Raman IdentiCheck

Getting Started Guide

PerkinElmer®
For the Better

Release History

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Introduction

About This Manual

This Getting Started Guide contains all of the information that you will need to setup your Raman IdentiCheck and start collecting spectra.

The Getting Started Guide is divided into the following chapters:

Introduction

This chapter contains an overview of this manual, and the conventions and warnings used.

Safety Practices

This chapter outlines the electrical and laser safety issues. It also provides information on the transportation of your Raman IdentiCheck to the site where it is to be used, and setting it up ready for use once you get there. We recommend that all users read this chapter.

Raman History, Theory and Instrumentation

This chapter contains a brief overview of the history and theory of Raman spectroscopy.

Introduction to the Raman IdentiCheck

This chapter gives an overview of the instrument, and contains an introduction to the spectrometer and the triggered fiber optic probe.

Using the Raman IdentiCheck

This chapter contains a number of Standard Operating Procedures (SOPs). These are a series of procedures which describe how to perform certain tasks, for example how to collect a spectrum, or how to calibrate the spectrometer.

Maintenance and Troubleshooting

This chapter contains information on how to maintain the system and solutions to problems you may encounter.

Appendix A: Using your own PC

This appendix contains information on the steps you need to carry out if you intend using your own PC with the Raman IdentiCheck.

Conventions Used in this Manual

Normal text is used to provide information and instructions.

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

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

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

Notes, Cautions and Warnings

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

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

CAUTION	*We use the term **CAUTION** to inform you about situations that could result in **serious damage to the instrument** or other equipment. Details about these circumstances are in a box like this one.*
D	***Caution (Achtung)*** *Bedeutet, daß die genannte Anleitung genau befolgt werden muß, um einen **Geräteschaden** zu vermeiden.*
DK	***Caution (Bemærk)*** *Dette betyder, at den nævnte vejledning skal overholdes nøje for at undgå en **beskadigelse af apparatet**.*
E	***Caution (Advertencia)*** *Utilizamos el término **CAUTION** (ADVERTENCIA) para advertir sobre situaciones que pueden provocar **averías graves en este equipo** o en otros. En los recuadros como 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**.*

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

D

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

DK

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

E

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

F

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

I

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

NL

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

P

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

Safety Practices

Overview

This chapter contains details of safety practices. Everyone who is going to setup and/or use the Raman IdentiCheck must read and follow the precautions before unpacking, installing or using the instrument.

Before performing any of the operations outlined in this manual, read all of the safety practices and instructions, and make sure that you understand the procedures explained.

If you do not understand any of the details regarding general safety precautions, please contact PerkinElmer before proceeding.

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General Operating Conditions

WARNING

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

The Raman IdentiCheck spectrometer has been designed and tested in accordance with PerkinElmer specifications and in accordance with the safety requirements of the International Electrotechnical Commission (IEC). The Raman IdentiCheck conforms to IEC 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 2006/95/EC.

The instrument is designed to operate in a covered environment where it is sheltered from weather conditions such as direct sunlight, rain, sleet and snow. The instrument is designed to be shower-proof when the lid is closed.

CAUTION

The IdentiCheck must always be used with the lid of the transport case open and the air filters clear of any obstruction.

The instrument has been designed to operate under the following conditions:

- Altitude up to 2000 m.
- Ambient temperatures of 5 °C to 35 °C.

  The temperature range for optimal performance is 15 °C to 30 °C: this range being defined by the requirements of NIST calibration.
- A maximum ambient relative humidity of 80% (non condensing) for temperatures up to 35 °C.

NOTE: The performance of the instrument will be affected by the ambient temperature and humidity. At elevated temperatures the internal camera may shut down in order to prevent it being damaged. This is indicated by a beep.

- Mains fluctuations not exceeding ±10% of the nominal voltage.

If the electricity supply does not conform to these specifications, please consult PerkinElmer prior to installation. If the supply of power is erratic please use an uninterruptible power supply (UPS). Power fluctuations or brown-outs may damage the spectrometer power supply.

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

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

Storage

When not in use, the IdentiCheck should be stored, packed in its case, indoors, at a temperature between −20 °C to 60 °C.

CAUTION	*Do **NOT** store your IdentiCheck in a location that receives direct sunlight; as elevated temperatures generated inside the case may damage the electronics.*

CAUTION	*Do **NOT** store or transport your IdentiCheck turned upside down.*

Electrical Safety

The Raman IdentiCheck spectrometer module comes assembled within a protective housing to prevent exposure to electrical hazards.

WARNING

Removal of the protective housing or external panels is dangerous.

If the protective covers or service panels on the instrument appear to be damaged, turn the instrument off, secure the instrument against any unauthorized operation and contact PerkinElmer for advice before using it again.

Electrical Protection

Insulation: Class I rating for external circuits. Only connect equipment that meets the requirements of IEC 61010-1, IEC 60950 or equivalent standards.

Installation Category: The instruments are 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.

Pollution Degree 2: Normally only non-conductive POLLUTION occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.

Power Supplies

The Raman IdentiCheck is powered by one external power supply unit. The power supply unit can adjust automatically to a variety of AC power sources as outlined in *Table 1 Power supply unit input voltages and mains fluctuations information*. For information on line frequency and current please review the rating plate on the power supply unit.

Input Voltage	Mains Fluctuations
100-230 VAC	±10% of the nominal voltage

Table 1 Power supply unit input voltages and mains fluctuations information

WARNING

Under no circumstances should you attempt to disassemble the power supply unit and carry out repairs. If the power supply unit has a fault, please contact your PerkinElmer Service Engineer. The entire unit must be replaced.

Connect the power supply unit to a three-wire (live, neutral and ground/earth) socket. The ground must be a non-current carrying wire that is connected to the earth ground at the main distribution box.

WARNING

Check the line voltage and frequency of the power point (socket) before the instrument is connected or the power is switched on.

Power Cord

The power cord used to connect the instrument power supply unit to the power point (socket) should be appropriate for the country listed as the shipping destination.

WARNING

If the power cord is not appropriate for your country it must be removed from use immediately and replaced.

If the power cord has any physical damage it must be removed from use immediately and replaced.

To avoid electrical hazards, the ground pin on the power cord should not be interfered with in any way.

Fuses

WARNING

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

The only fuses that you may have to replace are those in the mains power cords (UK only).

EMC Compliance

EC directive

The Raman IdentiCheck has been designed and tested to meet the requirements of the EC directive 2004/108/EC. The Raman IdentiCheck complies with the EMC standard EN61326 (EMC standard for electrical equipment for measurement, control and laboratory use), and EN55011 (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

Details of the IdentiCheck laser source are summarized below.

Laser Specification	
Class	3B
Wavelength	785 nm
Power output	250 mW (max)

IdentiCheck complies with the requirements of IEC 60825-1:2007 and 21CFR 1040.10 FDA performance standards for laser products, except for deviations pursuant to Laser Notice No. 50, dated 26 July 2001.

WARNING

Use of controls or adjustments or the performance of any procedures other than those specified in this document may result in exposure to hazardous laser radiation.

WARNING

Removal of the protective housing or external panels is dangerous.

If the protective covers or service panels on the instrument appear to be damaged, turn the instrument off, secure it against any unauthorized operation and contact PerkinElmer for advice before using the instrument again.

The triggered fiber optic probe (TFOP) provides a focused beam of laser radiation (100 mW at 785 nm).

During normal operation laser radiation is accessible from the end of the probe. The output energy should be enclosed whenever possible (using an enclosure or a beam attenuator) to avoid unnecessary exposure to laser radiation.

WARNING

Avoid direct exposure to the laser beam.

WARNING

Do not look at the laser light or scattered laser light.

Use protective laser safety goggles, with an optical density (OD) of at least 3 at 785 nm, as a precaution against accidental exposure to the direct or reflected laser light. Suitable goggles are available from PerkinElmer (part number L1323518).

Class 3B Safety Precautions

You should follow Class 3B laser safety precautions such as the use of door interlocks and the wearing of laser safety goggles. For information on these precautions refer to an appropriately trained laser safety officer within your own facility. Laser safety is very important. Inappropriate use of laser emitting devices may result in permanent injury. In the United States the precautions are described in the ANSI Z136.1-2000 Standard. For information on the ANSI Z136 standard please consult your laser safety officer and/or consult http://www.z136.org. Outside the United States the guidelines are described in PD IEC TR 60825-14 (Safety of laser products–Part 14: A user's guide). You should also be familiar with the guidelines published by the national authorities in your country.

The following information is provided as a general overview. This information is rudimentary and is supplied to assist in the interpretation of this manual. Under no circumstances use this information as the basis of a laser safety code of behavior:

1. Class 3B lasers may emit visible and/or invisible radiation up to a maximum of 0.5 W continuous wave (CW is longer than 0.25 s). They present a hazard to the eye if the direct beam or specular reflections are viewed without appropriate protection. You must only operate Class 3B lasers in a designated area.

2. You must fit each Class 3B device with a captive key control switch, such that the key cannot be removed from the lock except in the OFF position. The key should be removed from the laser when it is not in use and kept in a safe place in the custody of a nominated person. Keys must never be issued to unauthorized persons.

3. Each Class 3B device should be assessed by a suitably trained laser safety officer to determine the accessible radiation emitted by the device. The laser safety officer should consider laser power, wavelength and beam divergence when determining if the Class 3B device's remote interlock connector should be connected to an interlock switch at the entrance. For certain laser systems, the laser safety officer may require the shutter to be interlocked with the laboratory entrance in order to prevent inadvertent exposure of persons entering to very hazardous laser radiation.

4. Rooms in which Class 3B devices are used should have notices affixed to the doors so that they conform to the requirements of appropriate Laser Safety Regulations.

General Laser Safety Issues

Laser Keyswitch

There is a captive laser key control switch on the top panel of the Raman IdentiCheck. This key is required to operate the laser. A laser safety officer should control the use of this key.

Laser Warning Labels

Laser warning labels are attached to the instrument for your safety. Please observe the necessary precautions. For more details see *Warning Labels* on page 24.

Triggered Fiber Optic Probe Safety

When attached to the Raman IdentiCheck, a triggered fiber optic probe (TFOP) provides a focused beam of Class 3B laser radiation. During normal operation, laser radiation is accessible from the end of the probe.

The following precautions must be observed at all times:

- Keep the protective cover in place on the probe tip when the probe is not in use. If you are using the TFOP with a plastic spacer, always rotate the spacer so that the screw is beneath the probe barrel when not in use; when in this position the spacer acts as a lens cap.
- Never look directly into the laser beam or at the laser light scattered from a reflective surface or sample. Permanent eye-injury may result. Do NOT attempt to examine the probe tip when the Path Active light on the probe is lit.
- Post warning signs near the laser operating areas.
- Controlled access areas, limited to individuals trained in the safe operation of lasers, are suggested for laser operations.
- When the probe is in use, always ensure that no stray laser radiation is directed at people in the vicinity.
- Use protective laser safety goggles, with an optical density (OD) of at least 3 at 785 nm, as a precaution against accidental exposure to the direct or reflected laser light. Suitable goggles are available from PerkinElmer (part number L1323518).
- Do not use the TFOP if it shows any sign of damage.
- If repair or servicing is needed, call your PerkinElmer Service Representative for advice.

Calculation of Nominal Hazard Zones for use of Fiber Optic Probe

The following calculations show how to calculate a nominal hazard zone. These calculations are taken from ANSI Z136.1-1933. A laser safety officer uses these calculations to help define how to use your Raman probe safely in your environment.

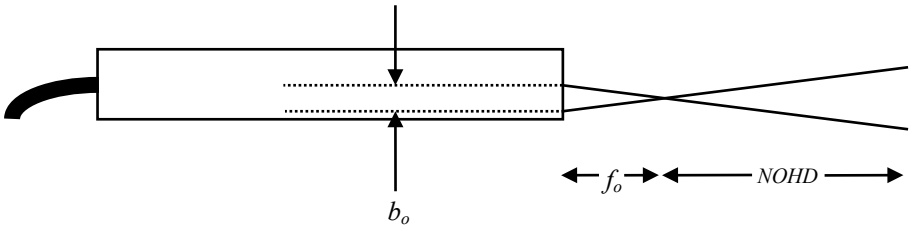


Figure 1 Probe parameters used to calculate the nominal ocular hazard distance

The equation for a focused beam as given here (Figure B5 in ANSI Z136.1-1933) is used to calculate the nominal ocular hazard distance (NOHD) for the TFOP. The equation is:

$$NOHD = \left(\frac{f_o}{b_o}\right)\left(\frac{4\Phi}{\Pi.MPE}\right)^{1/2}$$

Where:

f_o = Probe focal length (cm)

b_o = Diameter of laser beam incident on probe focusing lens (mm)

Φ = Total radiant output power of probe (watts)

MPE = Maximum permissible exposure (J cm^{-2})

For the TFOP b_o is 0.254 cm therefore the above equation can be simplified to give:

$$NOHD = 4.442.f_o\left(\frac{\Phi}{MPE}\right)^{1/2}$$

For the wavelength range 700–1050 nm the MPE for a 10 second exposure can be calculated from:

$$MPE = \left[(10.1)\left(10^{2(\lambda-0.7)}\right)\right]10^{-4}\ \text{J cm}^{-2}$$

Where λ is the laser wavelength in micrometers (μm). For example, a laser wavelength of 785 nm (0.785 μm) will have an MPE value of 1.49 x 10^{-2} J cm^{-2} or 1.49 x 10^{-3} W cm^{-2} for a 10 second exposure or longer. Table 2 shows the calculated nominal ocular hazard distance for 785 nm Raman systems.

Table 2 Nominal Ocular Hazard Distance (NOHD) for 785 nm

Probe focal length / mm	NOHD for 100 mW exiting fiber optic probe / cm
7.5 (±10%)	27.3

NOTE: Other focal lengths are available; contact PerkinElmer for details. In particular, the use of an ultra-long working distance lens adaptor (part number L1320071) provides a working distance of 25 mm. Where different focal lengths are used, the NOHD should be calculated accordingly.

Internal Interlock System

There is no internal interlock system fitted to the Raman IdentiCheck. If instrument panels are removed collimated laser light may be visible. Under no circumstances remove any instrument panels.

External Interlock System

Class 3B laser systems have the potential to cause harm or injury to those using them or others in the vicinity of the instrument. For more information refer to *Attaching the External Interlock Override* on page 41.

The Raman IdentiCheck has been designed for use outside of a laboratory, with the external interlock overridden.

WARNING

The Raman IdentiCheck should not be left unattended when the laser safety key is in place.

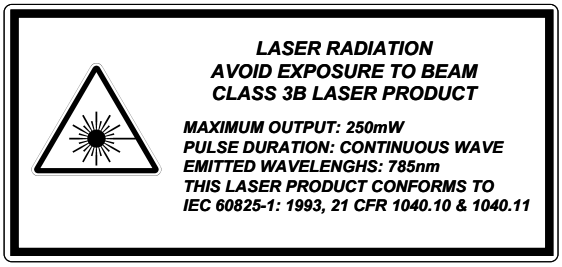
The laser should always be turned off and the key removed when the system is not in use.

