

Technical Information

Raman Rxn2



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Function and system design

Analyzer technology

The Raman Rxn2 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 Rxn2 suite of analyzers are based on advanced and innovative technologies that provide distinct advantages over traditional instrumentation. The HoloPlex advantage, standard in all Raman Rxn2 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 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 precision of the analyzer 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.

There are four possible configurations of the Raman Rxn2 analyzer: single-channel, four-channel, hybrid, and starter. 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 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. Refer to the *Raman RunTime Operating Instructions (BA02180C)* for complete instructions on configuring and using the Raman Rxn2 with Raman RunTime.

Front panel

The front panel of the Raman Rxn2 analyzer is shown below.

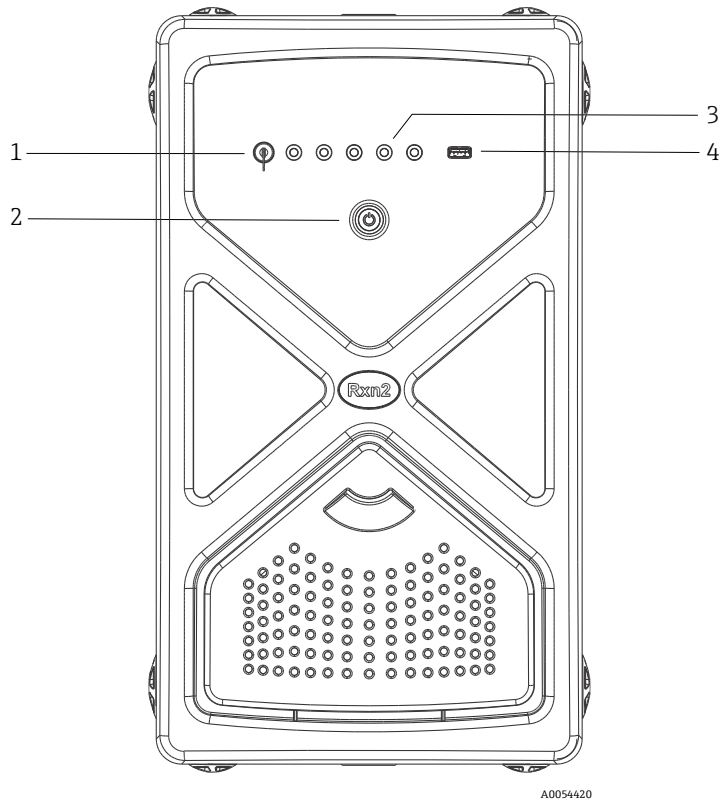


Figure 1. Front panel of a Raman Rxn2 four-channel analyzer

#	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. 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.
3	Probe connection status indicators	The bank of Yellow LED indicators between the laser key and USB 3.0 port indicates the physical connection status of the probes. While the Raman Rxn2 four-channel configuration front panel has four LED indicators, the front panel of the Raman Rxn2 hybrid configuration has only two LED indicators, and the front panel of the Raman Rxn2 single-channel configuration has only one LED indicator.
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 Rxn2 analyzer is shown below.

