

i-Raman Plus



2.955.0010 / 2.955.0020 / 2.955.0030

Manual

8.955.8001EN / v1 / 2026-03-15



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Technical Communication
Metrohm Spectro, Inc.
Plainsboro Township, NJ 08536

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1. Overview

1.1. Product Description

The i-Raman Plus products are Raman spectrometers that collect Raman scattering. This scattering is transformed into a spectrum, which can act as a molecular fingerprint that can be used for reaction monitoring, material identification, and quantitative analysis.

The i-Raman Plus is designed to operate in a laboratory environment. The instrument is connected to the power supply and an external computer through a USB-C connection.

SpecSuite Software

The i-Raman Plus utilizes Metrohm's SpecSuite software, an all-in-one software suite designed for both routine and exploratory research. The SpecSuite software is used to operate the instrument, collect data, and evaluate the measured scattered spectra. **SpecSuite is available with 21CFR Part 11 regulatory compliance.**

SpecSuite has the following license packages:

- **Basic** – Real-time data visualization and simple control over parameters like laser power, integration time, spectral averaging, and basic spectral processing.
- **Identification** – Supports creation of custom Raman libraries for identifying unknowns or verifying known substances.
- **Quantitative** – Facilitates development and deployment of predictive models for streamlined routine analysis.
- **Regulatory compliance** – Supports audit trail, electronic signatures, and other 21CFR Part 11 functionalities.
- **Libraries** – Licenses for Metrohm Raman spectral libraries are also available for use with the Identification license.



Additional information on the licenses can be obtained from your regional Metrohm representative.

1.2. Product Versions

The product is available in the following versions:

Article Number	Designation	Version Feature
2.955.0010	i-Raman Plus 532	532 nm laser
2.955.0020	i-Raman Plus 785HR	785 nm laser, high resolution
2.955.0030	i-Raman Plus 785S	785 nm laser, wide spectral range

The article number and serial number for identifying the product is located on the type label:

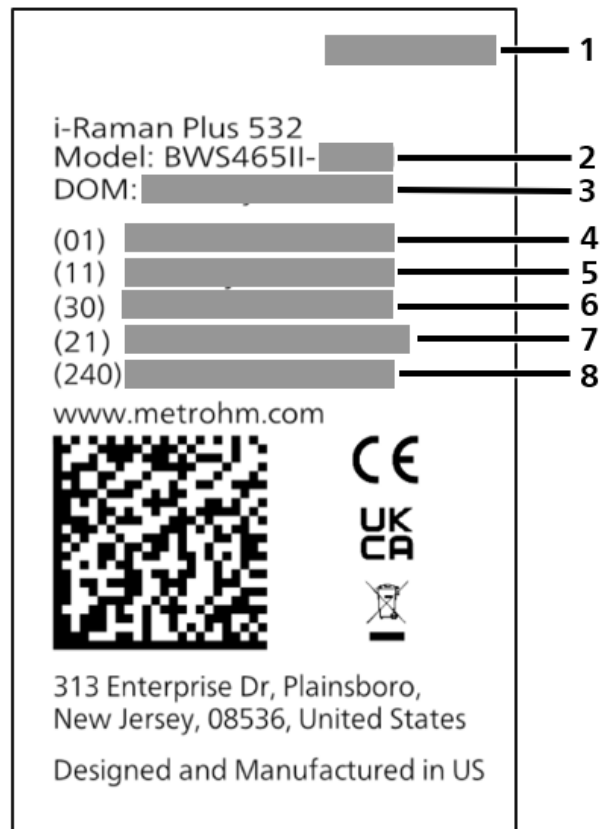


Figure 1: Type Label for i-Raman Plus



- Click on to download the accessories list as a PDF.
- Metrohm recommends keeping the downloaded PDF for reference purposes.

2. Safety

2.1. Intended Use

The i-Raman Plus systems are suitable for spectroscopic analysis of a wide range of organic and inorganic samples including common chemicals, active pharmaceutical ingredients (APIs) and excipients, polymers, pigments, petroleum products.

The device is designed for indoor use, including laboratories and manufacturing facilities.

Read the entire manual before operating the system.

