

Technical Information

Raman Rxn4



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Function and system design

Analyzer technology

The Raman Rxn4 analyzer, powered by Kaiser Raman technology, is a for-purpose embedded system with built-in Raman RunTime control software. Raman spectroscopy provides the chemical specificity of mid-infrared (IR) spectroscopy and the sampling simplicity of near-IR spectroscopy. By operating in the visible or near-IR spectral region, Raman spectroscopy allows vibrational spectra to be collected *in situ*, using fiber-coupled probes, without sample purging, and without the use of specialty sampling devices.

The Raman Rxn4 suite of analyzers are based on advanced and innovative technologies that provide distinct advantages over traditional instrumentation. The HoloPlex advantage, standard in all Raman Rxn4 analyzers, yields both full spectral coverage and high spectral resolution simultaneously for improved qualitative and quantitative analysis. Analysis is fast because the entire Raman spectrum is measured simultaneously, which translates into real-time data collection for reaction analysis and monitoring.

All Raman Rxn4 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 Rxn4 suite of analyzers allow for remote fiber-optic connections to probe sampling points for installation flexibility.

There are three possible configurations of the Raman Rxn4 analyzer: single-channel, four-channel, and hybrid. All are designed for use with the Endress+Hauser Raman fiber-optic probe line.

Raman RunTime

Raman RunTime is the embedded control software installed on all the Raman Rxn4 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. Refer to the *Raman RunTime Operating Instructions (BA02180C)* for complete instructions on configuring and using the Raman Rxn4 with Raman RunTime.

Front panel

The front panel of the Raman Rxn4 analyzer is shown below.

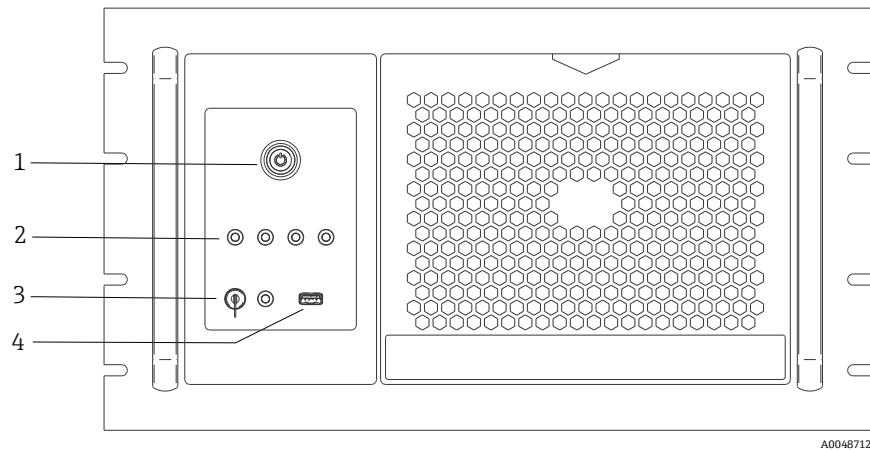


Figure 1. Front panel of a Raman Rxn4 four-channel analyzer

#	Name	Description
1	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 (all components are powered when lit). The Power push button will communicate error conditions using blink codes when embedded software is not able to communicate them. To turn the instrument on, press and release the Power button once. To turn a responsive instrument off, shut down using Raman RunTime. If the instrument is unresponsive, it may be powered down using a long 10 second press and hold of the Power button.
2	Probe connection status indicators	The bank of Yellow LED indicators above the laser key and USB 3.0 port indicates the physical connection status of each probe. The LED is lit when the corresponding probe is properly connected. While the Raman Rxn4 four-channel configuration front panel has four LED indicators, the front panel of the Raman Rxn4 hybrid configuration has only two LED indicators, and the front panel of the Raman Rxn4 single-channel configuration has only one LED indicator.
3	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 the laser, turn the laser key switch to the ON position. The Red LED indicator should remain lit whenever the laser is ON.
4	USB 3.0 port	The USB 3.0 port is intended to obtain diagnostic exports from the instrument using a USB flash drive.

Rear panel

The rear panel of the Raman Rxn4 analyzer is shown below.

