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Brief Operating Instructions
Raman Rxn2

Endress+Hauser
People for Process Automation

Table of Contents

1 About this document

1.1 Disclaimer

These Instructions are Brief Operating Instructions; they do not replace the Operating Instructions included in the scope of supply.

1.2 Warnings

Structure of Information	Meaning
⚠ WARNING **Causes (/consequences)** If necessary, consequences of non-compliance (if applicable) ▸ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation can result in a fatal or serious injury.
⚠ CAUTION **Causes (/consequences)** If necessary, consequences of non-compliance (if applicable) ▸ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or more serious injuries.
NOTICE **Cause/situation** If necessary, consequences of non-compliance (if applicable) ▸ Action/note	This symbol alerts you to situations which may result in damage to property.

Table 1. Warnings

1.3 Symbols

Symbol	Description
	The Laser Radiation symbol is used to alert the user to the danger of exposure to hazardous visible laser radiation when using the Raman Rxn2 system.
	The High Voltage symbol that alerts people to the presence of electric potential large enough to cause injury or damage. In certain industries, high voltage refers to voltage above a certain threshold. Equipment and conductors that carry high voltage warrant special safety requirements and procedures.
	The ETL Listed Mark provides proof of product compliance with North American safety standards. Authorities Having Jurisdiction(AHJ) and code officials across the US and Canada accept the ETL Listed Mark as proof of product compliance to published industry standards.
	The WEEE symbol indicates that the product should not be discarded as unsorted waste but must be sent to separate collection facilities for recovery and recycling.
	The CE Marking indicates conformity with health, safety, and environmental protection standards for products sold within the European Economic Area (EEA).

Table 2. Symbols

1.4 U.S. export compliance

The policy of Endress+Hauser is strict compliance with U.S. export control laws as detailed in the website of the Bureau of Industry and Security at the U.S. Department of Commerce.

2 Safety

2.1 Requirements for the personnel

- Installation, commissioning, operation, and maintenance of the measuring system may be carried out only by specially trained technical personnel.
- The technical personnel must be authorized by the plant operator to carry out the specified activities.
- The electrical connection may be performed only by an electrical technician.
- The technical personnel must have read and understood these Operating Instructions and must follow the instructions contained therein.
- Faults at the measuring point may only be rectified by authorized trained personnel. Repairs not described in this document must be carried out only directly at the manufacturer's site or by the service organization.

2.2 Designated use

The Raman Rxn2 analyzer is designed for use in the following applications:

- Chemical composition measurements of solids, liquids, gases, or turbid media in a laboratory or process development environment. The Raman Rxn2 is particularly suited for use in the following applications:
  - Endpoint monitoring of chemical reactions.
  - Crystallinity monitoring of solid materials.
  - Critical process parameter monitoring and control in upstream cell culture or fermentation bioprocesses.
  - Molecular structure and composition of plant-based proteins, dairy solids, and cell-based foods.
  - Small molecule pharmaceutical polymorph identification and monitoring.

Use of the device for any purpose other than that described, poses a threat to the safety of people and of the entire measuring system and is not permitted.

2.3 Electrical safety

As the user, you are responsible for complying with the following safety conditions:

- Installation guidelines.
- Local standards and regulations electromagnetic compatibility.
- The product has been tested for electromagnetic compatibility in accordance with the applicable international standards for industrial applications.
- The electromagnetic compatibility indicated applies only to a product that has been properly connected.

2.4 Operational safety

Before commissioning the entire measuring point:

1. Verify that all connections are correct.
2. Ensure that electrical cables and optical fiber connections are undamaged.
3. Do not operate damaged products, and protect them against unintentional operation.
4. Label damaged products as defective.

During operation:

1. If faults cannot be rectified: products must be taken out of service and protected against unintentional operation.
2. Keep the door closed when not carrying out service and maintenance work.

⚠ CAUTION

Activities while the analyzer is in operation introduce risk of exposure to measured materials.

- ▶ Follow standard procedures for limiting exposure to chemical or biological materials.
- ▶ Follow workplace policies on personal protective equipment including wearing protective clothing, goggles and gloves and limiting physical access to analyzer location.
- ▶ Clean any spills using the appropriate site policies on cleaning procedures.

⚠ CAUTION

Risk of injury from analyzer door stop mechanism

- ▶ If the enclosure needs to be open, always open the analyzer door fully to ensure the analyzer door stop engages properly.

2.5 Lifting provisions for non-cart-mounted Raman Rxn2

The Raman Rxn2 has incorporated a total of four lifting handles—two on each side of the base unit.

⚠ CAUTION

▶ Two people are required to lift and move the Raman Rxn2 instrument.

The Raman Rxn2 is designed to be lifted and moved by two persons in the horizontal orientation. One person must be on each side of the base unit, with each person using both provided handles.

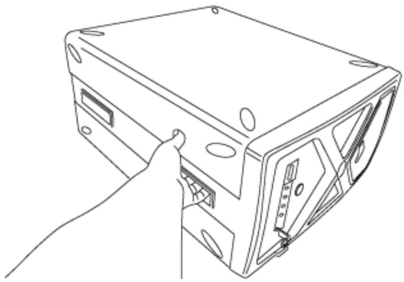


Figure 1. Raman Rxn2 integrated lifting handles

⚠ CAUTION

▶ Disconnect fiber cables before moving a non-cart mounted instrument.

2.6 Product safety

The product is designed to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. The relevant regulations and international standards have been observed. Devices connected to the analyzer must comply with the applicable safety standards. See *Laser safety* for additional details on laser safety.

2.7 Important safeguards

- Do not use the Raman Rxn2 for anything other than its intended use.
- Do not drape the power cord over counters or on hot surfaces.
- Do not open the enclosure of the Raman Rxn2.
- Do not look directly into the laser beam.
- Do not stare or focus a laser in a diffused direction.
- Do not point a laser at a mirrored surface.
- Do not leave attached and unused probes uncapped or unblocked.
- Avoid shiny surfaces and always use a laser beam block.
- Probe shutter on the Rxn-10 probehead should always be in the **OFF** position when probe is not in use.

2.8 Health and safety considerations

It is the user's responsibility to understand and comply with all applicable safety regulations. These will be variable based on the installation location of the instrument. Endress+Hauser takes no responsibility for determining the safe use of the instrument based on this qualification procedure.

The following actions and laser safety precautions must always be observed while using the Raman Rxn2:

- The Raman Rxn2 is a Center for Devices and Radiological Health (CDRH) Class 3B device. The user should wear appropriate eye protection.
- The Raman Rxn2 should only be used in a location with a suitable and stable power supply.
- If an interlock is required, all entryways to the room or area housing the Raman Rxn2 analyzer must be fitted with warning signs on doors into the Class 3B area.

