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Technical Information

Rxn-46 Raman spectroscopic probe

Endress+Hauser
People for Process Automation

Table of Contents

Function and system design

Fields of application

The Rxn-46 Raman spectroscopic probe is designed for laboratory and process analysis of liquids.

Recommended cell culture applications include glucose, lactate, amino acids, cell density, titer, and more.

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.

Rxn-46 probe

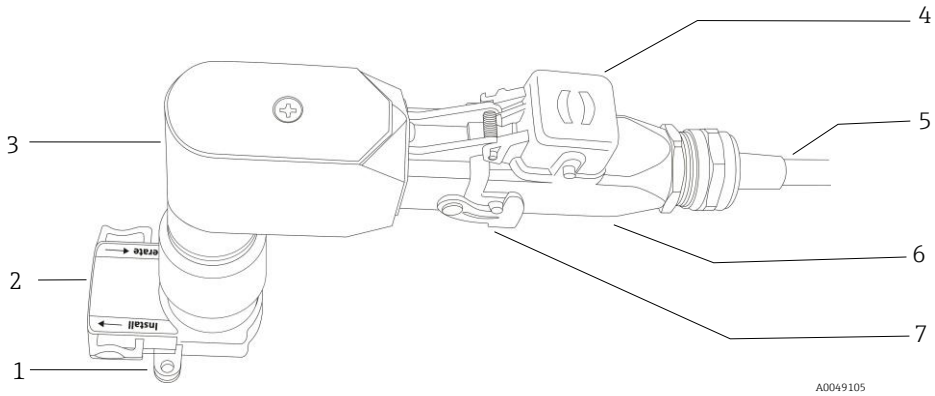

Figure 1. Rxn-46 probe

#	Description
1	Connection to process equipment
2	Probe slider in Operate position
3	Probe body
4	Spring-loaded fiber connector cap
5	Fiber cable
6	Fiber cable connector
7	Fiber cable connector clip

Laser safety interlock

The Rxn-46 probe, as installed, forms part of the interlock circuit. The interlock circuit is a low-current electrical loop. If the fiber cable is severed, the laser will turn off within milliseconds of the breakage.

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 connector in the fiber cable must be plugged into the interlock socket on a Raman Rxn analyzer, and is automatically connected when the fiber optic cable process connector is plugged into the Rxn-46 probe. When there is potential for the laser to be energized, the laser interlock indicator light on the probe body is illuminated.

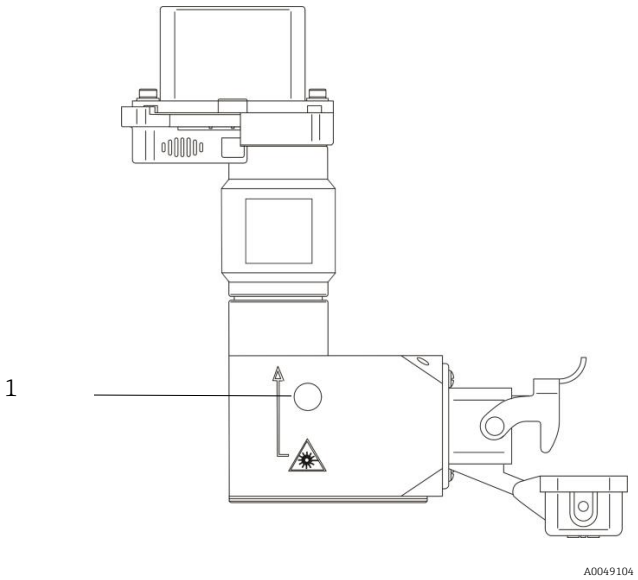

Figure 2. Location of laser interlock indicator light (1)

Installation

The Rxn-46 probe only interfaces to Sartorius's BioPAT® Spectro compatible parts.

During installation, standard eye and skin safety precautions for Class 3B laser products (as per EN 60825/IEC 60825-14) should be observed. Additionally, observe the following:

WARNING	**Standard precautions for laser products should be observed.** ▶ When not installed in a sample chamber, probes should always be capped, pointed away from people, and pointed toward a diffuse target.
CAUTION	**If stray light is allowed to enter an unused probe, it will interfer with data collected from a probe in-use and may cause calibration failure or measurement errors.** ▶ Unused probes should ALWAYS be capped to prevent stray ligh from entering the probe.
NOTICE	**When installing the probe *in situ*, the user must provide strain relief to the fiber optic cable at the probe installation location.**

Analyzer compatibility

The Rxn-46 probe is compatible with the Endress+Hauser Raman Rxn analyzers below operating at 785 nm.