2.2. Responsibility of the Operator

The operator must ensure that the basic national and international regulations on laser safety, occupational safety and accident prevention in chemical laboratories are observed. The operator has the following responsibilities:

- Instruct personnel in the safe handling of the product.
- Train personnel in the use of the product according to the user documentation (e.g. install, operate, clean, eliminate faults).
- Train staff on basic occupational safety and accident prevention regulations.
- Provide personal protective equipment (e.g. laser safety goggles, gloves).
- Provide suitable tools and equipment to execute the work safely.
- Ensure compliance with applicable laws, regulations and standards.

2.3. Requirements for Operating Personnel

Only qualified personnel may operate the product. Qualified personnel are persons who meet the following requirements:

- Basic regulations on occupational safety and accident prevention for chemical laboratories are known and complied with.
- Knowledge of handling hazardous chemicals is present. Personnel have the ability to recognize and to avoid potential dangers.
- Knowledge regarding the application of fire prevention measures for laboratories is available.
- Safety-relevant information is communicated and understood. The personnel can operate the product safely.
- The user documentation has been read and understood. The personnel operate the product according to the instructions in the user documentation.

2.4. Laser Safety

An i-Raman Plus system contains 1 Class 3B laser light source. The product will have either a visible or an invisible laser, based on the model. The visible laser wavelengths includes 532 nm. The invisible laser wavelength includes 785 nm.

The i-Raman Plus systems comply with IEC 60825, and the US Federal Code of Regulations 21 CFR 1040.10, Laser Products.

Both Visible and Invisible laser light sources are potentially hazardous.

2.4.1. Laser Emission Aperture

The i-Raman Plus should be operated with a fiber probe or accessory connected.

When a fiber is connected to the instrument, the laser emission aperture is at the end of the probe shaft. The probe has a yellow **laser emission aperture label** pointing towards the aperture.



Figure 2: Raman Probe laser emission aperture



Removing the fiber probe from the instrument will cause the FC coupler port labeled Excitation to be a laser emission aperture. This emission port has a **laser emission aperture label**.



Figure 3: System laser emission aperture with fiber disconnected

2.4.2. Nominal Ocular Hazard Distance (NOHD)

The nominal ocular hazardous distances (NOHD) is the minimum distance from a laser source a person must be to avoid eye damage. **Within this distance, proper laser safety eyewear is required.**

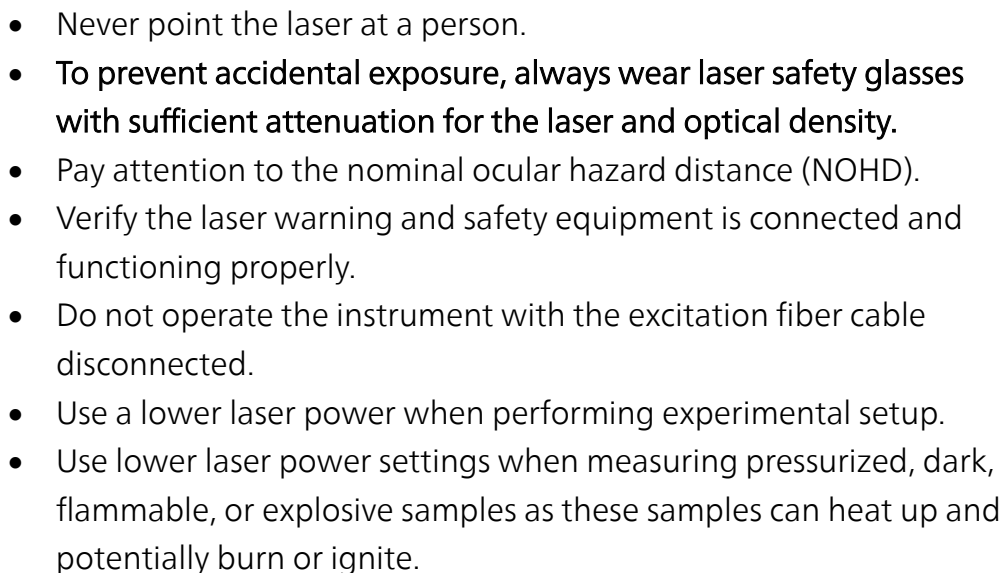
The NOHD is different based on the laser in the instrument and the laser's emission location. The following table shows the NOHD of each product version at each exit aperture:

Exit Aperture	532 nm Laser NOHD (cm)	785 nm Laser NOHD (cm)
FC coupler at laser port	38	94
BAC10x w/ standard shaft RSS100	17	41
BAC10x w/ RIS100-FS shaft	27	69
BAC10x w/ RIS100-SA shaft	28	71
BAC10x w/ immersion shafts	7	17
10X Objective of Microscope	38	93
20X Objective of Microscope	19	47
50X Objective of Microscope	8	19
100X Objective of Microscope	9	11
BAC10x without shaft	837	2075

The NOHD values were calculated based on a maximum laser power existing these apertures of 55 mW for the 532 nm model and 500 mW for the 785 nm models.

