TI01632C/66/EN/04.25
70231721

Technical Information

Rxn-30 Raman spectroscopic probe

System design and specifications

Application

The Raman Rxn-30 probe has cross-industry appeal for its robust gas-phase headspace monitoring, *in situ* measurements, and material compatibility. Certified for use in hazardous area environments, the Raman Rxn-30 probe can be inserted directly into processes with temperatures up to 150° C (302° F) and pressures up to 68.9 barg (1000 psig). It is available with a variety of mounting options for maximum installation and sampling flexibility.

- **Chemical:** ammonia, methanol, HyCO, reaction monitoring, blending, catalysis
- **Polymer:** polymerization reaction monitoring
- **Gas-phase streams in refining:** hydrogen production and recycle fuel blending, fuel characterization
- **Power and energy:** IGCC power plants, gas turbines
- **Pharmaceutical:** active pharmaceutical ingredient (API) reaction monitoring, drying
- **Food and beverage:** fermentations, offgas, volatiles

Device properties

- 316/316L stainless steel
- PTFE
- Sapphire
- Fused silica glass

Your benefits

- Reliable, quantitative gas-phase measurements
- In situ measurement/no transfer lines or fast loops required
- Industry standard installation options
- Direct insertion, side insertion, or sample loop
- Suitable for hazardous area/classified environments

Endress+Hauser
People for Process Automation

Table of Contents

Function and system design 3

Application 3
Laser safety interlock 3
Rxn-30 probe 3
Particulate filter (optional) 4
NPT cross fitting on Rxn-30 probe 5
Compression cross fitting on Rxn-30 probe 5
Process and probe compatibility 6
Installation 6

Specifications 7

General specifications 7
MPE: ocular exposure 8
MPE: skin exposure 8

Certificates and approvals 9

Hazardous area approvals 9
Certifications and markings 9
Hazardous area drawing 10

Function and system design

Application

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 invalidates any warranty.

Laser safety interlock

The Rxn-30 probe, as installed, forms part of the interlock circuit. If the fiber cable is severed, the laser will turn off as a result of the breakage, in compliance with IEC 60079-28 and IEC 60825-2.

NOTICE

Permanent damage may result if cables are not routed appropriately.

- Handle probes and cables with care, ensuring they are not kinked.
- Install fiber cables with a minimum bend radius according to the *Raman fiber-optic cables KFOC1 and KFOC1B Technical Information (TI01641C)*.

The interlock circuit is a low-current electrical loop. If the Rxn-30 probe is used in a hazardous classified area, the interlock circuit must pass through an intrinsically safe (IS) barrier.

Rxn-30 probe

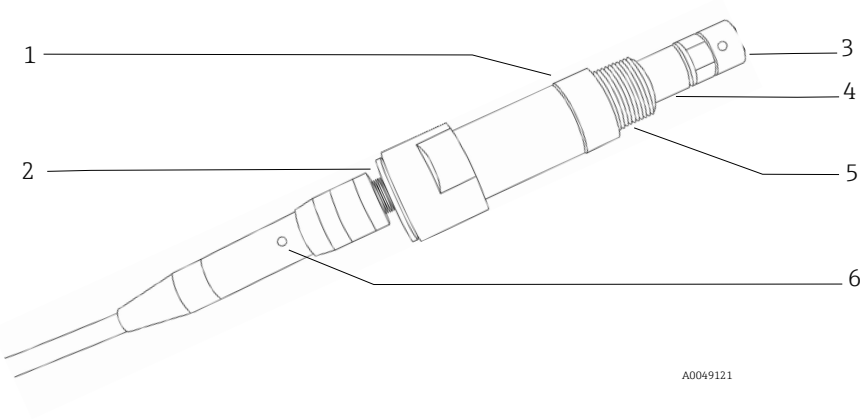


Figure 1. Rxn-30 probe

#	Description
1	1″ diameter compression fitting compatible
2	Connector/cable interface (leave attached)
3	Retro assembly
4	Sample gas ports located under a sintered metal filter
5	½″ NPT interface thread
6	LED laser indicator: When there is potential for the laser to be energized, the LED laser indicator light is illuminated.