- Ambr® 15 and Ambr® 250: Raman Rxn2 analyzer, single-channel, benchtop
- Biostat STR®: Raman Rxn2 or Rxn4 analyzers, up to four channels; benchtop or mobile wheeled cart (Raman Rxn2) rack mounted or NEMA 4x enclosure (Raman Rxn4)

Specifications

General specifications

General specifications for the Rxn-46 probe are listed below.

Item		Description
Laser wavelength		785 nm
Spectral coverage		probe spectral coverage is limited by the coverage of the analyzer being used
Maximum laser power into probe		< 499 mW
Probe operating temperature		10 to 50 °C (probe is non-contact) (50 to 122 °F)
Probe dimensions (standard)		162 x 159 x 52 mm (6.4 x 6.3 x 2.0 in)
Fiber optic cable (cable sold separately)	design	PVC jacketed, proprietary construction
	connections	proprietary electro-optic (EO) or FC to EO fiber converter(s)
	temperature	–40 to 70 °C (–40 to 158 °F)
	length	EO cable available in 5 m (16.4 ft) increments up to 200 m (656.2 ft), with the length limited by the application
	minimum bend radius	152.4 mm (6 in)
	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

Table 1. General specifications

Probe dimensions: side view

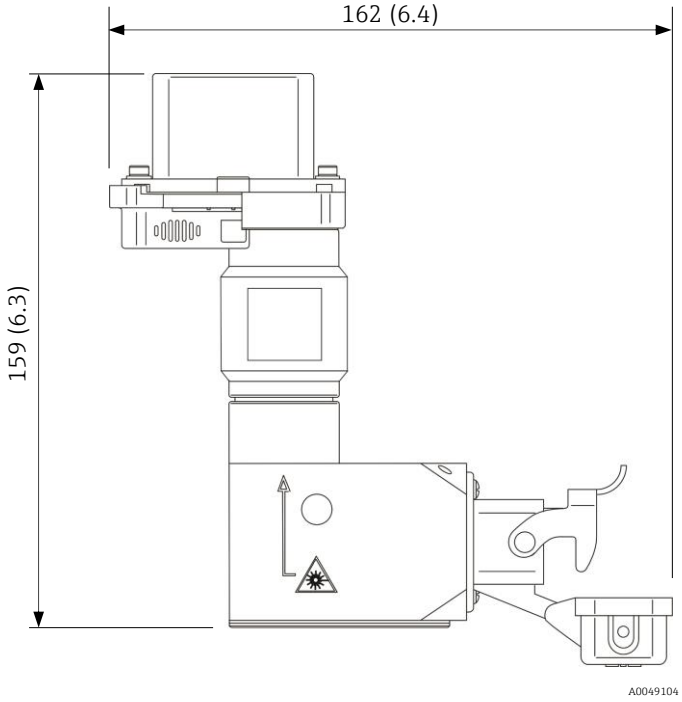

Figure 3. Rxn-46 probe side view. Dimensions: mm (in)

Probe dimensions: top view

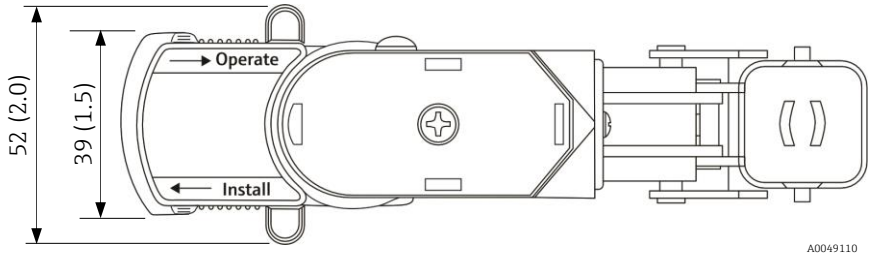

Figure 4. Rxn-46 probe top view. Dimensions: mm (in)

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

Table 2. Wavelength dependent correction factor C_A

MPE for point source ocular 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})	
785	10^{-13} to 10^{-11}	1.5 $C_A \times 10^{-8}$	-	2.2×10^{-8} (J·cm^{-2})
	10^{-11} to 10^{-9}	2.7 $C_A\, t^{0.75}$	-	Insert time (t) and calculate
	10^{-9} to 18×10^{-6}	5.0 $C_A \times 10^{-7}$	-	7.40×10^{-7} (J·cm^{-2})
	18×10^{-6} to 10	1.8 $C_A\, t^{0.75} \times 10^{-3}$	-	Insert time (t) and calculate
	10 to 3×10^4	-	C_A x 10^{-3}	1.4971×10^{-3} (W·cm^{-2})

Table 3. MPE for ocular exposure with 785 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 λ (nm)	Exposure duration t (s)	MPE calculation		MPE where C_A = 1.4791
		(J·cm^{-2})	(W·cm^{-2})	
785	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})

Table 4. MPE for skin exposure with 785 nm laser emission