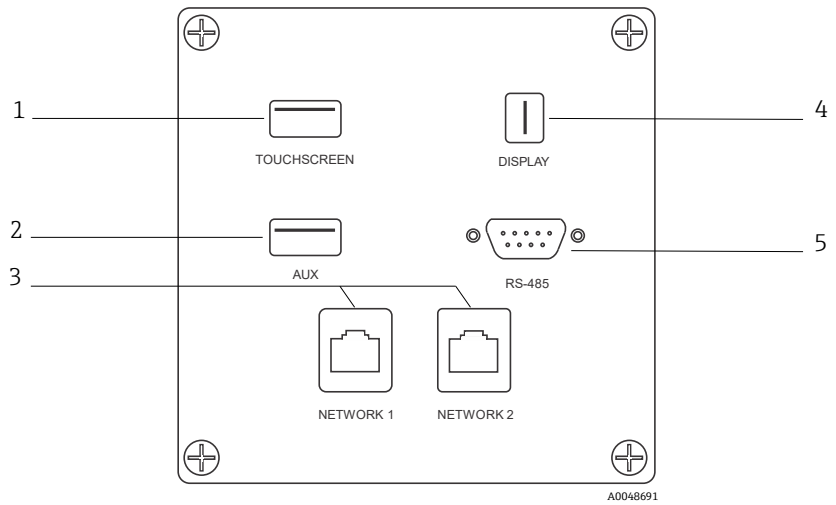
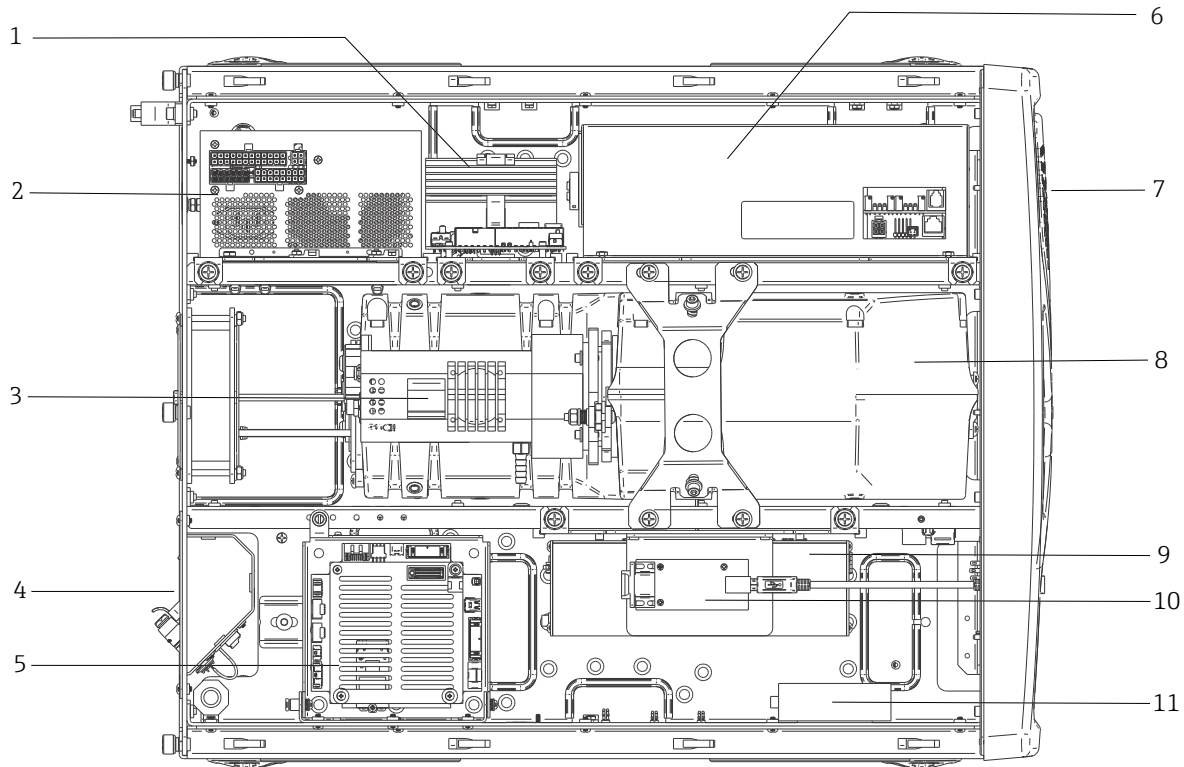


Figure 2. Rear external circuit input/output panel of a Raman Rxn embedded analyzer

#	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 Rxn2

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



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Figure 3. The interior of the Raman Rxn2 analyzer

#	Description
1	Power control module (PCM)
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 Rxn2 analyzer are shown below.