Particulate filter (optional)

The optional particulate filter is supplied as a kit consisting of:

- 1 sintered metal filter sleeve (20 micron pore size)
- 2 Teflon sealing gaskets

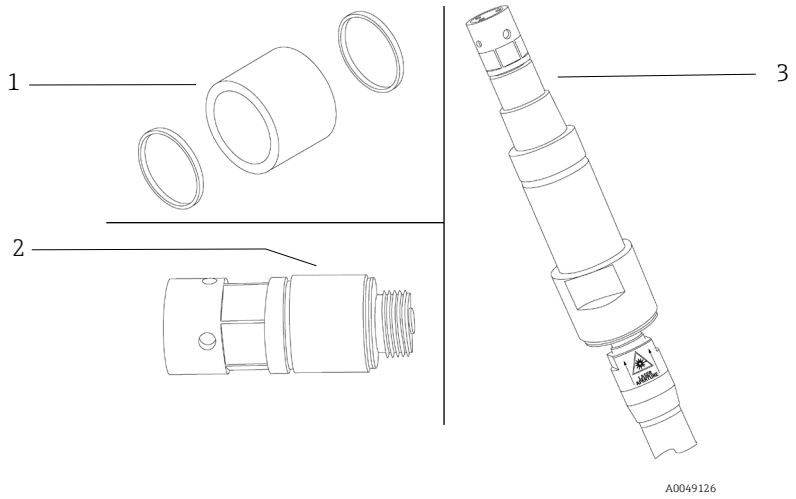


Figure 2. Particulate filter kit and installation

#	Description
1	Particulate filter kit with filter sleeve and 2 sealing gaskets
2	Particulate filter on sample tube
3	Final reassembly of the Rxn-30 probe with particulate filter

NPT cross fitting on Rxn-30 probe

Endress+Hauser offers an optional, custom ½″ NPT cross fitting with standard NPT adapters for ¼″ stainless tubing (P/N 70187793, not included). It provides four ½″ NPT ports. The fourth port may be used for temperature or pressure sensors, condensate drainage, or it may be plugged.

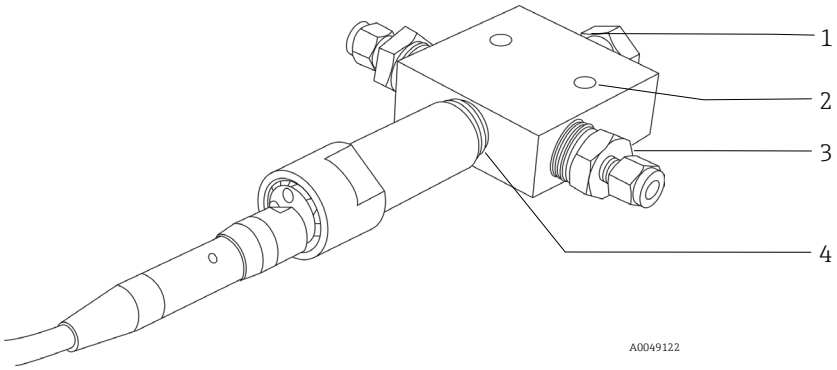


Figure 3. Rxn-30 probe integrated to ½" NPT cross fitting

#	Description
1	½″ NPT plug for port not in use
2	(2) ¼″ mounting holes
3	(2) ½″ NPT to ¼″ stainless tubing compression adapters
4	½″ NPT Rxn-30 port

NOTICE

If the probe will be removed and reinstalled, a compression fitting is recommended.

- NPT interconnects are not the preferred probe interface if the probe will be removed and reinstalled.

Compression cross fitting on Rxn-30 probe

The Rxn-30 probe may also be installed using a standard *1″* compression cross fitting, commercially available or from Endress+Hauser (p/n 71675522).

