Kaiser Raman Probes Robust optical measurement of chemical composition

For lab-to-process safety, quality, and optimization

- Robust and reliable inline, on-line, or at-line measurement data
- Increased process understanding, control, and monitoring of key quality parameters
- In situ, real-time measurement of multiple components with a single probe
- Simplified process equipment and seamless model transferability
- Faster processing time, less waste, and enhanced yields
- Easier compliance with strict industry regulatory requirements
- Flexibility for use with any phase of matter in any installation environment





Kaiser Raman probes quality matters

Kaiser Raman probes are the "eyes" that see into your process to help you understand, monitor, and control your chemistries. Just as healthy eyes and clear vision are essential to help the human brain process information, the quality and accuracy of your sampling probes are crucial to gaining a clear picture of your processes. This transparency is an important component to operational excellence.

Kaiser Raman sampling probes are designed to be rugged, robust, and high-performing. They are constructed with the highest quality contact materials and offer the most flexible sampling capabilities available on the market. Whether you want to measure solids, liquids, gases, or slurries, Kaiser Raman probes deliver continuous, real-time inline measurement data with exact precision.

You can count on Kaiser Raman probes to help you meet rigorous industry standards, while boosting plant safety, ensuring product quality, and increasing operational efficiency across your enterprise. **Safety data you can count on** Boost plant safety and performance through automation and transparency into your process. Kaiser Raman *in situ* probes maximize personnel safety by avoiding extractive sampling and enable monitoring of critical safety parameters to better predict and mitigate risk.

Product quality and compliance at your

fingertips Improve quality and compliance by gaining process control and identifying quality markers for realtime release. As a result, you can consistently produce higher, better quality yields and more easily comply with industry regulations.

Lab-to-process optimization and scalability Kaiser Raman probes are uniquely designed to work with our award-winning analyzers, providing a system that scales from the laboratory to the process environment without missing a beat. This transferability results in seamless model transfer, faster time to market, and a quicker return on investment.



Top quality material & design

- Corrosion resistant materials
- High purity, low background windows
- Bubble shedding characteristics
- Fixed-focus design



Lab-to-process scalability

- Simplified equipment
- Easy method transferability
- Self-alignment & calibration innovation

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Sampling versatility

- Non-invasive, non-destructive sampling
- No-touch and remote measurements
- Representative measurements
- Direct insertion, side insertion, or sample loop
- Through site glass, in a sleeve-type port, or in slip-stream

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Industry standards/regulation compliance

- ATEX, North American, & IECEx hazardous area certification
- CIP/SIP, autoclave, and gamma radiation sterilization protocols
- cGMP, ASME BPE
- ISO 9001:2015
- NeSSI compatibility



Environmental flexibility

- All phases of matter
- Any installation environment
- Wide range of application suitability
- Modular designs for site installation or site acceptance



Reliable data accuracy

- Inline, on-line, at-line
- Real-time
- Continuous 24/7 & 365
- Long-term measurement stability
- Streamlined calibration and verification procedures



Not all Raman probes are created equal

When only the best will do, trust Kaiser Raman

The Kaiser Raman probe portfolio is backed by over 30 years of process Raman leadership, expertise, reliability, and innovation. All of our probes are uniquely designed to enable non-invasive compositional analysis of a material without needing to extract, prepare, or destroy the native sample or modify existing hardware. Each probe line has been tailored, by design, to its target use by incorporation of specific windows, materials, and sampling features. In addition, our probes include self-alignment and calibration innovation for unparalleled method transfer capabilities.

Kaiser Raman probes are optimized for solids, liquids, gases, and turbid media to ensure high performance in the laboratory or in process environments. They can be configured to the Raman sampling point for your application or plant setting, thereby providing reliable chemical analysis in any installation environment.