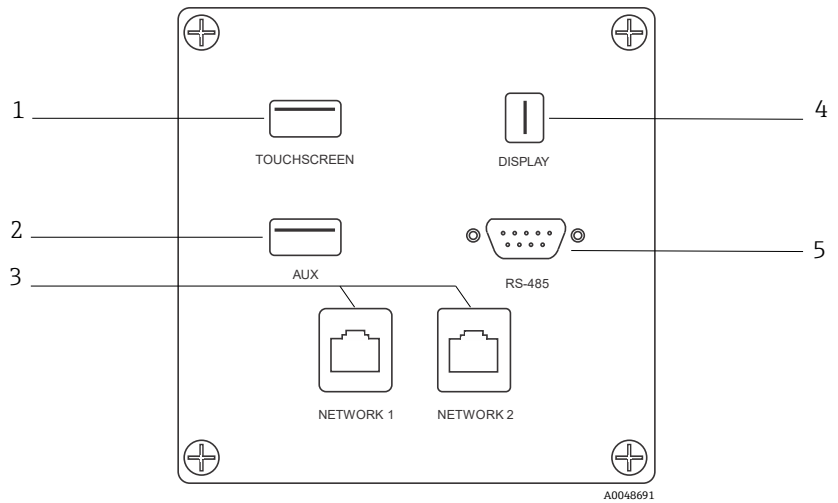


Figure 2. Rear external circuit input/output panel of a Raman Rxn embedded analyzer

#	Name	Description
1	Touchscreen USB port	USB 2.0 port used to connect to the touchscreen.
2	USB port (auxiliary)	USB 2.0 backup port. Reserved for future use.
3	Ethernet port (2)	Ethernet ports for the network connection.
4	Touchscreen video port	Touchscreen video port for connection to local touchscreen display (if needed).
5	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.

Interior of the Raman Rxn4

The interior of the Raman Rxn4 with the cover removed is shown below. The internal components are common among all configurations.

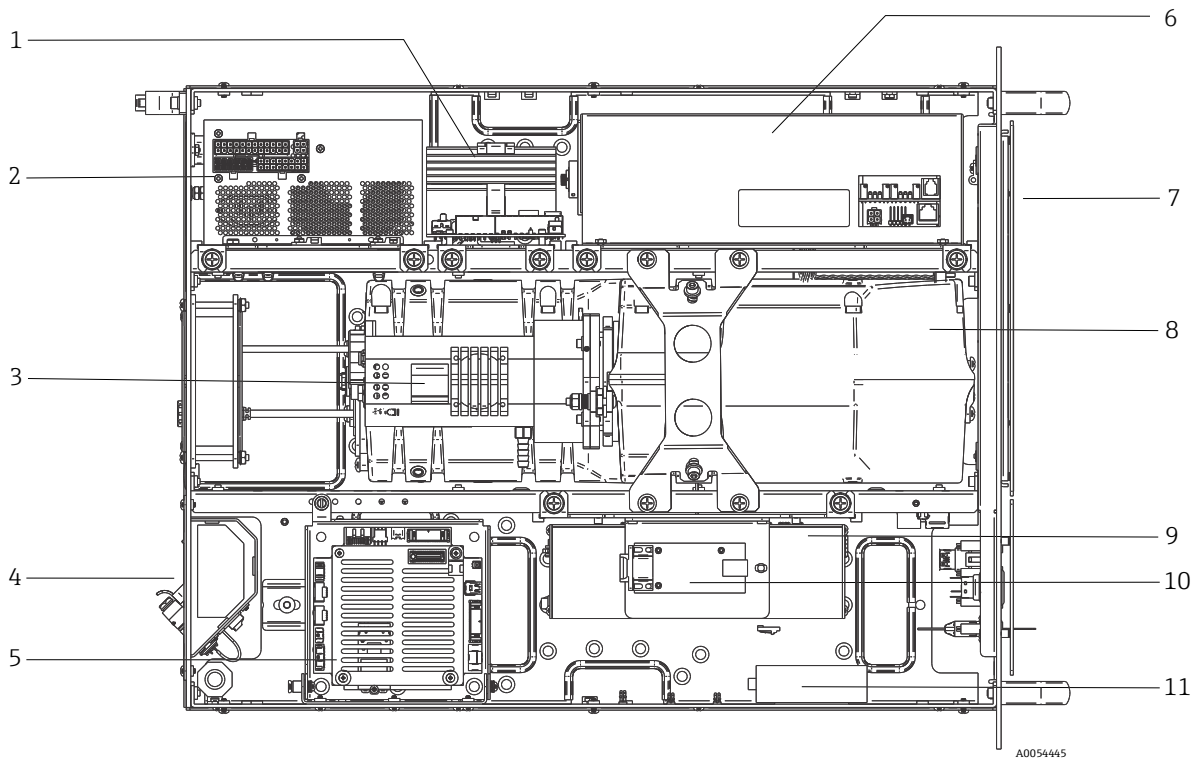


Figure 3. The interior of the Raman Rxn4 analyzer

#	Description
1	Power control module
2	Power supply
3	Internal temperature sensor
4	Excitation and collection fiber optics
5	Embedded controller
6	Laser module
7	Air inlet with incorporated ambient temperature sensor
8	Spectrograph module
9	CSM module
10	Serial converter
11	USB hub

Port connections

The port connections for the Raman Rxn4 analyzer are shown below.