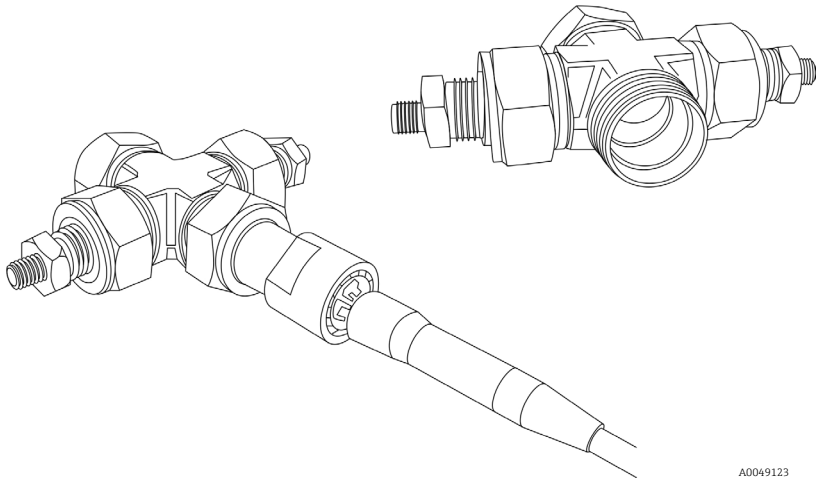


Figure 4. Rxn-30 probe integrated to 1" standard compression cross fitting

Process and probe compatibility

Before installation, the user must verify that the probe pressure and temperature ratings, as well as the materials from which the probe is made, are compatible with the process into which it is being inserted.

Installation

Before installation in the process, verify that the amount of laser power out of each probe is no more than the amount specified in the Hazardous Area Equipment Assessment (4002266) or equivalent.

Standard eye and skin safety precautions for Class 3B laser products (as per EN 60825/IEC 60825-14) should be observed.

Specifications

General specifications

General specifications for the Rxn-30 probe are listed below.

Item	Description
Laser wavelength	532 nm
Spectral coverage	probe spectral coverage is limited by the coverage of the analyzer being used
Ambient temperature	Nonexplosive environments: −20 to 150 °C / −22 to 302 °F Explosive environments: T4: −20 to 70 °C / −4 to 158 °F T6: −20 to 65 °C / −4 to 149 °F Limited to normal ambient temperature IEC 60079-0 for Korea
Maximum laser power into probe	< 499 mW
Operating temperature (probe body/sample)	−20 to 150 °C (−4 to 302 °F)
Operating temperature (cable and connector)	−40 to 70 °C (−40 to 158 °F)
Temperature ramp	≤ 6 °C/min (≤ 10.8 °F/min)
Maximum operating pressure (sample space)	68.9 barg (1000 psig)
Operating humidity	0 to 95% relative humidity, non-condensing
Probe body purge	helium
Probe body hermeticity	purge helium leak rate < 1×10^{-7} mbar·L/s
IEC 60529 rating	IP65
Chemical resistance	per sample contact with sapphire, fused silica, 316 stainless, dielectric coatings (SiO_2, TiO_2), thin dense chrome (TDC), and Teflon
Signal collection efficiency (system level, with nominal Raman Rxn base unit)	ambient air N_2 peak height Rxn-30-532: > 2.5 e^-/sec/mW
Background suppression, N_2 baseline	adjacent baseline < 0.15X N_2 ambient air peak at < 2331 cm^{-1}
Background suppression, full spectrum	max background < 1.0X N_2 air peak
Wetted materials	316/316L stainless steel PTFE sapphire fused silica glass

All fiber-optic cable specifications can be found in the *Raman fiber-optic cables KFOC1 and KFOC1B Technical Information (TI01641C)*.

MPE: ocular exposure

Refer to the tables below from the ANSI Z136.1 standard to calculate the maximum permissible exposure (MPE) for point source ocular exposure to a laser beam.

A correction factor (C_A) may also be required and can be determined below.

Wavelength λ (nm)	Correction Factor C_A
400 to 700	1
700 to 1050	$10^{0.002(\lambda-700)}$
1050 to 1400	5

MPE for point source ocular exposure to a laser beam			
Wavelength *λ (nm)*	Exposure duration *t (s)*	MPE calculation	
		(J·cm⁻²)	*(W·cm⁻²)*
532	10^{-13} to 10^{-11}	1.0×10^{-7}	-
	10^{-11} to 5×10^{-6}	2.0×10^{-7}	-
	5×10^{-6} to 10	$1.8\ t^{0.75} \times 10^{-3}$	-
	10 to 30,000	-	1×10^{-3}

MPE: skin exposure

Refer to the table below from the ANSI Z136.1 standard to calculate the MPE for skin exposure to a laser beam.