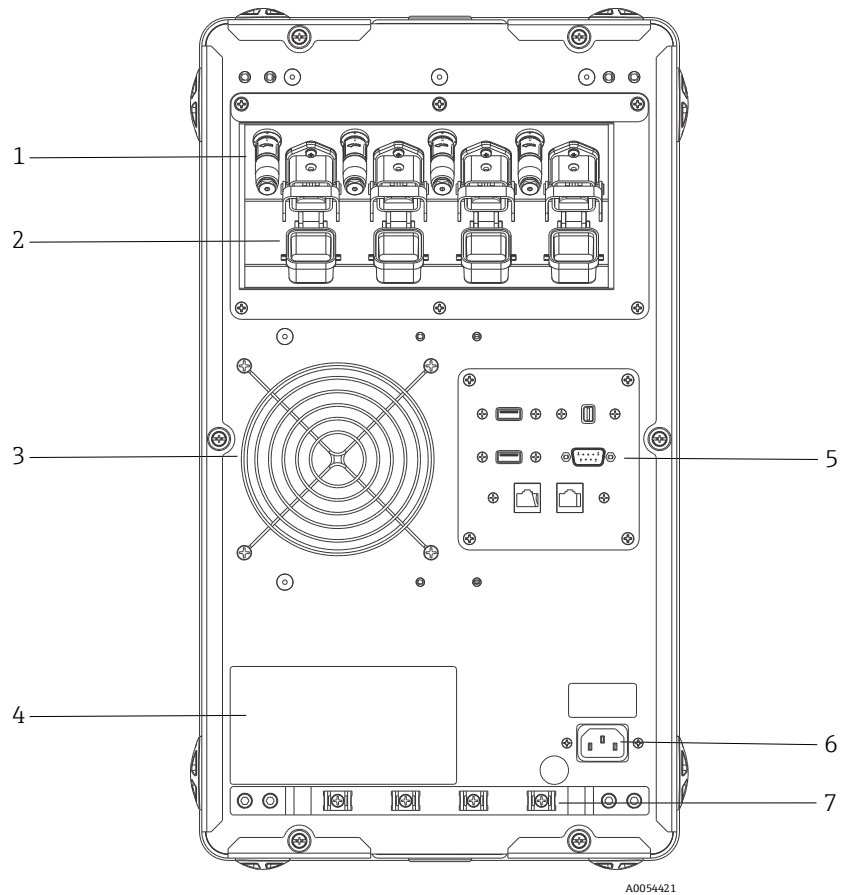


Figure 4. Rear panel of Raman Rxn2 four-channel analyzer

#	Name	Description
1	Remote interlock connectors	Safety feature. To interrupt the laser, remove the black plug.
2	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.
3	Air exhaust	Air exhaust fan and outlet.
4	CDRH product label	Product information about the Raman Rxn2 analyzer.
5	Analyzer ports	Touchscreen USB port, USB port, ethernet ports, RS-485 serial port, and touchscreen video port.
6	AC inlet AC 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.
7	Strain relief	EO fiber cable strain relief mounting location.

Installation

Mounting location

The analyzer can be located on a level surface such as a laboratory benchtop or an equipment cart. The location selected for installation should be:

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

Ventilation

The location selected should allow for adequate ventilation to both the front and rear of the base unit. A minimum space of 152.4 mm (6 in) must be provided in both the front and rear of the base unit for proper inlet and outlet air movement.

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 (p/n 70207492) is needed, refer to our website (<https://endress.com/contact>) for the list of local sales channels in your area.

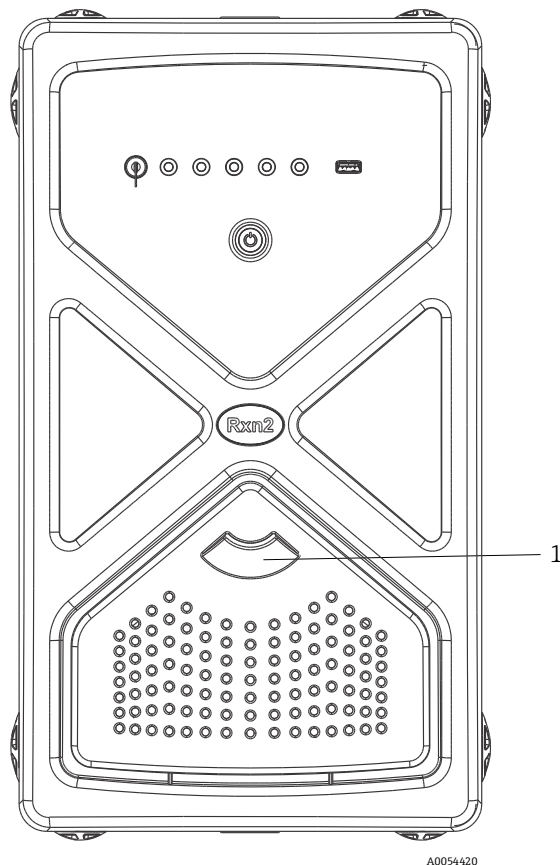
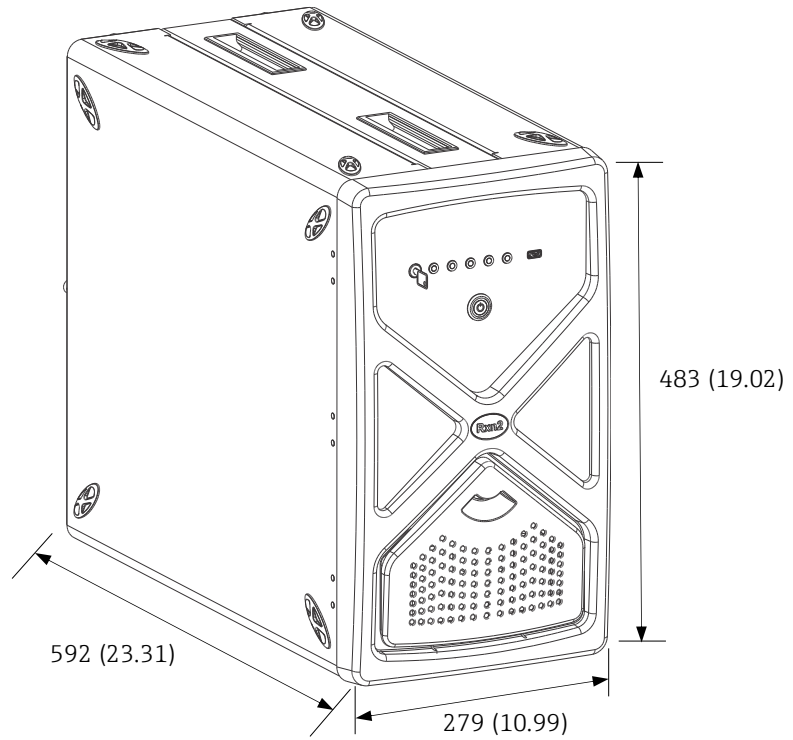