2.9 Safety and handling notice

Raman Rxn2 analyzers incorporate a 532 nm, 785 nm, or 993 nm laser excitation source. Take the following precautions when handling the analyzer and probes when the laser is **ON**:

- Turn **OFF** the laser power (using the key on the front of Raman Rxn2) before making fiber connections and probe inspections.
- If using a Rxn-10 probehead, turn laser output shutter to the **OFF** position before the removal or attachment of optics.
- Do not look directly into the fiber probe output (when the optic is disconnected) or the output (window) of any probes. If a Rxn-10 probehead is found with no optic or probe attached – Turn laser output shutter on the Rxn-10 probehead to OFF or the laser power key on the Raman Rxn2 analyzer to **OFF**.

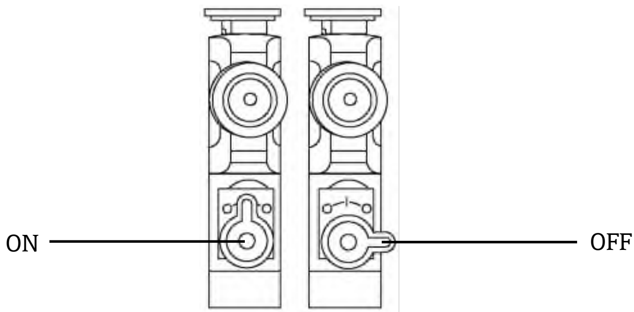


Figure 2. Rxn-10 probehead showing the ON and OFF shutter positions

NOTICE

▶ Handle probes and cables with care. Fiber cables should NOT be kinked and should be routed to maintain minimum bend radii (~6 inches). Permanent damage to the cables may result if they are bent beyond the minimum radius.

2.10 Laser safety

Laser light presents special safety hazards not associated with other light sources. All laser users, and others present, need to be aware of the special properties and dangers involved in laser radiation. Familiarity with the Raman Rxn2 and the properties of intense laser radiation will aid in the safe operation of the Raman Rxn2. The Raman Rxn2 may contain an 532 nm, 785 nm, or 993 nm laser. Refer to your system specification information to determine which laser you have. The combination of intense monochromatic light concentrated in a small area means that, under certain conditions, exposure to laser light is potentially hazardous. In workplace environments, a laser safety program provides environmental, training, and safety controls which may reduce the risk of laser-related injuries and/or workplace damage. For more assistance with taking appropriate precautions and setting the proper controls when dealing with lasers and their hazards, refer to the most current version of ANSI for Safe Use of Lasers Z136.1. The Raman Rxn2 analyzer has hardware safety controls to reduce the risk of laser-based injuries including an interlock and a spring-loaded protective cap covering the laser output of the fiber-optic cables.

The beam is routed from the rear panel of the instrument via a fiber optic patch-cord. In the unlikely event that the fiber optic probe cable is removed, the interlock is overridden, and the spring-loaded protective cap is overridden, there will be a laser beam exiting the analyzer unit. This beam has a beam diameter of 103 µm and a Numerical Aperture (NA) of 0.29.

Table 4 provides the fiber core size and mode and the nominal ocular hazard distance equation for the case of laser exiting directly from the analyzer unit.

Base Unit Used	**Fiber Core Size and Mode**	**Nominal Ocular Hazard Distance (NOHD) Equation**
		
Rxn2 Standard	103 µm multi-mode (NA =0.29)	$r_{NOHD} = 1.7/NA\ (\Phi/\pi MPE)^{1/2}$ multimode equation
MPE at 532 nm continuous viewing – 1 x 10^{-3} W·cm^{-2} MPE at 785 nm continuous viewing – 1.479 x 10^{-3} W·cm^{-2} MPE at 993 nm continuous viewing – 3.854 x 10^{-3} W·cm^{-2}		
Φ = Maximum Power in Watts (W)		

Table 3. Laser safety

Another nominal hazard zone calculation needs to be performed to account for the scenario when the analyzer is equipped with a probe. Depending upon the probe utilized, the beam diameter, numerical aperture of the fiber optical cable to the probehead and focusing characteristics of the probehead, the nominal hazard zone calculation will change depending upon if the potential exposure point is at the tip of the probe or at a broken optical fiber. Refer to the specifications section in the pertinent Endress+Hauser Raman probe operating instructions for the appropriate information to complete the nominal hazard zone calculations pertaining to other exposure points.

CAUTION

- Laser beams can cause ignition of certain substances such as volatile chemicals. The two possible mechanisms for ignition are direct heating of the sample to a point causing ignition and the heating of a contaminant (such as dust) to a critical point leading to ignition of the sample.

WARNING

- The Raman Rxn2 uses a Class 3B laser as defined in ANSI Z136.1. Direct eye contact with the output beam from the laser will cause severe damage and possible blindness.
- Use of controls or adjustments or performance of procedures other than those specified in this manual may result in hazardous radiation exposure.

For more assistance on appropriate precautions and setting the proper controls when dealing with lasers and their hazards, refer to the most current version of ANSI for Safe Use of Lasers Z136.1.

2.10.1 Optical safety

The Raman Rxn2 is outfitted with a Class 3B laser. Lasers at 785 nm and 993 nm present further safety concerns because the radiation is nearly invisible. Always be aware of the initial direction and possible scattering paths of the laser. The use of OD3 safety glasses is highly recommended for 532 nm and 785 nm excitation wavelengths and OD4 for a 993 nm excitation wavelength.

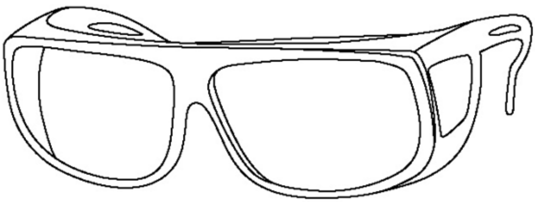


Figure 3. Laser safety glasses

2.10.2 Electrical safety

The Raman Rxn2 utilizes AC and DC voltages inside the enclosure. Do not disassemble the laser enclosure as there are no serviceable parts inside the laser assembly. Only qualified personnel familiar with high voltage electronics should open the system enclosure to perform necessary maintenance or service.

2.10.3 CDRH compliance

The Raman Rxn2 is designed and built to meet the laser performance requirements of 21 Code of Federal Regulations (CFR), Chapter I, Subchapter (J) and is registered with the CDRH.

The product report for the Raman Rxn2 can be found under accession number 1110121-000.

2.10.3.1 Protective housing

The Raman Rxn2 is enclosed in a protective housing to prevent human access in excess of the limits of Class I radiation as specified in U.S. 21 CFR Section 1040.10 (f) (1) except for the output, which is Class 3B.