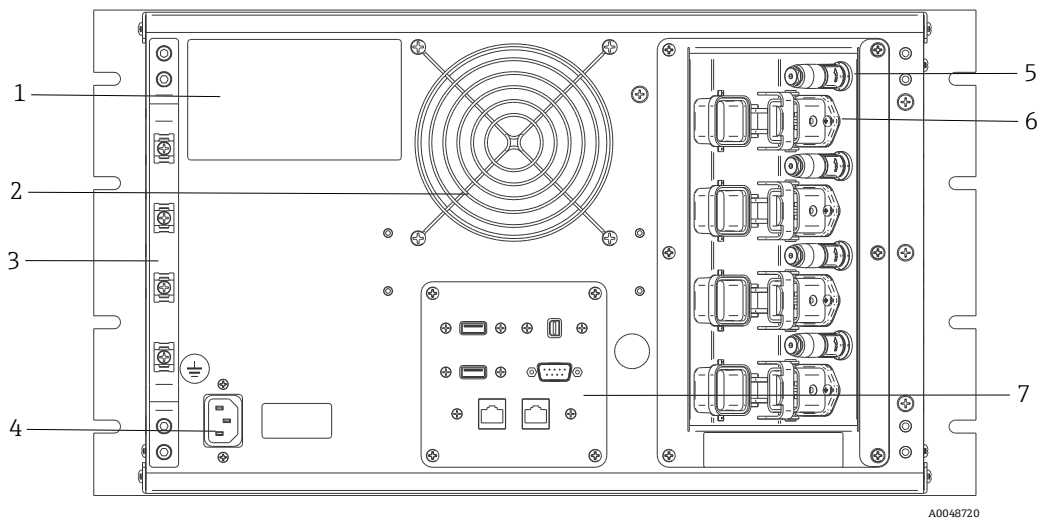


Figure 4. Rear panel of Raman Rxn4

#	Name	Description
1	CDRH product label	Product information about the Raman Rxn4 analyzer
2	Air exhaust	Air exhaust fan and outlet
3	Strain relief	EO fiber cable strain relief mounting location
4	AC inlet 100 to 240 V 50/60 Hz	Power socket outlet that provides AC power to the base unit. Ground pin on this connector serves as the protective conductor terminal.
5	Remote interlock connectors	Safety feature. To interrupt the laser, remove the black plug.
6	EO fiber connector	Provides fiber-optic laser radiation output, fiber-optic Raman collection and electrical laser interlock loop for each instrument channel. The electrical laser interlock loop is intrinsically safe and is governed by Endress+Hauser drawing 4002396. Match 3 prongs on probe to 3 plugs on EO. Pull latch down to secure probe in place. Laser radiation may NOT exit a channel whose EO fiber connector is removed because removing the EO connector also interrupts the laser interlock loop for that channel.
7	Analyzer ports	Touchscreen USB port, USB port, Ethernet ports, RS-485 serial port, and touchscreen video port

Installation

Mounting location

The Raman Rxn4 analyzer is available with 4 different installation options: as a stand-alone single unit, in a rack holding up to two analyzers, as a single unit in an enclosure on a trolley, and as a single unit in an enclosure on a stand. The location selected for installation should be:

- Free of moisture, dust, and corrosive vapors
- Isolated from excess vibrations
- Protected from direct sunlight

Ventilation

Stand-alone analyzer

The location selected should allow for adequate ventilation to the base analyzer. A minimum space of 203.2 mm (8 in) in the front, top, back, and sides of the Rxn4 analyzer outer casing must be provided for proper inlet and outlet air movement.

Analyzer in rack

The location for the computer or server rack should allow for adequate ventilation to both the front and rear of the rack. A minimum space of 203.2 mm (8 in) must be provided on the left side of analyzer (as viewed from the front of the analyzer) for proper inlet and outlet air movement.