2.4.3. General Laser Safety

- Never look directly into the laser beam path or scattered laser light from any reflective surface.
- Never look directly into the laser aperture.



- **CDRH-Radiological Health Program**
Office of Communication, Education and Radiation Programs
Center for Instruments and Radiological Health
US Food and Drug Administration
10903 New Hampshire Avenue W066-4613, Silver Spring, MD 20993 USA
Tel: 1-800-638-2041 Fax: 1-301-847-8149
dsmica@fda.hhs.gov
- **Laser Institute of America**
13501 Ingenuity Drive, Suite 128, Orlando, FL 32826 USA
Tel: 1-407-380-1553 Fax: 1-407-380-5588
www.lia.org

The i-Raman Plus comes with the following laser safety parts:

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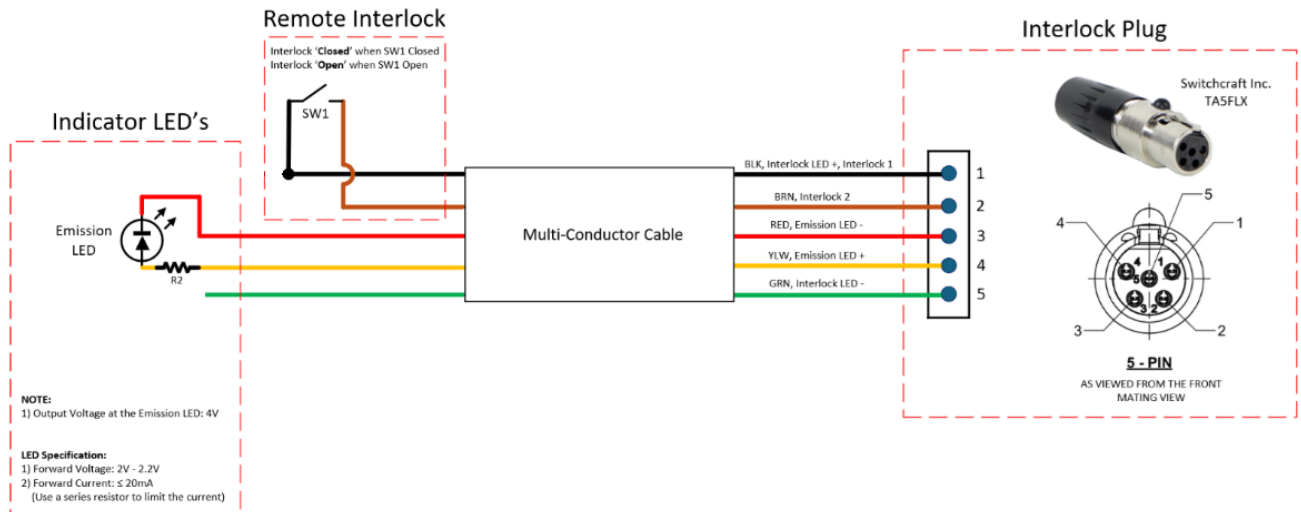


Figure 5: Remote interlock schematic

To install an interlock switch, the user must cut open the interlock loop and connect the 2 wires to the switch terminals.

2.4.6. Risk of Injury Measuring Thermally Sensitive Materials

Measuring a thermally sensitive sample that is in a tightly sealed vessel can lead to a pressure increase and subsequent explosion of the vessel.

2.4.7. Laser Warning Label

The laser warning label is located on the rear panel of the system. It includes:

- laser safety class
- laser wavelength
- maximum power of the laser

Lasers that are >700 nm wavelength have an "Invisible Laser Radiation" note next to their wavelength.

