spectrum RX I, it also applies if you move your Spectrum RX I at a later date.

Opening the Shipping Containers

Before proceeding with the installation, make sure that all the parts listed below are present. If any items are missing or damaged, contact your local PerkinElmer office.

Part Number	Description	Quantity
	<u>Large Container</u>	
Various	Spectrum RX I FT-IR	1
N017 1159	Extra desiccant	4
N017 1020	Hexagonal wrench, 3/32 inch	1
0990 7220	Hexagonal wrench, 3/16 inch	1
0496 0995	Screwdriver, 1/4 inch blade	1
0C97 3085	Spare Fuse 3.15A, 250V Slo-Blo	1
Various	Power cable	2
L118 1021	1 cm ⁻¹ J-stop plate	1
N017 1191	2 cm ⁻¹ J-stop plate	1
L118 1090	Half aperture plate	1
L118 1092	Reference aperture plate	1
0186 2082	Polystyrene film card	1
L105 0044	Spectrum RX I Manuals CD Contains: 0993 4217 Routine Operations manual 0993 4218 Advanced Operations manual	1
L105 0045	Getting Started Guide	1
	<u>Small Container</u>	
L118 5010	Screen, including base and users manual	1

Unpacking the Spectrum RX I

CAUTION

Do not switch the Spectrum RX I on until you have completed the unpacking procedure. In particular, ensure that the shipping bolts have been loosened, and the desiccant has been changed. Your Spectrum RX I may be seriously damaged if you do not follow these instructions.

Removing the Packaging

1. Carefully remove the Spectrum RX I from the shipping carton, but not from the bag in which it was shipped.
2. If the shipping containers were stored in a cold area, leave the Spectrum RX I in the bag overnight to reach room temperature. Even if the shipping containers were stored at room temperature, the Spectrum RX I must be left in the bag for a minimum of 4 hours.

The Spectrum RX I can be damaged by the condensation caused by opening the bag before the Spectrum RX I has equilibrated to room temperature.

3. Remove the Spectrum RX I from the bag and position it on the bench where it will be used.

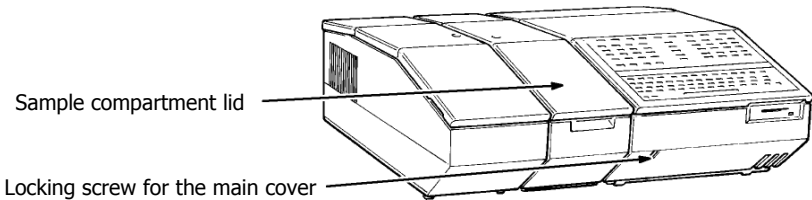


Figure 1 The Sample Compartment Lid and the Locking Screw

4. Open the sample compartment using the recess in the front edge of the lid. The sample compartment lid lifts and pivots toward the back of the Spectrum RX I.
5. Remove the foam and desiccant bags and close the lid of the sample compartment.
6. Pull the front edge of the Spectrum RX I to the front edge of the bench so that the locking screw on the lower front cover is accessible (see Figure 1).

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7. Use the larger of the two hexagonal wrenches supplied (3/16 inch) to unlock the main cover of the instrument by turning the locking screw counterclockwise until it is loose.

The lid of the Spectrum RX 1 creeps up approximately 2 cm (about 15 turns of the wrench).



Make sure that the power cable is not connected.

8. Lift the main cover from the front.
9. Support the cover with the prop, which is stored on the underside of the main cover to the right. Insert the free end into the notched receptacle (Figure 2).

Do not support the prop on the power inlet module, which is behind the notched receptacle.

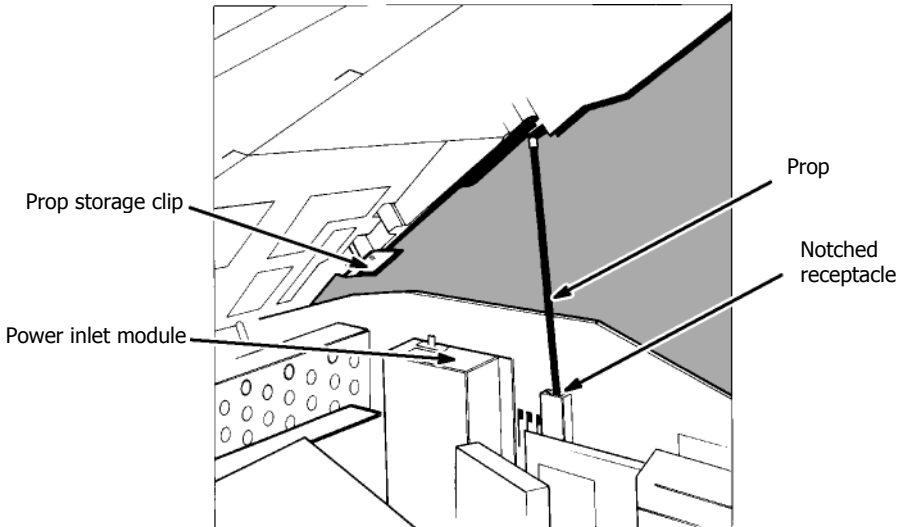


Figure 2 Propping Open the Main Cover

- Using the flat blade screwdriver supplied, remove each of the shipping bolts from the centers of the three positions indicated in Figure 3. When you remove each bolt, place it in its storage position, as shown in Figure 3 and Figure 4.

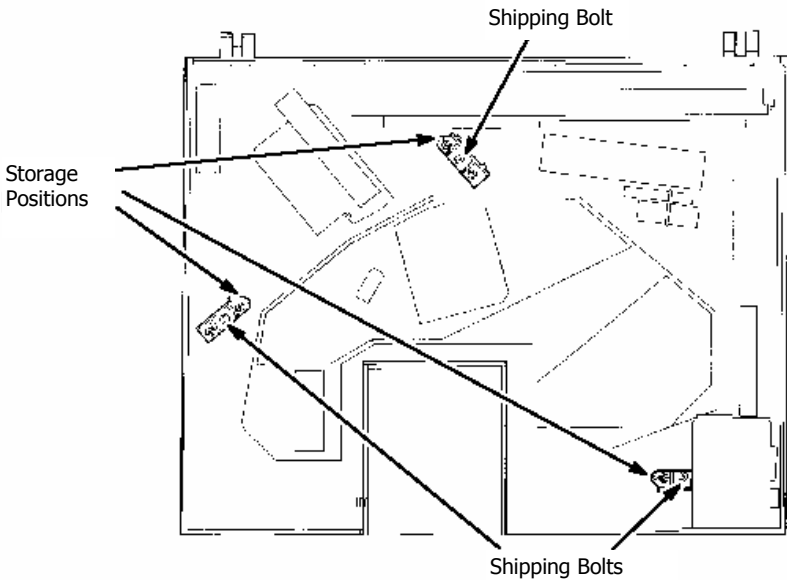


Figure 3 Locations of the shipping bolt

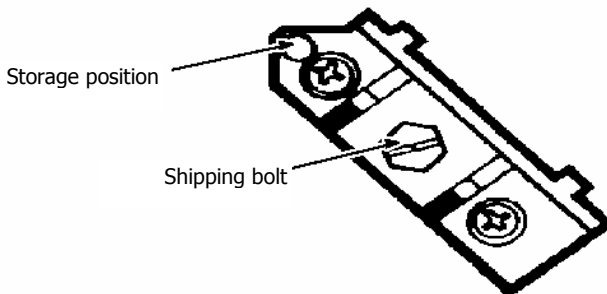


Figure 4 Shipping Bolt and Storage Position

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11. When the bolts have been moved to their storage positions, the optical base should float on the vibration dampers and should move slightly when you push down gently on the clear plastic purge cover.
12. Loosen the shipping clamp on the scan mirror by turning the bolt counterclockwise (Figure 5). Loosen the bolt until it no longer turns easily and the scan mirror becomes free to move.