Warning Labels

When this label is attached to an instrument it means refer to the manual to find out the nature of the potential hazard and any actions which have to be taken.

Safety Labels on the Raman IdentiCheck

The following labels are displayed on the top panel of the Raman IdentiCheck:



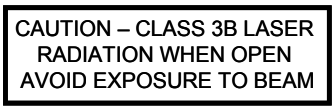


Figure 2 Labels on the Raman IdentiCheck

Moving the Instrument

Before you move the instrument, you should ensure that the components, including the triggered fiber optic probe and, if appropriate, the tablet PC are securely packed within the transport case and the straps secured. The external interlock override, cables, etc., should be stored in the cable bag. Finally, you should ensure that the lid of the transport case is clipped shut.

Transporting the instrument without the use of the shipping carton may affect the performance of the instrument. We recommend using the shipping carton when moving the instrument over long distances.

The Raman IdentiCheck weighs ~30 kg (including the optional tablet PC and the power supply unit). To avoid injury or damage to the instrument, please use proper lifting techniques.

WARNING

The IdentiCheck transport case is fitted with wheels and can be pulled along by one person.

To lift the instrument safely requires two people.

CAUTION

*Do **NOT** store or transport your IdentiCheck turned upside down.*

Siting the Instrument

Adverse environmental conditions will affect the quality of the results obtained from the instrument. In particular, major changes in temperature should be avoided. When moving between environments where the temperature difference is more than 10 °C, you should leave the instrument to stabilize before starting to collect data.

The following conditions should be observed, as far as is practicable, in order to obtain the best results.

- The instrument should be set up on a surface that is flat and level.
- Any supporting surface must be strong enough to support the combined weight of the instrument and any ancillary equipment without warping or wobbling.
- There must be two power points available (one for the instrument power supply unit and one for the PC).
- Floor vibrations or noise from heavy manufacturing equipment can affect the performance of the instrument.
- Avoid proximity to intense magnetic fields.
- Never place the instrument near a window that receives direct sunlight.

We recommend that you use the instrument in a room which meets the appropriate safety requirements for a Class 3B laser product.

Ensure all users understand laser safety issues before locating and using the instrument. Consult your laser safety officer and perform a risk assessment before using the equipment.

For further information on IdentiCheck operating conditions see *General Operating Conditions* on page 13.

Raman History, Theory and Instrumentation

The History of Raman Spectroscopy

Inelastic light scattering was first predicted in 1923 by A.G. Smekal in Germany. Research carried out by A. H. Compton discovered inelastic scattering of X-rays, which led the Indian scientist C. V. Raman to investigate this phenomenon. Raman and his assistant Krishnan observed what came to be known as the Raman effect (Figure 3) for the first time in 1928. They separated the blue light from sunlight and observed the scattering from water and alcohol visually. In addition to the blue incident light, a faint green light also scattered, later named Stokes scattering. By the 1930's much of the theory underlying Raman scattering was understood, but due to the complexity of the instrumentation the initial interest in Raman spectroscopy was not maintained. Improvements in charge-coupled device (CCD) detectors, filters and lasers over the past 25 years have radically simplified Raman instrumentation, and interest in Raman spectroscopy has been renewed. Lasers are ideal excitation sources for Raman because they give highly monochromatic radiation and provide high irradiances at the sample.

Raman Theory

When photons from a monochromatic light source impinge on a sample, a small fraction are scattered in all directions. Most of the scattered photons are of the same energy as those of the incident beam, and hence the same frequency, giving rise to Rayleigh scattering (Figure 3).

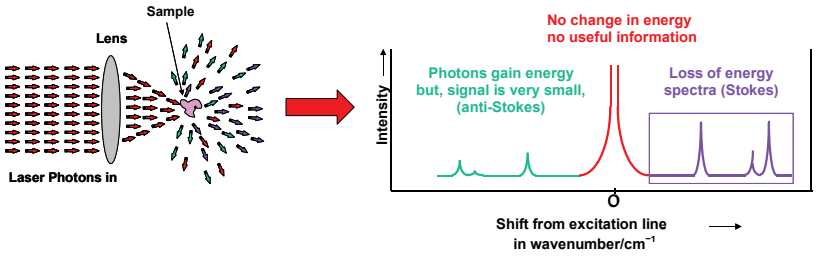


Figure 3 The Raman effect: Irradiation of sample and subsequent scatter

Some photons will be inelastically scattered and will be detected at either longer wavelengths (lower frequencies, ν′, Stokes scattering) or shorter wavelengths (higher frequencies, ν″, Anti-Stokes scattering). With Stokes scattering, some of the incident photons give up a portion of energy to the molecules and are detected at a lower frequency (longer wavelength) than the Rayleigh radiation (Figure 4).

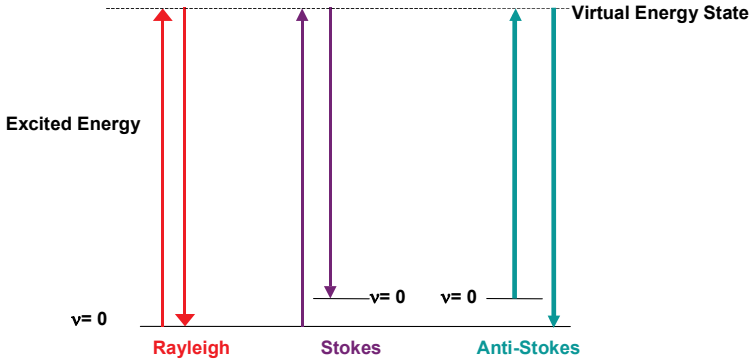


Figure 4 Rayleigh, Stokes and Anti-Stokes Scattering

The change between the incident radiation and the Stokes/Anti-Stokes radiation represents a change in the vibrational and/or rotational energy of the molecule. The frequency shifts from the frequency of the incident beam are displayed on the x-axis of a Raman spectrum, generally in relative wavenumbers (otherwise known as Raman Shift) and the intensity of the bands are displayed in arbitrary units on the y-axis.

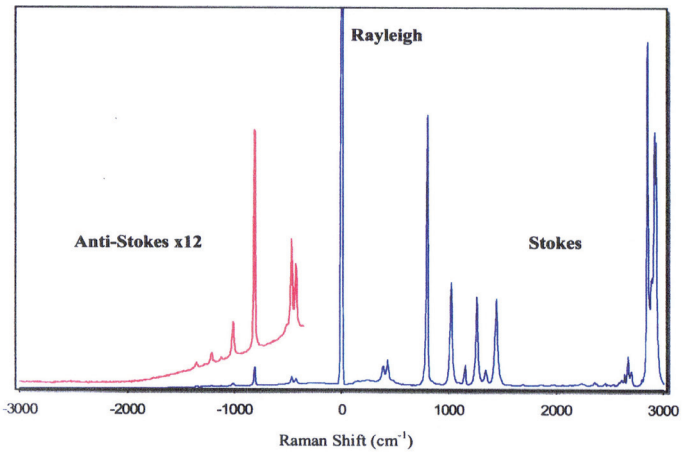


Figure 5 Raman spectrum of cyclohexane, showing Stokes, anti-Stokes and Rayleigh scattering

Spectrometers

The Raman IdentiCheck includes a Raman spectrometer with laser excitation wavelength at 785 nm.

The instrument is composed of a laser, mirrors, fiber optics, filters, lenses, spectrograph and a CCD detector. The laser supplies light through an optical pathway onto the sample through the fiber optic probe. The scattered light from the sample is collected and transmitted back to the spectrometer.

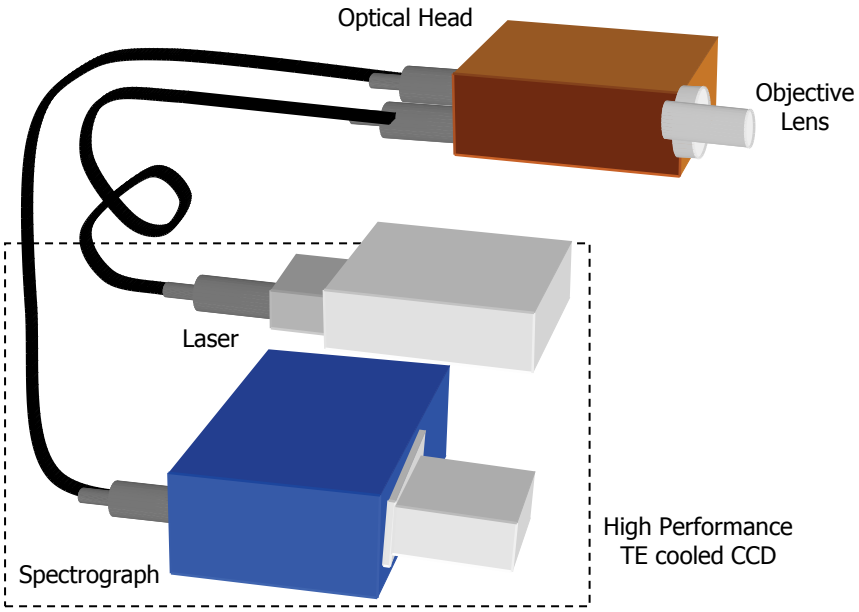


Figure 6 Schematic of the Raman IdentiCheck

Spectrograph Detector Systems

The Raman IdentiCheck is equipped with an Echelle spectrograph.

The Echelle Spectrograph

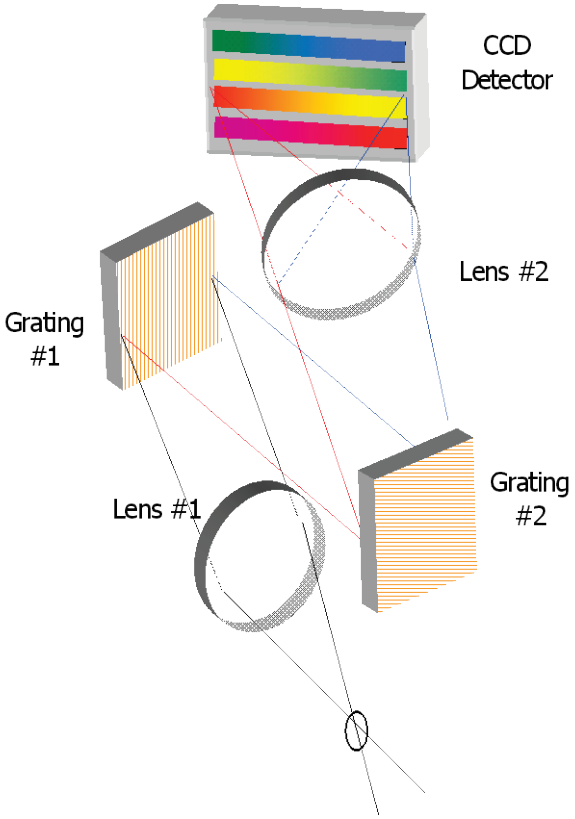


Figure 7 Schematic of the Echelle Spectrograph

PerkinElmer's Echelle detector is shipped in the Raman IdentiCheck. The system contains two components; the Echelle spectrograph and a two-dimensional CCD detector. The system works by dispersing the light in two dimensions by using two gratings (Figure 7). The first grating disperses the light horizontally onto the second grating, where the light is further dispersed vertically onto the CCD detector. The light is spread over a number of strips on the CCD that are read simultaneously, therefore a full spectral range (at high resolution) can be achieved with one acquisition.

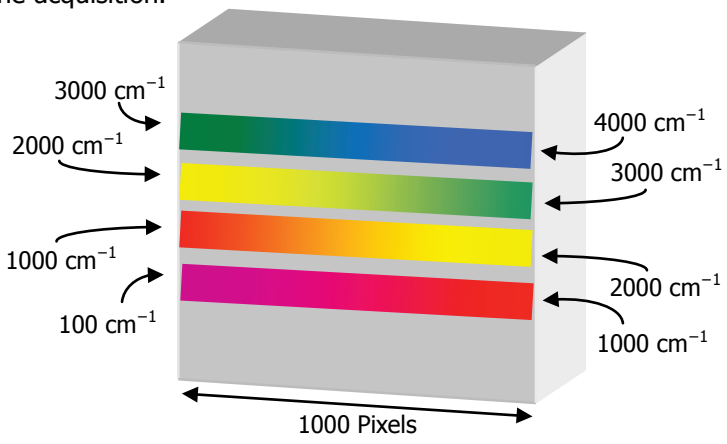


Figure 8 Strips of light on the CCD detector using the Echelle spectrograph.

Range 1 + Range 2 + Range 3 + Range 4 = Complete Spectrum (all ranges acquired simultaneously).

Figure 8 shows a schematic diagram of light falling on the CCD detector. Here 4 strips of light are shown for clarity, but in practice 8 or 10 strips are acquired and resolution of up to 2 cm^{-1} (peak FWHM) can be achieved.

The advantages of PerkinElmer's Echelle spectrograph are:

- Full spectral range at high resolution in a single acquisition.
- It takes less than a second to acquire a high resolution spectrum with a full spectral range.
- There are no moving parts in the spectrograph, which improves instrument reliability, ruggedness and the quality of calibration.
- The absence of moving parts also means that as you acquire the spectrum, there is no change in the spectrograph's stray light performance, meaning that there are no stitch marks in the final spectrum.

No light is lost, all the light goes onto the detector, and all the strips are read out simultaneously. The concept of an Echelle detector is not unique to PerkinElmer. Echelle detectors are commonly used in applications where high resolution and wide spectral range are required. Examples include plasma spectroscopy (ICP and LIBS) and Echelle detectors find very widespread use in astronomy.

Introduction to the Raman IdentiCheck

Overview

A Raman IdentiCheck has the following major components:

- A Raman spectrometer, built into a transport case, with wheels and a carrying handle
- A power supply unit
- A 5 meter triggered fiber optic probe (a 20 meter option is available; as are other types of probe)
- A tablet or laptop PC

This chapter provides an introduction to these components and also describes how to unpack and prepare your IdentiCheck for use.

Figure 9 Raman IdentiCheck

Specifications

Raman IdentiCheck	
Weight	~30 kg (including optional tablet PC and PSU)
Height	353 mm
Width	622 mm
Depth	492 mm
Laser Class	Class 3B
Operational Temperature	5 °C (41 °F) – 35 °C (95 °F)
Optimal Temperature	15 °C (59 °F) – 30 °C (86 °F)
Humidity	Max 80% (non condensing)
Power Supply	100–230 V ±10%, 50–60 Hz
Power Consumption	50 W (max)

If the electricity supply does not conform to these specifications, please consult PerkinElmer prior to installation. If the supply of power is erratic please use an uninterruptible power supply (UPS). Power fluctuations or brown-outs may damage the spectrometer power supply.