Analyzer in enclosure

The location selected should allow for adequate ventilation to both the front and rear of the enclosure. A minimum space of 203.2 mm (8 in) must be provided on the left side of analyzer enclosure (as viewed from the front of the analyzer) for proper inlet and outlet air movement for the air-conditioning unit.

Air filter

The Raman Rxn4 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 (p/n 70199233) is needed, refer to our website (<https://endress.com/contact>) for the list of local sales channels in your area.

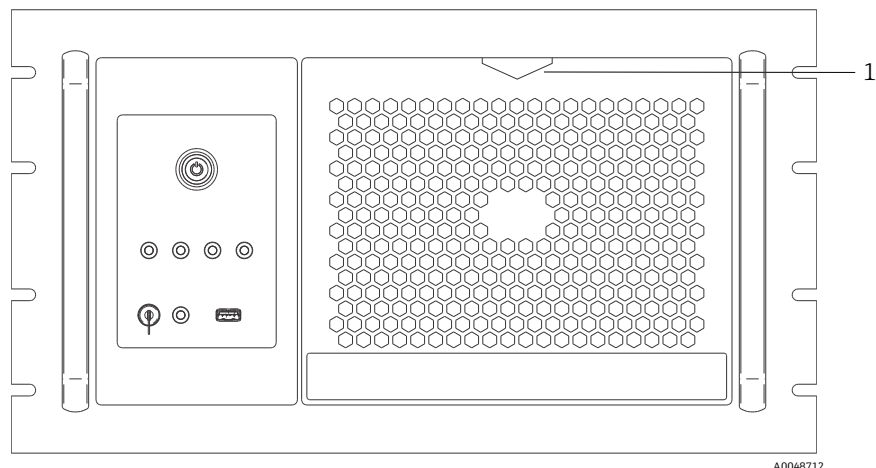


Figure 5. Pull (1) for access to air filter

Specifications

Dimensions

The dimensions of the Raman Rxn4 are shown below.

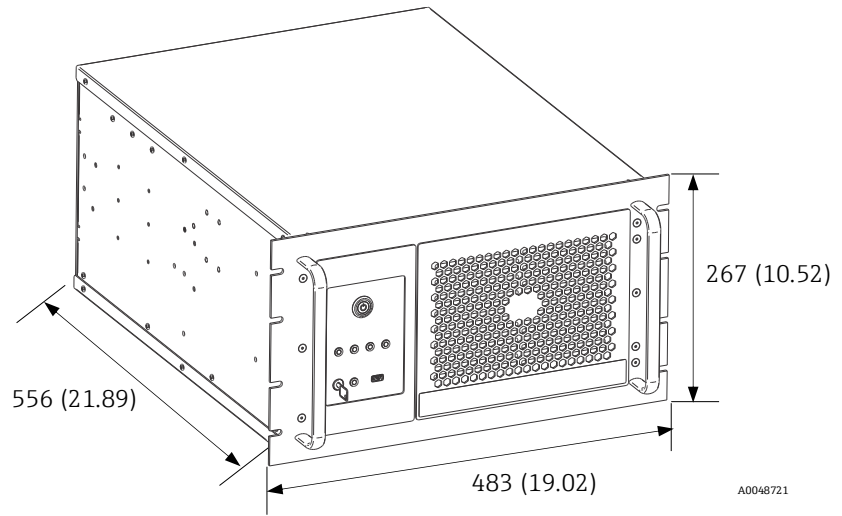


Figure 6. Raman Rxn4 analyzer. Dimensions: mm (in)

Analyzers

The specifications for different configurations of Raman Rxn4 analyzers are listed below.