Laser Safety Warning for Product Version with a Visible Laser

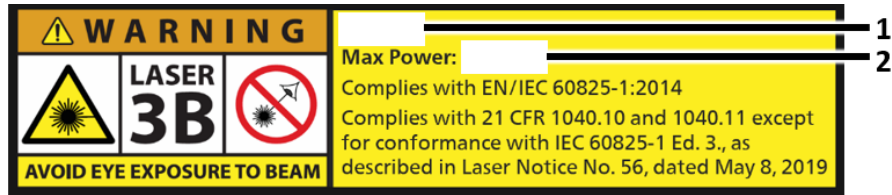


Figure 6: Laser warning for 532nm systems

1 Laser wavelength	Instrument		Laser wavelength
	2.955.0010	i-Raman Plus 532	532 nm
2 Max laser power	Instrument		Max laser power
	2.955.0010	i-Raman Plus 532	55 mW

Laser Safety Warning for Product Versions with Invisible Lasers

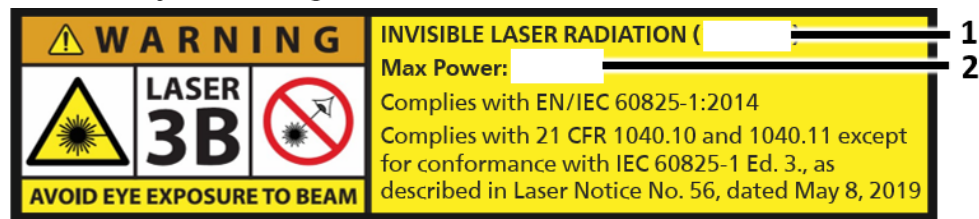


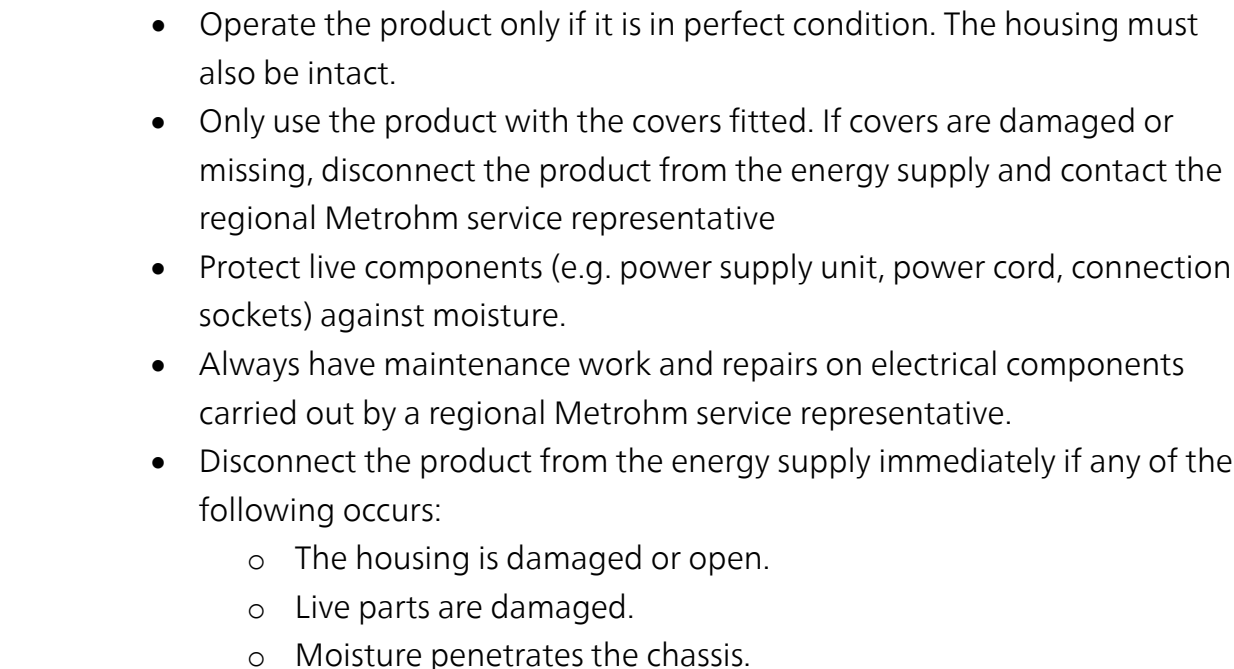
Figure 7: Laser warning for 785nm systems

1 Laser wavelength	Instrument		Laser wavelength
	2.955.0020	i-Raman Plus 785HR	785 nm
	2.955.0030	i-Raman Plus 785S	785 nm
2 Max laser power	Instrument		Max laser power
	2.955.0020	i-Raman Plus 785HR	495 mW
	2.955.0030	i-Raman Plus 785S	495 mW