Unscrewing this bolt raises a clamp that holds the scan mirror. You might notice the scan mirror swing free when you have unscrewed the bolt sufficiently. The bolt must protrude by at least 1.5 cm.

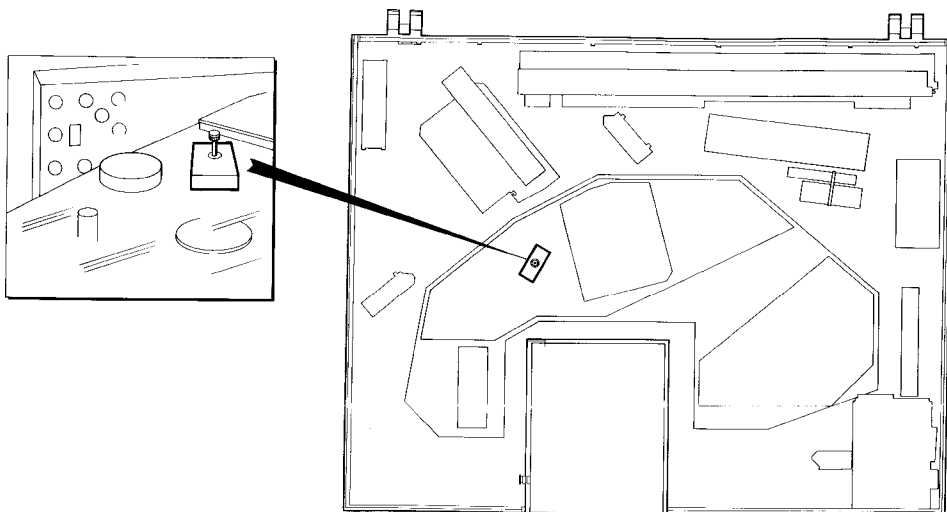


Figure 5 The Scan Mirror Clamp

Changing the Desiccant

The optical system of the Spectrum RX I is purged at the factory, then sealed under a clear plastic purge cover. This protects the KBr both in the beamsplitter and in the sample compartment windows from being damaged by humidity. Four replaceable bags of desiccant maintain the purge.

Re-usable desiccant packs are also available for the Spectrum RX I. The part number is 0499 4725, and 2 packs are required for each instrument. For more information see *Re-activating and Replacing the Desiccant Packs* in *Advanced Operations*.

CAUTION

Before switching on the Spectrum RX I for the first time, renew the desiccant to make sure that the purge is good. Old, used desiccant releases moisture and can cause catastrophic failure of the beamsplitter.

Do not use damaged bags of desiccant. Make sure that the bags of desiccant you use have not been left in contact with the air.

CAUTION

During the following procedure, the purged optical system is exposed to the atmosphere. To minimize the loss of purge, have the new desiccant ready before you begin, and complete the procedure as quickly as possible.

Do not start the procedure if the temperature of the Spectrum RX I has not equilibrated with the ambient temperature of the laboratory.

Do not start the procedure if the relative humidity is >75%. You can determine the relative humidity using the humidity detector on the purge cover (Figure 6).

1. Loosen the screws on the desiccant box, and lift the box from the Spectrum RX I.

The desiccant box is located behind the sample compartment (Figure 6).

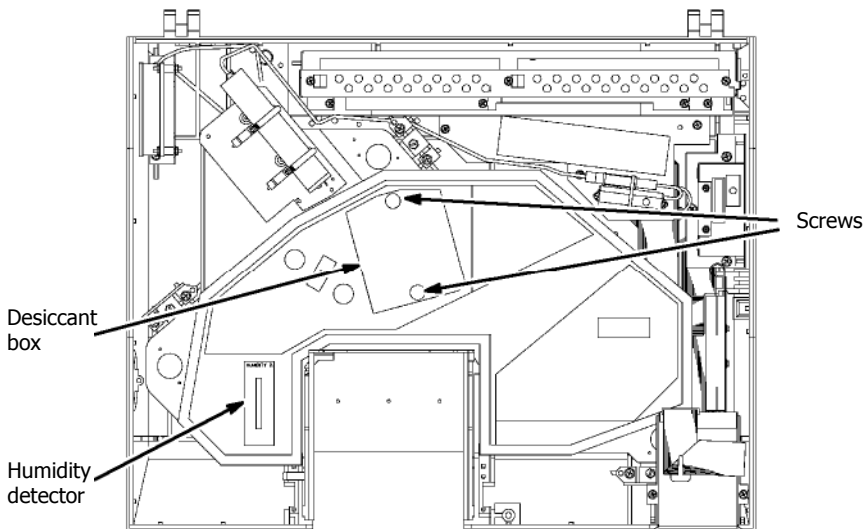


Figure 6 Location of the Desiccant Box

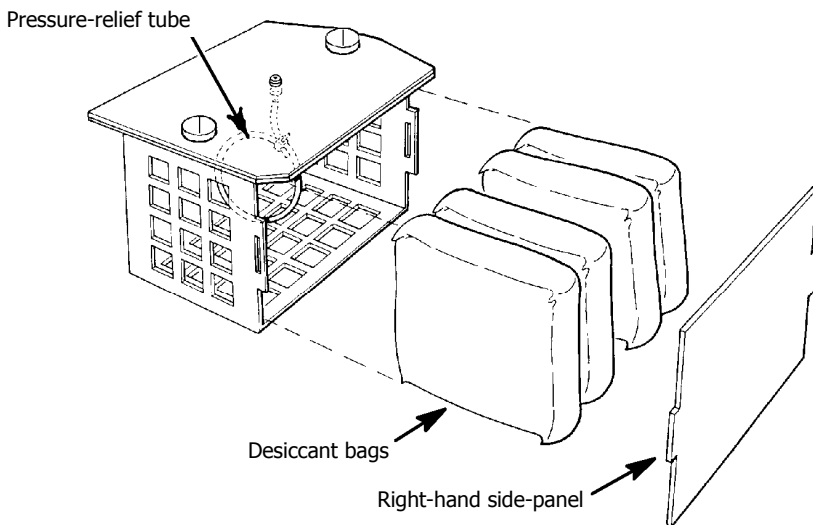


Figure 7 Replacing the desiccant

Five surfaces of the desiccant box are formed from a single sheet of metal. The sixth surface (the right-hand side-panel) is a separate piece (Figure 7).

2. To open the box, snap out the right-hand side-panel.
3. Remove the old desiccant bags and discard them. Take care not to damage the pressure-relief tube that lies between the middle two bags (Figure 7).

NOTE: Do not attempt to dry the bags of desiccant for re-use. The temperature needed to dry them will destroy the bag.

4. Open a new desiccant pack and carefully insert the two bags of desiccant between the pressure-relief tube and the side panel of the box.
5. Reposition the pressure-relief tube so it is flat against the desiccant bags.
6. Open another new desiccant pack and insert the two bags of desiccant at the other side of the tube.
7. Snap the right-hand side-panel back onto the box.
8. Lower the box into the Spectrum RX I.
9. Tighten the screws on the top of the desiccant box.