2.10.3.2 Remote interlock connector

The Raman Rxn2 is supplied with a remote interlock connector for each channel. This connector allows the operator to utilize an external interlock circuit in conjunction with Raman Rxn2 operations. Design and function of an external interlock circuit should meet the capability and intent of the most current revision of the ANSI Z136.1 Standard. No laser radiation for a particular channel is emitted unless both the fiber and remote interlock connectors are connected.

2.10.3.3 Key control

The Raman Rxn2 utilizes a key control system. The laser radiation will not be accessible until the system key switch is in the **ON** position. The key cannot be removed when the switch is in the **ON** position.

2.10.3.4 Compliance labels

The Raman Rxn2 analyzer is certified to comply with the U.S. Federal Regulation 21 CFR, Chapter I, Subchapter (J), as administered by the CDRH.

2.10.4 WEEE directive compliance

The Raman Rxn2 complies with the Waste Electrical and Electronic Equipment (WEEE) Directive 2012/19/EU. The WEEE Symbol shown below is placed on all WEEE-compliant assemblies.

Figure 4. WEEE symbol

If no other means of disposal are available, Endress+Hauser offers a “Take Back” disposal program at no cost. To participate in the “Take Back” disposal program, please contact the Endress+Hauser Service Department at support.kosi@endress.com.

2.10.5 Specific conditions of use

1. The fiber optic cable shall be installed so that the minimum bend radius specified by the cable manufacturer is not exceeded.
2. Where it is necessary to monitor the process level to ensure that the optical beam is not exposed to a potentially explosive atmosphere, the devices used to monitor the level shall be intrinsically safe or classed as simple apparatus, or be installed so as to provide a fault tolerance of 2 for Equipment Protection Level (EPL) Ga equipment or a fault tolerance of 1 for EPL Gb equipment. The functional safety of this arrangement has not been assessed as part of this certification and it is the responsibility of the installer/user to ensure that an appropriate mechanism is in place.
3. Where Intrinsically Safe (IS) galvanic isolators are added to the main enclosure in order to produce IS signals to external apparatus not covered by this certification, the IS galvanic isolators shall have an ambient working temperature upper limit of at least 55°C. The IS parameters pertaining to these isolators shall be conveyed to the user in an appropriate manner. The IS nature of any such circuits has not been assessed as part of this certification and this certificate is not to be taken as indication that these IS circuits comply with relevant requirements.

3 Product description

The Raman Rxn2 Raman analyzer is a for-purpose embedded system with built-in Raman RunTime control software. Raman spectroscopy provides the chemical specificity of mid-IR spectroscopy and the sampling simplicity of near-IR spectroscopy. By operating in the visible or near-infrared spectral region, Raman spectroscopy allows vibrational spectra to be collected *in situ*, using fiber-coupled probes, without sample purging, and without the use of speciality sampling devices. There are four possible configurations of the Raman Rxn2 analyzer: single-channel, four-channel, hybrid, and starter. All Raman Rxn2 analyzers employ a unique self-monitoring system to ensure the validity of each analysis. The analyzer is capable of two-point self-calibration in extreme environments and utilizes self-diagnostics and spectral correction methods when system calibration is unnecessary. The analyzer's precision is essential for robust chemometric analyses and calibration transfer between instruments. The Raman Rxn2 suite of analyzers allow for remote fiber-optic connections to probe sampling points for installation flexibility. And, all configurations of the Raman Rxn2 analyzer are designed for use with the Endress+Hauser line of Raman fiber optic probes and optics. An ergonomic mobile cart (including built-in probe and optic storage) is available as an option for all Raman Rxn2 configurations.

Raman Rxn2 single channel or four channel analyzers can be configured with a 532 nm, 785 nm, or 993 nm excitation wavelength laser.

3.1.1 The Raman Rxn2 Hybrid analyzer

The Raman Rxn2 Hybrid analyzer is configured with two fiber-optic sampling probe connectors: one Rxn-20 probe channel and one Alternate (ALT) non-Rxn-20 probe channel. The Raman Rxn2 Hybrid analyzer is a unique Raman analyzer because it features the Rxn-20–based large volumetric Raman probe and a backscattered Raman probe. These two probe types enable a variety of applications for solids, liquids, and turbid media. A backscattered immersion probe is the preferred approach for measuring liquids because of its short focus, optical window, and bubble-shedding design. The Rxn-20 probe is optimized for large volumetric measurements, enabling focus-free, non-contact representative measurements of solids or turbid media. Since the Raman Rxn2 Hybrid is equipped with these two probes, this analyzer provides maximal sampling flexibility for laboratory, quality control, and process development purposes. With the Raman RunTime software embedded into the analyzer, the Raman Rxn2 Hybrid analyzer meets the needs of both Good Laboratory Practice (GLP) and Good Manufacturing Practice (GMP) governed areas within the pharmaceutical industry for Process Analytical Technology (PAT) and Quality by Design (QbD) applications.

The Raman Rxn2 Hybrid analyzer is only available with a 785 nm excitation wavelength laser.

3.1.2 The Raman Rxn2 Starter analyzer

The Raman Rxn2 Starter analyzer is a complete kit comprised of a lower-resolution single-channel Raman Rxn2 analyzer and a Rxn-10 probehead. While configured for a single probe connector, the Raman Rxn2 Starter can be configured up to four channels. The Raman Rxn2 Starter is designed for cart-portable or benchtop uses such as material quality, reaction monitoring, basic science research, quality assurance, and unknowns identification. The variety of non-contact or immersion optics compatible with the Rxn-10 probehead provides sampling flexibility to support a variety of applications.

The Raman Rxn2 Starter analyzer is only available with a 785 nm excitation wavelength.

3.2 Product design

3.2.1 Front panel

On the front panel of the instrument are the standard user interfaces. These include the main **ON/OFF** power switch, the laser **ON/OFF** key switch, Light Emitting Diode (LED) indicators, and a Universal Serial Bus (USB) 3.0 port.

Figure 5. Front panel of a Raman Rxn2 four channel analyzer

#	Name	Description
1	Laser Key Switch	The laser key switch turns the laser on and off. The **Red** LED indicator adjacent to the laser key switch indicates the laser power status. To activate turn the key to the **ON** position.
2	Main Power Switch	The main power switch turns the instrument on and off, which includes the laser regardless of the position of the laser key switch. The **Power** push button incorporates a **Blue** LED in the shape of a power symbol, which indicates the system power status. The **Power** push button will communicate error conditions using blink codes when embedded software is not able to communicate them.
3	USB 3.0 Port	The USB 3.0 port is intended to obtain diagnostic exports from the instrument using a USB flash drive.
4	Probe Connection Status Indicators	The bank of **Yellow** LED indicators between the laser key and USB 3.0 port indicate the physical connection status of the probes. While the Raman Rxn2 four channel analyzer front panel has four LED indicators, the front panel of the Raman Rxn2 Hybrid analyzer has only two LED indicators, and the front panel of the Raman Rxn2 single channel analyzer has only one LED indicator.