Unpacking the Instrument

When the instrument has been delivered, allow it to equilibrate to room temperature for at least 12 hours before opening. The instrument may have been stored at low temperature prior to delivery and you should allow it to equilibrate to stop moisture condensing on the internal electronics and optics.

When unpacked, check the Raman IdentiCheck for any physical damage. If there is any damage, do not continue with the installation. Contact your PerkinElmer Customer Care Representative immediately.

Spectrometer Parts

Part Number	Description
L1320090	Raman IdentiCheck Spectrometer module
LX108870 OR LX108871	Spectrum Std for Raman Software Kit Contains the IR & Raman Applications CD (LX100884), the Raman Instrument Installation Disk (LX108925), the Raman Instrument Configuration Disk (LX108869) Spectrum ES for Raman Software Kit Contains the Spectrum ES Software CD (LX100881), the Raman Instrument Installation Disk (LX108925), the Raman Instrument Configuration Disk (LX108869)
L1321884	Mains PSU (supplied with country-specific power cable)
L1320264	External Interlock Override
L1320845	1 m USB Cable (for PC to spectrometer connection)
L1320844	2 m USB Cable (for PC to spectrometer connection)
L1323503	Laser Key (x2)
L1321930	Cable bag
L1181228	Polystyrene sample

Optional Tablet PC

If you have purchased the optional tablet PC provided by PerkinElmer, the following items will be supplied.

Part Number	Description
L9003694 (Italy) OR L9003646 (US) OR L9003695 (UK)	Dell XT-2 Tablet PC
Various	Country-specific power cable
L9003770	External Media Bay (DVD-RW Drive)

Triggered Fiber Optic Probe Parts

Part Number	Description
L1320030	Triggered Fiber Optic Probe, 5 m cable
L1320324	Raman probe fixed spacer kit (7.5 mm)

Manuals

Part Number	Description
L1050002	Spectrum Manuals CD

Spectrometer Module

Right-hand Panel

The right-hand panel of the Raman IdentiCheck (Figure 10) contains:

- 3 LED indicators (see table below for details)
- Laser key switch
- Air filters for the cooling fans
- External interlock override

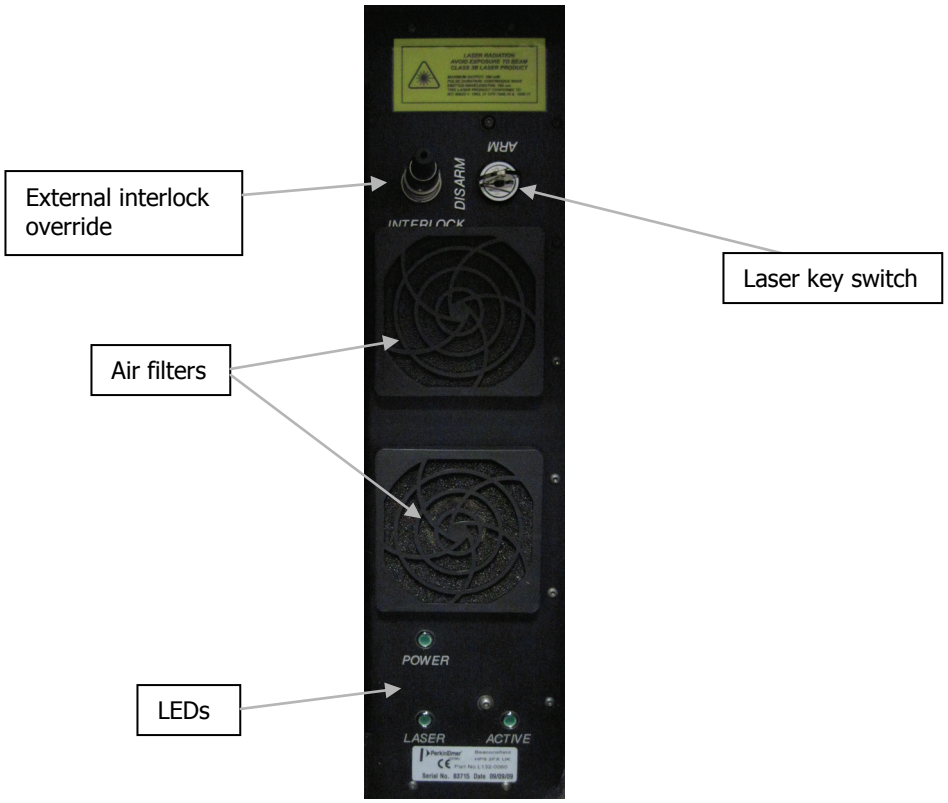


Figure 10 Spectrometer module right-hand panel

The LEDs are as follows:

LED	Description
Power	If the Power LED is illuminated, this indicates that the instrument is receiving power.
Laser	This LED indicates the power status of the laser. If the LED is illuminated then the laser is receiving power. This does not mean that laser radiation is present throughout the optical path of the instrument, only that the laser power is on.
Active	This LED indicates the status of the laser shutters. If the LED is illuminated then the shutters are activated (open) and the laser radiation will be present throughout the optical path of the instrument.

Attaching the External Interlock Override

The Raman IdentiCheck has an external interlock connection located on the right-hand side of the top panel (Figure 10).

To operate the instrument, the external interlock must be satisfied. This can be achieved in one of two ways:

- Either by attaching the External Interlock Override (L1320264) supplied with the instrument.

- Or, if you are working on-site and if required by the site Laser Safety Officer, you can connect an external door interlock. See *Additional Parts and Upgrades* on page 64 for details.

Left-hand Panel

The left-hand panel of the Raman IdentiCheck (Figure 11) contains:

- Fiber optic probe connectors
- USB port, to connect the PC to the spectrometer
- Main power connector
- Aux power connector (should not be used)

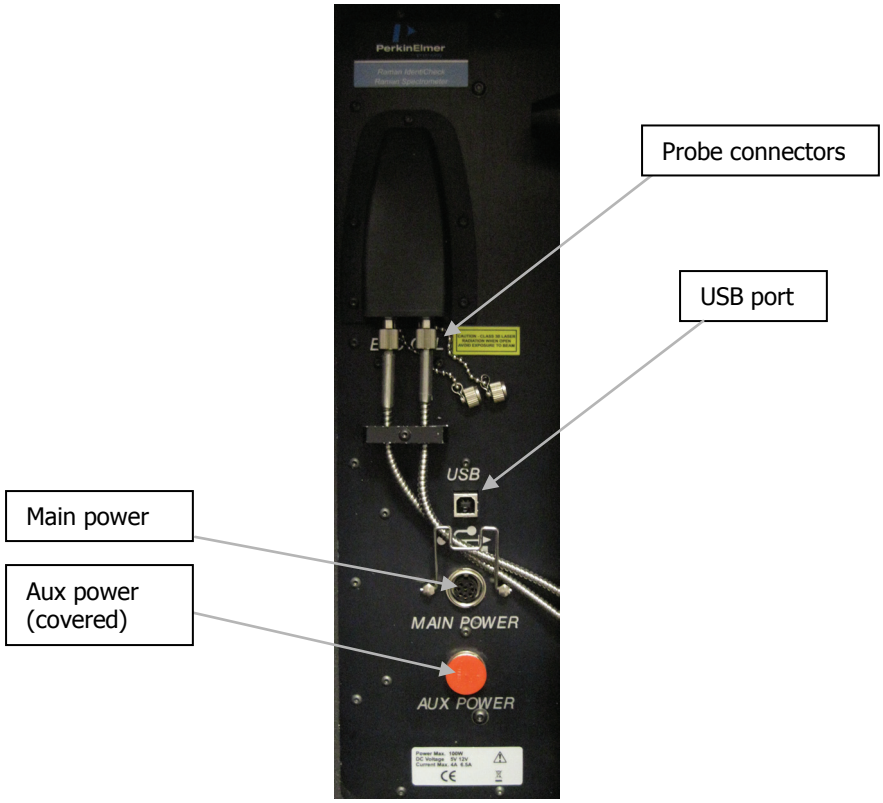


Figure 11 Spectrometer module left-hand panel

WARNING

The Aux power connector is covered and should not be used.

Triggered Fiber Optic Probe (TFOP)

The Raman IdentiCheck comes fitted with a Triggered Fiber Optic Probe (TFOP), designed to enable the remote measurement of samples.

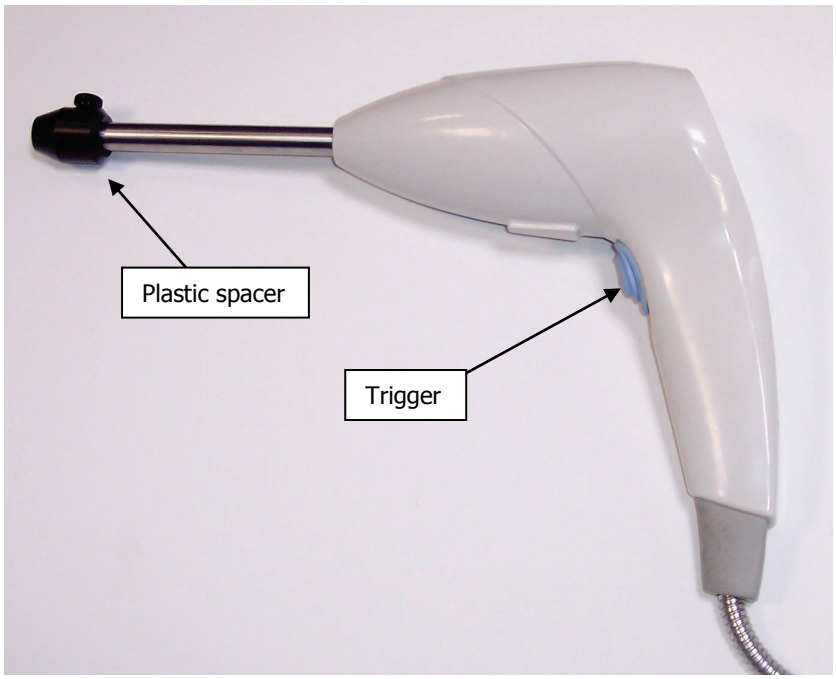


Figure 12 Side-view of probe, with plastic spacer fitted, ready for use

The probe body contains the filtering optics and electronics, and is interfaced with two fiber optic cables (an excitation fiber and collection fiber). Care should be taken when handling the probe body so that the optical window is not soiled or damaged.

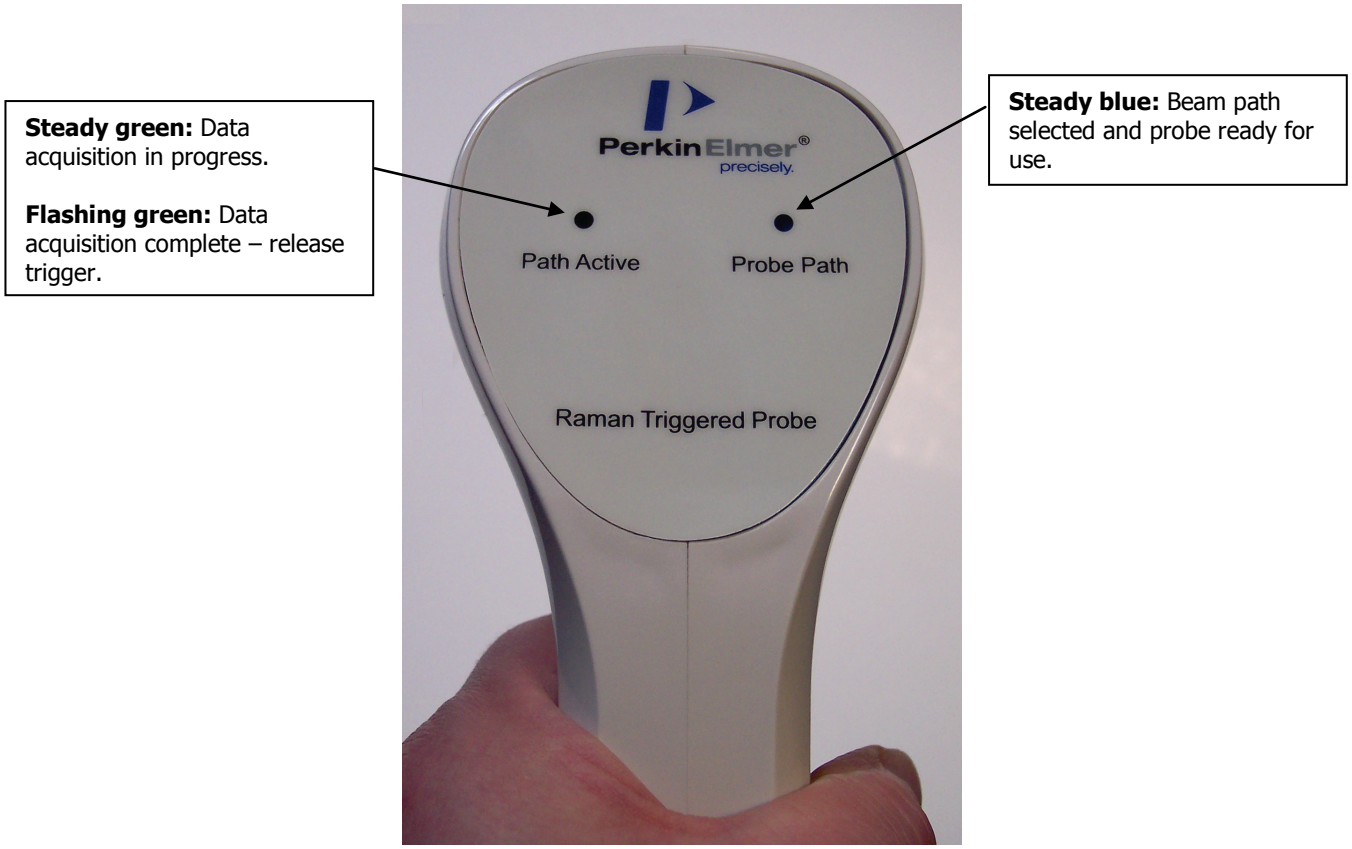


Figure 13 Probe indicators

The Probe Path indicator lights-up blue when the probe is selected in the Beam Path drop-down list, in the Spectrum software, and is ready for use.

The Path Active indicator lights-up green when you press and hold the trigger and start to acquire data, indicating that laser energy is being emitted from the end of the probe. At this point, you can release the trigger. Once data acquisition is complete, the Path Active indicator is extinguished or changes to flashing green if you are still depressing the trigger.

Analyzing Samples with the Probe

NOTE: A set of sampling accessories is available for use with a TFOP. See *Additional Parts and Upgrades* on page 64 for details.

Analyzing free solids

The standard TFOP has a tight focus spot that is approximately 7.5 mm away from the lens (other customized distances are available). The focused spot enables you to pinpoint the measurement area on the sample.

Alternatively, a plastic spacer (part number L1320324) can be attached to the end of probe. In this case, the system optics are optimized when the probe is brought into direct contact with the sample.