Locating the Interferometer Adjustment Screws

During the installation procedure, you adjust the interferometer by turning the adjustment screws located under the clear plastic purge cover. Because the main cover of the Spectrum RX I will be closed when you adjust the interferometer, we suggest you familiarize yourself with the location and feel of the adjustment screws while you have the main cover of the Spectrum RX I open:

The adjustment screws are accessed through small slits in the two septum covers in the clear plastic purge cover (Figure 8).

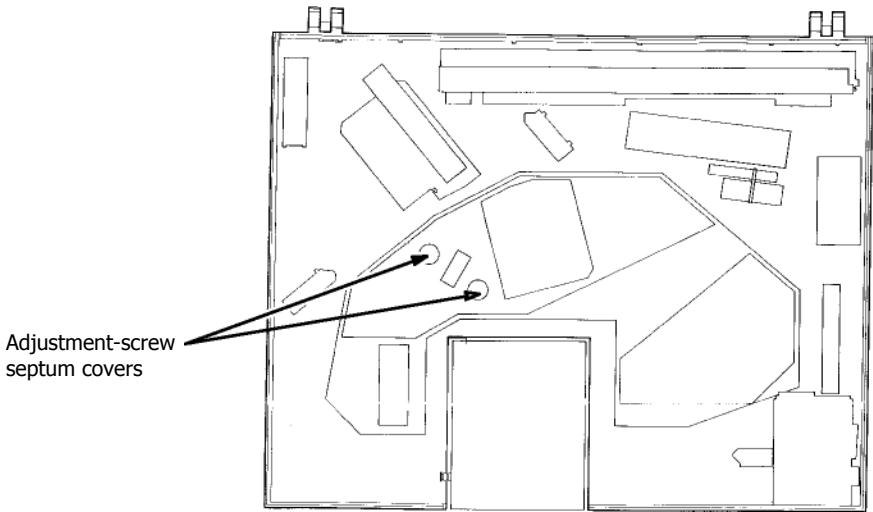


Figure 8 Location of the Adjustment-Screw Septum Covers

NOTE: The interferometer has been aligned at the factory and should only need to be optimized by the adjustment during the installation procedure. For this reason, it is important that you do not turn the screw more than a quarter-turn in each direction during the following procedure.

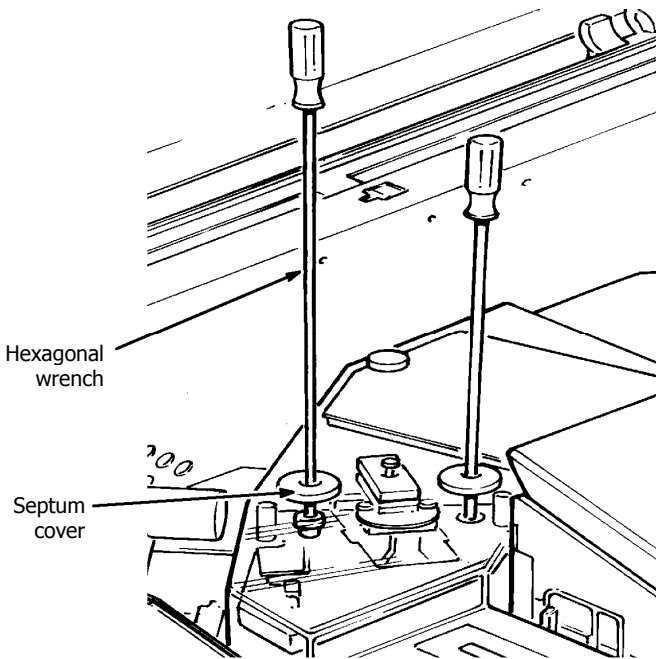


Figure 9 Use of the Hexagonal Wrench

1. Insert the smaller hexagonal wrench through the left-hand septum cover such that the handle of the wrench is at an angle of about 6° towards the left front corner of the instrument.
2. Push the wrench down onto the top of the adjustment screw (a depth of about 4 cm) as shown in Figure 9. Gently rotate the wrench until it drops into the top of the adjustment screw.
3. Turn the screw a quarter-turn clockwise and then a quarter-turn counterclockwise to familiarize yourself with the feel of turning the screw.
4. Remove the hexagonal wrench from the left-hand septum cover and insert it into the right-hand septum cover such that the handle of the wrench is at an angle of about 6° towards the left front corner of the instrument.

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5. Push the wrench down through the hole in the metal plate and onto the top of the adjustment screw below (a depth of about 11.5 cm) as shown in Figure 9. Rotate the wrench until it drops into the top of the adjustment screw.
6. Give the screw a quarter-turn clockwise and then a quarter-turn counterclockwise to familiarize yourself with the feel of turning the screw.
7. Remove the hexagonal wrench.
8. Close the main cover and lock it by turning the locking screw clockwise until it becomes difficult to turn.
Do not overtighten the locking screw because this may cause damage to the main cover.
9. Push the Spectrum RX I back on the bench, to the position required.

Unpacking the Screen

1. Carefully remove the screen from the shipping carton.

NOTE: We recommend that you do not attach the base supplied with the screen. With the screen in the lower position there is a better visual alignment between the soft keys on the Spectrum RX I keypad and the soft key labels that will appear at the bottom of the screen.

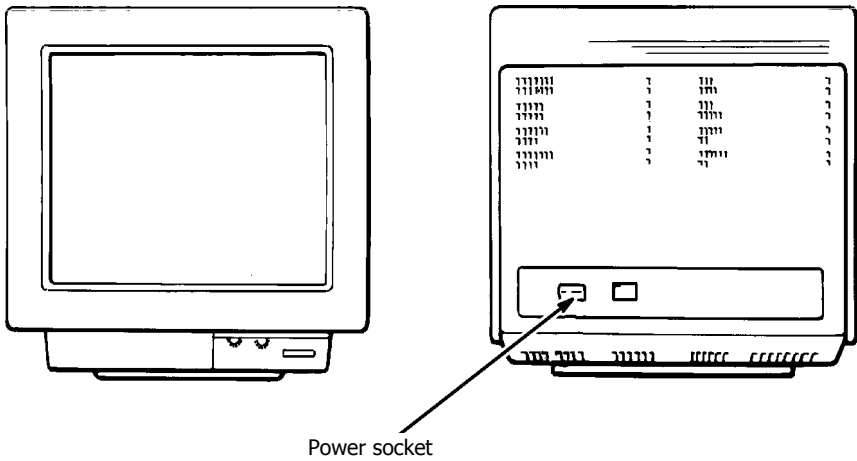


Figure 10 The Screen

2. Connect the power cable to the socket on the rear of the screen (Figure 10).
3. Connect the communication lead from the monitor into the **MONITOR** port on the right-hand side of the Spectrum RX I (Figure 11).