Table 4. Front panel of Raman Rxn2

3.2.2 Rear panel

On the rear panel of the instrument are standard input/output (I/O) ports. These include touchscreen, USB, ethernet, serial, and video ports.

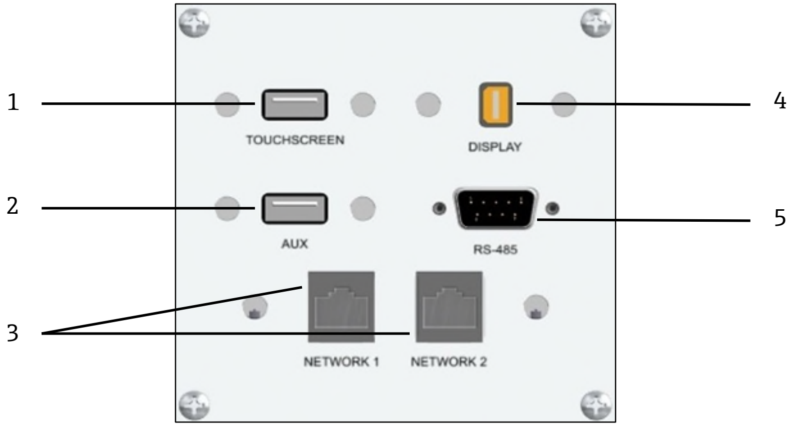


Figure 6. Rear external circuit input/output panel of a Raman Rxn embedded analyzer

#	Name	Description
1	Touchscreen USB Port	USB 3.0 port used to connect to the touchscreen.
2	USB Port (Auxiliary)	USB 3.0 backup port. Reserved for future use.
3	Ethernet Port (2)	Ethernet ports for the network connection.
4	RS-485 Serial Port	RS-485 serial port, half-duplex. Provides automation data via Modbus Remote Terminal Unit (RTU). Port settings configurable in Raman RunTime.
5	Touchscreen Video Port	Touchscreen video port for connection to local touchscreen display (if needed).

Table 5. Raman Rxn2 ports

4 Incoming product acceptance and identification

4.1 Incoming acceptance

1. Verify that the packaging is undamaged. Notify the supplier of any damage to the packaging. Keep the damaged packaging until the issue has been resolved.
2. Verify that the contents are undamaged. Notify the supplier of any damage to the delivery contents. Keep the damaged goods until the issue has been resolved.
3. Check that the delivery is complete and nothing is missing. Compare the shipping documents with your order.
4. Pack the product for storage and transportation in such a way that it is protected against impact and moisture. The original packaging offers the best protection. Make sure to comply with the permitted ambient conditions.

If you have any questions, please contact your supplier or your local sales center.

NOTICE

Incorrect transportation can damage the analyzer

▶ Always use a lifting truck or a fork-lift to transport the analyzer.

4.1.1 Nameplate

The nameplate located on the rear of the Analyzer provides the following information about your device:

- Manufacturer Contact Information
- Laser Radiation Notice
- Electric Shock Notice
- Model Number
- Serial Number
- Wavelength
- Maximum Power
- Build Month
- Build Year
- Patent Information
- Certification Information

Compare the information on the nameplate with the order.

4.1.2 Identifying the product

The order code and serial number of your product can be found in the following locations:

- On the nameplate.
- In the delivery papers.

4.1.3 Manufacturer address

Endress+Hauser, 371 Parkland Plaza, Ann Arbor, MI 48103 USA

4.2 Scope of delivery

The scope of delivery comprises:

- Raman Rxn2 analyzer in the configuration ordered
- Raman Rxn2 Operating Instructions
- Raman Rxn2 Certificate of Product Performance
- Local declarations of conformity, if applicable
- Certificates for hazardous zone use, if applicable
- Raman Rxn2 optional accessories, if applicable

If you have any queries: Please contact your supplier or local sales center.

4.3 Certificates and approvals

The Raman Rxn family of base analyzer units are CE-marked as being compliant with the low-voltage safety directive, as well as applicable laser eye/skin safety standards 21 CFR 1040 LVS [low voltage safety] directive 2014/35/EU, EMC [electromagnetic compatibility] directive 2014/30/EU and IEC 60825-1 laser safety standard.

The Raman Rxn2 base unit has been certified for installation in a non-hazardous area with output into explosive atmospheres under the ATEX Directive, IECEx, and the applicable North American standards.

5 Electrical connection

5.1 Port connections

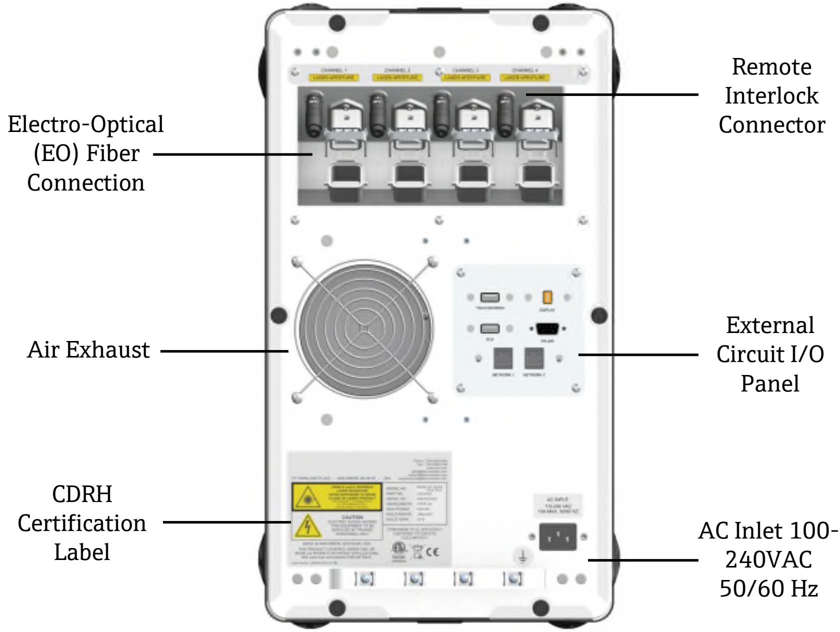


Figure 7. Rear panel of Raman Rxn2

5.2 Power and grounding

The Raman Rxn2 has a standard IEC-320 C-14 inlet for power at the rear of the instrument. Any power cord with an IEC-320 C-13 plug will connect to the base unit. The Raman Rxn2 accepts AC power from 100 – 240V and 50/60 Hz. For U.S. applications, a power cord is supplied. For non-U.S. applications, the user must supply a power cable that meets local/national standards.

Also included on the rear of the instrument is a functional earth terminal for additional grounding if required. Primary grounding occurs through the IEC power inlet plug ground terminal which should be connected to the building grounding system.