Analyzing liquids by immersion

The TFOP can only be immersed in liquid if you also use the immersible probe sleeve (part number L1320070). Do not totally submerge the probe; it should be immersed only up to 2.5 cm from the top of the sleeve. It may be useful to focus the sample by sliding the TFOP up and down inside the immersion sleeve to obtain the best spectrum. Note that the immersion sleeve has a quartz window. This can yield a detailed Raman spectrum; do not confuse this with the spectrum of the sample.

Analyzing samples in containers

Samples can be analyzed in glass and plastic containers, by mounting the TFOP on a stand, without a plastic spacer, and adjusting the focal spot onto the sample.

When working through containers it is best to try different probe positions. If the liquid of interest is not absorbing, it may be best to focus through the container by placing the TFOP in direct contact with the container.

When using 785 nm lasers, many types of glass exhibit bands between 1400–1600 cm^{-1}. Spectra of the container should be obtained before analyzing the sample to ensure that glass-derived bands do not pose a problem. With 785 nm excitation, fused silica (quartz) should be used instead of glass where possible as this does not yield peaks. Pyrex is also excellent for Raman analysis.

If this glass interference is a problem and it is not possible to use quartz containers, then it is possible to acquire a spectrum of the container and spectrally subtract this from any spectra containing this signature.

Analyzing slurries / highly absorbing species

Please refer to *Analyzing liquids by immersion*. For sample immersion, care taken in focusing the probe within the sleeve can result in a dramatic improvement in spectral quality.

Power Supply Unit

The power supply unit supplied with the Raman IdentiCheck is shown below.

Figure 14 Power supply unit

The power supply unit is designed to operate *in-situ*, strapped within the lid of the IdentiCheck transport case, although it can be removed if required.

CAUTION	*You must ensure that the power supply unit is secured within the lid of the case, using the straps provided, during transport.*

NOTE: For information on running the Raman IdentiCheck from a battery-supplied powerpack, contact your PerkinElmer Business Unit.

Raman IdentiCheck PC

We recommend that you purchase the tablet PC specifically provided for use with Raman IdentiCheck by PerkinElmer. This conforms to the necessary PC requirements and will be setup, and the necessary PerkinElmer software installed, on-site by a PerkinElmer Service Engineer.

The tablet PC is designed to be used *in-situ*, within the lid of the IdentiCheck transport case, although it can be removed if required.

Figure 15 Tablet PC

CAUTION	*You must ensure that the tablet PC is secured within the lid of the case, using the straps provided, during transport.*

NOTE: If you choose to provide your own laptop or tablet PC for use with your Raman IdentiCheck, you must ensure that it meets the appropriate hardware and software specifications, that it is configured correctly, and that the appropriate software is installed.

See *Appendix A: Using your own PC* on page 75 for details.

Commissioning your Instrument

Before you use your IdentiCheck for the first time you should carry out the procedure described below in order to prepare it for use.

1. Attach the external interlock override or connect an external door interlock.

2. Insert the key into the laser power keyswitch on the top panel of the spectrometer module and ensure that it is turned to the ARM position.

NOTE: The Raman IdentiCheck is supplied with two keys. One should be placed in the instrument and the other should be stored in a safe place. Replacement keys (L1323503) can be obtained from PerkinElmer.

3. Carefully uncoil the triggered fiber optic probe cable and then attach the bifurcated end of the cable to the probe connectors on the instrument, as described in *Attaching a probe* on page 69.

4. If you have purchased the optional tablet PC from PerkinElmer:

   - Connect the USB cable from the **USB port**, on the left-hand panel of the instrument, to the PC.

   - Connect the USB extender cable from the triggered fiber optic probe to the PC.

CAUTION *If you intend using your own tablet or laptop PC, you should not connect it to the instrument or to the triggered fiber optic probe at this time.*

5. Switch on the laptop or tablet PC and start-up the Windows operating system.

NOTE: If you are using your own laptop, you should follow the procedures described in *Appendix A: Using your own PC* starting on page 75, before continuing at step 11 of this procedure.

6. Connect the instrument power supply unit (L1321884) to the spectrometer **Main Power** socket, plug it into the mains supply, and then switch the mains supply on.

7. Start the Spectrum software.

   On the Windows Start menu select All Programs/PerkinElmer Applications/Spectrum.

   On the tablet PC supplied by PerkinElmer, both the Username and Password will be set to **administrator**.

   You are strongly advised to create your own usernames and passwords; see the on-screen help provided by the Spectrum software for details.

8. Select **Instrument** from the Setup menu.

   The Scan and Instrument Setup dialog is displayed.

9. Click 

.

10. In the Accessory Configuration section, click in the Beampath drop-down list to activate the **Triggered Fiber Optic Probe** option.

    When you make the selection, the Probe Path indicator on the probe will light-up blue. This indicates that the probe is ready for use.

NOTE: For safety reasons, when the TFOP is selected as the Beam Path option, all **Scan** buttons in the software are disabled. Scanning with a TFOP can only be started using the trigger on the probe; see *SOP-5: Collecting a Spectrum with a Triggered Fiber Optic Probe* on page 57 for details.

11. Leave the system to equilibrate.

    How long this takes will depend on the environmental conditions; up to 30 minutes at 30 °C, as an extreme example.

    Messages are issued to advise you of the progress of this.

12. Carry out a Wavelength Calibration Verification, as described in SOP-7 on page 60.

    Once this calibration verification has been successfully completed, your IdentiCheck system is ready to use.

Using the Raman IdentiCheck

Introduction

The Raman IdentiCheck combined with the Spectrum software is a very flexible instrument. This chapter demonstrates how to perform a number of tasks. The procedures provided may not be the most straightforward or simple for the task you wish to perform, so treat these Standard Operating Procedures (SOPs) as a starting point and with time you may wish to develop your own SOPs which better suit your specific mode of use. This chapter also acts as a "learn by doing" section allowing you to explore the functionality of the software and spectrometer.

NOTE: If you are in any doubt about any aspect of using your Raman IdentiCheck, contact PerkinElmer before proceeding.

General SOPs

SOP-1: Switching the IdentiCheck on

1. Open the case; remove and carefully uncoil the triggered fiber optic probe.
   Remove the cable bag.

2. Connect the USB extender cable from the probe to your PC.

3. Connect the USB cable from the spectrometer to your PC.

4. Switch on your PC and login to Windows.

NOTE: If you run your PC on batteries, you should check from time-to-time that sufficient power remains to carry out the experiments you want to perform.

5. Ensure that the laser interlock is satisfied or the interlock override is fitted.

6. Insert the laser power key and turn it to the ARM position.

7. Connect the power supply unit to a power supply socket and to the instrument. Then switch the power supply on.

8. Check that the Power LED on the top panel is On.
   The Laser LED and the Active LED should be off. If the Power LED is not on, turn off the power, check all of the connections, and then switch the power back on again.

9. Start the Spectrum software.
   On the Windows Start menu select All Programs/PerkinElmer Applications/Spectrum/Spectrum.
   When you start the software the instrument will prepare for use.
   The laser will be turned on. The Laser LED on the instrument and the Probe Path LED on the probe will come on.
   The detector will be cooled to its operating temperature (usually -50^{o}C).

10. Leave the system to equilibrate.
    How long this takes will depend on the environmental conditions; up to 30 minutes at 30 °C, is an extreme example.
    Messages are issued to advise you of the progress of this.

You are now ready to start using the instrument.

NOTE: While the instrument is on, make sure not to cover the fans or close the lid of the transport case.

SOP-2: Packing up the Instrument after use

When you have completed your work, follow the steps described below to shut-down and pack up your instrument.

1. Shut down Spectrum software by selecting **Exit** from the File menu to return to the Windows operating environment.

2. Remove the laser power key and, if appropriate, the interlock override.

3. Switch off the power supply and then unplug the power supply unit.

4. Shut-down your PC and then disconnect the triggered fiber optic probe USB extender cable.

5. Disconnect the USB cable that connects the PC to your IdentiCheck.

6. If appropriate, remove the plastic spacer from the end of the triggered fiber optic probe and fit the lens cap.

7. Carefully coil-up the triggered fiber optic probe cable and place it in the foam compartment.

8. Ensure that the power supply unit and, if appropriate, the tablet PC are secured, using the straps provided, within the lid of the case.

9. Pack the following items in the cable bag:

    - The laser power key.
    - The IdentiCheck power supply unit power cable.
    - Your PC power supply unit and cables.
    - The USB cable that connects your PC to the instrument.

10. Place the cable bag in the case, above the right-hand panel.

11. Shut the case, ready for transport.

NOTE: For further information on transporting your IdentiCheck see *Moving the Instrument* on page 25.

SOP-3: Setting-Up and Saving Experimental Parameters

This SOP is designed to act as a quick guide to help you start collecting data. The exact setup for optimized spectral collection is sample dependent, and we recommend that you modify these settings to suit your needs.

NOTE: If you intend using PerkinElmer software packages other than Spectrum to carry out data acquisition or analyses, AssureID for example, you should refer to the appropriate user guides and / or on-screen help provided.

1. Ensure that the Raman IdentiCheck is switched on by following SOP-1.

2. Start the Spectrum software and then select **Instrument** from the Setup menu.

   The Scan and Instrument Setup dialog is displayed.

   The Scan and Instrument Setup dialog has a number of pages that enable you to setup and save the experimental parameters.

3. On the Experiment page, select the Set-up tab and then set the **Exposure time** and **Number of exposures**.

   Typical values for Exposure time and Number of exposures are 1 or 2 seconds and 5 scans, respectively. Spectra may be optimized by increasing or decreasing the Exposure time and Number of exposure. To obtain a good signal-to-noise ratio, you should co-add a number of spectra.

4. On the Advanced tab, in the Background Handling section, we recommend that you select **#Backgrounds=#Scans**. This sets the number of background scans to the same value as the number of sample scans.

   You may also choose one of the Renew Background options to define when a background will be taken. For extended kinetic experiments, for example, you may find it useful for the background to be renewed during the course of your experiment.

5. On the Advanced tab, in the Spectral Information section, set the required values.

6. If you wish these parameters to be stored as a new set of experimental setup default parameters, select **Save As** from the File menu.

   Experimental parameters are stored as *.REX files. This is the "Raman Experiment" file. If you would like to save this set of parameters as the default set, that loads when the software is opened, then save your experiment settings as Default.rex.

   If you select **Save** from the File menu, the current experimental parameters are stored as the default parameters in the software.

NOTE: The Spectrum software automatically saves to the currently loaded .REX file, without prompting, any configuration changes made that affect the safety of the instrument, such as the beampath selection. You should be aware of this when creating your own .REX file and, as soon as you have saved the configuration you want to be retained, you should reload DEFAULT.REX (or some other .REX file), using the **Load Experiment File** option from the File menu.

NOTE: In Spectrum ES, the File menu options **Save** and **Save As** are not available to users logged on as an Analysts. The role of an Analyst is to use .REX files prepared by Administrators.

7. When you have finished defining your experimental parameters click on the **Setup Scan Parameters** button, on the Set-up tab.

   The Scan Parameters dialog screen is displayed, which you can use to define how the scan data will be stored. See SOP-4 for details.

Parameter	**Recommended Set Up**
Exposure time (Experiment page/Set-up tab)	1 or 2 seconds (sample dependant)
Number of exposures (Experiment page/Set-up tab)	5 (sample dependant)
Spectral Information Range (Experiment page/Advanced tab)	250–3500 cm^{-1}
Spectral Information Data Interval (Experiment page/Advanced tab)	2 cm^{-1} (default)
Background Handling – Number of Background Scans (Experiment page/Advanced tab)	5 (the recommendation is that this should be same as **Number of exposures**, and a minimum of 1)
Background Handling – Renew background at start of each sample (Experiment page/Advanced tab)	Yes
Accessory Configuration – Beam path (Instrument page/Hardware tab)	Triggered Fiber Optic Probe
Accessory Configuration – Sample accessory and Sample holder (Instrument page/Hardware tab)	No Accessory

Table 3 Recommended experimental setup

SOP-4: Defining Scan Parameters

1. Ensure the Raman IdentiCheck is switched on, if not follow SOP-1.

2. Setup the experimental parameters by following SOP-3.

3. Click on the **Setup Scan Parameters** button, on the Set-up tab.

   The Scan Parameters dialog is displayed.

   This dialog displays a summary of the experimental configuration. It also allows you to add a comment; specify a file prefix to be used on files containing spectrum data; and specify the folder in which the scan data will be stored.

NOTE: If you choose to save spectra to a folder other than the default one specified for your instrument, the data will not be displayed automatically. To view the spectrum you will need to open the data file manually, using the **Open** option from the File menu, after the scan has completed.

4. Click **OK** to save your scan parameters.

You are now in a position to acquire data. See SOP-5 for details.

SOP-5: Collecting a Spectrum with a Triggered Fiber Optic Probe

1. Ensure that the appropriate laser safety precautions are being observed.

2. If appropriate, fit the plastic spacer to the end of the probe.

   The use of a 7.5 mm plastic spacer (part number L1320324) attached to the end of your TFOP will ensure the optimum positioning of the probe when direct contact can be made between the sample and the probe.

3. To begin collecting data, **press and hold down** the trigger until the Path Active indicator on the probe lights-up green (approximately 2 seconds). Rapid pressing and releasing of the trigger may result in a failure to start data collection.

   Once the Path Active indicator is illuminated, you can release the trigger.

   The indicator will remain lit during data collection, indicating that laser light is being emitted from the TFOP.

   When the acquisition is complete, the indicator will extinguish, or will start to blink if you are still depressing the trigger.

NOTE: To abort data collection BEFORE acquisition is complete, **press and hold down** the trigger until the Path Active indicator is extinguished and then you can release the trigger. The shutter will close, data collection will stop, and any data collected will be lost.

4. Repeat this procedure for each sample.

Spectra are always background corrected. If there is not a valid background in memory, a background will be acquired before data collection starts. Spectrum will show a progress bar within the message with, for example, *Collecting Background x of y*, where *x* is the current scan and *y* is the total number of backgrounds. You can enter the number of backgrounds, as part of your experiment parameters, on the Scan and Instrument Setup dialog. When the collection of backgrounds is complete, the software will automatically begin collecting spectra. The *Collecting data x of y*, progress bar is displayed, where *x* is the current scan and *y* is the total number of scans.

NOTE: Depending upon the number of backgrounds you have chosen to take, some considerable time may elapse between the Path Active light coming on and the shutter opening to start data collection.

Calibration and Performance Verification SOPs

Several different automated calibration routines are included in the software, these are:

- Wavelength (x-axis) calibration uses the position of precisely known lines in a neon emission spectrum to calibrate the detector.
- Laser frequency determines the exact laser wavelength.
- Intensity (y-axis) calibration is performed using special doped glass with a well characterized emission spectrum. This is used to correct for non-linearity in detector response.