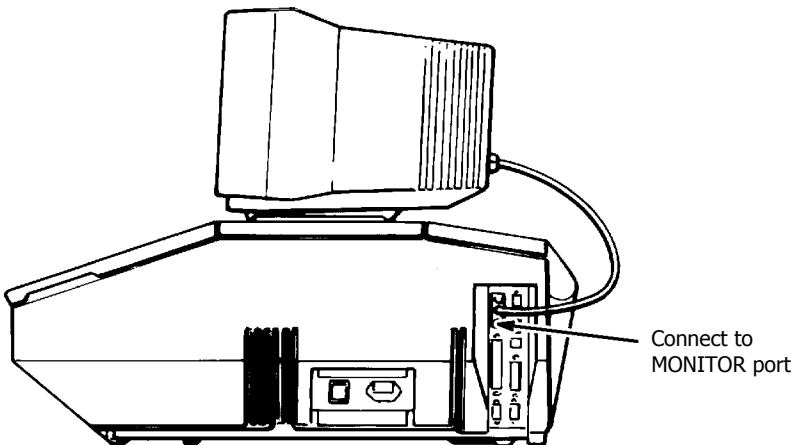


Figure 11 The Screen Connected to the Spectrum RX I

4. Position the screen on top of the Spectrum RX I as shown in Figure 12.

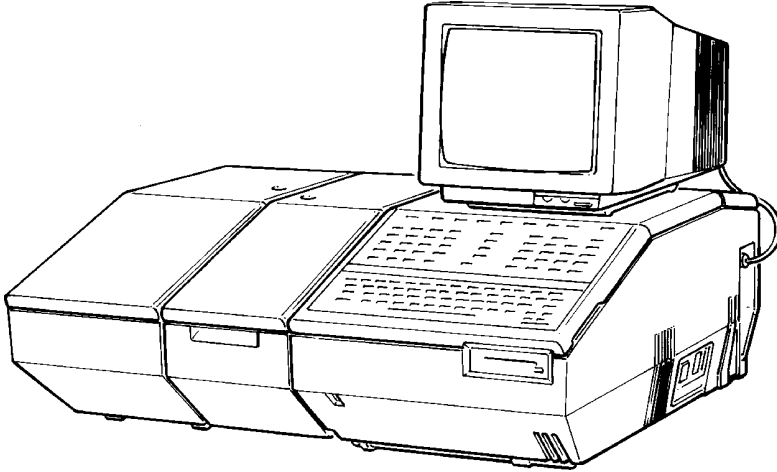


Figure 12 The Spectrum RX I and the Screen

Installation

NOTE: It can take the Spectrum RX I up to 2 hours to equilibrate after it has been switched off overnight. To save time, we suggest that you leave the Spectrum RX I switched on at all times.

1. Connect the Spectrum RX I power cable to the socket on the right-hand side of the Spectrum RX I.

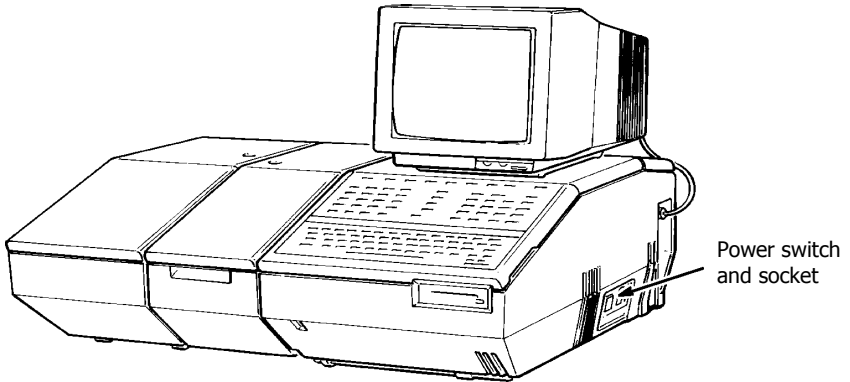


Figure 13 The Spectrum RX I Power Socket

2. Connect both power cables to the power supply.
3. Switch on the power to the screen, using the switch on the front.
4. Switch on the power to the Spectrum RX I, using the switch next to the power cable socket.

The Spectrum RX I begins running its start-up diagnostic tests, which are described fully in the Instrument Diagnostics section of Advanced Operations.

Two beeps sound while the screen is still blank. A list of the tests that have been passed appears on the screen during start-up. On completion, the list is replaced by the Installation screen.

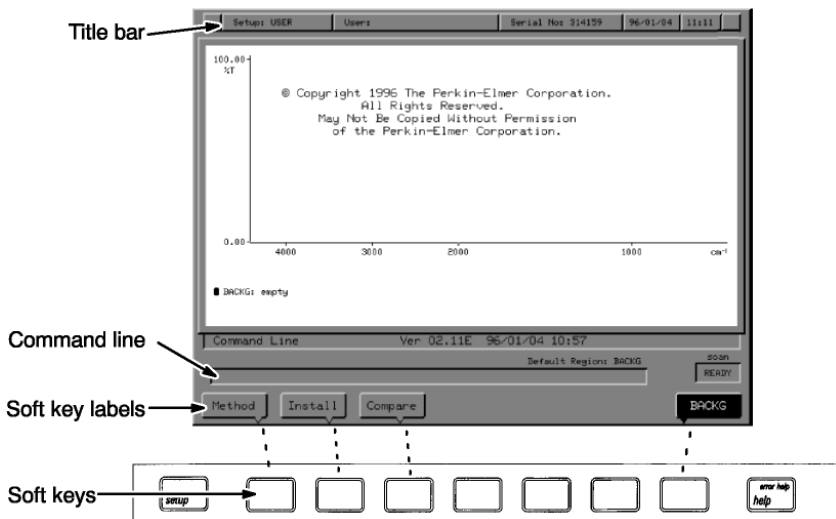


Figure 14 The Installation screen

5. If the Installation screen is not displayed, make sure that:
 - the power supply to both the Spectrum RX I and the screen is properly connected.
 - the brightness and contrast controls on the front of the screen are set appropriately.
6. If the Installation screen is still not displayed, see *Contacting PerkinElmer* on page 43.
7. Adjust the screen display so it is centred on the screen. Refer to the manual supplied with the screen if there are any problems.
8. Position the screen unit such that the pointers on the soft key labels are aligned with the soft keys on the Spectrum RX I.

NOTE: To help align the screen unit with the soft keys, press **setup** and move the screen unit such that the center (method) soft key label is aligned with the center soft key. Press **EXIT** to return to the Installation screen. An example of the alignment of soft keys and soft key labels is shown in Figure 14.

Resetting the Date of Previous Desiccant Change

Six months after the previous desiccant change, the following message is displayed every time you switch on the Spectrum RX I and every time the screen goes into Sleep mode:

Time to change desiccant: see MAINTENANCE chapter of manual.

After you change the desiccant, always reset the date of previous desiccant change so that the reminder message will be displayed again after the specified interval. You can change the interval for your next reminder message (see *Resetting a Maintenance Warning in Advanced Operations*), however, we recommend that you use the default of six months.

Before performing any other tasks after the initial power-up on installation, set the date of the desiccant change:

1. At Ready For Next Command, press

setup OTHERS OTHERS misc maintain desicnt .

The command line and soft keys shown in Figure 15 are displayed.

The screenshot shows a command line interface for setting maintenance parameters. The title bar reads 'Enter date last maintenance performed'. The main display area contains the following text: 'MAINTAIN' on the left, 'item' above 'DESICCANT', 'year' above '96', 'month' above '07', 'day' above '30', and 'interval' above '6'. Below the main display are four soft keys: 'year', 'month', 'day', and 'interval'. To the right of the main display is a 'READY' key, and at the bottom right is an 'EXECUTE' key.