2.5. General Safety

2.5.1. Danger from Electrical Potential

Contact with electrical potential can cause serious injuries or death. To avoid danger from electrical potential, observe the following:



Using highly flammable substances or gases may cause fires or explosions. To avoid danger from highly flammable substances, observe the following:

- ## 2.6. Design of Warning Messages

Structure

- ## Hazard levels



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3. Functional Description

3.1. Instrument Overview

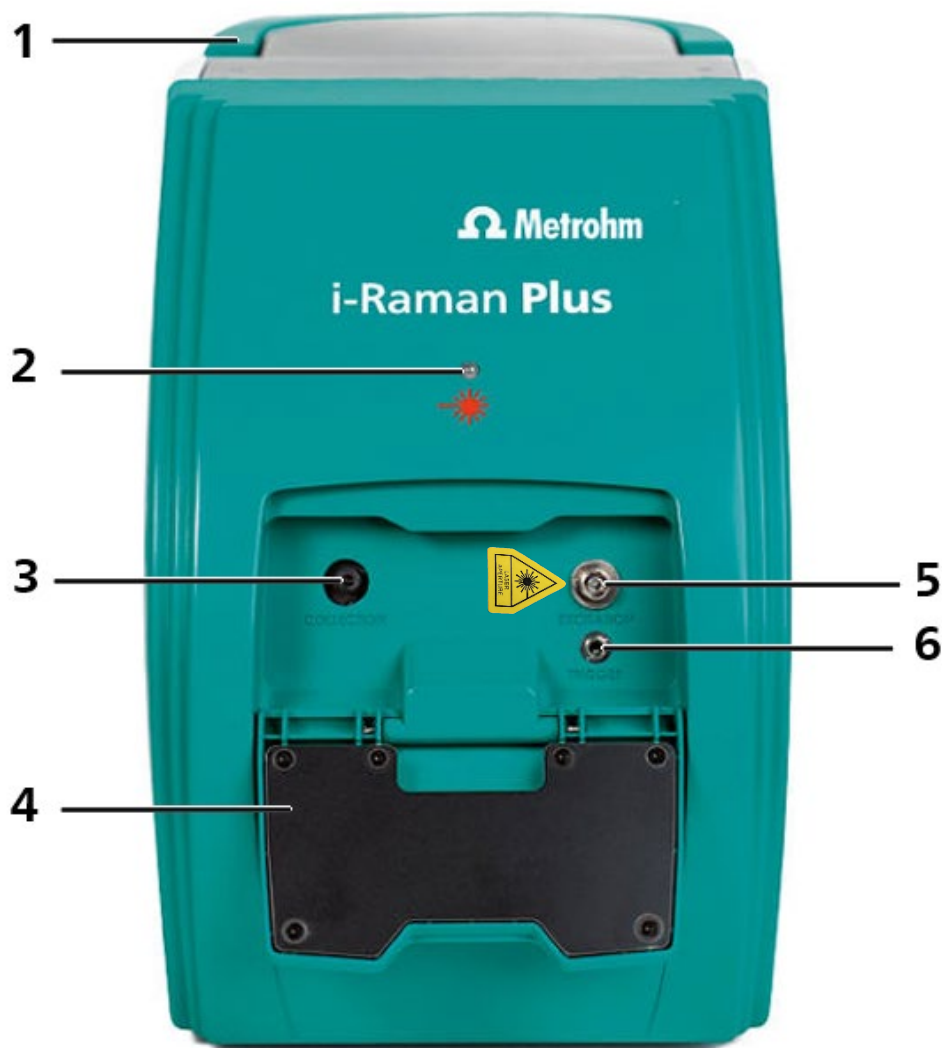


Figure 8: i- Raman Plus Front

1	Carrying handle	2	Laser emission LED
3	Collection fiber port Optical SMA connection	4	Front panel door
5	Excitation fiber port FC/PC connection	6	Trigger port



Figure 9: i-Raman Plus Rear

1	USB-C port	2	Venting fan
3	Product label	4	Laser safety label
5	Fuse	6	Power port
7	Power switch	8	Interlock
9	AUX port	10	Laser key switch

