

# Technical Information

## **Rxn-30 Raman spectroscopic probe**



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## Function and system design

### Fields of application

The Rxn-30 Raman spectroscopic probe is intended for gas phase sample analysis.

Recommended applications include:

- **Chemical:** ammonia, methanol, HyCO
- **Gas-phase streams in refining:** hydrogen production and recycle fuel blending, fuel characterization
- **Power and energy:** integrated gasification combined cycle (IGCC) power plants, gas turbines
- **Life sciences/food and beverage:** fermentations, offgas, volatiles

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**

**Handle probes and cables with care.**

Fiber cables should NOT be kinked and should be routed to maintain the minimum bend radius of 152.4 mm (6 in.).

- ▶ Permanent damage may result if cables are not routed appropriately.

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

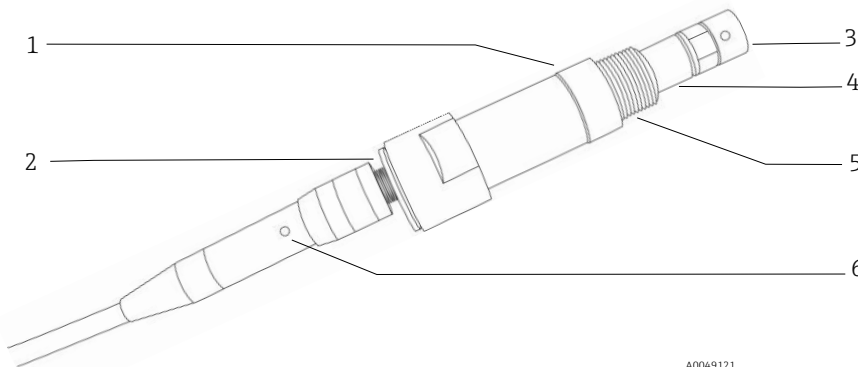


Figure 1. Rxn-30 probe

#	Description
1	1 inch diameter compression fitting compatible (25.4 mm)
2	Connector/cable interface (leave attached)
3	Retro assembly
4	Sample gas ports located under a sintered metal filter
5	½ inch NPT interface thread (12.7 mm)
6	LED laser indicator: When there is potential for the laser to be energized, the LED laser indicator light is illuminated.

Table 1. Rxn-30 probe parts

**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

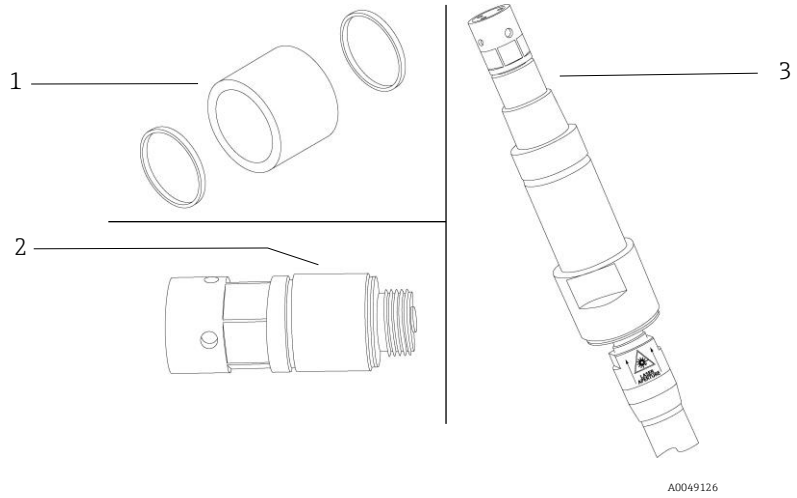


Figure 2. Particulate filter kit and installation

#	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

Table 2. Particulate filter kit and installation

**NPT cross fitting on Rxn-30 probe**

Endress+Hauser offers an optional, custom ½ inch NPT cross fitting (12.7 mm) with standard NPT adapters for ¼ inch stainless tubing (6.35 mm) (P/N 2013463, not included). It provides four ½ inch NPT ports (12.7 mm). The fourth port may be used for temperature or pressure sensors, condensate drainage, or it may be plugged.