Figure 15 Desiccant Maintenance Warning Command Line

2. If necessary, correct the date by pressing **year**, **month** or **day** and typing the required value.
3. You may also change the interval for your next maintenance warning by pressing **interval** and typing the required value.
4. When the correct data and interval are displayed, press **EXECUTE**

The Spectrum RX I records the date that is in the command line as the date of the last change, as shown in the following screen:



5. Press **EXIT**.

The Spectrum RX 1 records the date that is in the command line as the date of the previous desiccant change. A message is displayed:

desiccant changed

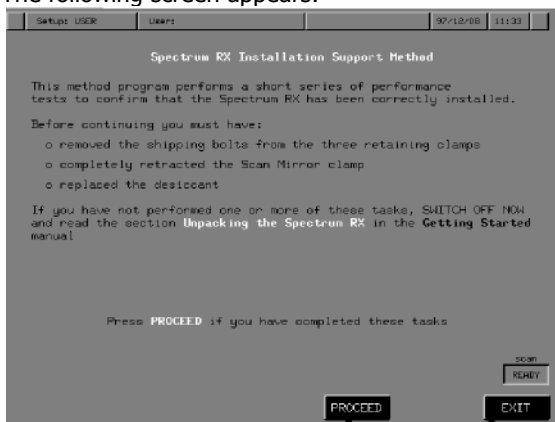
Ready For Next Commands returns.

Install

The Spectrum RX I has a series of performance tests it uses to ensure that it has been installed correctly.

1. To start the checking procedure, press **Install**

The following screen appears:



The procedures for removing the shipping bolts, retracting the scan mirror clamp and renewing the desiccant are in *Unpacking the Spectrum RX I* on page 19.

2. To confirm that the unpacking procedure has been followed, press **PROCEED**

The following screen appears:



A diagram of the sample slide, showing the correct position of the alignment-light control-lever is shown in Figure 16.

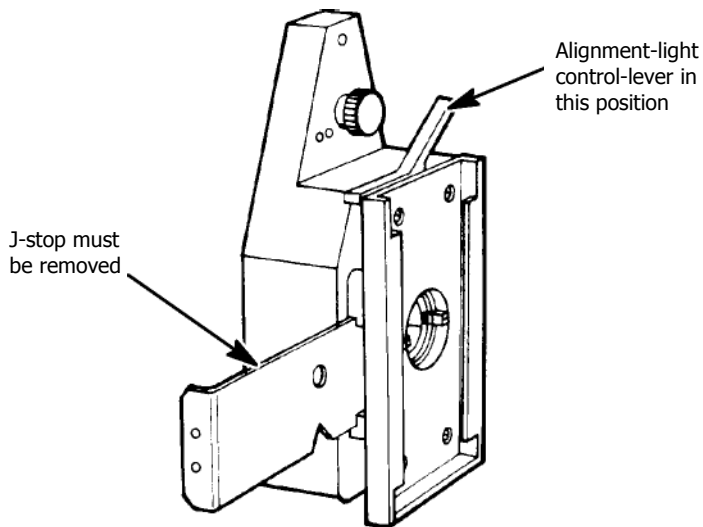


Figure 16 The Sample Slide

3. To confirm that the beam path is clear of all obstructions, press **PROCEED**

The Spectrum RX I starts a series of tests. When it finishes, a confirmation screen appears.

4. At the confirmation screen, press **PROCEED**
The following screen appears:

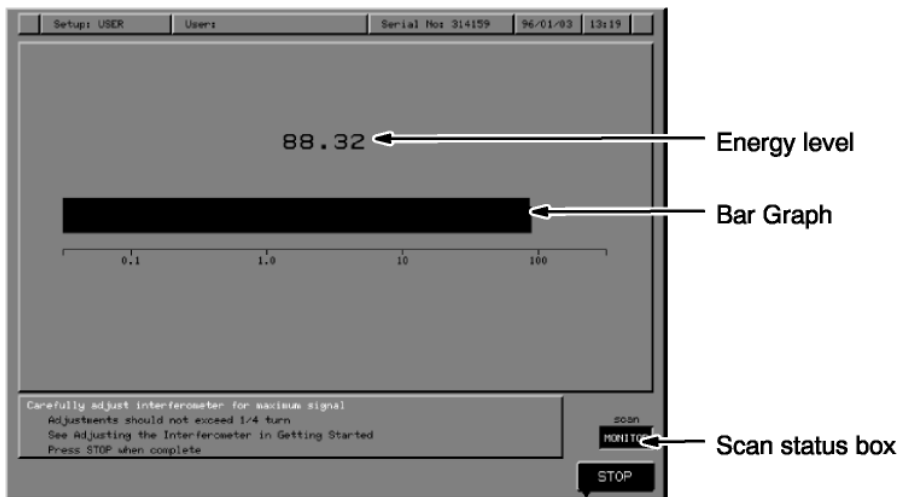


NOTE: At this stage, an error will occur if the scan mirror clamp has not been fully retracted, see *Unpacking the Spectrum RX I* on page 19.

When the tests have been completed and the Spectrum RX I has been switched on for long enough to fully equilibrate, you will be required to adjust the interferometer alignment.

Adjusting the Interferometer

1. When the Spectrum RX I is ready for you to adjust the interferometer, the following screen appears:



The screen for adjusting the interferometer has the following features:

- A bar graph. The greater the energy throughput, the longer the bar.
- The bar is a different color at the right-hand end. This shows the greatest length that the bar has reached.
- A number above the bar. The number is in arbitrary units, related to the amount of energy reaching the detector.

In the following steps, you adjust the interferometer so that the energy is maximized.

2. Remove the two round inserts from the left-hand side of the top of the main cover (Figure 17). To do this, push down the edge of the insert that is near the back of the Spectrum RX I.

The front of the insert lifts up.

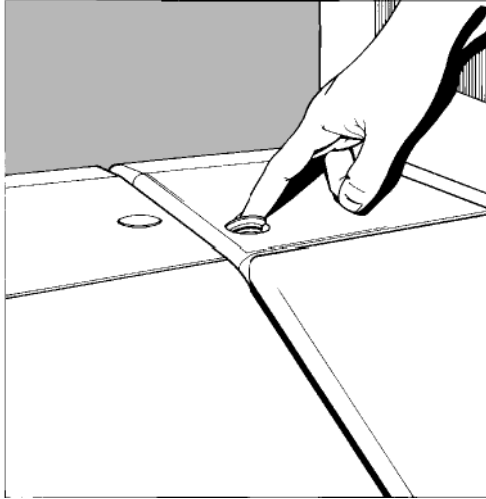


Figure 17 Removing the Inserts

3. Lift away the insert.
A hole is visible below each insert.
4. Insert the smaller hexagonal wrench down the center of the left-hand hole (the handle of the wrench will be at a slight angle towards the left front corner of the instrument).
5. Push the wrench down onto the top of the adjustment screw. Gently rotate the wrench until it drops into the top of the adjustment screw.

NOTE: Scan errors may be caused when the wrench is first engaged. If the scan status box changes to red with the word **ERROR**, wait until the scan has recovered before proceeding. This may take several seconds, and the scan status box will return to **MONITOR** when the instrument is ready to continue.

6. Carefully adjust the screw until the energy bar on the screen is within one whole number of the maximum obtainable.

NOTE: The adjustment is sensitive. The energy should reach the maximum within one half turn of the key.

7. Remove the hexagonal wrench from the left-hand hole and insert it down the center of the right-hand hole (the handle of the wrench will be at a slight angle towards the left front corner of the instrument).
8. Push the wrench down onto the top of the adjustment screw. As you observed while you were unpacking the Spectrum RX I (see *Locating the Interferometer Adjustment Screws* on page 27) the wrench goes down further into this hole than into the other. Rotate the wrench until it drops into the top of the adjustment screw.
9. Adjust this screw also, to give maximum energy.
10. Repeat steps 8 through 13 until you are sure that the energy throughput is maximized.