SMA connection

3.2. Raman Probe

3.2.1. Overview

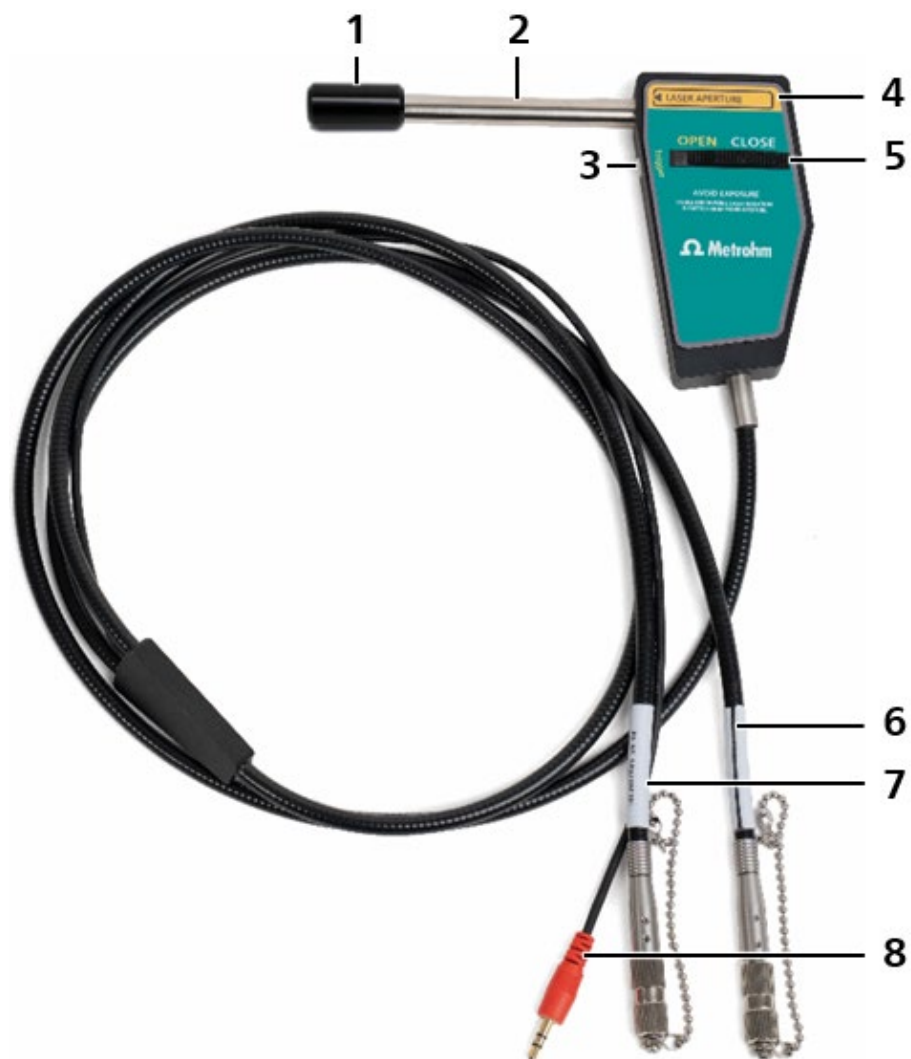


Figure 10: i-Raman Plus probe with distance regulator

1	Distance regulator	2	Shaft
3	Trigger button	4	Aperture label
5	Shutter	6	Collection fiber cable
			Optical SMA connection
7	Excitation fiber cable	8	Trigger cable
	FC/PC connection		

The Raman probe is used with the instrument for sampling. Each probe has a manual **shutter** to open / close the laser beam. The **shutter** can block unwanted laser emission. The shutter can block incoming light to facilitate a true-dark measurement.

The **trigger button** on the probe can facilitate convenient Raman data collection.

The **probe shaft** is attached to the probe body by twisting clockwise. When sampling with a probe, the shaft must be properly attached.



WARNING

Firing the laser without a shaft attached

Risk of injury from firing the laser without a shaft attached. The laser will be collimated and will increase the NOHD and risk of injury.

- Do not fire the probe without a shaft attached.
- Wear laser safety glasses when firing the laser



NOTICE

Hand tighten probe shaft

Risk of breaking the probe if tightened with tools or too tight.

- Do not overtighten.
- Do not use tools.

3.2.2. Fiber Connection

The Raman probe has 2 fibers marked “**Excitation**” and “**Collection**” and a third cable with a red plug (**trigger plug**) connected to the unit. On i-Raman Plus, the excitation fiber port is FC/PC and the collection fiber port is SMA905.