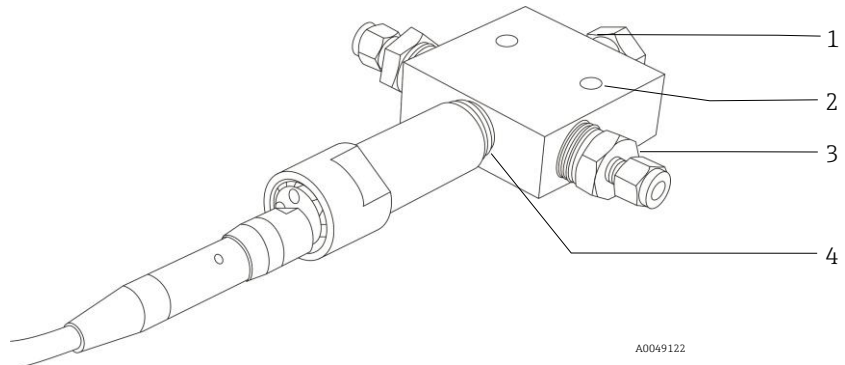


Figure 3. Rxn-30 probe integrated to ½ inch NPT cross fitting

#	Description
1	½ inch NPT plug for port not in use (12.7 mm)
2	(2) ¼ inch mounting holes (6.35 mm)
3	(2) ½ inch NPT to ¼ inch stainless tubing compression adapters (12.7 mm to 6.35 mm)
4	½ inch NPT Rxn-30 port (12.7 mm)

Table 3. Rxn-30 probe integrated to ½ inch NPT cross fitting

**NOTICE**

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

For these types of installations, a compression fitting is recommended.

**Compression cross fitting on Rxn-30 probe**

The Rxn-30 probe may also be installed using a standard 1 inch compression cross fitting (25.4 mm), commercially available or from Endress+Hauser (p/n 2013461).

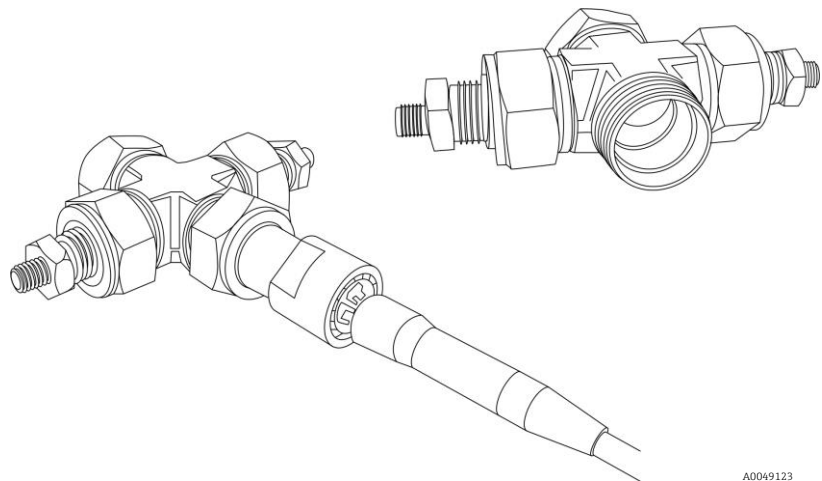


Figure 4. Rxn-30 probe integrated to 1 inch standard compression cross fitting

**Process and probe compatibility**

Prior to 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**

Prior to 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
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 < $1 \times 10^{-7}$ mbar·L/s
Chemical resistance		per sample contact with sapphire, fused silica, 316 stainless, dielectric coatings (SiO <sub>2</sub> , TiO <sub>2</sub> ), thin dense chrome (TDC), and Teflon
Signal collection efficiency (system level, with nominal Raman Rxn base unit)		ambient air N <sub>2</sub> peak height Rxn-30-532: > 2.5 e <sup>-</sup> /sec/mW
Background suppression, N <sub>2</sub> baseline		adjacent baseline < 0.15X N <sub>2</sub> ambient air peak at < 2331 cm <sup>-1</sup>
Background suppression, full spectrum		max background < 1.0X N <sub>2</sub> air peak
Wetted materials		316/316L stainless steel PTFE sapphire fused silica glass
Fiber optic cable (sold separately)	flame resistance	Certified: CSA-C/US AWM I/II, A/B, 80C, 30V, FT1, FT2, VW-1, FT4 Rated: AWM I/II A/B 80C 30V FT4
	length	available in 5 m (16.4 ft.) increments with the length configured to suit and limited by the application

Table 4. Rxn-30 probe specifications

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

Table 5. Wavelength dependent correction factor  $C_A$

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

Table 6. MPE for ocular exposure with 532 nm laser emission

**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 $\lambda$ (nm)	Exposure duration $t$ (s)	MPE calculation		MPE where $C_A = 1.4791$
		( $J \cdot cm^{-2}$ )	( $W \cdot cm^{-2}$ )	
532	$10^{-9}$ to $10^{-7}$	$2 C_A \times 10^{-2}$	-	$2.9582 \times 10^{-2}$ ( $J \cdot cm^{-2}$ )
	$10^{-7}$ to 10	$1.1 C_A t^{0.25}$	-	Insert time ( $t$ ) and calculate
	10 to $3 \times 10^4$	-	$0.2 C_A$	$2.9582 \times 10^{-1}$ ( $W \cdot cm^{-2}$ )

Table 7. MPE for skin exposure with 532 nm laser emission



## Certificates and approvals

### Hazardous area approvals

The hazardous area approvals are listed below.