An additional wavelength calibration verification routine has been included in the software, which compares a series of peaks for polystyrene (ASTM E 1840) with values collected using a polystyrene sample. These calibration/validation tests allow for in-house instrument performance verification.

Intensity calibration is only performed as part of an annual service, or following a service repair of the instrument.

Backgrounds are always collected during a calibration procedure. The background measures the bias and dark signal over the selected area of the CCD. This is a necessary part of the calibration routines, so it is always performed.

The spectrometer has no moving parts in its detection system, therefore frequent calibration is not necessary.

We recommend that you calibrate the instrument in accordance with the following SOP.

SOP-6: Calibration/Performance Verification

We recommend that wavelength calibration verification is performed on a regular basis to ensure that the instrument is performing within specification. This can be once a day or once a week depending on your requirements and the environment in which the instrument is used.

On completion of the wavelength calibration verification, a calibration verification report will provide details on the outcome of the verification procedure.

IMPORTANT: If the instrument passes the wavelength calibration verification procedure, the instrument is optimized for performance and does not require wavelength calibration.

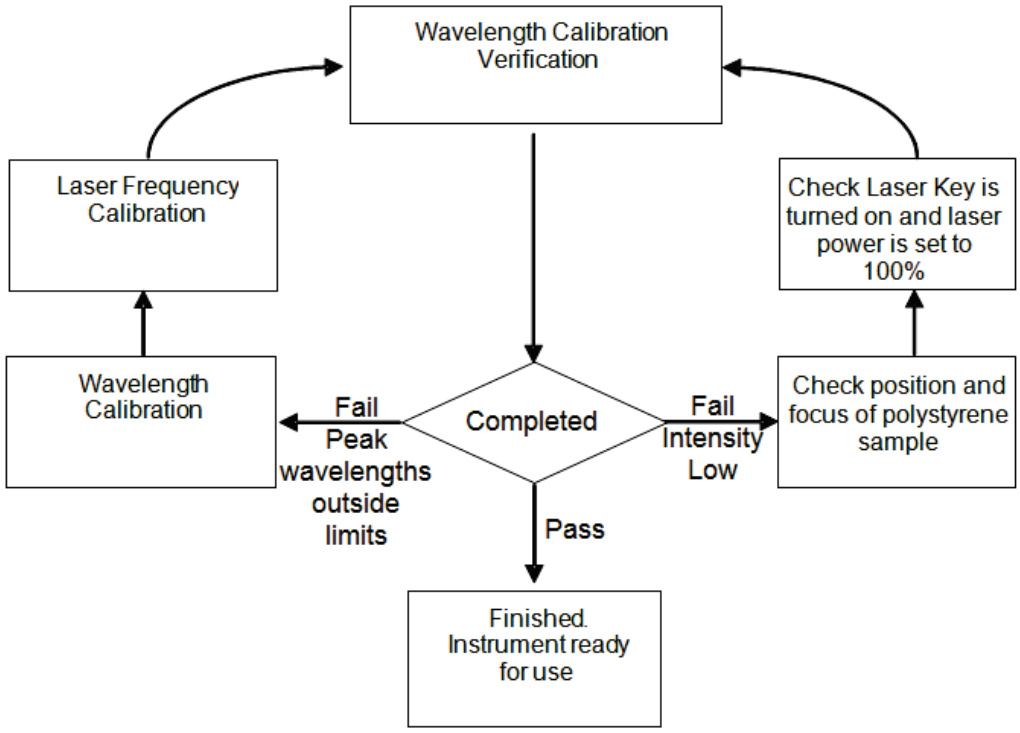


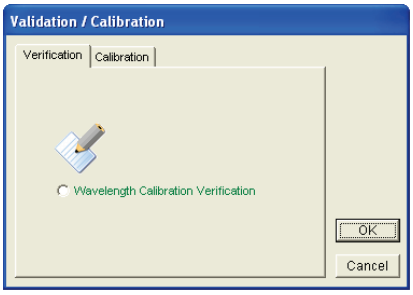
Figure 16 System verification / calibration flow diagram

If wavelength calibration verification fails and there is an error message stating that peak wavelengths are outside limits, then wavelength and laser frequency calibrations should be performed. When these calibrations have finished, repeat the wavelength calibration verification to ensure that the instrument has been brought back within specification.

If the wavelength calibration verification fails because the spectral intensity is low, then this may also be due to the calibration sample holder not being correctly positioned, optimally focused or because the laser key is not switched on or the laser power is too low. Then repeat the wavelength calibration verification to ensure that the instrument has been brought back within specification. If the instrument fails the wavelength calibration verification again, please contact PerkinElmer.

SOP-7: Wavelength Calibration Verification of the Raman IdentiCheck

1. Ensure the instrument is switched on by following SOP-1.
2. Ensure that the Triggered Fiber Optic Probe is selected in the Spectrum beam path; see *Commissioning your Instrument* on page 48.
   The Probe Path LED on the probe will be illuminated.
3. On the Hardware tab of the Instrument page, ensure that the laser power is set to 100%.
4. Close the Scan and Instrument Setup dialog by clicking **Exit**.
5. Fit the plastic spacer (L1320324) on to the end of your triggered fiber optic probe, position the probe tip in direct contact with a polystyrene sample (L1181228) and then clamp it in place.
6. Cover the probe and sample with a black cloth to avoid any stray light reaching the detector.
7. Select **Validate** and then **Instrument** from the Instrument menu in Spectrum.
   The Validation / Calibration dialog is displayed.
8. Select the Verification tab.



9. Select **Wavelength Calibration Verification**.
10. Press and hold down the probe trigger until the Path Active light is illuminated.
    The wavelength calibration verification routine begins. This will take a few minutes. After completing the wavelength calibration verification routine, an audit log is generated.
11. When the Path Active light on the probe goes out, remove the polystyrene sample and store safely.
    The instrument is now ready for use.

In the unlikely event that the wavelength calibration verification should fail, follow Figure 16.

Further details on the wavelength calibration verification are provided as a spectral (*.sp) file, which is saved in *C:|pel_data|config|Raman|Calibration Files|Logs* folder.

SOP-8: Wavelength Calibration of the Raman IdentiCheck

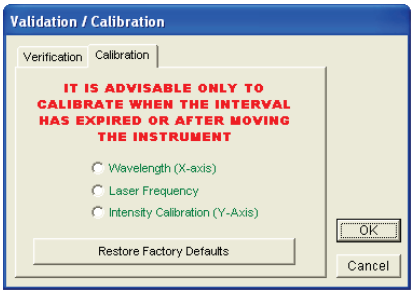
Wavelength calibration should only be performed if the instrument has failed a wavelength calibration verification. It uses an internal neon standard.

1. Cover the tip of your triggered fiber optic probe with a lens cap, to ensure that no light can enter the probe.

2. Ensure the Raman IdentiCheck is switched on.
   If not follow SOP-1.

3. Select **Validate** and then **Instrument** from the Instrument menu in Spectrum.
   The Validation / Calibration dialog is displayed.

4. Select the Calibration tab.



5. Select **Wavelength (X-axis)**, and then click **OK**.
   The instrument will now perform the wavelength calibration routine. This will take some time.

The instrument is now wavelength calibrated.

SOP-9: Laser Frequency Calibration of the Raman IdentiCheck

Laser frequency calibration should only be performed, following a wavelength calibration, in the event of the instrument failing a wavelength calibration verification.

1. Ensure the IdentiCheck is switched on and is stable, by following SOP-1.
2. Ensure that the Triggered Fiber Optic Probe is selected in the Spectrum beam path; see *Commissioning your Instrument* on page 48.
   The Probe Path LED on the probe will be illuminated.
3. On the Hardware tab of the Instrument page, ensure that the laser power is set to 100%.
4. Close the Scan and Instrument Setup dialog by clicking **Exit**.
5. Fit the plastic spacer (L1320324) on to the end of your triggered fiber optic probe, position the probe tip in direct contact with a polystyrene sample (L1181228) and then clamp it in place.
6. Cover the probe and sample with a black cloth to avoid any stray light reaching the detector.
7. Select **Validate** and then **Instrument** from the Instrument menu in Spectrum.
   The Validation / Calibration dialog is displayed.
8. Select the Calibration tab.
9. Select **Laser Frequency**.
10. Press and hold down the probe trigger until the Path Active light is illuminated.
    The instrument will now perform the laser frequency calibration routine. This will take a few minutes.
11. When the Path Active light on the probe goes out, remove the polystyrene sample and store safely.

After completing the laser frequency calibration routine, a report is generated on-screen that gives details on the outcomes of the laser frequency calibration.

The instrument in now laser frequency calibrated.

In the unlikely event that the laser frequency calibration routine should fail, please perform a wavelength calibration and repeat the laser frequency calibration.

SOP-10: Intensity Calibration of the Raman IdentiCheck

The intensity calibration must be performed using the National Institute of Standards and Technology (NIST) Standard Reference Material. NIST SRM 2241 is the relative intensity correction standard for Raman spectroscopy when using 785 nm excitation.

NOTE: NIST calibration is temperature dependent. If you intend to perform quantitative analyses, you should ensure that your instrument is NIST calibrated at the temperature at which data is to be acquired. Otherwise, any data should be used for qualitative analyses only.

For further information, contact your PerkinElmer Raman Business Unit.

1. Ensure the IdentiCheck is switched on and is stable, by following SOP-1.
2. Ensure that the Triggered Fiber Optic Probe is selected in the Spectrum beam path; see *Commissioning your Instrument* on page 48.
   The Probe Path LED on the probe will be illuminated.
3. On the Hardware tab of the Instrument page, ensure that the laser power is set to 100%.
4. Close the dialog by clicking **Exit**.
5. Fit the plastic spacer (L1320324) on to the end of your triggered fiber optic probe, position the probe tip in direct contact with the appropriate NIST standard (L1321831, with the frosted side facing up) and then clamp it in place.
6. Cover the probe and sample with a black cloth to avoid any stray light reaching the detector.
7. Select **Validate** and then **Instrument** from the Instrument menu in Spectrum.
   The Validation / Calibration dialog is displayed.
8. Select the Calibration tab.
9. Select **Intensity Calibration Y-axis**.
10. Press and hold down the probe trigger until the Path Active light is illuminated.
    The instrument will now perform the intensity calibration routine. This will take approximately 1 hour.
11. When the Path Active light on the probe goes out, remove the intensity correction standard and store safely.

After completing the intensity calibration routine, a report is generated on-screen, which gives details on the outcome of the intensity calibration.

Any data acquired will now be intensity corrected.

In the unlikely event that the intensity calibration routine should fail, please ensure the NIST sample is correctly positioned, and that the laser key switch is set to ARM. If this is the case shut down the PC, switch the instrument off, restart the PC and switch the instrument back on and repeat the calibration.

Additional Parts and Upgrades

Safety and Calibration

Part Number	Description
L1320262	Raman Laser Safety Kit (785 nm) Contains external interlock cable (L1320820), laser glasses (L1323518), laser detection card (L1323521), and door warning label (L1323523)
L1323503	Replacement Laser Keys
L1320229	Final Test Sample Plate Assembly
L1321831	NIST 2241 Relative Intensity Correction

Triggered Fiber Optic Probe

Part Number	Description
L1320031	Triggered Fiber Optic Probe, 20 m cable **NOTE:** A 20 m triggered fiber optic probe cannot be transported within the Raman IdentiCheck case.
L1320070	Short immersion sleeve for TFOP
L1320071	Ultra-long working distance lens adaptor for Raman fiber optic probes
L1320095	Raman probe sampling accessory kit

Other Probes and Options

The Raman IdentiCheck can also be used in conjunction with a standard fiber optic probe (L1320002) and with a RamanMicro 300 microscope. Contact PerkinElmer for details.

Maintenance and Troubleshooting

Maintenance

The system does not require regular maintenance other than occasional checking and cleaning.

Cleaning the Spectrometer and Power Supply Units

WARNING

Disconnect the instrument from the power supply unit before cleaning.

You can clean the left- and right-hand panels of the spectrometer using a soft, lint-free cloth, moistened if required with a little water. Mild detergent may be used, if necessary. Do not use abrasive or solvent-based cleaning materials. Always perform a patch test on a small area before you clean the entire instrument.

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

WARNING

Do not directly clean electrical contacts.

WARNING

To avoid any electrical shock hazards, do not allow liquids to run down into the external power supply unit. Also, do not allow liquids to run into the spectrometer. Only use a soft, dry cloth to clean the spectrometer or the power supply unit.

Servicing the Spectrometer

There are no other user-serviceable parts in the spectrometer module. If you require an instrument service please contact PerkinElmer. Only PerkinElmer Service Engineers should attempt to service the spectrometer.

WARNING

Removal of the spectrometer from its transport case, or removal of the either of the spectrometer panels, will allow potentially hazardous Class 3B laser radiation to be emitted and will invalidate the instrument warranty.

Cleaning the Air Filters

The air filters are located on the right-hand panel of the spectrometer module. You should clean the filters regularly.

To clean the filters:

1. Disconnect the power supply unit from the mains supply.
2. Unclip the filter covers (see Figure 10), remove the filters and wash in a mild detergent.
3. Dry the filters thoroughly.
4. Fit the air filters back into the spectrometer module.

Maintaining the Triggered Fiber Optic Probe

The TFOP is designed to be maintenance free under normal operating conditions, and should not be opened or adjusted by anyone other than a PerkinElmer Service Engineer. Contact PerkinElmer if you have any questions regarding maintenance or servicing of the TFOP.

Damage to the TFOP as a result of accident, neglect, misuse, or as a result of service or modification by anyone other than PerkinElmer will invalidate the TFOP warranty.

Cleaning the Triggered Fiber Optic Probe

NOTE: We recommend the use of non-abrasive, pH-neutral, phosphate-free detergents. Some detergents, particularly those designed for use in washing machines, are alkaline and may etch non-ferrous metals and some plastics. The product chosen must be capable of being fully removed by wiping with a damp cloth.

Decontaminating the probe tip

Wipe the barrel and tip using, for example, the recommended concentration of a standard laboratory detergent, clean off the detergent using a cloth dampened with de-ionized water and then air dry.

Cleaning the probe body and cable

Wipe all external surfaces with a lint-free cloth. If necessary, this cloth may be dampened with a mild detergent solution.

CAUTION	*Do not use copious amounts of water or allow the water to enter the probe casing.*

Replacing the Triggered Fiber Optic Probe

The TFOP is constructed such that a single armored cable bifurcates into an **excitation** cable and a **collection** cable. The excitation fiber transmits the laser energy, whereas the collection cable is a conduit for the Raman energy. Both fibers terminate in FC style connectors.

Removing a probe

1. Ensure the attenuator cap is attached to the probe.
2. Disconnect the instrument from the power supply.
3. Unscrew and remove the probe cable retaining bar (Figure 17).