The Raman probe is connected to the instrument using the 2 fiber ports located on the front panel of the instrument.



NOTICE

Aligned Fiber

FC/PC terminated fiber cables have a notched connection with a key on the cable and a keyway on the port.

- Align the fiber cable with the keyway on the device port before connecting and tightening.



Figure 11: Aligning FC/PC fiber cable to port

Hand tighten fiber

Risk of breaking the probe or instrument

- Do not overtighten.
- Do not use tools.

3.2.3. Working Distance

The working distance is the distance between the laser emission aperture and the laser focal point.



The **distance regulator** allows for quick and easy measurements of bulk material.



Figure: Scanning with the distance regulator

For more control of the sampling positioning, Raman probes can be attached to the optional **Probe holder accessory**. The **Probe holder** allows fine tune adjustments to be made.



Figure 13: Fine adjusting the sampling position with Raman probe holder

Raman probes can use an optional **Vial Holder** accessory to sample liquids in a 15mm diameter vial. The optional **Vial Holder** accessory is recommended for sampling liquids because the focal point is inside the vial where the sample is, past the wall of the vial. Additionally, the **Vial Holder** accessory's top cap blocks stray light.



Figure 14: Installing vial holder accessory top cap

Raman probes can use an optional **Cuvette Holder** accessory to sample liquids and powders in a cuvette of 12.5 mm x 12.5 mm outer diameter (1 cm path length). The optional **Cuvette Holder** accessory uses an internal mirror with a three-point precision locking mechanism for unmatched reproducibility, thereby increasing the Raman signal compared to conventional cuvette holders. It is designed so that the probe shaft does not directly contact the cuvette and includes a light trap to reduce background fluorescence.



Figure 15: Sampling with cuvette holder

The ideal sample positioning changes based on the material being sampled. The following positioning is generally recommended to achieve the maximum Raman signal:

3.5. Interfaces

Port	Purpose	Location
Collection (fiber)	Connect the probe to the instrument. Carries the Raman signal through the probe fiber to the spectrometer.	Front Panel
Excitation (fiber)	Connect the probe to the instrument. Carries the laser through the probe fiber to the emission aperture.	Front Panel
USB-C	Connect the instrument to the computer for control and analysis using SpecSuite	Rear Panel
AUX	Power the light source of the optional accessory Raman Video Micro-Sampling System. When the accessory is connected to the AUX port, SpecSuite will automatically turn off the light source of the microscope when sampling.	Rear Panel

4. Delivery and Transport

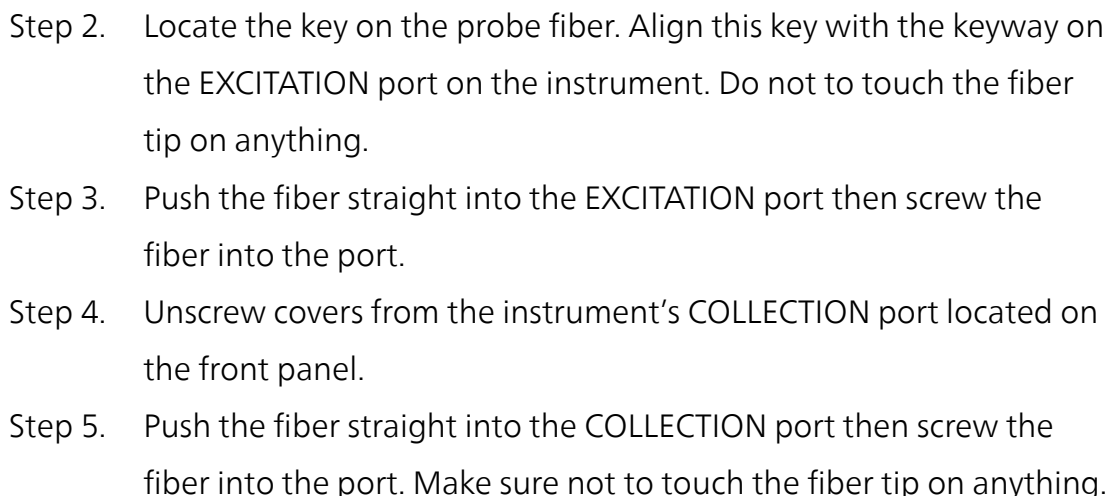
4.1. Delivery

Inspect the delivery immediately upon receipt:

- Check the delivery against the delivery note to ensure completeness.
- Check the product for damage.
- If the delivery is incomplete or damaged, contact your regional Metrohm representative.