Benefit Highlights

- Increased safety through reliable, non-extractive, in situ measurement techniques, which minimize human intervention while maximizing risk avoidance capabilities
- Enhanced product quality through increased process visibility and tighter control of critical quality parameters
- Optimized process efficiency through faster delivery of real-time, highly accurate measurement data and streamlined lab-to-process scalability
- Lower costs by reducing maintenance, product waste, and cleaning burdens while increasing yields and plant availability
- Easier compliance with industry and safety regulations through better process control and 24/7/365 monitoring



Kaiser RamanRxn probehead

Liquids & solids / laboratory analysis

Designed for product and process development, the RamanRxn probehead is the workhorse of the Kaiser Raman probe portfolio. It is trusted to deliver high performance Raman measurements across a wide spectral range.

The RamanRxn probehead is compact, lightweight, and flexible - offering multi-purpose convenience for both solids and liquids analysis in the laboratory environment.

The RamanRxn probehead accepts a variety of interchangeable optics which make it a highly versatile and easily adaptable instrument in your laboratory toolbox.

- Non-contact optic for use with solids or turbid media or when sample contamination is a concern
- Immersion optic for use in reaction vessels, laboratory reactors, or process streams
- bIO-Optic for use with continuous inline measurement in benchtop bioreactor/fermentor applications requiring headplate entry
- SUB Optic for use with disposable fittings for single-use bioreactors



Benefits at a glance

- Multipurpose use for both solids and liquids measurement
- Lightweight and compact
- Integrated laser safety interlock, including "laser on" indication and remote shut-off
- Flexible output compatible with a range of sampling options
- Easy switching of non-contact, immersion, and bioprocessing optics to suit a variety of applications
- Wide spectral range, including access to a critical low-wavenumber region

Field of application

- Chemical: reaction monitoring, blending, catalysis, hydrocarbon speciation, process unit optimization
- Polymer: polymerization reaction monitoring, extrusion monitoring, polymer blending
- Pharmaceutical: active pharmaceutical ingredient (API) reaction monitoring, crystallization
- Biopharmaceutical: cell culture and fermentation monitoring, optimization, control
- Food & Beverage: zonal heterogeneity mapping of meats and fish

- Laser wavelength: 532 nm, 785 nm, or 1000 nm
- Maximum laser power: <499 mW
- Construction: 6061 Aluminum, 316L stainless steel, and 303 stainless steel
- Length: 200 mm
- Diameter: 19 mm



Kaiser RamanRxn probe optics

Liquids & solids / laboratory & process analysis

Kaiser RamanRxn probe optics broaden sampling flexibility so you can tailor your Raman system to your specific laboratory and manufacturing needs.

RamanRxn probehead optics		
	 Non-contact optic Range of working distances for remote measurements either directly or through sight glass and translucent packaging Highly versatile- measuring films to pellets to powders Can measure static or moving samples Contact-free analysis of delicate or corrosive samples 	
	 Immersion optic Ideal for quick liquids, slurries & semisolids measurements in the lab Superior signal performance Available in ¼" and ½" diameters Wettable components that resist corrosion in harsh environments 	
	 blO-Optic Immersion optic for multi-component bioprocess measurement Compatible with standard bioreactor ports Fixed-focus design Available in 12 mm diameter with Pg 13.5 threaded connector 120, 220, 320, or 420 mm lengths Autoclavable 	
	 SUB Optic system Disposable fitting for single-use bioreactors (SUB), plus a non-contact reusable optic Developed to industry standards for single-use sensors Gamma sterilizable Tested and supplied by multiple SUB vendors 	



Kaiser Raman bIO-PRO probe

Liquids / process analysis

The Kaiser Raman bIO-PRO probe capitalizes on the power of Raman in bioprocess manufacturing by measuring multiple, specific components in real-time for continuous, around-the-clock process feedback. It also meets the daunting sampling requirements of compliance, sterilization, port compatibility, and convenience. The bIO-PRO probe offers a surface finish suitable for cGMP manufacturing, fits the side ports of large bioreactors, and is compatible with CIP/SIP protocols. With flexibility in mind, the bIO-PRO probe was designed for installation in development and cGMP stainless-steel reactors. The Pg 13.5 connector allows for installation with multiple port types, utilizing industry standard sensor housings for 25 mm side ports. Welded port connectors and flanges are also available in multiple brands and sizes. The bIO-PRO is successfully used to provide an analytical "eye" into large-scale bioprocesses.