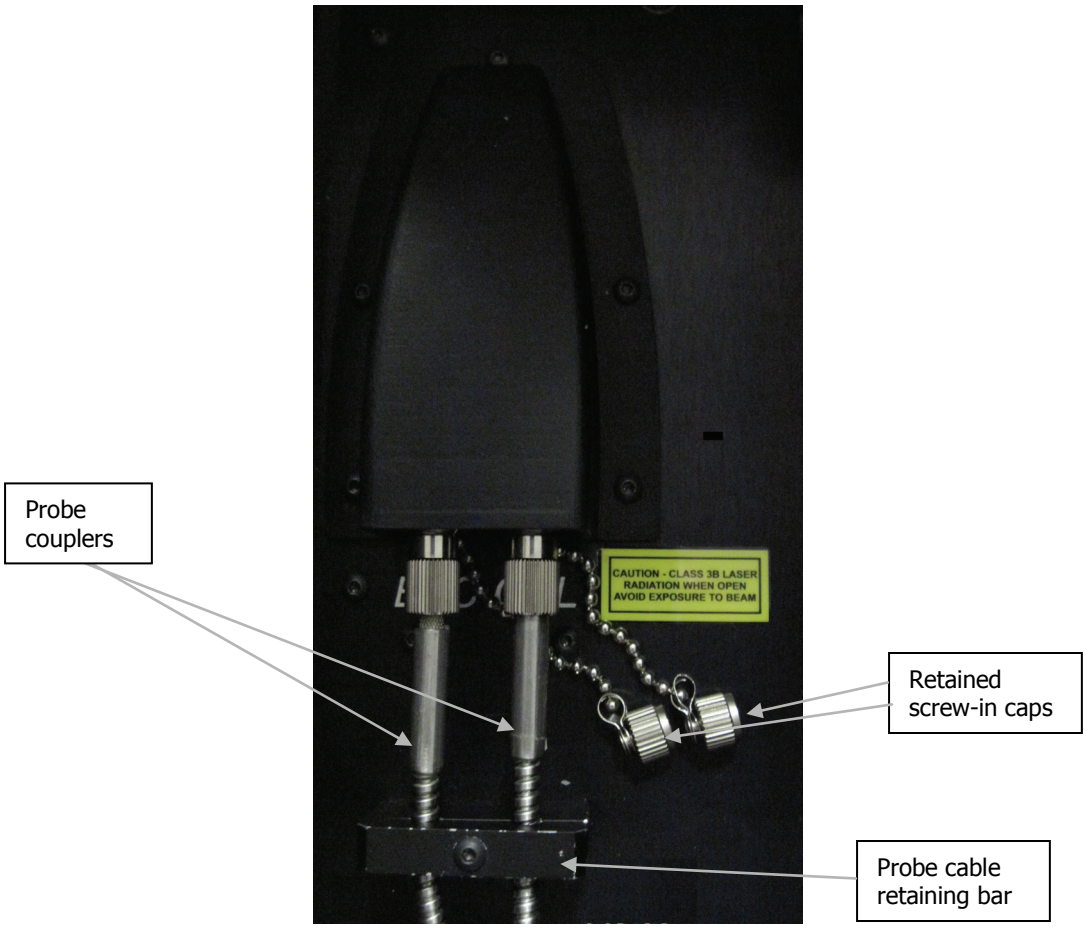


Figure 17 Probe connectors

4. Carefully remove the retained ends of the probe by unscrewing and pulling the cables away from the couplers perpendicularly.

   Be extremely careful when removing the probe fibers as you can easily damage the instrument and/or the ends of the fibers.

5. Fit protective caps on to the ends of the probe fibers, in order to prevent damage.

6. Fasten the retained screw-in caps onto the couplers.

Attaching a probe

1. Ensure the attenuator cap is attached to the probe.

2. Disconnect the instrument from the power supply.

3. Remove the retained screw-in caps from the two couplers on the left-hand panel.

4. Remove the protective caps from the ends of the probe fibers and keep them for future use.

5. Connect the excitation and collection cables of the probe to the appropriately labeled couplers.

   Make sure that the polarizing ridge on the probe cables are aligned with the slot in the coupler casing before carefully pushing the cable into the coupler (Figure 18).

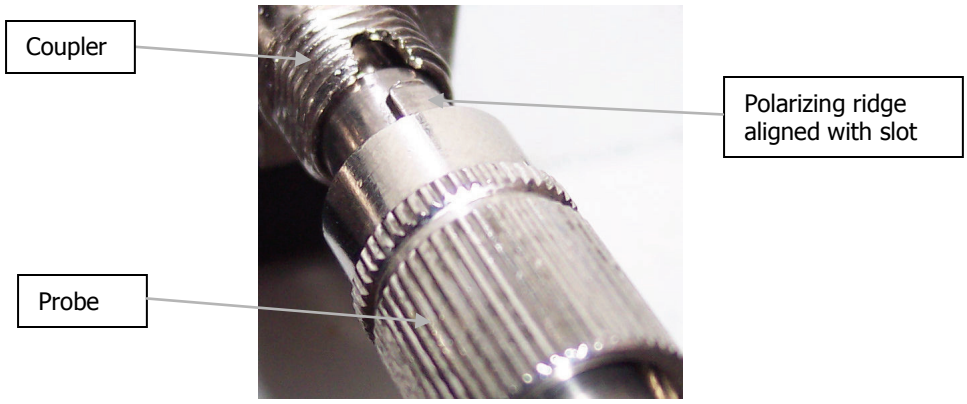


Figure 18 Connecting the fiber optic probe

6. Replace the probe cable retaining bar.

   Care should be taken to avoid damage to the fibers. Do not overtghten.

7. Reconnect the power cables.

Troubleshooting

This section is a reference guide if you are having any problems with your instrument. Troubleshooting outlines what to do if your instrument or software malfunctions or crashes.

Hardware

Problem:	**During the installation procedure the USB devices are not recognized.**
Description	This may mean that there is not enough power on the USB sockets on your PC.
Solution	Ensure that your PC has USB 2.0 sockets. If you are not sure, use a USB 2.0 power hub.

Problem:	**Cannot collect data because an interlock is breached.**
Description	This means that, for some reason, the interlock system is detecting an open circuit.
Solution 1	Ensure the interlock override is inserted in the connector on the top panel of your IdentiCheck.
Solution 2	Ensure your external interlock is wired up correctly and that any interlocked room entrances or sampling enclosures are closed.

Software

Problem	**Scan and Instrument Setup dialog stops responding.**
Description	When you are using the Scan and Instrument Setup dialog, for some reason it stops working, that is, mouse clicks have no effect.
Solution	Hold down the CTRL+ALT+DELETE keyboard buttons to display the Windows Security dialog. Click **Task Manager** and then click the **Processes** tab. In the list under Image Name look for *Raman.exe* (to find this you may have scroll through the list using the scroll bar on the right side) click on this, then click **End Process**. If a Task Manager Warning dialog is displayed click **OK**. Re-start the software. If you are unsure how to do this please refer to SOP-1.

Problem	**You get any of the following messages 'An unexpected error has occurred', 'EAccess Violation' or 'Divide by Zero'**
Description	While working in the software, a dialog is displayed with one of these messages. The software may appear to operate correctly but you must perform the following solution.
Solution	Close and open the Spectrum software.

Problem	**During system initialization the laser does not stabilize.**
Description	The laser initialization form displayed during system initialization runs for over 60 seconds. During this time the laser should have stabilized.
Solution	Ensure that the laser key on the top panel of the spectrometer is set to the ARM position.

Problem	**Detector cannot achieve operational temperature.**
Description	During system initialization a message box stating, 'Detector temperature could not be achieved' is displayed.
Solution 1	Shut down and restart the software.
	Ensure that the instrument is being used within the acceptable ambient temperature limits. See *Specifications* on page 37 for details.

Decontamination

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

Customers wishing to return instrumentation and/or associated materials to PerkinElmer for repair, maintenance, warranty or trade-in purposes are advised that all returned goods must be certified as clean and free from contamination.

The customer's responsible body is required to follow the "Equipment Decontamination Procedure" and complete the "Certificate of Decontamination". These documents are available on the PerkinElmer public website:

http://las.perkinelmer.com/OneSource/decontamination.htm

Alternatively, if you do not have access to the internet contact Customer Care:

Customer Care USA:	1-800-762-4000	(inside the USA)
(8:30 a.m. – 7 p.m. EST)	(+1) 203-925-4602	(outside the USA)
Customer Care Canada:	800-561-4646	
Customer Care EU:	0800 40 858	(Brussels)
	0800 90 66 42	(Monza)

If you are located outside of these regions, please call your local PerkinElmer sales office for more information.

WEEE Instructions for PerkinElmer Products

or

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

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

The requirements for waste collection, reuse, recycling, and recovery programs are set by the regulatory authority in your location. Contact your local responsible person (such as your laboratory manager) or authorized representative for information regarding applicable disposal regulations.

See the PerkinElmer web address below for information specific to PerkinElmer products, and contact details for the Customer Care department in your region.

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

Products from other manufacturers may also form a part of your PerkinElmer system. These other manufacturers are directly responsible for the collection and processing of their own waste products under the terms of the WEEE Directive. Please contact these manufacturers directly before discarding any of their products. Consult the PerkinElmer web address (above) for manufacturer's names and web sites.

Appendix A:
Using your own PC

Introduction

If you have purchased the tablet PC specifically provided for use with Raman IdentiCheck by PerkinElmer, it will be setup, the Spectrum software installed, and the system made ready for use, on-site by a PerkinElmer Service Engineer. All that you need to do to commission your Raman IdentiCheck is to unpack and check the instrument, as described on page 38.

If you choose to provide your own laptop or tablet PC for use with your Raman IdentiCheck, you must first:

- Ensure that is satisfies the appropriate hardware and software requirements.
- Configure the PC correctly.
- Install the Spectrum software.
- Configure the Spectrum software to use a triggered fiber optic probe.

NOTE: If you choose to provide your own laptop or tablet PC, these steps will be carried out by a PerkinElmer Service Engineer. The following sections are provided for your information only.

Hardware Requirements

The PC on which you install the Spectrum software must meet the following minimum specifications:

- Intel® Pentium 4 – 400 or 533 MHz processor
- At least 256 MB of Random Access Memory (RAM)
- Video card and monitor capable of displaying at least high color (16 bit) at 1024 × 768 SVGA, but ideally a screen resolution of 1280 × 1024 pixels
- 10 GB hard disk with at least 1 GB free space as an NTFS drive

NOTE: We have locked the system into using an NTFS drive because the alternative FAT32 file system doesn't provide enough protection at a folder and file level to ensure that users and groups of users cannot delete or amend data files, while at the same time being able to create new data files.

- CD-ROM drive
- Ethernet network connection
- A keyboard and mouse
- Hi-Speed USB 2.0 port (×2)

NOTE: The foam insert is designed to allow PCs with a maximum size of 297 × 220 × 38 mm to be transported in the lid of the IdentiCheck case.

Software Requirements

Operating System

Spectrum requires that Windows XP Professional Service Pack 2 operating system is installed on the PC before you install the software.

We have specified Windows XP Professional because it is a robust, industry strength operating system that provides inbuilt security and auditing. The system has been tested for use with English and other European languages.

Microsoft Service Packs can be downloaded from www.microsoft.com/downloads.

Windows Administrator Level

It is important to note that you must be logged on at Administrator level on Windows before installing the software. Logging on as an Administrator ensures that installation of the software can be undertaken and that the necessary system registry updates that form part of the installation process are successfully completed. Administrators have the capability to assign privileges and logon rights and therefore have the ability to make system-wide changes. Users do not have this ability, or may have restricted abilities depending on the rights and privileges assigned by the Administrator.

Configuring the PC

1. Please refer to the manufacturer's instructions for unpacking and assembling the PC.
2. Switch on the PC.

NOTE: Do not attach any cables between the instrument and the PC at this time.

3. If you are prompted to login to Windows when you start the PC, log in.
   If your PC was provided by PerkinElmer your username and password will be:
   Username: Administrator
   Password: Administrator
4. Click **OK**.
   You can now start using the PC.
5. It is important that the PC used with Raman IdentiCheck does not switch into Standby mode.
   Select the **Display** option on the Control Panel. On the Screen Saver page of the Display Properties dialog, click **Power** and then set the System standby and Turn off hard disks values to **Never** for both **Plugged in** and **Running on batteries**.

NOTE: To help ensure PC security, we recommend that the Administrator Password is changed regularly. For more information, see your Microsoft Windows documentation.

Installing Spectrum Software

Before you Start

NOTE: Before installing the software, we recommend that you read and print the Release Notes which can be found as a .rtf file and a .pdf file on the root of the CD, because they contain important information that may not be in this manual or the Spectrum Help.

To read .pdf files you will need Adobe Reader 5.0 or later. An installation of this software is available on the *Software Utilities CD*.

Before installation, please ensure that:

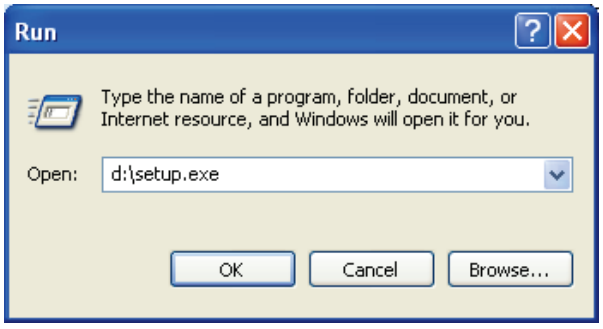
- All programs have been closed, including any anti-virus software running on the PC.
- The USB cables between the PC and the IdentiCheck and, between the PC and triggered fiber optic probe, are **NOT** connected.
- Your IdentiCheck is switched on.

Installation Procedure

NOTE: It is important to note that you must be logged on at Administrator level on Windows before installing the software.

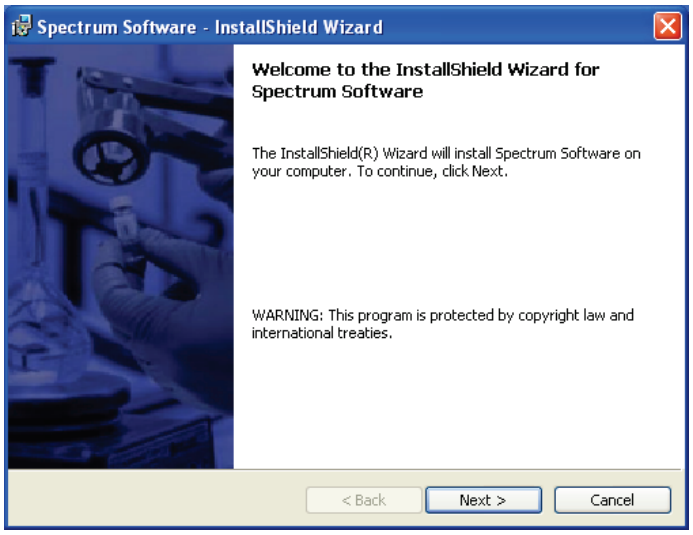
The Installation Wizard helps you install the software on your PC.