Type	Description
Hazardous area approvals	<p><b>ATEX</b></p> <p>The Rxn-30 probe has been third-party approved for use in hazardous areas in accordance with Article 17 of Directive 2014/34/EU of the European Parliament and of the Council dated 26 February 2014. The Rxn-30 probe has been certified to the ATEX Directive for use in Europe, as well as in other countries accepting ATEX-certified equipment.</p> <p><b>IECEX</b></p> <p>The Rxn-30 probe can also be marked for <a href="#">International Electrotechnical Commission</a> (IEC) Certification Systems for Explosive Atmospheres when installed in accordance with the Hazardous Area Installation Drawing. The</p> <p><b>North American</b></p> <p>The Rxn-30 probe has also been approved for use in hazardous areas in the United States (US) and Canada by the <a href="#">Canadian Standards Association</a> when installed in accordance with the Hazardous Area Installation Drawing.</p> <p>The products are eligible to bear the CSA Mark with adjacent indicators 'C' and 'US' for Canada and US or with adjacent indicator 'US' for US only or without either indicator for Canada only.</p>

Table 8. Hazardous area approvals

**Certifications and markings**

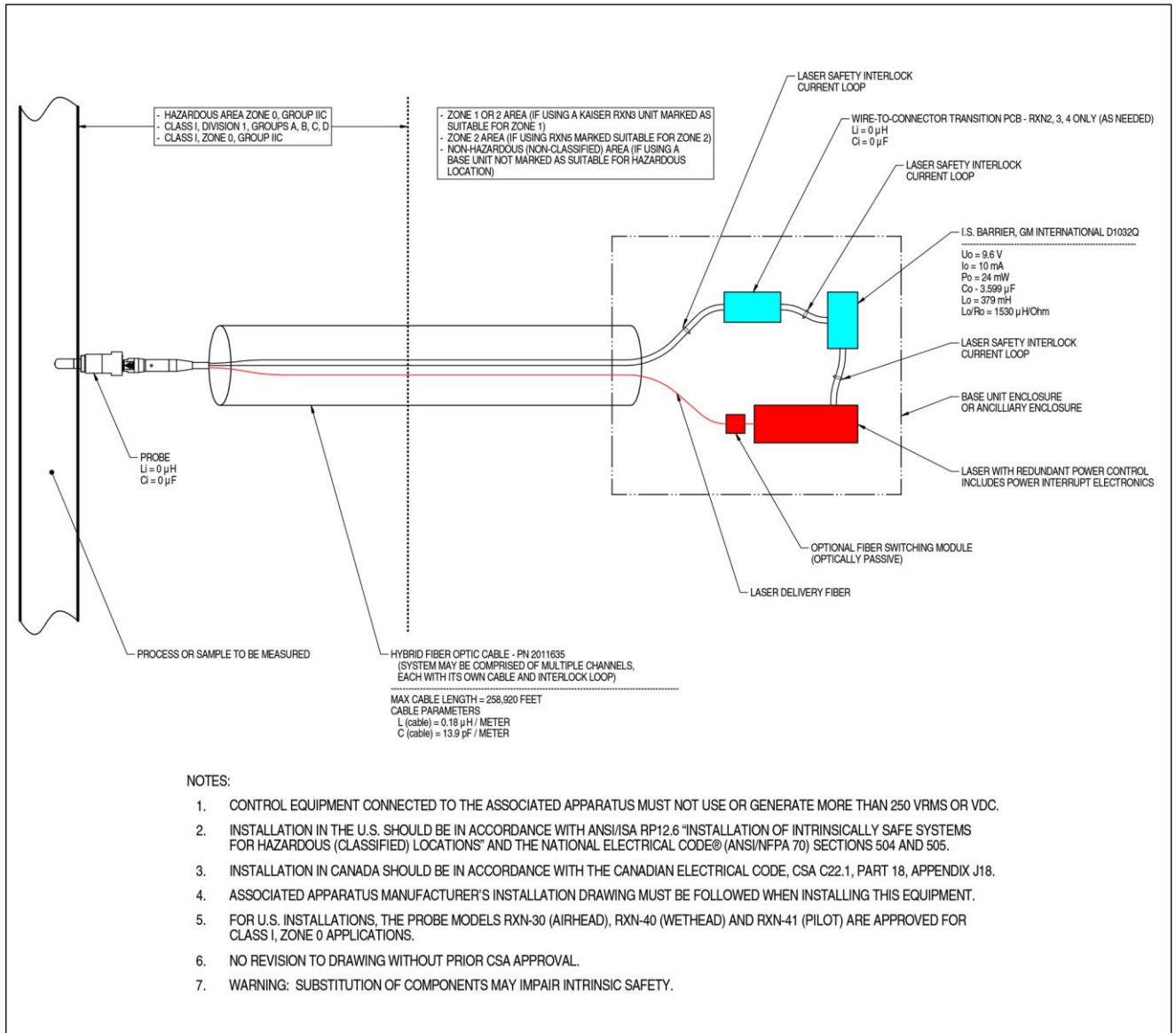
Endress+Hauser offers certifications for the Rxn-30 probe to the standards below. Select the desired certification(s) and the probe or probe tag is marked accordingly.