Benefits at a glance

- Measures multiple components in real-time for automated 24/7 process feedback
- Provides long-term measurement stability
- Offers a suitable surface finish for cGMP manufacturing
- Provides compatibility with industry standard bioreactor side ports and sensor housings
- Offers the flexibility of being installed in development and production reactors
- Compatible with CIP/SIP standards for reduced sterilization and cleaning burdens

Field of application

- Cell culture: glucose, lactate, cell density, titer, amino acids, and more
- Fermentation: glucose, glycerol, acetate, methanol, ethanol, biomass, and more

- Laser wavelength: 785 nm, 1000 nm
- Process connection: Pg 13.5
- Surface finish: Ra 15 with electropolish
- Insertion length: 120 mm
- Diameter: 12 mm
- Body: 316L stainless steel
- Sterilization protocol: CIP/SIP compatibility



Kaiser Raman bIO-PRO, KS probe

Liquids / laboratory & process analysis

The Kaiser Raman bIO-PRO, KS is the latest innovation in our robust bioprocessing probe series. Optimized to fit the BioPAT[®] Spectro platform by Sartorius, this collaboration represents the first instance of Raman being brought down to Sartorius' Ambr[®] scale and Biostat STR[®] single-use product lines. It offers the market an ideal interface to high throughput development through single-use commercial manufacturing. By providing fast, reliable, and accurate measurement of key process variables from lab-to-process, the Kaiser Raman bIO-PRO, KS probe empowers bioprocessing companies to more easily scale-up and scale-out from development to cGMP while complying with strict quality standards.

Benefits at a glance

- Enables faster, easier, and more robust model building via integration with Ambr[®] 15 and Ambr[®] 250
- Allows high throughput process development which supports 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



Field of application

 Cell culture: glucose, lactate, cell density, titer, amino acids, and more

- Laser wavelength: 785 nm
- Process connection: non-contact, only attaches to BioPAT[®] Spectro for Ambr[®] and Biostat STR[®]
- Analyzer compatibility: Ambr[®] 15 and Ambr[®] 250: Raman Rxn2 single channel; Biostat STR[®]: Raman Rxn2/4 up to four channels, or upgraded non-embedded four channel analyzers



Kaiser Raman WetHead probe

Liquids / laboratory & process analysis

Designed to promote versatility and materials compatibility, the Kaiser Raman WetHead probe is a compact, sealed immersion probe for *in situ* Raman spectroscopy of liquid-phase samples in a laboratory or process plant setting. The WetHead probe provides inline, real-time chemical measurements without needing to send a technician to the field and collect a sample from the stream. The process connection for the WetHead probe can be swaged, compression-mounted, flange-mounted, installed in a Kaiser flow cell, and is NeSSI compatible. These options allow for direct insertion in slip-streams, drain-valves, reactors, circulation loops, blend headers, and inlet or outlet pipework. The WetHead probe is available in two variations—the WetHead Max and the WetHead Mini—to aid customization to your process and offer greater sampling flexibility. In addition, the WetHead probe is compatible with installations in hazardous areas/classified environments.



Benefits at a glance

- Customizable to your process
- Robust design with a range of process connections
- In situ /no transfer lines or fast-loops required
- Faster, simpler installation
- Support for a range of chemical processes and corrosivity requirements
- Ensures safety and meets regulatory requirements
- Suitable for hazardous /classified environments

Field of application

- Chemical: reaction monitoring, blending, catalysis, feed and final product monitoring
- Polymer: polymerization reaction monitoring, extrusion monitoring, polymer blending
- Pharmaceutical: API reaction monitoring, crystallization, polymorph, blending
- Oil & Gas: fuel blending, fuel characterization