Figure 5. Pull (1) for access to air filter

Specifications

Dimensions

The dimensions of the Raman Rxn2 analyzer are shown below.



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Figure 6. Raman Rxn2 analyzer. Dimensions: mm (in)

Analyzers

The specifications for different configurations of Raman Rxn2 analyzers are listed below.

Item	Starter	Base model	Hybrid
Laser wavelength	785 nm	532 nm 785 nm 993 nm	785 nm
Spectral coverage	300 to 3300 cm ⁻¹ (785 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	10 cm ⁻¹ 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	15 to 30 °C (59 to 86 °F)	15 to 30 °C (59 to 86 °F)	15 to 30 °C (59 to 86 °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	20 to 80 %, non-condensing	20 to 80 %, non-condensing
Input voltage	100 to 240 V 50 to 60 Hz ±10 %	100 to 240 V 50 to 60 Hz ±10 %	100 to 240 V 50 to 60 Hz ±10 %
Power consumption	400 W (maximum) 250 W (typical start-up) 120 W (typical running)	400 W (maximum) 250 W (typical start-up) 120 W (typical running)	400 W (maximum) 250 W (typical start-up) 120 W (typical running)
Warm-up time	120 minutes	120 minutes	120 minutes
Benchtop model dimensions	279 x 483 x 592 mm (10.99 x 19.02 x 23.31 in)	279 x 483 x 592 mm (10.99 x 19.02 x 23.31 in)	279 x 483 x 592 mm (10.99 x 19.02 x 23.31 in)
Cart model dimensions	685 x 1022 to tabletop x 753 mm 26.97 x 40.24 to tabletop x 29.65 in	685 x 1022 to tabletop x 753 mm 26.97 x 40.24 to tabletop x 29.65 in	685 x 1022 to tabletop x 753 mm 26.97 x 40.24 to tabletop x 29.65 in
Weight	<i>Base unit:</i> 32 kg (71 lbs) <i>Cart model:</i> 93 kg (205 lbs)	<i>Base unit:</i> 32 kg (71 lbs) <i>Cart model:</i> 93 kg (205 lbs)	<i>Base unit:</i> 32 kg (71 lbs) <i>Cart model:</i> 93 kg (205 lbs)
Hazardous area certifications	ATEX, North American, IECEx, UKCA, JPEX	ATEX, North American, IECEx, UKCA, JPEX	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	Benchtop (standard) or mobile wheeled cart	Benchtop (standard) or mobile wheeled cart	Benchtop (standard) or mobile wheeled cart