NOTE: Typically, the maximum energy will be between 90 and 120 units. It should take about three repeats of steps 8 through 13 to achieve an alignment to within 1 whole number of the maximum observed value.

11. Refit the inserts in the holes by pressing down and twisting them into position.

12. Press **STOP**

The instrument performs the following installation checks:

- a series of automatic calibration routines that compensate for the change in alignment;
- a diagnostic scan that confirms the instrument operation;
- a check on the quality of the alignment;
- a series of instrument performance tests.

When these checks are complete, the instrument creates an installation report.

Contacting PerkinElmer

If the instrument has been damaged during shipment, an error may occur that requires you to contact PerkinElmer.

When you contact your local PerkinElmer service engineer, have the following information available:

- Instrument model;
- Serial number of the instrument.
Given on the information plate beside the power switch on the right-hand side of the Spectrum RX I.
- Details of the error screen shown.

Storing the Results of the Installation

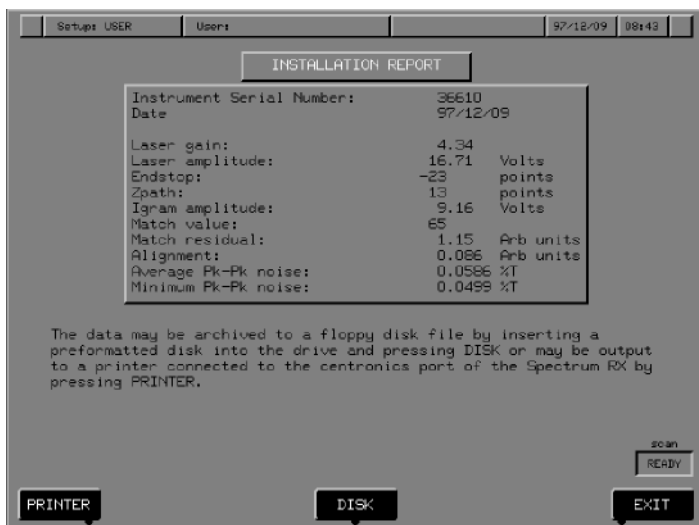
When all the checks have been completed, the first screen of the installation report will be displayed:



NOTE: If this screen shows a warning about excessive noise level, pressing **RETRY** will automatically recheck the signal-to-noise level. This can also be performed manually (see *Determining the Signal-to-Noise Ratio* on page 46).

1. To store the installation report, press **STORE**

The second screen of the installation report appears:



The installation report can be printed or saved to disk:

- Press **PRINTER** to send the report to the printer;
- Press **DISK** to save the report to disk.

The first screen of the installation report screen returns when you choose one of these options.

2. Press **EXIT** to exit from the installation report.

The following screen appears:



The installation procedure is now complete.

3. Press **EXIT** to exit from the installation procedure.

The startup screen appears without the **Install** key.

NOTE: We recommend that you leave your Spectrum RX I switched on overnight and then adjust the interferometer again, see *Adjusting the Interferometer* on page 56.

Determining the Signal-to-Noise Ratio

Although the Spectrum RX I will automatically perform a signal-to-noise ratio during installation, the following section describes how to perform a manual signal-to-noise ratio.

1. Make sure that the sample slide is empty, the Jacquinet stop (J-stop) is removed and the lever for the alignment light is in the off position (Figure 18).

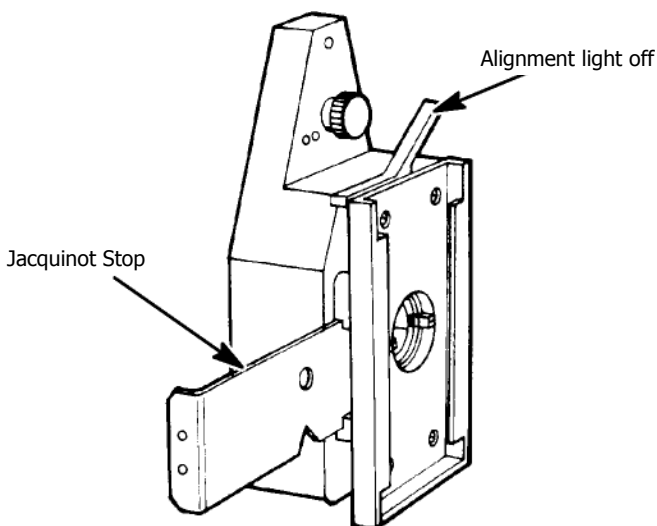


Figure 18 Preparing the Sample Slide.

2. Press **shift** **restore** **setup** **factory**

This ensures that all the instrument parameters are set consistently.

3. Press **scan** **Backg** **16**

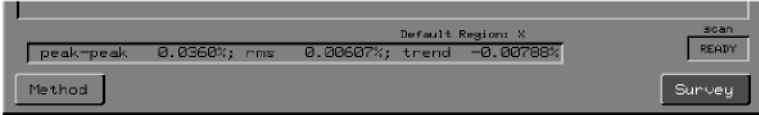
The Spectrum RX I collects 16 background scans. Wait until the scan status box reports **READY** before continuing.

4. Press **scan** **X** **1**

The Spectrum RX I collects a single scan - the 100% line - and ratios it against the 16 background scans. The scan is stored in region X. Wait for the scan to be completed before continuing.

Calculating the signal-to-noise ratio

- Type **noise X 2600 2500** and press **enter**.
The noise in region X over the range 2600 to 2500 cm^{-1} is calculated.
- The three results of **noise** appear in the command line.



The three results (in %T) are:

- **peak-peak** - the peak-to-peak noise;
- **rms** - the root mean square noise;
- **trend** - the linear trend in the noise.

S/N is given by the signal amplitude (in this case, 100%T) divided by the peak-to-peak noise (in the illustration above, 0.0360%T).

When the Spectrum RX I executed the Noise command above, it displayed the results on the screen and also stored those results in its memory. The Spectrum RX I can store up to 100 numeric *V-variables* called V0 through V99. The results of the Noise command were stored in V0, V1 and V2. They remain in these V-variables until the Spectrum RX I is switched off or until they are overwritten (for example, by the results of another command).

You can use the result for peak-to-peak noise that the Spectrum RX I stored in V0 to calculate the S/N.

The value for the peak-to-peak noise stored in V0 is in transmittance, not %T (100 x transmittance = %T). The 100%T line has a transmittance value of 1.0. This means that the S/N is given by $1.0 \div V0$.

- Press **1** **/** **v-var** **0**.
1/V0 appears in the command line.

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8. Press  .

The value for the S/N is reported in the command line. In the example below, the value is 2775:1.



The value expected depends on the type of detector fitted in your Spectrum RX I:

- high-linearity LiTaO₃ detector $\geq 1000:1$

Scanning and Viewing a Spectrum

Now that your Spectrum RX I is fully installed, we suggest that you familiarize yourself with the instrument and install any peripheral devices you have (printers, plotters, and so on).

The installation of peripheral devices is described in the *Communicating with Other Devices* section of *Advanced Operations*.

The next section gives you a brief introduction to collecting spectra with the Spectrum RX I.

Collecting a Background

The **BACKG** and **Survey** keys

Before you collect the sample spectrum, you need to collect a background spectrum. When you have both background and sample spectra, the Spectrum RX I can generate a ratio spectrum, which has background effects removed.