- Laser wavelength: 532 nm, 785 nm, 1000 nm
- Maximum laser power: <499 mW
- Immersible length: 36mm (WetHead mini); up to 457 mm (WetHead Max)
- Immersible diameter: 12.7, 19.05, 25.4 mm options
- Wetted material: C276 Alloy, 316L stainless steel, or Grade 2 Titanium
- Hazardous area certified: ATEX, North American, IECEx



Kaiser Raman Pilot-E probe

Liquids / process analysis

The Kaiser Raman Pilot-E probe is a rugged, process insertion probe with no sample handling system. Its single cable design streamlines installation, eliminates risk scenarios, and minimizes installation cost for long fiber runs in the process environment. The Pilot-E probe utilizes a hybrid electro/optical fiber cable assembly to carry the analytical signal and the safety interlock in a single easy-to-install cable. The Pilot-E probe is ideally suited for use in chemical plants and refineries to measure batch or continuous flow production. It is also highly effective for use in pharmaceutical manufacturing facilities for glasslined reactors as part of a Quality-by-Design (QbD) solution using Process Analytical Technology (PAT) analyzers. For direct measurements in cryogenic fluids, an optimized cryogenic version of the Pilot-E probe is available.

Field of application

- Chemical: reaction monitoring, blending, feed, and final product monitoring
- Polymer: polymerization reaction monitoring, polymer blending
- Pharmaceutical: API reaction monitoring, crystallization, polymorph, drug substance production unit operation
- Oil & Gas: fuel blending, fuel characterization

Technical highlights

- Laser wavelength: 532 nm, 785 nm, 1000 nm
- Maximum laser power: <499 mW
- Body: C276 Alloy (316L stainless steel or Grade 2 Titanium upon request)
- Length: customizable up to 4,600 mm (up to 350 mm for Grade 2 Titanium)
- Diameter: 25 or 60 mm (25 mm only for Grade 2 Titanium)
- Suitable for hazardous /classified environments

Benefits at a glance

- Constructed to individual site requirements
- Sealed probe design
- Integrated "laser on" indicator
- One in/one out fiber optics
- Direct insertion compatibility
- Meets Category 1 pressure equipment safety standards
- Hazardous area certifications: ATEX, North American, & IECEx



Kaiser Raman PhAT probe

Solids / laboratory & process analysis

For solids and semi-solids analysis, the P^hAT probe reigns supreme. Its state-of-the-art, stainless-steel probe design produces representative, focus-free, quantitative Raman measurements. The P^hAT probe illuminates a large surface area and eliminates the need to align the probe for surface roughness. A large excitation spot (6 mm) and multiple collection fibers in the P^hAT probe achieves heterogenous solids sampling in both the axial and lateral dimensions. In doing so, it provides information on deeper layers in addition to the surface, which is highly useful for measuring heterogenous solids such as tablets, capsules, food solids, and polymer beads.

To enhance sampling flexibility, both insertion and non-contact sampling optics are available for the P^hAT probe.

Benefits at a glance

- Non-contact measurement of heterogeneous solids for better representation
- Improved process control and efficiency through faster measurements
- Non-destructive measurements from a distance
- Reproducible sampling
- "Focus free" alignment
- No need to align probe for surface roughness
- Surface and deep layer analysis

Field of application

- Polymers: extruded pellet quality, crystallinity, density, raw materials
- Pharmaceutical: crystallinity, polymorphism, granulation, blend uniformity, content uniformity, coating, tableting
- Chemicals: final product quality, blend impurities, crystallinity, raw materials
- Food & Beverage: quality of dairy solids, meat and fish composition

- Laser wavelength: 785 nm
- Maximum laser power: <499 mW
- Working distance: 35 mm to 250 mm (1 mm to 6 mm spot size)
- Body: 316L stainless steel
- Hazardous area certified: ATEX, North American, IECEx







Kaiser Raman AirHead probe

Gases / process analysis

The Kaiser Raman AirHead probe has cross-industry appeal for its robust gas-phase headspace monitoring, *in situ* measurements, and material compatibility. In chemical processes, it successfully addresses common gas/vapor phase process application challenges such as corrosivity, wetness of the sample environment, and low sensitivity of analyzer technology. Food & Beverage companies rely on its ability to reliably measure gas-phase volatile organics during sugar fermentations. Certified for use in hazardous area environments, the AirHead probe can be inserted directly into processes with temperatures up to 150 degrees Celsius and pressures up to 1,000 psi, and it is available with a variety of mounting options for maximum installation and sampling flexibility.