1. Place your *IR & Raman Applications CD* into your CD-ROM drive.
   The software must be version 6.3.2 or later.
2. If the installation program does not start automatically, from the Start Menu select **Run**.
   The Run dialog is displayed.



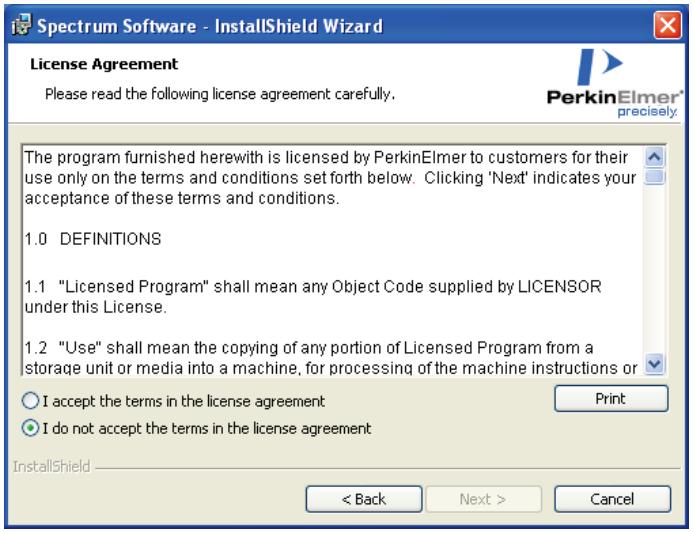
3. Enter **d:\Setup.exe** and then click **OK**.
   Replace d:\ with the drive letter for your CD-ROM drive.

The InstallShield Wizard dialog appears while the system is preparing to install the software. When the installer is ready, the Welcome dialog is displayed.



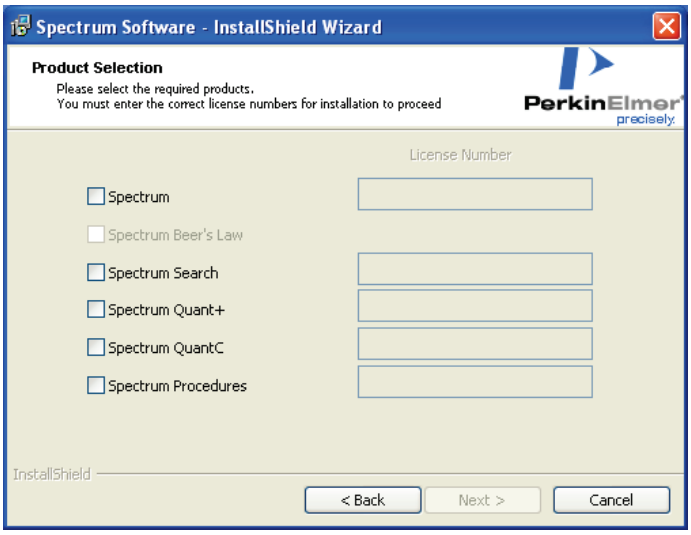
If your PC does not meet the software requirements given in *Software Requirements* starting on page 78, an appropriate error message will inform you of the problem. You will need to correct this problem before the installation can be performed.

4. Click **Next**.
   The License Agreement page is displayed.



5. Read the license and if you accept the terms, select that option and then click **Next**.

You will then be asked which products you want to install.



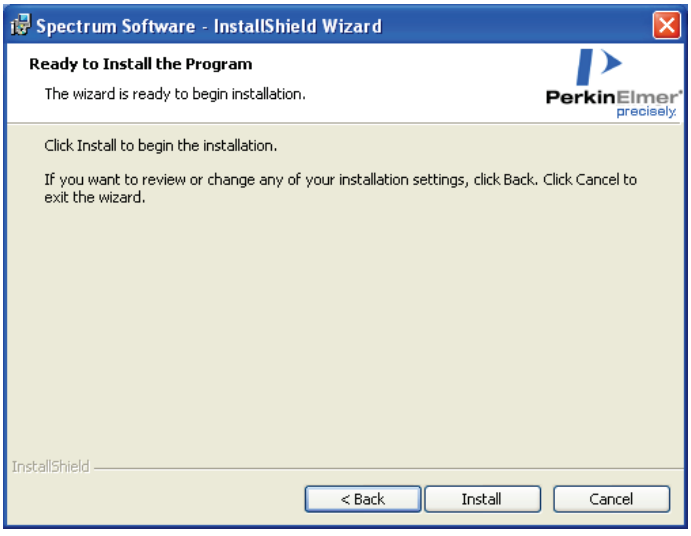
6. Select the required product(s) and then enter the **License Number(s)** as found on the Software License Certificate.

   You must enter the correct license number(s) to proceed with the installation. If you enter an incorrect license number the **Next** button is disabled.

   The Spectrum Beer's Law check box is automatically selected when you select the Spectrum check box. You do not need to enter a license number for Spectrum Beer's Law.

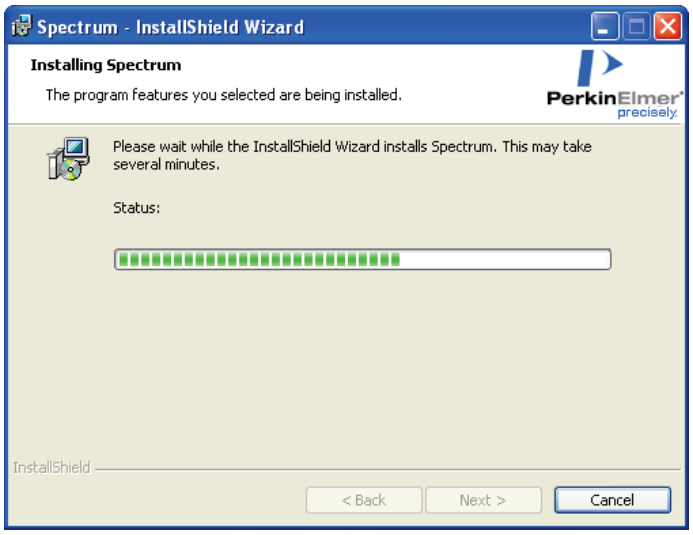
7. Click **Next**.

   The Ready to Install the Program page is displayed.

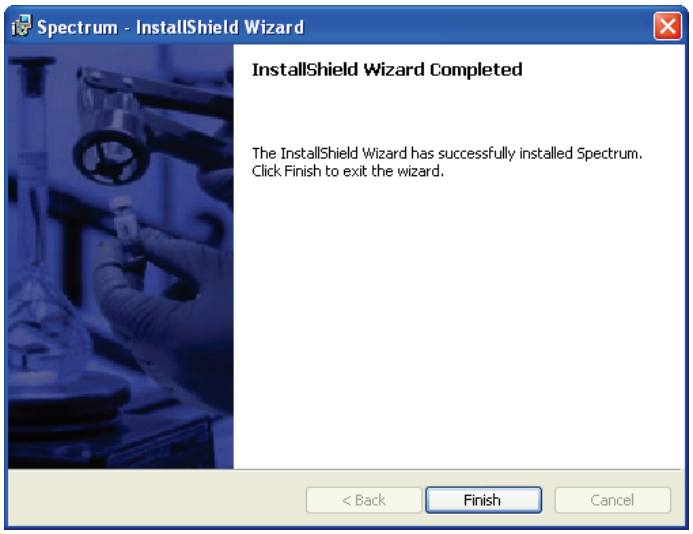


8. Click **Install** to begin installing Spectrum.

The Installing Spectrum Software page is displayed, which informs you of the status of the installation.



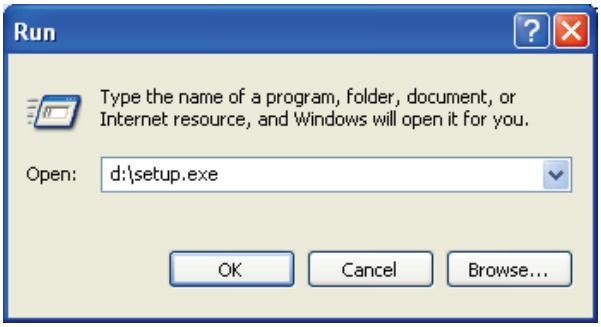
When the installation is complete, the InstallShield Wizard Completed page is displayed.



9. Click **Finish**.
   Before you can collect spectra you must configure your Raman instrument.

10. Place your *Raman Instrument Installation Disk (LX108925)* into your CD-ROM drive.

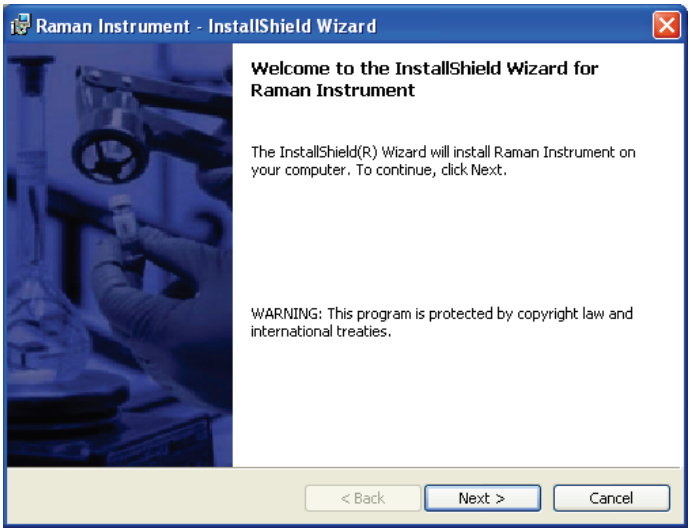
11. If the installation program does not start automatically, from the Start Menu select **Run**.
    The Run dialog is displayed.



12. Enter **d:\setup.exe** and then click **OK**.

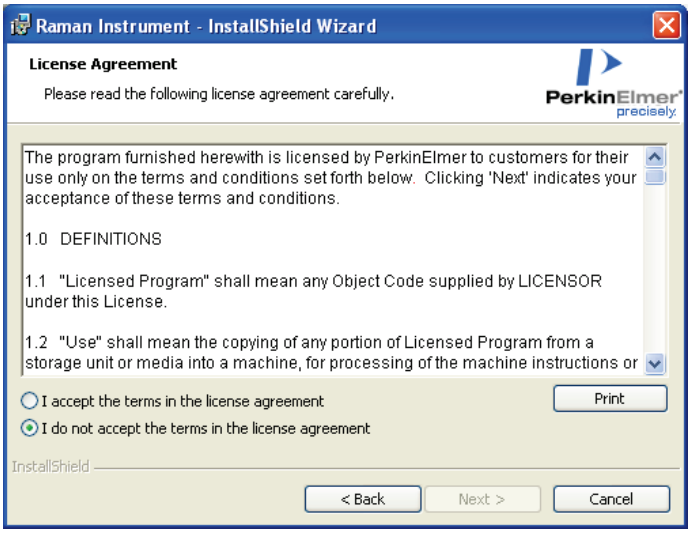
    Replace d:\ with the drive letter for your CD-ROM drive.

    The InstallShield Wizard dialog appears while the system is preparing to install the software. When the installer is ready, the Welcome to the InstallShield Wizard for Raman Instrument page is displayed.



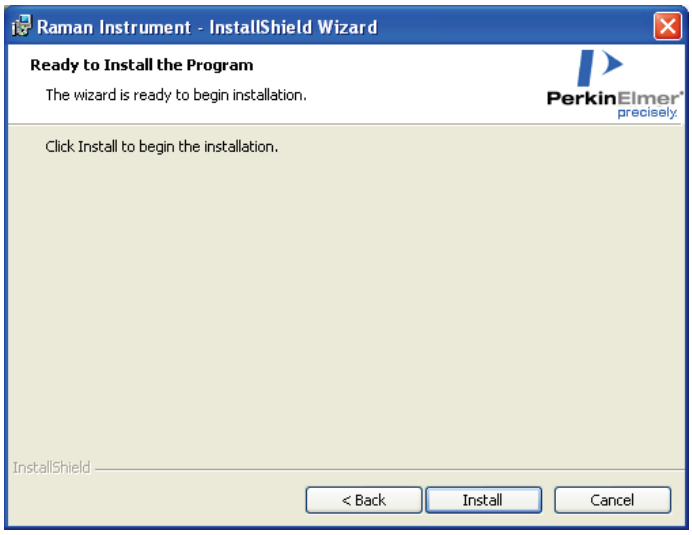
13. Click **Next**.

    The License Agreement page is displayed.



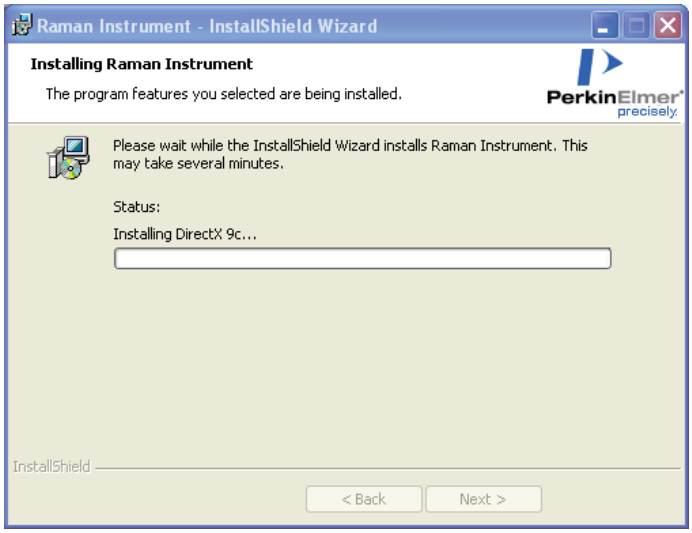
14. Read the license and if you accept the terms, select that option and then click **Next**.

The Ready to Install the Program page is displayed.

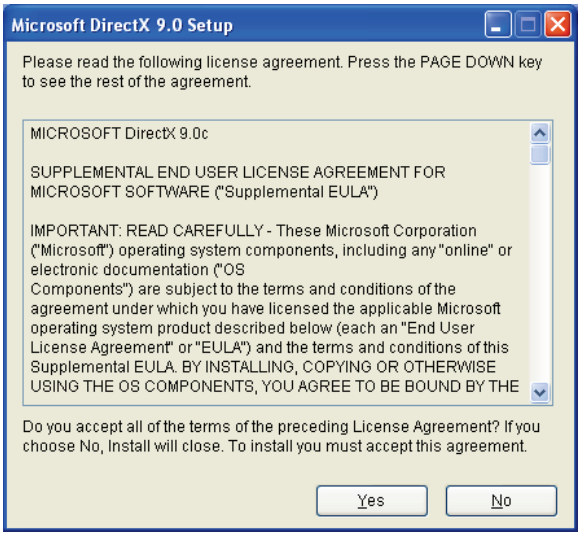


15. Click **Install** to begin installing the Raman instrument.

    The Installing Raman Instrument page is displayed, which informs you of the status of the installation.