When Fourier Transform Infrared (FT-IR) spectrometers such as the Spectrum RX I are used to collect infrared spectra, the data they collect are influenced not only by the sample, but also by the characteristics of the spectrometer: the infrared source, detector, beamsplitter, and window material all contribute to the spectrum. Also, any infrared-active species in the optical path (in particular, atmospheric CO₂ and water vapor) add to the spectrum.

To remove instrument and atmospheric characteristics, you must collect a spectrum without a sample; this is the background spectrum of the spectrometer. The Spectrum RX I can then divide the sample spectrum by the background spectrum to calculate a ratio spectrum, which is free from background effects.

$$\text{Ratio spectrum} = \frac{\text{Sample spectrum}}{\text{Background spectrum}}$$

1. Make sure that the sample slide is empty, the alignment light is off, and the Jacquot stop (J-stop) has been removed (Figure 19).

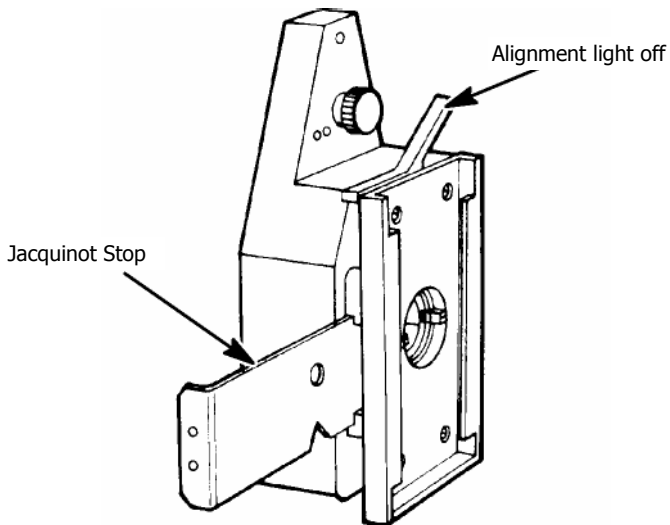
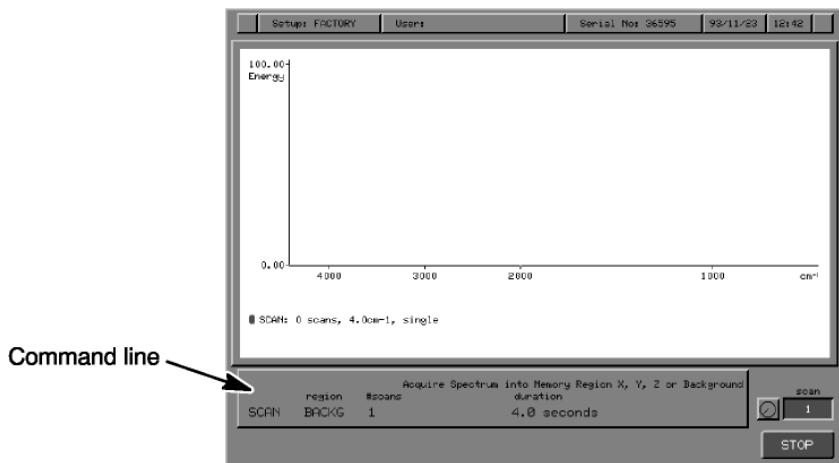


Figure 19 The Sample Slide

2. Press **BACKG**.
The following screen appears.



Notice the following:

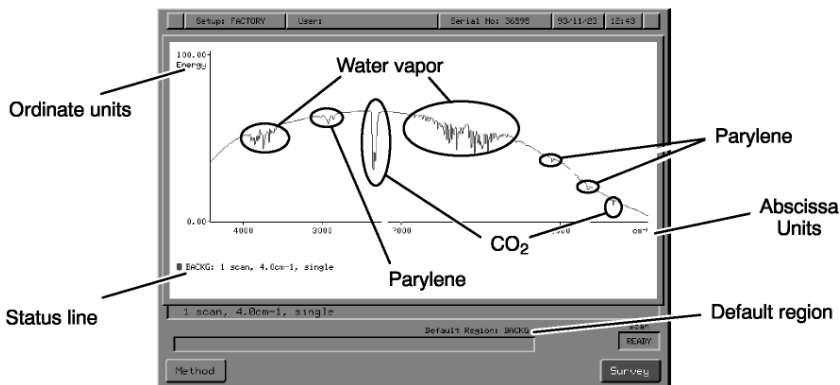
- The command line is now raised, indicating that the Spectrum RX I is no longer waiting for a command.
- The command line reports that the Spectrum RX I is collecting one scan and will store it in the Backg spectrum region.
- The status reports that the scan is in single-beam mode, the mode for background scans.
- A clock face beside the scan status box tells you to wait for a spectrum to be displayed.

When the scan is complete, the background spectrum is displayed briefly. It is immediately replaced by empty axes. Ready For Next Command returns, with **BACKG** replaced by **Survey**.

The background spectrum is not permanently displayed because you are usually not interested in it: you are usually interested in the ratio spectrum of your sample. The ratio spectrum will appear, when you collect it, in the empty axes that are displayed.

3. To display the background spectrum, press **Backg**.

The background spectrum appears. The curved profile of the background spectrum is characteristic of the infrared source, the beamsplitter, the detector, and any window materials in the optical path (for example, the parylene coating of the optics appears as bands between 2975 and 2825 cm^{-1}). Also, atmospheric water vapor appears as bands in the regions 3950 to 3500 cm^{-1} and 1950 to 1300 cm^{-1} , and CO_2 appears as a band in the region 2400 to 2300 cm^{-1} and a sharp band at 662 cm^{-1} .



NOTE: Most of the optical path of the Spectrum RX I is isolated from the atmosphere. The optics are sealed and desiccated, so most of the atmospheric contribution to the background comes from the beam path through the sample compartment. If it is important for you to keep the atmospheric contributions in your spectra to an absolute minimum, you can pass a continuous flow of dry nitrogen through the sample compartment. This is called purging (see the *Collecting Spectra* section of *Routine Operations*).

4. Identify the following features of the Spectrum RX I graphics display:

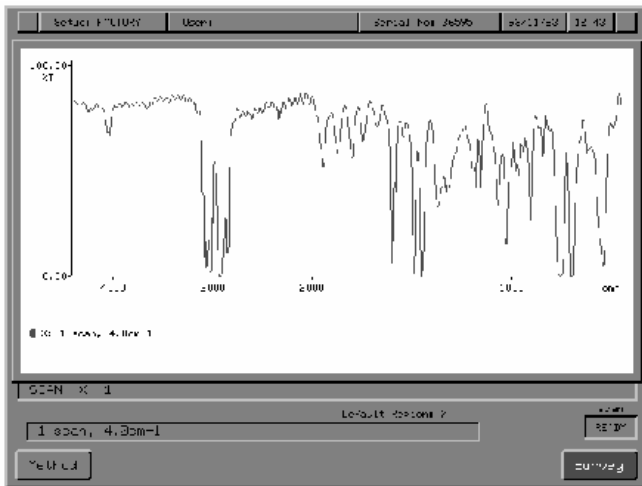
- Abscissa (horizontal axis) and ordinate (vertical axis) units.
- *Status line:* This reports the spectrum region in which the spectrum is stored, the number of scans collected, and the resolution (4.0 cm⁻¹). The colored mark to the left of the region name identifies the color of the related spectrum on the display. This is particularly important when you have more than one spectrum displayed.
- *Default region:* The Spectrum RX I contains four memory regions for the temporary storage of spectral data. These regions are called spectrum regions X, Y, Z, and Backg. The Spectrum RX I always designates one to be the **default region**, the region it uses next unless you specify otherwise.