Benefits at a glance

- Reliable, quantitative gas-phase measurements
 In situ measurement / no transfer lines or fast
- loops required
- Can be directly inserted into processes with temperatures up to 150°C and 1,000 psi
- Industry standard installation options
- Direct insertion, side insertion, or sample loop
- Suitable for hazardous area/classified environments

Field of application

- Chemical: Ammonia, methanol, HyCO, reaction monitoring, blending, catalysis
- Polymer: polymerization reaction monitoring
- Pharmaceutical: API reaction monitoring, drying
- Gas-phase streams in refining: Hydrogen production and recycle fuel blending, fuel characterization
- Power & Energy: IGCC power plants, gas turbines
- Food & Beverage: fermentations, offgas, volatiles

- Laser wavelength: 532 nm
- Body: C276 (316L stainless steel or Grade 2 Titanium upon request)
- Temperature: -30°C to 150°C
- Pressure at probehead: up to 1000 psi
- Hazardous area certified: ATEX, North American, IECEx



Technical specifications: probes for liquid-phase

Technical Specifications

	RamanRxn probehead with immersion optic	WetHead	Pilot-E
Laser wavelength	532 nm, 785 nm, 1000 nm	532 nm, 785 nm, 1000 nm	532 nm, 785 nm, 1000 nm
Spectral coverage	150-4350 cm ⁻¹ (532 nm) 150-3425 cm ⁻¹ (785 nm) 200-2400 cm ⁻¹ (1000 nm)	150-4350 cm ⁻¹ (532 nm) 150- 3425 cm ⁻¹ (785 nm) 200-2400 cm ⁻¹ (1000 nm)	150-4350 cm ⁻¹ (532 nm) 150-3425 cm ⁻¹ (785 nm) 200-2400 cm ⁻¹ (1000 nm)
Laser maximum	Maximum power into probehead: <499 mW		
Sample interface	Temperature, immersion optic: -30°C to 120°C (316L stainless steel), -30°C to 280°C (C276 Alloy), -30°C to 300°C (Grade 2 Titanium) Temperature, RamanRxn probehead: -10°C to 70°C Temperature ramp: ≤30°C/ min	Temperature, WetHead Mini: $-30^{\circ}C$ to 120°C (316L stainless steel), $-30^{\circ}C$ to 150°C (C276 Alloy), $-30^{\circ}C$ to 150°C (Grade 2 Titanium)Temperature ramp: ≤30°C/minTemperature, WetHead Max : $-30^{\circ}C$ to 120°C (316L stainless steel), $-30^{\circ}C$ to 280°C (C276 Alloy), $-30^{\circ}C$ to 300°C (Grade 2 Titanium)Temperature ramp: ≤30°C/minTemperature ramp: ≤30°C/minTemperature ramp: ≤30°C (DID) C to 120°C (316L stainless steel), $-30^{\circ}C$ to 300°C (C276 Alloy), $-30^{\circ}C$ to 300°C (Grade 2 Titanium)Temperature ramp: ≤30°C/minFlange: ANSI B16.5 and DIN EN1092 Type B flanges available upon request	Temperature: -30°C to 120°C (316L stainless steel), -30°C to 150°C (C276 Alloy), -30°C to 150°C (Grade 2 Titanium) Temperature ramp: ≤6°C/min Flange: up to 305 diameter, ANSI B 16.5 or DI
	Relative humidity: up to 95% Pressure: 316L stainless steel 150 psi	, non-condensing : up to 370 psi, C276 Alloy: up to 65	0 psi. Grade 2 Titanium: up to
Wetted materials	Immersion optic metal: C276 Alloy (316L stainless steel or Grade 2 Titanium upon request) Immersion optic window: High-purity sapphire	Metal: C276 Alloy, 316L stainless steel, or Grade 2 Titanium Window: High-purity sapphire	Metal: C276 Alloy, 316L stainless steel, or Grade 2 Titanium Window: High-purity sapphire
Fiber optic cable	Design: PVC jacketed, proprietary construction Connections: proprietary electro-optic Temperature: -40°C to 80°C Length: 5000 mm (16.4 feet) standard, custom lengths available Minimum bend radius: 152.4 mm (6 inches)		
Immersible length (mm)	Immersion optic: 1/2" sealed: 152, 305, 457 1/4" sealed: 152, 203 (other immersion optic types available)	WetHead Mini: 36 WetHead Flange and WetHead Max: up to 457 (up to 350 for Grade 2 Titanium)	Up to 4600 (up to 350 for Grade 2 Titanium)
Immersible diameter (mm)	Immersion optic: 12.7	12.7, 19.05, 25.4	25 or 60 (25 only for Grade 2 Titanium)
Hazardous area certifications	n/a	ATEX, North American, and IECEx	ATEX, North American, and IECEx