Category	Base model	Enclosure	Hybrid
Laser wavelength	532 nm 785 nm 993 nm	532 nm 785 nm 993 nm	785 nm
Spectral coverage	150 to 4350 cm ⁻¹ (532 nm) 150 to 3425 cm ⁻¹ (785 nm) 200 to 2400 cm ⁻¹ (993 nm)	150 to 4350 cm ⁻¹ (532 nm) 150 to 3425 cm ⁻¹ (785 nm) 200 to 2400 cm ⁻¹ (993 nm)	175 to 1890 cm ⁻¹ (785 nm)
Spectral resolution	5 cm ⁻¹ (532 nm) 4 cm ⁻¹ (785 nm) 6 cm ⁻¹ (993 nm) average	5 cm ⁻¹ (532 nm) 4 cm ⁻¹ (785 nm) 6 cm ⁻¹ (993 nm) average	4 cm ⁻¹ (785 nm) average
Operating temperature	5 to 35 °C (41 to 95 °F) (532 nm, 785 nm) 5 to 30 °C (41 to 86 °F) (993 nm)	5 to 50 °C (41 to 122 °F)	5 to 35 °C (41 to 95 °F)
Storage temperature	-15 to 50 °C (5 to 122 °F)	-15 to 50 °C (5 to 122 °F)	-15 to 50 °C (5 to 122 °F)
Relative humidity	20 to 80 %, non-condensing	80 % for temperature range 5 to 31 °C (4 °F to 87.8 °F), decreasing linearly to 20 % at 50 °C (122 °F)	20 to 80 %, non-condensing
Input voltage	100 to 240 V 50 to 60 Hz ±10 %	120 V ±10%, 60 Hz OR 230 V ±10 %, 50/60 Hz	100 to 240 V 50 to 60 Hz ±10 %
Power consumption	400 W (maximum) 250 W (typical start-up) 120 W (typical running)	1560 W (maximum) 1560 W (typical start-up) 750 W (typical running)	400 W (maximum) 250 W (typical start-up) 120 W (typical running)
Warm-up time	120 minutes	240 minutes	120 minutes
Unit dimensions	483 x 267 x 556 mm (19.02 x 10.52 x 21.89 in)	1175 x 1480 x 826 mm (46.26 x 58.27 x 32.52 in) with optional trolley	483 x 267 x 556 mm (19.02 x 10.52 x 21.89 in)
Weight	28.5 kg (63 lbs)	185.5 kg (409 lbs) with optional trolley	28.5 kg (63 lbs)
Hazardous area certifications	ATEX, North American, IECEx, UKCA, JPEX	Pending	ATEX, North American, IECEx, UKCA, JPEX
Connection interface	OPC, Modbus (contact Endress+Hauser for other options)	OPC, Modbus (contact Endress+Hauser for other options)	OPC, Modbus (contact Endress+Hauser for other options)
Installation options	19-inch rack package	NEMA 4X enclosure; wall-mountable, mobile trolley, or fixed stand	19-inch rack package

Laser

The specifications for the laser are listed below.

Item	Description
532 nm Excitation wavelength Maximum power output Warranty	532 nm 120 mW 1 year or 5000 hours
785 nm Excitation wavelength Maximum power output Warranty	785 nm 400 mW unlimited hours for 1 year
993 nm Excitation wavelength Maximum power output Warranty	993 nm 400 mW unlimited hours for 1 year

Probes

The specifications for the probes are listed below.

Analyzer configuration	Description
Raman Rxn4 (single-channel and four-channel)	Compatible with: Rxn-10 probe equipped with immersion or non-contact optics Endress+Hauser liquid phase Raman probe Endress+Hauser bioprocessing Raman probes
Raman Rxn4 hybrid	Compatible with: Rxn-20 probe and 1 other ALT probe including: <ul style="list-style-type: none"> • Rxn-10 probe equipped with immersion or non-contact optics • Endress+Hauser liquid phase Raman probe • Endress+Hauser bioprocessing Raman probes

Sound levels

The specifications for the sound levels are listed below:



Analyzer /accessory	Sound level from operator's position
Raman Rxn4	58.2 dB

Certificates and approvals

Certifications

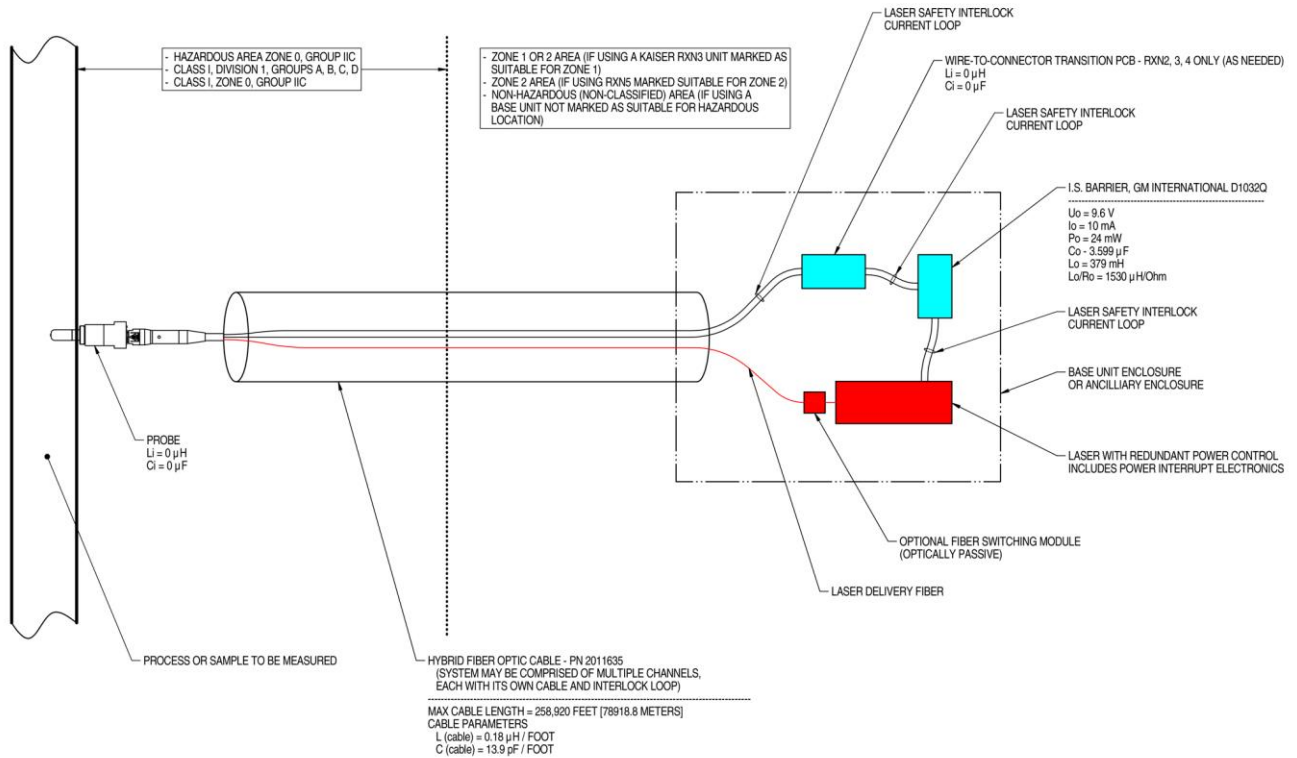
Raman Rxn4 analyzers carry certifications for installation in a general-purpose zone with output into hazardous areas. For more specific information on the hazardous area rating for field measurements, refer to the Operating Instructions for the installed probe.

Certification: base unit (fiber-optic and interlock outputs only)

Certification	Marking	Temperature (ambient)
IECEX	Ex [ia Ga] [op sh Gb] IIC	5 to 35 °C (41 to 95 °F)
ATEX	 II (2)(1) G Ex [ia Ga] [op sh Gb] IIC	5 to 35 °C (41 to 95 °F)
North America	Class I, Division 1, Groups A, B, C and D or [Ex ia] Class I, Division 1, Groups A, B, C, and D: [Ex ia Ga] IIC Class I, Division 2, Groups A, B, C and D: [Ex ia Ga] [op sh Gb] IIC	5 to 35 °C (41 to 95 °F)
UKCA	 II (2)(1) G Ex [ia Ga] [op sh Gb] IIC	5 to 35 °C (41 to 95 °F)
JPEX	Ex [ia Ga] [op sh Gb] IIC	5 to 35 °C (41 to 95 °F)

Hazardous area drawing

The hazardous area installation drawing is shown below.



NOTES:

- CONTROL EQUIPMENT CONNECTED TO THE ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 VRMS OR VDC.
- INSTALLATION IN THE U.S. SHOULD BE IN ACCORDANCE WITH ANSI/ISA RP12.6 "INSTALLATION OF INTRINSICALLY SAFE SYSTEMS FOR HAZARDOUS (CLASSIFIED) LOCATIONS" AND THE NATIONAL ELECTRICAL CODE® (ANSI/NFPA 70) SECTIONS 504 AND 505.
- INSTALLATION IN CANADA SHOULD BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, CSA C22.1, PART 18, APPENDIX J18.
- ASSOCIATED APPARATUS MANUFACTURER'S INSTALLATION DRAWING MUST BE FOLLOWED WHEN INSTALLING THIS EQUIPMENT.
- FOR U.S. INSTALLATIONS, THE PROBE MODELS RXN-30 (AIRHEAD), RXN-40 (WETHEAD) AND RXN-41 (PILOT) ARE APPROVED FOR CLASS I, ZONE 0 APPLICATIONS.
- NO REVISION TO DRAWING WITHOUT PRIOR CSA APPROVAL.
- WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

A0049010

Figure 7. Hazardous area installation drawing (4002396 X6)

www.addresses.endress.com