Type	Description
ATEX marking and installations	<p>ATEX marking is available as an option at the time of purchase. Available markings: II 2/1 G Ex ia op is IIA or IIB or IIB+H2 or IIC T3 or T4 or T6 Ga</p> <p>Prior to the order, the marking for the particular probe/application must be determined. The customer must do one of the following:</p> <ul style="list-style-type: none"> <li>▪ Work with purchasing to identify the required marking OR</li> <li>▪ Provide Endress+Hauser with a completed copy of the Hazardous Area Equipment Assessment (4002266).</li> </ul> <p>Endress+Hauser will mark the Rxn-30 probes according to the customer's provided information. Endress+Hauser is not responsible for the customer's inaccuracies.</p> <p><b>⚠ WARNING</b> <b>In an ATEX-governed environment, only ATEX-marked probes may be used.</b></p>
North American hazardous area marking and installations	<p>CSA marking is available as an option at the time of purchase. Available markings: Ex ia op is IIA or IIB or IIB + H2 or IIC T3 or T4 or T6 Ga Class I, Zone 0 AEx ia op is IIA or IIB or IIB + H2 or IIC T3 or T4 or T6 Ga Class I, Division 1, Groups A, B, C, D T3/T4/T6</p> <p>Prior to the order, the marking for the particular probe/application must be determined. The customer must do one of the following:</p> <ul style="list-style-type: none"> <li>▪ Work with purchasing to identify the required marking OR</li> <li>▪ Provide Endress+Hauser with a completed copy of the Hazardous Area Equipment Assessment (4002266).</li> </ul> <p>Endress+Hauser will mark the Rxn-30 probes according to the customer's provided information. Endress+Hauser is not responsible for the customer's inaccuracies.</p> <p>For North American applications into classified environments, the probe set will have the CSA mark and can be considered intrinsically safe when installed according to the Hazardous Area Installation Drawing (4002396).</p> <p><b>⚠ WARNING</b> <b>In a CSA-governed environment, only CSA-marked probes may be used.</b></p>
IECEX hazardous area marking and installations	<p>IECEX marking is available as an option at the time of purchase. Available markings: Ex ia op is IIA or IIB or IIB + H2 or IIC T3 or T4 or T6 Ga IECEX ITS 14.0015X</p> <p>Prior to the order, the marking for the particular probe/application must be determined. The customer must do one of the following:</p> <ul style="list-style-type: none"> <li>▪ Work with purchasing to identify the required marking OR</li> <li>▪ Provide Endress+Hauser with a completed copy of the Hazardous Area Equipment Assessment (4002266).</li> </ul> <p>Endress+Hauser will mark the Rxn-30 probes according to the customer's provided information. Endress+Hauser is not responsible for the customer's inaccuracies.</p> <p>For IECEX applications into classified environments, the probe set will have the IECEX mark and can be considered intrinsically safe when installed according to the Hazardous Area Installation Drawing (4002396).</p> <p><b>⚠ WARNING</b> <b>In an IECEX-governed environment, only IECEX-marked probes may be used.</b></p>

Table 9. Certifications and markings

**Hazardous area drawing**

The Hazardous Area Installation Drawing (4002396) is shown below.



A0049010

Figure 5. Hazardous Area Installation Drawing (4002396 version X5)

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