Technical specifications: probes for liquid-phase bioprocessing

Technical Specifications

	RamanRxn probehead with bIO-Optic	RamanRxn probehead with SUB Ontic	bIO-PRO probe	bIO-PRO, KS
Laser wavelength	785 nm, 1000 nm	785 nm, 1000 nm	785 nm, 1000 nm	785 nm
Spectral coverage	150-3425 cm ⁻¹ (785 nm) 200-2400 cm ⁻¹ (1000 nm)	150-3425 cm ⁻¹ (785 nm) 200-2400 cm ⁻¹ (1000 nm)	150-3425 cm ⁻¹ (785 nm) 200-2400 cm ⁻¹ (1000 nm)	150-3425 cm ⁻¹ (785 nm)
Max laser power into probehead	<499 mW	<499 mW	<499 mW	<499 mW
Sample interface	Temperature, bIO- Optic: -30°C to 150°C Temperature, RamanRxn probehead: -10°C to 70°C Pressure: ≤200 psi Temperature ramp: -30°C/min	Temperature, SUB Optic: -0°C to 100°C Temperature, RamanRxn probehead: -10°C to 70°C Pressure: ≤200 psi Temperature ramp: -30°C/min	Temperature: -30°C to 150°C Temperature ramp: -30°C/min Pressure: ≤200 psi	Temperature: probe is non-contact; operating temp: 10°C to 50°C Pressure: n/a (probe is non-contact)
Wetted materials	blO-Optic body: 316L stainless steel Window: Proprietary material, optimized for bioprocesses Process connection: Pg 13.5 Surface finish: Ra 15 with electropolish Adhesive: USP Class VI and ISO993 compatible	SUB Optic body: 316L stainless steel Window: Proprietary material, optimized for bioprocesses Process connection: n/a (SUB ports provided by SUB vendor) Surface finish: Ra 15 with electropolish Adhesive: USP Class VI and ISO993 compatible	Body: 316L stainless steel Window: Proprietary material, optimized for bioprocesses Process connection: Pg 13.5 for industry standard sensor housings, welded port connectors available Surface finish: Ra 15 with electropolish Adhesive: USP Class VI and ISO993 compatible	Body: n/a Window: n/a Process connection: Sartorius BioPAT(R) Spectro Surface finish: n/a Adhesive: n/a
Fiber optic cable	 Design: PVC jacketed, proprietary construction Connections: proprietary electro-optic (EO), or FC to EO fiber converter(s) for non-embedded systems Temperature: -14°C to 80°C Length: 5000 mm (16.4 feet), contact Kaiser for custom lengths Minimum bend radius: 152.4 mm (6 inches) 			
lmmersible length (mm)	blO-Optic: 120, 220, 320, 420	SUB-barb length: 63.5	120	n/a
lmmersible diameter (mm)	bIO-Optic: 12	SUB-barb diameter: 15.7-11.7 tapered	12	n/a
Sterilization method	Autoclave	Gamma irradiation	SIP/CIP	n/a