Do not position the Raman Rxn2 in a way that makes it difficult to remove the mains cord. Only use adequately rated power cables with the Raman Rxn2 system.

6 Commissioning

6.1 Air filter

The Raman Rxn2 incorporates a tacked polyester spun air filter element to reduce dust intake into the base unit. The air filter is accessed by a magnetically secured access panel on the front of the instrument. The air filter should be cleaned with compressed air once every month or if the embedded software is reporting an internal over-temperature error (if ambient temperature is within specification). In extremely dusty conditions, the air filter should be cleaned more often. The air filter has a **Blue** tacky side which should be oriented toward the outside of the base unit.

If a replacement air filter is needed, please contact the Endress+Hauser Service Department at support.kosi@endress.com.

Figure 8. Filter access

6.2 Interior of the Raman Rxn2

The interior of the Raman Rxn2 with the cover removed is shown below. The internal components are common among all configurations.

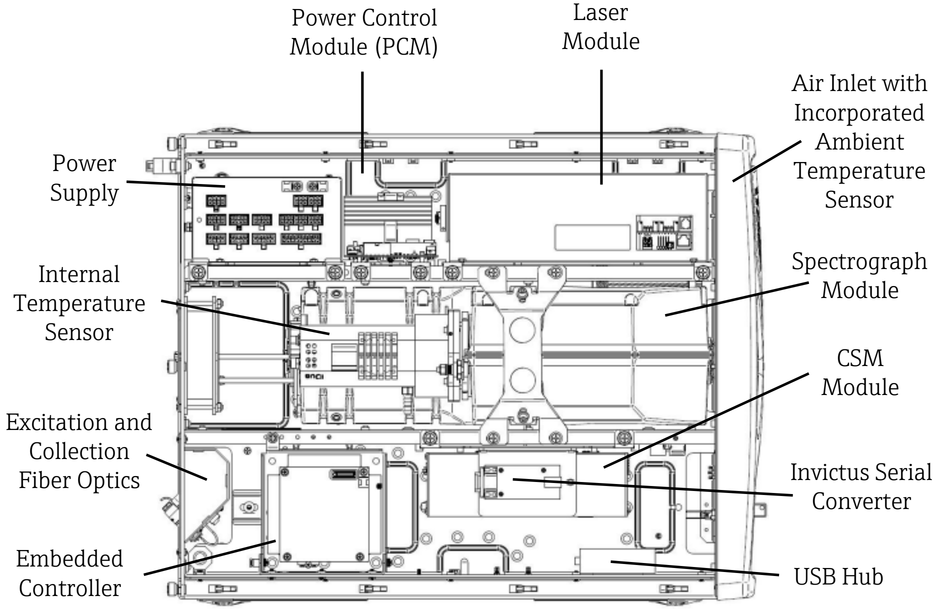


Figure 9. The interior of the Raman Rxn2 analyzer

6.3 Electrical interconnect diagram – single channel Raman Rxn2

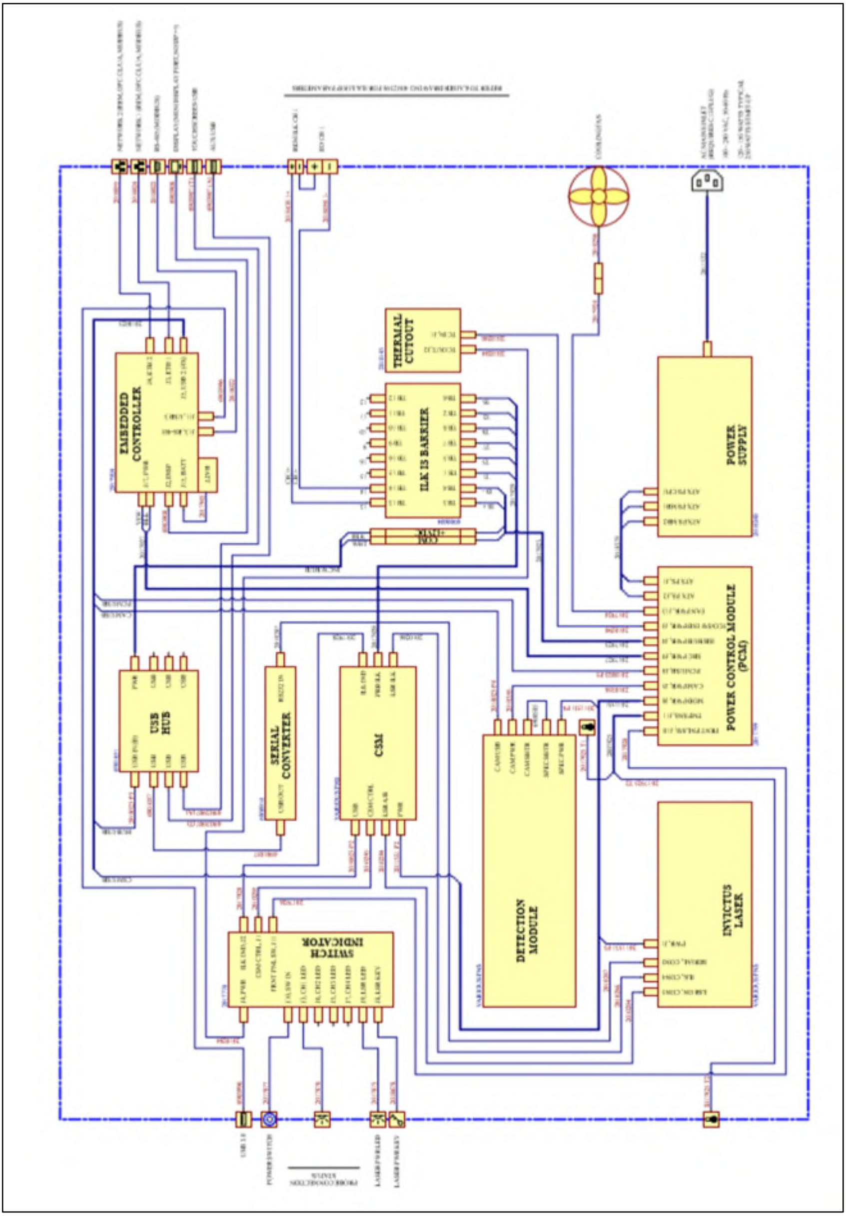


Figure 10. Single channel Raman Rxn2

6.4 Electrical interconnect diagram – four channel Raman Rxn2

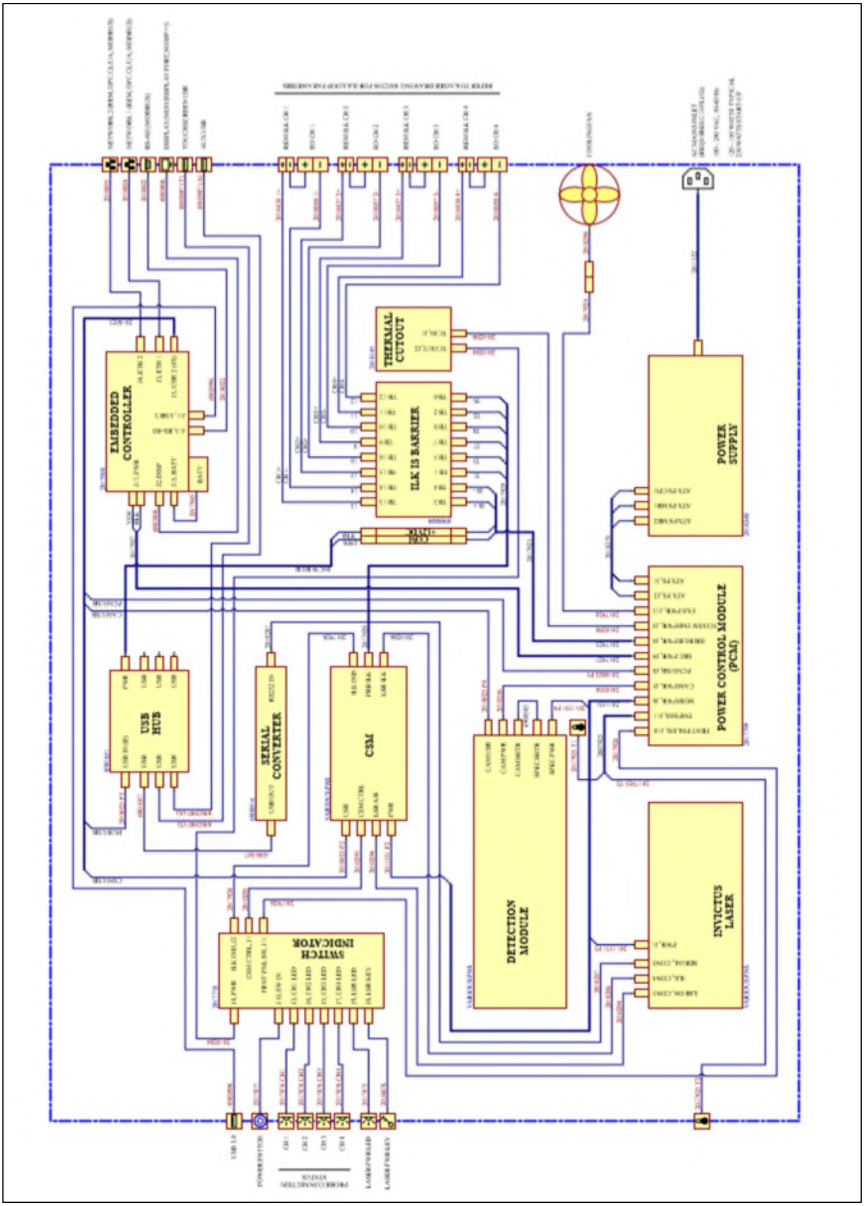


Figure 11. Four channel Raman Rxn2

6.5 Electrical interconnect diagram – Hybrid Raman Rxn2

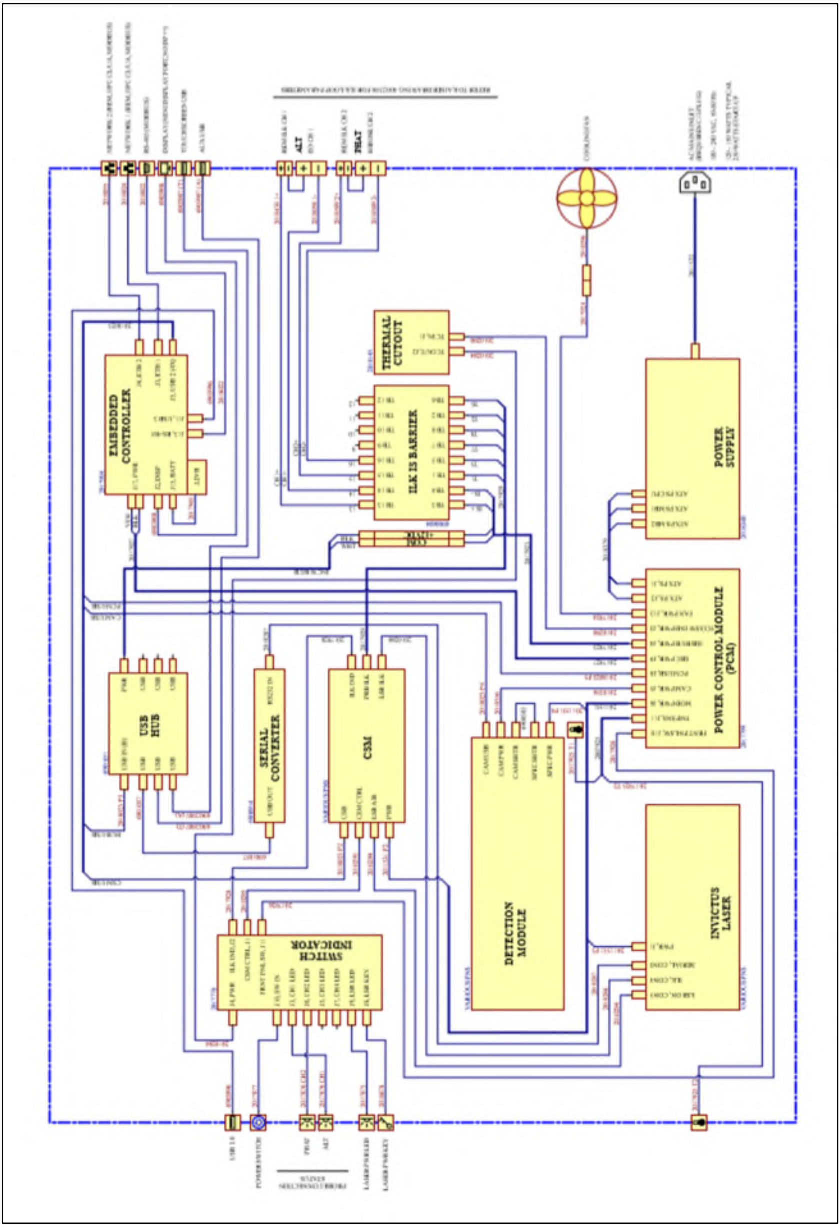


Figure 12. Hybrid Raman Rxn2

6.6 Hazardous area installation drawing

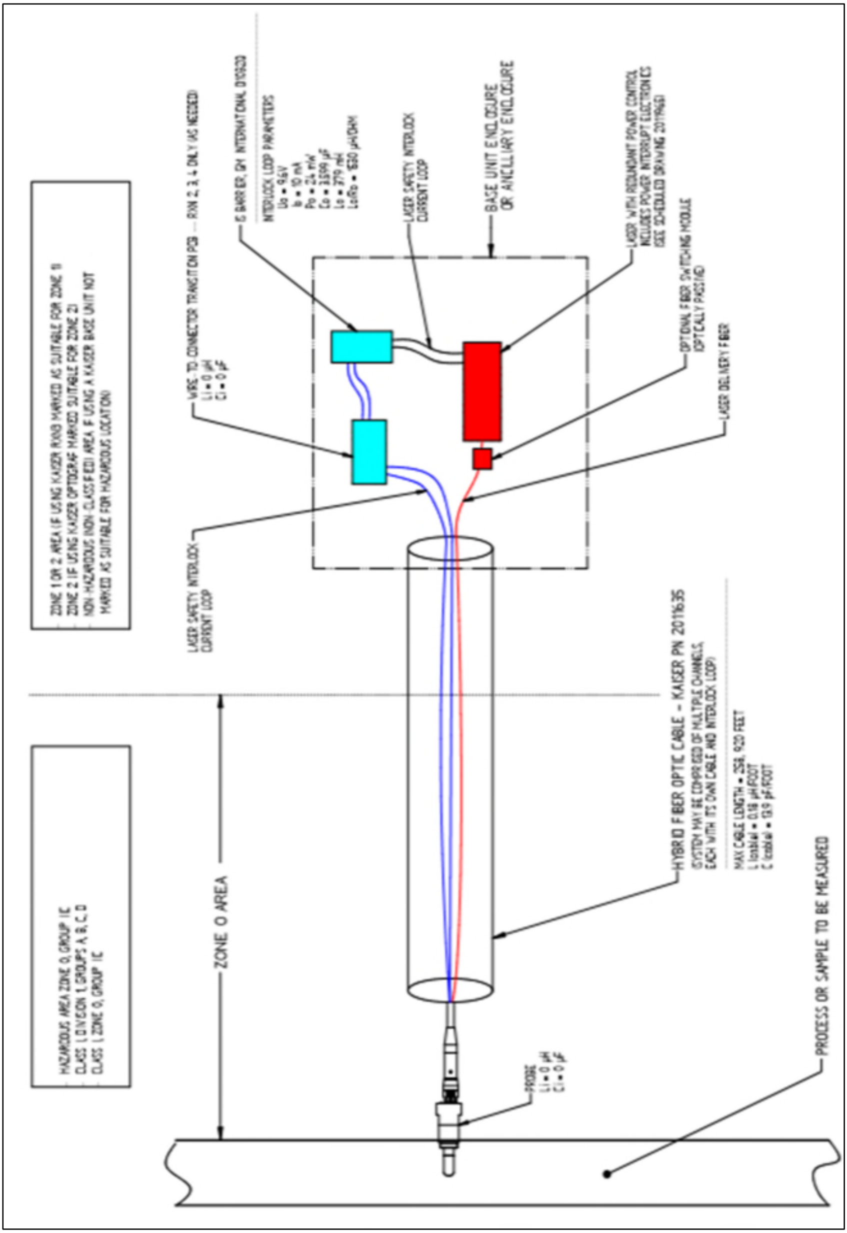


Figure 13. Hazard area installation drawing

7 Operation

7.1 Raman RunTime embedded software