4.2. Packaging

The product and accessories are supplied in protective special packaging. Keep this packaging to ensure safe transportation of the product. If a transport locking device is present, keep this as well for future reuse.



Health hazard from electrical potential.

Severe injuries with possibly fatal consequences.

- Operate the product only if it is in perfect condition. The housing must also be intact.
- Only use the product with the covers fitted.
- Protect live components (e.g. power supply unit, power cord, connection sockets) against moisture.
- Always have maintenance work and repairs on electrical components carried out by a regional Metrohm service representative.

The power cord is connected to the instrument using the 5.5 mm O.D. barrel connection socket on the rear panel of the device (in [“Overview”, Chapter 3.1.](#)).

If there are problems with the main power supply (e.g., brownouts, power surges, frequent thunderstorms, or power blackouts), use an Uninterruptible Power Supply (UPS) unit to ensure uninterrupted operation.

For power supply requirements, see: [Energy supply](#).

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- ➦ (1) BWS465II-785S - VOV

Step 11. Follow any warm up instructions in section 6.2 Warm Up Period.

Before operating the device, the following steps must be completed:

Calibration Certificate

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- Raman Shift Calibration
- Performance Validation Test

Raman Shift Calibration and the Performance Validation test use the Polystyrene Validation Cap. This accessory is shipped with the unit and has a 4-year expiration date.



Figure 18: Performance Validation Cap for Raman probes with a shaft diameter of 9.5 mm



For a replacement or spare Polystyrene Validation Cap, contact your regional Metrohm service representative.

Information on intervals to run calibration and validation can be found in [Chapter 7.2.1, "Test and maintenance intervals"](#).

Additional information on the calibration and validation process can be found in Tutorial SpecSuite, section 5.4 Performance and section 5.5 Calibration.



Additional calibrations and validations are available from your local regional Metrohm service representative.

7. Maintenance

7.1. Good Operating Practice

To prolong the instrument's lifetime and maintain good operating practice:

- Keep the Raman probe connected to the instrument.
- When the Raman probe is not connected, cover the ends of the fiber with the protective caps.
- When the Raman probe is not connected, cover the fiber connectors with protective caps.
- Make sure the fiber tips of the probe do not touch anything.
- Do not bend the fiber cables more than a 10 cm radius.



Altitude / Pressure range	Max. 3,000 m. above sea level
---------------------------	-------------------------------

9.2. Energy Supply

Power supply requirements:

- 12 V DC
- 6.6 A
- 80 W MAX

9.2.1. External Power Supply Unit

Inlet

<i>Nominal voltage range</i>	100 V AC to 240 V AC
<i>Frequency range</i>	50 to 60 Hz
<i>Typical Current</i>	1.3 A

Outlet

<i>Nominal voltage range</i>	12 V DC
<i>Nominal current</i>	7.0 A

9.2.2. Instrument

Power In

<i>Barrel port</i>	5.5 mm O.D. / 2.5 mm I.D.
<i>Nominal voltage</i>	12 V DC
<i>Nominal current</i>	6.67 A
<i>Max Power</i>	80 W

Power Out

AUX port	5 V DC	SMA
	400 mA	



Laser Safety Connectors

<i>Interlock port</i>	5 pin	
<i>Laser key switch</i>	Laser key switch	The key can only be removed when it is in the OFF position.

Fiber Connectors

<i>Collection port</i>	Optical SMA	Black fiber connection.
<i>Excitation port</i>	FC/PC	Silver fiber connection.

9.5.2. External Power Supply Unit

Input cable

<i>Ext. Power supply side</i>	IEC 320-C, type C14
<i>Building side</i>	country-specific

Output plug

<i>Barrel connector</i>	Barrel jack	5.5 mm O.D. / 2.5 mm I.D. 11 mm barrel length center positive
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9.6. Operation

Power Switch	On/Off
--------------	--------

9.7. Spectrometer Specifications

Spectral range

<i>2.955.0010</i>	65 – 3400 cm ⁻¹
<i>2.955.0020</i>	65 – 2800 cm ⁻¹
<i>2.955.0030</i>	65 – 3350 cm ⁻¹

Resolution

<i>2.955.0010</i>	< 3.5 cm ⁻¹ at 614 nm
<i>2.955.0020</i>	< 3.5 cm ⁻¹ at 912 nm