Collecting a survey scan

BACKG collected one scan and placed it in Backg. Next, you are going to use **Survey** to collect one scan and place it in the X spectrum region.

1. Open the sample compartment lid.
2. Insert the sample of polystyrene film, supplied with the Spectrum RX I, into the sample slide.
3. Close the sample compartment lid.
4. Press **Survey**.

Axes are displayed. When the scan is complete, the spectrum of polystyrene appears. The status line reports that the spectrum is in X.



Using the View Keys

The 12 view keys, located toward the top right of the keypad, enable you to display spectra and manipulate them in various ways.

The region keys


You use the view keys in the top row to select the spectrum region (**X**, **Y**, **Z**, or **Backg**) that you want to view.

1. Press **Backg**.
The background spectrum you collected earlier is displayed.
2. Press **Z**.
Empty axes appear, and the status line reports that the Z spectrum region is empty.
3. Press **Y**.
The status line reports that Y is also empty.
4. Press **X**.
The survey spectrum of polystyrene returns.

The arrow keys

You can use the view keys in the second and third rows to move the displayed spectrum horizontally and vertically.


1. Press **←** once.
The spectrum moves a small step to the left.
2. Press **←** several times in succession.
The spectrum moves several small steps to the left.
3. Press **←** and hold it down.
The spectrum moves to the left, faster and faster.
4. Repeat steps 1 through 3 with **→**.
5. Repeat steps 1 through 3 with the "Horizontal Expand" key (**<>**).
6. Repeat steps 1 through 3 with the "Horizontal Contract" key (**><**).
7. Press **rerange** (**shift** **><**).
The original abscissa range returns.

Repeat the entire procedure above, using the vertical arrow keys rather than the horizontal, and end by pressing **rescale** (**shift** ) to restore the default ordinate limits.

Autex

autex expands the spectrum vertically to fill the display area. The following procedure demonstrates how **autex** behaves with the factory Setup options in effect.

1. Make sure that the polystyrene survey spectrum in region X is displayed.

2. Press **autex** (**shift** )

The spectrum expands vertically to fill the display area of the screen. The limit labels at the top and bottom of the ordinate axis display the changed scale.

3. Move the spectrum with the horizontal arrow keys.

The new ordinate limits do not change as the spectrum moves horizontally.

4. Move the spectrum with the vertical arrow keys.

The ordinate limits update as the spectrum moves vertically.

5. Press **rescale** **rerange** .

The default limits are redisplayed.

Adjusting the Interferometer

The following procedure should be performed after the Spectrum RX I has been left on overnight:

1. At Ready For Next Command, press **monitor**.

The Monitor command line and soft keys appear.

2. Press **energy**.

The display shown in Figure 20 appears. It has the following features:

- A bar graph. The greater the energy throughput, the longer the bar.
- A pointer at the right end of the bar. This indicates the greatest length the bar has reached.
- A number above the bar. The number is in arbitrary units, related to the amount of energy reaching the detector.

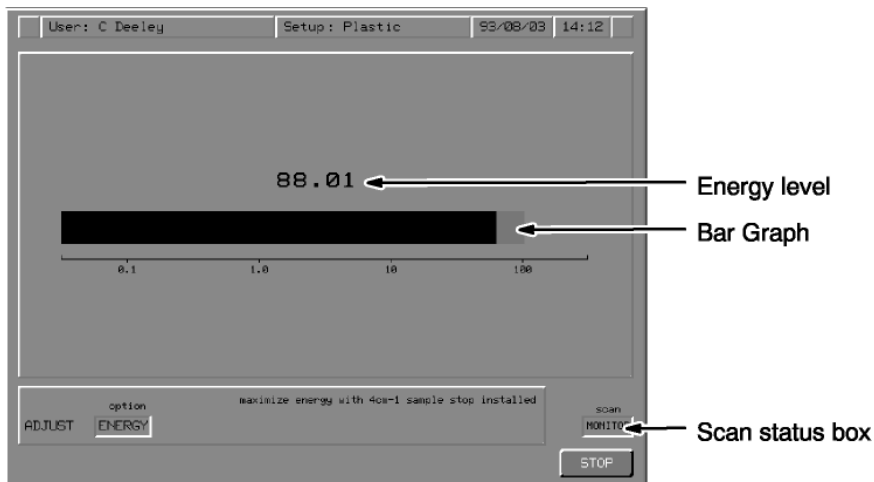


Figure 20 Monitoring the Energy Throughput

In the following steps you adjust the interferometer so that the energy is maximized.

3. Remove the two round inserts from the left-hand side of the top of the main cover (Figure 21). To do this, push down the edge of the insert that is near the back of the Spectrum RX I.

The front of the insert lifts up.

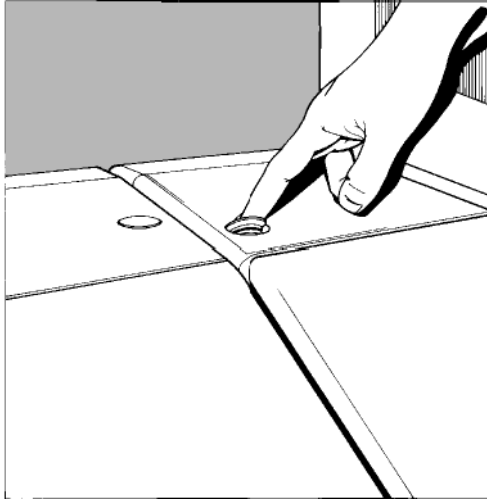


Figure 21 Removing the Inserts

4. Lift away the insert.
A hole is visible below each hole.
5. Insert the smaller hexagonal wrench (3/32 inch) into the left-hand adjustment screw for the interferometer, as follows:
 - a. Insert the wrench through the hole on the left.
 - b. Tilt the wrench toward the left front corner of the instrument at an angle of 6°.
 - c. Push the wrench in as far as it goes.
 - d. Gently rotate the wrench until it drops into the head of the adjustment screw.

NOTE: Scan errors may be caused when the wrench is first engaged. If the scan status box changes to red with the word **ERROR**, wait until the scan has recovered before proceeding. This may take several seconds, and the scan status box will return to **MONITOR** when the instrument is ready to continue.

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6. Adjust the screw until the energy bar on the screen is at the maximum obtainable.

NOTE: The adjustment is sensitive. The energy should reach the maximum within one quarter-turn of the key.

7. Insert the hexagonal wrench in the hole on the right, also at 6°. The wrench goes down farther into this opening than into the other.
8. Adjust this screw also, to give maximum energy.
9. Repeat steps 5 through 8 until you are sure that the energy throughput is maximized.

NOTE: Typically, the maximum energy will be between 90 and 120 units. It should take about three repeats of steps 5 through 8 to achieve an alignment to within 1 unit of the maximum observed value.

10. Refit the inserts in the holes by pressing down and twisting them into position.
11. Press **STOP**.
Ready For Next Command returns.

Related Documents

The Spectrum RX I is supplied with two other manuals on a CD to help you to get the most out of the instrument:

Routine Operations covers the tasks that you are likely to do regularly: collect, view and plot spectra, and so on.

Advanced Operations covers topics that you require less frequently, for example: maintenance, instrument diagnostics, and typed commands.

To view these manuals you will need Adobe Reader which is available free from www.adobe.com.