Raman RunTime is the embedded control software installed on all the Raman Rxn2 analyzers. It is intended for easy integration with standard multivariate analysis and automation platforms to enable a real-time, *in situ* process monitoring and control solution. Raman RunTime presents an OPC and Modbus interface which provides clients with analyzer data as well as analyzer control functions.

Depending on the instrument configuration being used, the main view of Raman RunTime displays four “quadrants” or windows (one for each of the four probes for the four channel analyzer), two windows (one for each of the two probes of the Hybrid analyzer), or one window (for the single probe used in the single channel analyzer). The main view of Raman RunTime also displays a status bar (bottom) for a quick view of warnings and acquisition status. Details are accessed and edited from each corresponding quadrant.

Figure 14. Raman RunTime main screen for a Raman Rxn2 four channel analyzer

To switch back and forth between the main view and detail views, simply click the **Title Bar** for each probe/window as applicable. Views of current spectrum vs. process values (model results) can also be easily swapped with a click on the display windows. Additional features, such as system settings, calibration and diagnostics, are found under the Options section. Raman RunTime is also used as the interface between the Raman Rxn2 analyzer and third-party PAT software suites such as synTQ and SiPAT.

NOTICE

▶ This section provides details on configuring and using the Raman Rxn2 with Raman RunTime, but it is not intended to replace the full *Raman RunTime Embedded Software Manual (p/n 4004889)* or analyzer installation and training from Endress+Hauser representatives.

7.2 Initial setup of Raman RunTime