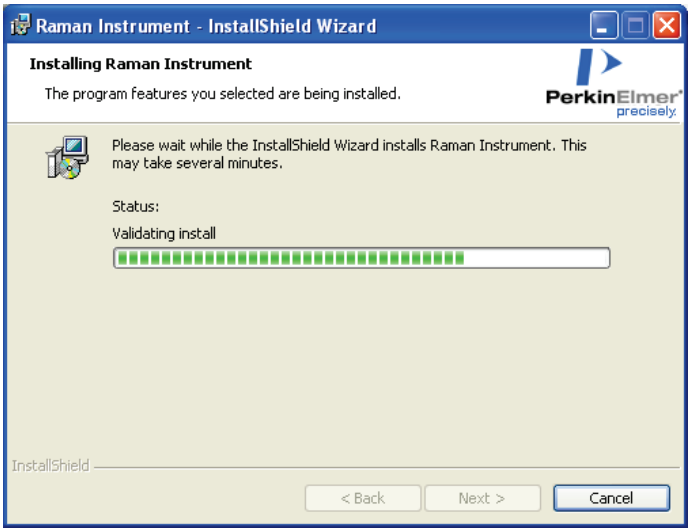


During this installation, the DirectX Setup page is displayed.



16. Read the license and if you accept the terms, click **Yes**.

    The Installing Raman Instrument page is displayed again which informs you of the status of the installation.

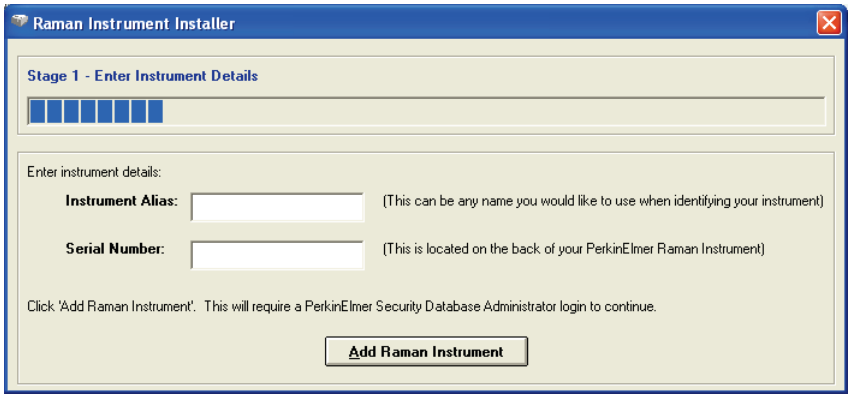


17. Click **Next**.

    The Raman Instrument Install Wizard opens at the Welcome page.

18. Click **Start**.

    The Enter Instrument Details page is displayed.



19. In the **Instrument Alias** field, enter a name for your Raman instrument.

    This should be a unique name to identify this instrument.

20. In the **Serial Number** field, enter the serial number of your instrument.

    This is included on a label postioned on the right-hand panel of the spectrometer, below the LEDs.

21. Click **Add Raman Instrument**.

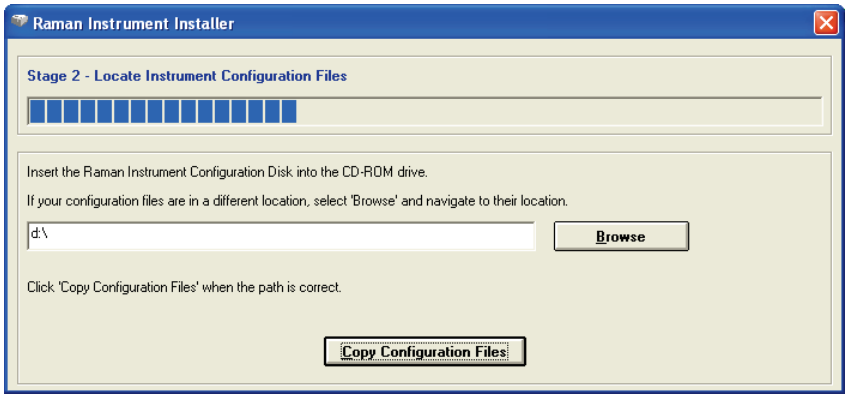
    If you have already installed PerkinElmer software on the PC, the PerkinElmer Login dialog is displayed.

    Login as a PerkinElmer Software Administrator.

    Use the Administrator **User name** that you use for the PerkinElmer software that is already installed on the PC.

    The default **User name** and **Password** are **administrator**.

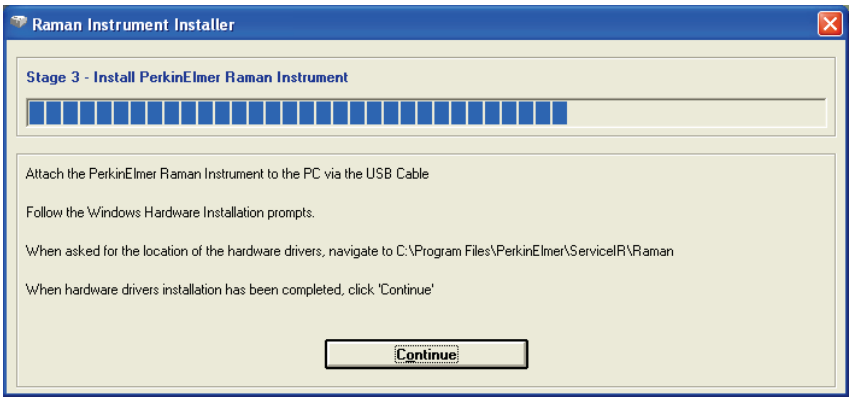
    The Locate Instrument Configuration Files page is displayed.



22. Place your *Raman Instrument Configuration Disk* into your CD-ROM drive, wait a few seconds, and then click **Copy Configuration Files**.

    If your configuration files have already been installed on your PC, click **Browse** and navigate to their location before you click **Copy Configuration Files**.

The Install PerkinElmer Raman Instrument page is displayed.

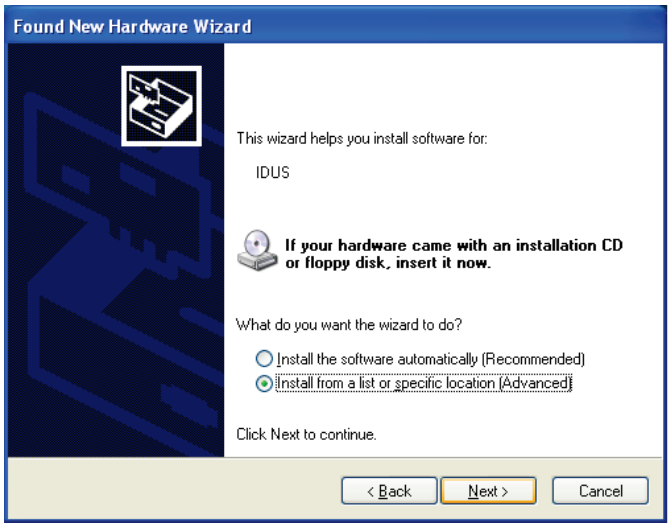


23. Attach your Raman IdentiCheck to the PC, via the USB cable.

NOTE: If you disconnect the instrument control USB cable and reattach it to a different USB port, you will be prompted for the drivers. By default this driver is stored in C:\Program Files\PerkinElmer\ServiceIR\Raman.

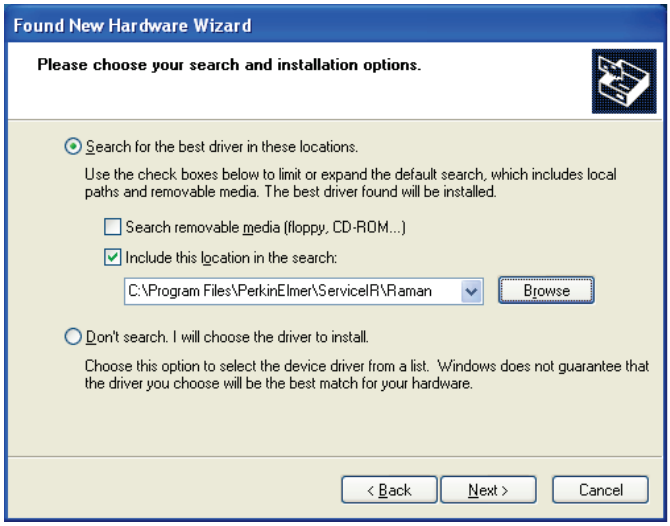
24. Wait until the Welcome to the Found New Hardware Wizard is displayed.

25. Select **No, not this time** and then click **Next**.
    The Found New Hardware Wizard page is displayed.



NOTE: The Found New Hardware Wizard page may inform you that it is helping you install software for **USB Device**. In this case continue with the installation in the same way as for **IDUS**.

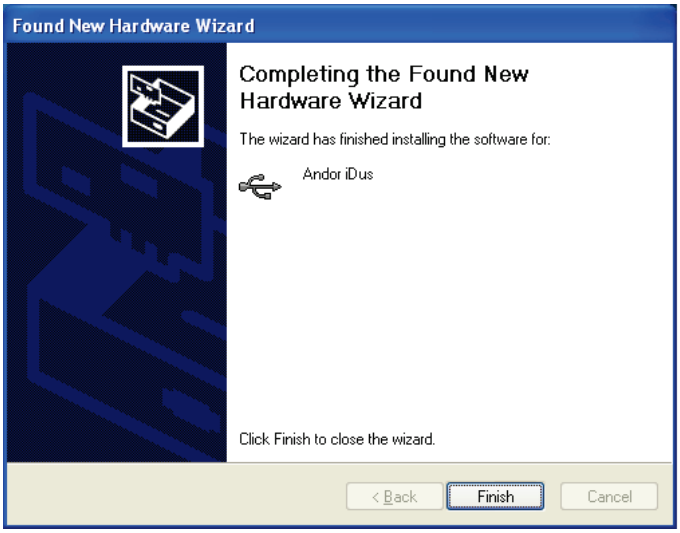
26. Select **Install from a list or specific location (Advanced)** and then click **Next**.
    The Please choose your search and installation options page is displayed.



27. Select **Include this location in the search**, click **Browse,** and then navigate to C:\Program Files\PerkinElmer\ServiceIR\Raman.

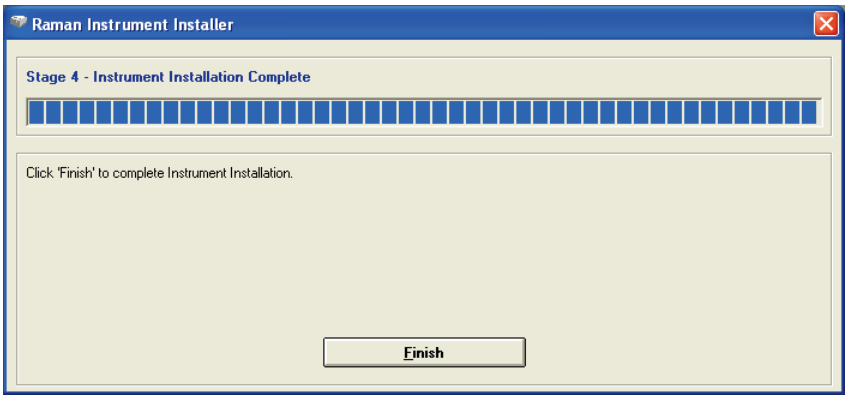
28. Click **Next**.

The Completing the Found New Hardware Wizard is displayed.

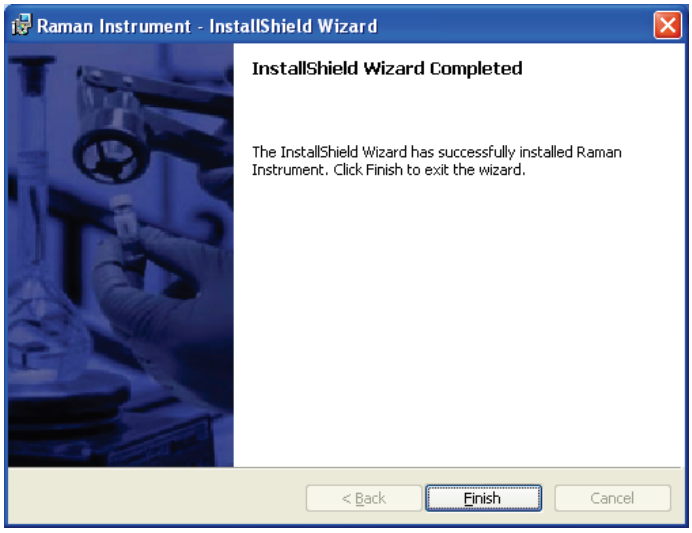


29. Click **Finish**.
    The Found New Hardware Wizard closes.

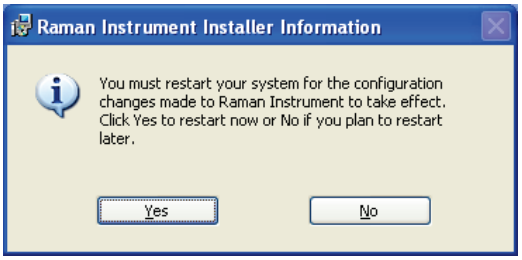
30. On the Install PerkinElmer Raman Instrument page, click **Continue**.
    The Instrument Installation Complete page is displayed.



31. Click **Finish**.
    The Raman Instrument Installer closes.
    When the installation is complete, the InstallShield Wizard Completed page is displayed.



32. Click **Finish**.
    The Raman Instrument Installer Information dialog is displayed.



33. Click **Yes** to restart your PC.

34. Once your PC has restarted, navigate to the folder C:\Program Files\PerkinElmer\ServiceIR\Raman\TriggeredFiberProbe.

35. Run the **CDM** utility program.
    This installs the drivers required by the triggered probe.

36. Connect the USB extender cable from the TFOP into a USB port on the PC.
    Windows acknowledges that New Hardware has been attached.

This completes the software installation procedure.

Configuring Spectrum to use a Probe

1. Ensure the instrument is switched on and the Spectrum software is running.
   See *SOP-1:* on page 53 for details.

2. Select **Instrument** from the Setup menu.
   The Scan and Instrument Setup dialog is displayed.

3. Click 

.

4. In the Accessory Configuration section, click in the Beampath drop-down list to activate the **Triggered Fiber Optic Probe** option.
   When you make the selection, the Probe Path indicator on the probe will light-up blue. This indicates that the probe is ready for use.

NOTE: For safety reasons, when the TFOP is selected as the Beam Path option, all **Scan** buttons in the Spectrum software are disabled. Scanning with a TFOP can only be started using the trigger on the probe; see *SOP-5: Collecting a Spectrum with a Triggered Fiber Optic Probe* on page 57 for details.