MPE for skin exposure to a laser beam				
Wavelength *λ (nm)*	Exposure duration *t (s)*	MPE calculation		MPE where $C_A = 1.4791$
		(J·cm⁻²)	*(W·cm⁻²)*	
532	10^{-9} to 10^{-7}	$2\ C_A \times 10^{-2}$	-	2.9582×10^{-2} (J·cm⁻²)
	10^{-7} to 10	$1.1\ C_A\ t^{0.25}$	-	Insert time (*t*) and calculate
	10 to 3×10^4	-	$0.2\ C_A$	2.9582×10^{-1} (W·cm⁻²)

Certificates and approvals

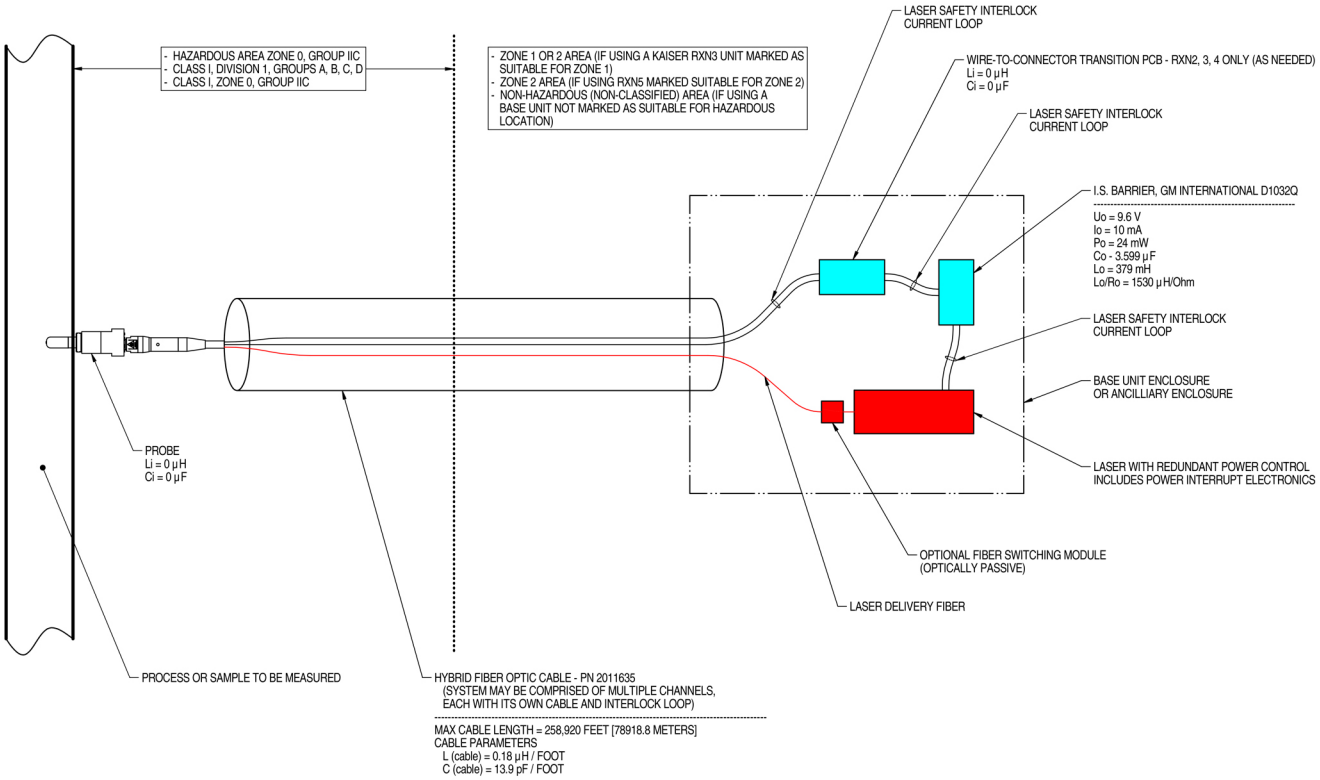
Hazardous area approvals

Refer to the *Rxn-30 Raman spectroscopic probe Safety Instructions (XA02748C)* manual for detailed certification and approval information.

Certifications and markings

Endress+Hauser offers certifications for the Rxn-30 probe. Select the desired certification(s) and the probe or probe tag is marked accordingly. Refer to *Rxn-30 Raman spectroscopic probe Safety Instructions (XA02748C)* documentation for more information about certifications.

Hazardous area drawing The Hazardous Area Installation Drawing (4002396) 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.

A0049010

Figure 5. Hazardous Area Installation Drawing (4002396 version X6)

www.addresses.endress.com

Endress+Hauser
People for Process Automation