1. Customize the analyzer name in **Options > System > General**. For example, Raman RXN2-785 sn0012345. Click **Apply**. This step is important because the analyzer name is how the system is identified via diagnostic exports.
2. Calibrate the touch screen (if needed):
   - Select **Options > System > General > Calibrate Touch Screen**.
   - Follow on screen prompts. A tip for achieving a better calibration is to use the edge of one's fingernail when following on screen prompts and touching the requested touch points.
3. Connect to a network using one of the available ethernet ports. View and customize network settings, at **Options > System > Network**.
4. Set the date and time either manually or via network connection by specifying the time server address at **Options > System > Date & Time**. If setting the date and time manually, first ensure the time zone is set up correctly before proceeding to other adjustments. This step is also important because spectral acquisition and resulting files and OPC tags are managed by the system's date/time.
5. Specify names for each probe/quadrant (such as Probe 1) at **Probe Detail view > Settings Tab > Name > Apply**.

⚠ CAUTION

▶ You should allow the system to stabilize for a minimum of two hours before proceeding to the calibration steps.

7.3 Calibration and verification

Follow these instructions to calibrate and verify your Raman Rxn2 analyzer for the first time. All calibrations are required prior to spectral acquisition. Raman RunTime will not allow spectra to be collected without passing internal and probe calibrations. Passing the verification step is not required but highly recommended.

Navigate to **Options > Calibration**. The next page shows different calibration window previews for the different Raman Rxn2 analyzer configurations.

