TI01634C/66/EN/05.25
70231740

Technical Information

Rxn-46 Raman spectroscopic probe

System design and specifications

Application

The union between our Raman analyzers equipped with Rxn-46 bioprocess probe technology and the BioPAT® Spectro platform by Sartorius offers the market an ideal interface to high-throughput development through single-use commercial manufacturing.

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

Device properties

Our Raman bioprocessing probe technology has been adapted to fit Sartorius's BioPAT® Spectro platform, utilizing the same probe design for Ambr® 15, Ambr® 250, and Biostat STR® bioreactors.

Your benefits

- Enables faster, easier, and more robust model building via integration with Ambr® 15 and Ambr® 250
- Allows high-throughput process development which supports Quality by Design (QbD)
- Provides a more efficient transfer to Biostat STR® for single-use manufacturing
- Offers a scale-independent interface from 15 mL in the laboratory to 2000 L in the production suite
- Requires no probe cleaning, sterilization, or frequent maintenance due to non-contact sampling

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Function and system design

Application

Using the device for any purpose other than that described may compromise personal safety, damage the measuring system, and invalidates any warranty.

Rxn-46 probe

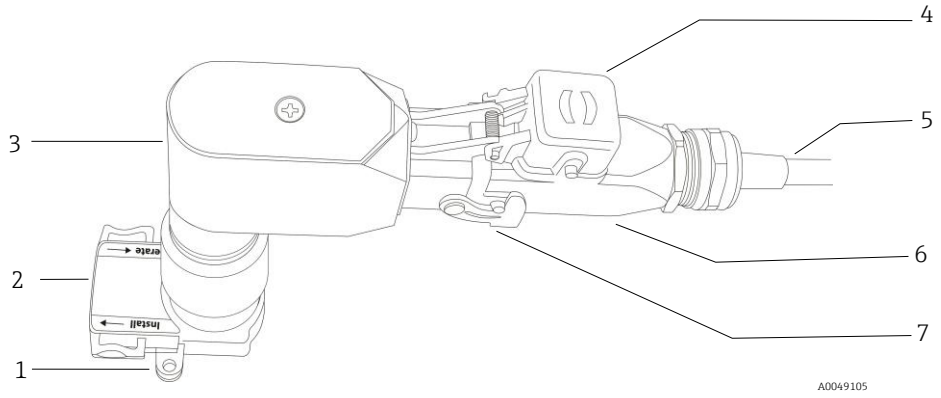

Figure 1. Rxn-46 probe

#	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

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 cable Technical Information (TI01641C)*.

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.

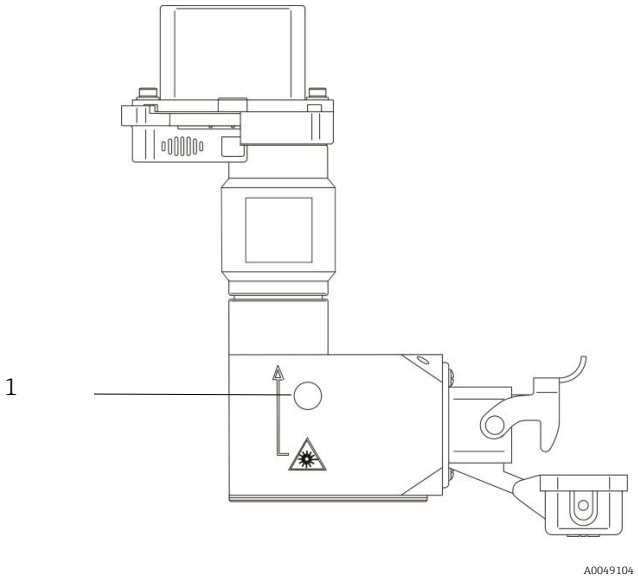

Figure 2. Location of laser interlock indicator light (1)

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 interfere 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 light 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
IEC 60529 for (EO) right angle connector	IP65
North American TYPE rating for (EO) right angle connector	TYPE 13[1]
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)

[1] This is a self-declaration of conformance to UL 50E TYPE 13 requirements. It does not constitute UL certification or authorization to use the UL mark. The Rxn-46 Raman spectroscopy probe optics are not air or watertight, therefore we do not make any environmental rating claims on that portion of the probe.

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

Probe dimensions: side view

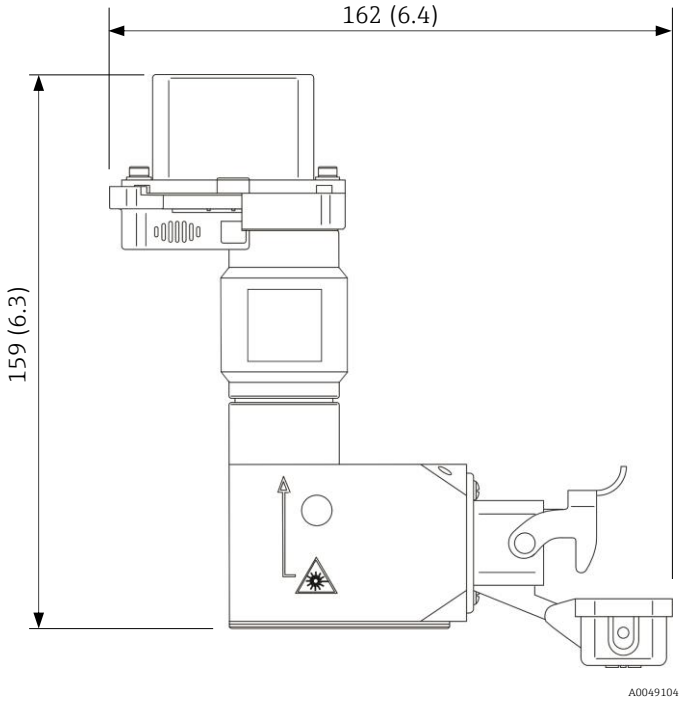

Figure 3. Rxn-46 probe side view. Dimensions: mm (in)

Probe dimensions: top view

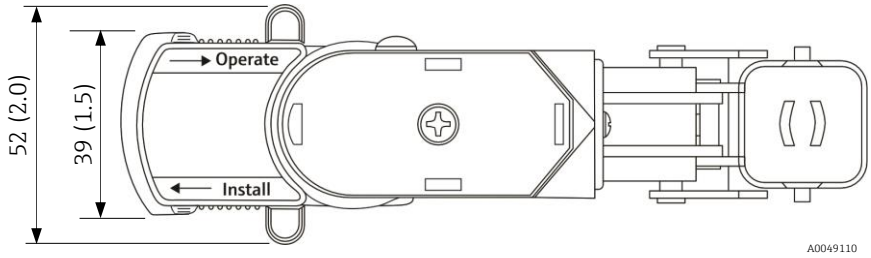

Figure 4. Rxn-46 probe top view. Dimensions: mm (in)

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

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})

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})

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