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	Probe compatibility
Raman Rxn2 single-channel, four-channel, and starter	Compatible with: Rxn-10 probe equipped with immersion or non-contact optics Endress+Hauser liquid phase Raman probes Endress+Hauser bioprocessing Raman probes
Raman Rxn2 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 probes • 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 Rxn2	58.9 dB

Certificates and approvals

Certifications

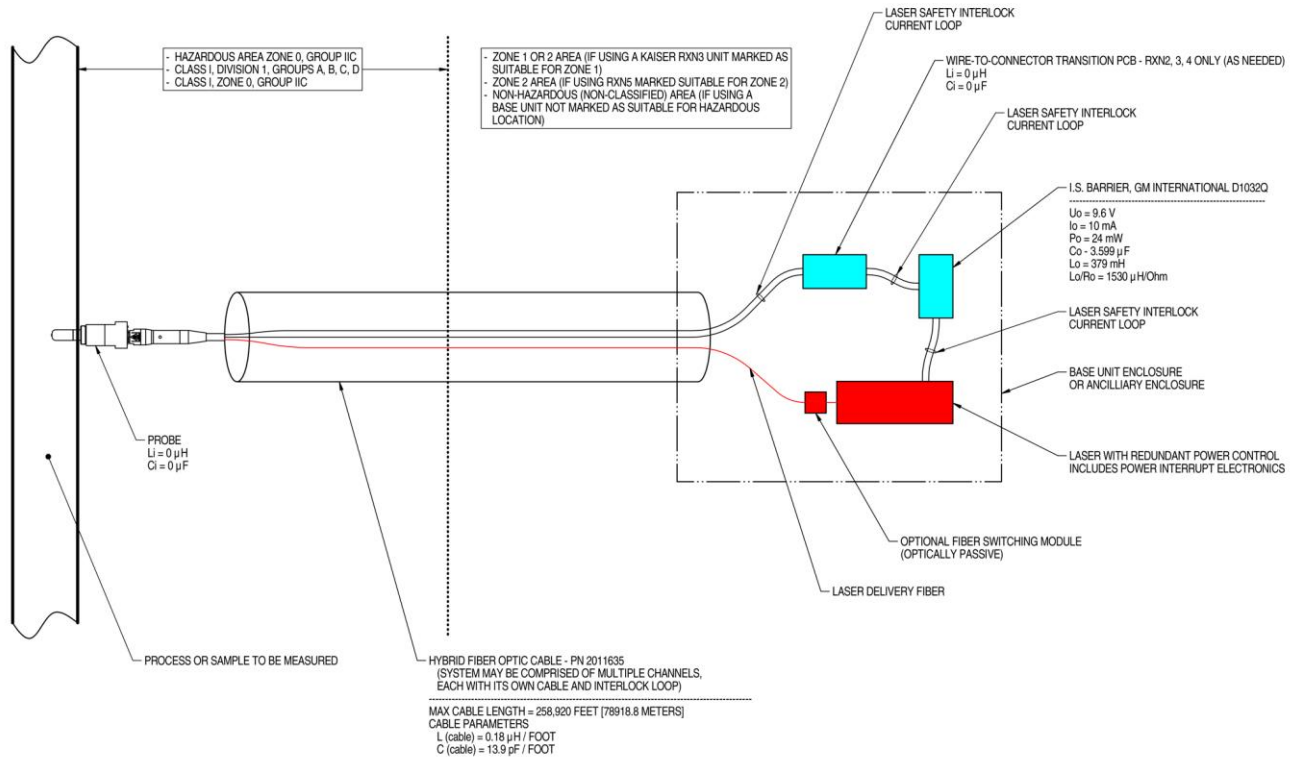
Raman Rxn2 analyzers carry certifications for installation in a general-purpose zone with output into hazardous areas. For more specific information on the hazardous area rating for field measurements, refer to the Operating Instructions for the installed probe.

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:

1. CONTROL EQUIPMENT CONNECTED TO THE ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 VRMS OR VDC.
2. 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.
3. INSTALLATION IN CANADA SHOULD BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, CSA C22.1, PART 18, APPENDIX J18.
4. ASSOCIATED APPARATUS MANUFACTURER'S INSTALLATION DRAWING MUST BE FOLLOWED WHEN INSTALLING THIS EQUIPMENT.
5. 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.
6. NO REVISION TO DRAWING WITHOUT PRIOR CSA APPROVAL.
7. WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

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Figure 7. Hazardous area installation drawing (4002396 X6)

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