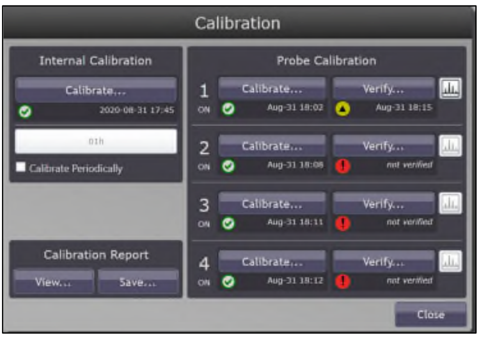


Figure 15. Calibration window with quick view buttons for a Raman Rxn2 four channel analyzer

Figure 16. Calibration window with quick view buttons for a Raman Rxn2 single channel analyzer

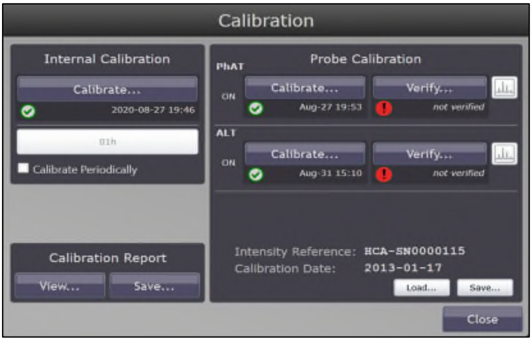


Figure 17. Calibration window with quick view buttons for a Raman Rxn2 Hybrid analyzer

8 Diagnostics and troubleshooting

8.1 Diagnositics

System diagnostics can be viewed from **Options > Diagnostics > Environment** tab. The purpose of the system's Diagnostics section is for the user to view system environment data, trend historical environment data, and to save an export file to perform a system restore, if necessary. Regular system exports should be done to ensure the system configurations and calibrations are backed up for future use.

NOTICE

- System exports are intended for Endress+Hauser Support to investigate problems or restore analyzers. The contents are subject to change with new RunTime versions and should not be treated as user accessible files.
- Full exports can be very large. A Full export is recommended for regular archival of system info and logs and is required for a system restore.

Figure 18. Steps to reach environment tab and export tab

8.2 Warnings and errors

When the system is fully calibrated and operating as expected, the **Status** button in the middle of the main view status bar will read OK and appear **Green**.

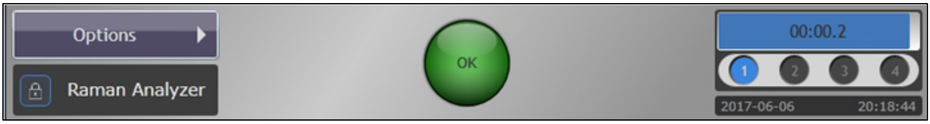


Figure 19. Status bar

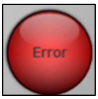
Symbol	Description
	The display will change to **Yellow** if a system warning is encountered. Warnings should be acknowledged but immediate action may not be necessary. Click the **Status** button to view details of the warning. The most common warning occurs when all the channels are not occupied. The button will pulse incessantly until the problem is resolved. Click the **Status** button to view details about the warning.
	The display will change to **Red** if a system error is encountered. An error requires immediate action to restore system performance. Click the **Status** button to view details about the error.

Table 6. Warning and errors

9 Maintenance

9.1 Optimization

If you move the Raman Rxn2, it may be necessary to re-optimize its performance. First, re-verify its performance using Raman RunTime and compare the results for the current to the previous verification. If the signal intensity has dropped significantly, you may benefit from following the optimization guidelines below.

9.1.1 Sample position

If the sample has been moved from the focal point of the probehead, less Raman scattering is recovered by the probehead lens and transmitted to the spectrograph. This is the easiest area to check first. Perform the following procedure in a darkened room:

1. Click **Focus** on the Stream Detail View.
2. Watch as the signal increases and decreases in response to the sample movement in front of the probehead lens.
3. Be aware of any potential laser light reflected off the sample container during this procedure.

9.1.2 Cleaning the lens or window

If the lens or window on the probehead has come in contact with a sample, dust or fingerprints, etc., it may need to be cleaned. Use a lens cloth and a water-based lens-cleaning solution to gently wipe away any contaminant.

9.1.3 Detector camera alignment

If the Raman Rxn2 spectrograph internal optics have shifted, the detector camera alignment may need to be changed.

⚠ CAUTION

▶ The CCD camera alignment is set at the factory and rarely needs to be altered in the field. Alignment should be performed only by experienced personnel.

Prior to performing a camera alignment operation, it is important to ensure that no stray light is entering any of the probes that are attached to the Raman Rxn2. Alignment is performed with an internal white light source, and stray light entering on any of the attached probes can interfere with the alignment light source.

To perform the camera alignment:

1. Navigate to **Options > Calibration**.
2. Click **Calibrate** under the Internal Calibration section then select **Recalibrate All** from the Calibration Mode drop-down list. Click **Calibrate**.

NOTICE

▶ All probe calibrations and verifications are invalidated after Recalibrate All and will need to be re-performed.

9.1.4 Calibration and verification wizard

Reliable, transferable calibration is important for comparing data acquired at various times or with different analyzers. Different instruments analyzing the same sample can generate nearly identical spectra if they are properly calibrated. The Raman RunTime software package includes an automatic calibration wizard that guides you through a procedure to automatically calibrate the wavelength and intensity axes and the wavelength of the laser.

NOTICE

- After the initial calibration during installation, the Calibrate Periodically function is usually sufficient to maintain the wavelength and laser calibration of the Raman Rxn2.

9.2 Support

Diagnostic exports and the current Raman RunTime version number will be needed for Endress+Hauser Support. The version can be viewed from **Options > System > Update**.

Click **Information** to display additional details about the versions and updates applied.

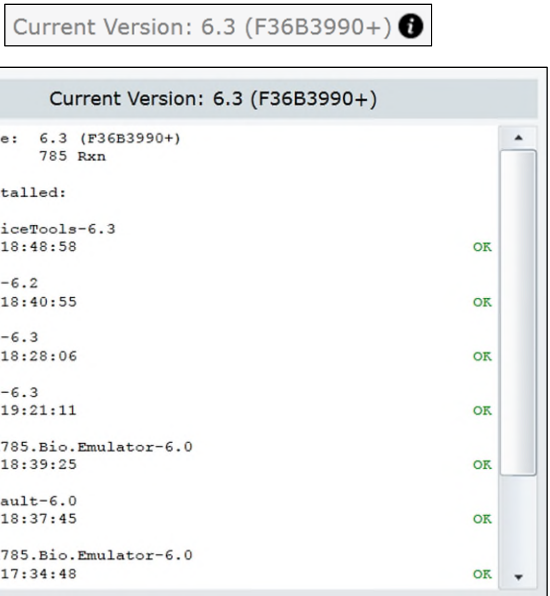


Figure 20. Current version

9.2.1 Contact information

Endress+Hauser will provide telephone consultation for this product during normal U.S. East Coast business hours 8:00 AM to 5:00 PM. Under no circumstances does telephone consultation affect the terms of any warranty agreement::

Email. support.kosi@endress.com

Address. Endress+Hauser, 371 Parkland Plaza, Ann Arbor, MI 48103 US www.addresses.endress.com

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