Technical specifications: probes for solid-phase

Technical Specifications

	RamanRxn probehead with non-contact optic	P ^h AT
Laser wavelength	532 nm, 785 nm, 1000 nm	785 nm
Spectral coverage	150-4350 cm ⁻¹ (532 nm) 150-3425 cm ⁻¹ (785 nm) 200-2400 cm ⁻¹ (1000 nm)	175-1890 cm ⁻¹ (785 nm)
Maximum laser power into probe head	<499 mW	<499 mW
Sample interface	Temperature, non-contact optic: ambient Temperature, RamanRxn probehead: -10°C to 70°C Pressure: ambient Relative Humidity: ambient	Temperature: 10°C to 40°C Pressure: ambient Relative Humidity: 20-80%, non-condensing
Body and window materials	Non-contact optic body: optic dependent RamanRxn probehead body: 6061 Aluminum, 316L stainless steel, and 303 stainless steel Window: optical-grade materials	Body: 316L stainless steel Window: optical-grade materials
Fiber optic cable	Design: PVC jacketed, proprietary construction Connections: proprietary electro-optic Temperature: -40°C to 80°C Length: 5000 mm (16.4 feet), contact Kaiser for custom lengths Minimum bend radius: 152.4 mm (6 inches)	Design: PVC jacketed, proprietary construction Connections: proprietary electro-optic Temperature: -40°C to 80°C Length: 15000 mm, contact Kaiser for custom lengths Minimum bend radius: 152.4 mm (6 inches)
Length (mm)	Non-contact optic: optic-dependent RamanRxn probehead: 200	305
Diameter (mm)	Non-contact optic: optic-dependent RamanRxn probehead: 19	46
Working distance	10-432 mm	35 mm (1 mm spot) 50 mm (1.5 mm spot) 125 mm (3 mm spot) 200 mm (4.7 mm spot) 250 mm (6 mm spot)
Hazardous area certifications	n/a	ATEX, North American, and IECEx

Technical specifications: probes for gas phase

Technical Specifications

	AirHead
Laser wavelength	532nm
Spectral coverage	150-4350 cm ⁻¹ (532 nm)
Maximum laser power into probe head	<499 mW
Sample interface	Operating temperature, probehead: -20°C to 150°C Temperature ramp: < 6°C/min Pressure at probehead: up to 1000 psi
Body and wetted materials	Metal: 316L stainless steel Window: High-purity sapphire
Fiber optic cable	Design: PVC jacketed, proprietary construction Connections: proprietary electro-optic at analyzer Temperature: -40°C to 80°C Length: 5000 mm (16.4 feet) standard, custom lengths available Minimum bend radius: 152.4 mm (6 inches)
Gas stream filtration	1 μm or better Multistage filtration recommended
Hazardous area certifications	ATEX, North American, and IECEx

About Kaiser Optical Systems, Inc.

Kaiser Optical Systems, Inc. (Kaiser), an Endress+Hauser company, is the global leader in Raman spectroscopic instrumentation for laboratory, process, and manufacturing environments. Our advanced optical measurement solutions harness the powerful analytical information of Raman spectroscopy to help companies understand, measure, and control their chemistries. As a trusted partner in Raman for over 30 years, Kaiser has a long history in supporting our customers' production settings with many proven successes. Our worldwide manufacturing installation base speaks to the fact that industry leaders across the globe trust their products to Kaiser Raman.

The Kaiser Raman comprehensive offering includes high performance analyzer equipment, fiber optic sampling probes, optics, user friendly software, and other accessories. The combination of our unmatched expertise, high quality labto-process solutions, and exceptional customer service sets Kaiser Raman far above any other Raman options in the marketplace. Kaiser Raman technology is currently used throughout the chemical, food and beverage, oil and gas, pharmaceutical, and biopharmaceutical industries to optimize process efficiency and deliver quality products. Kaiser's manufacturing and headquarters facility is located in Ann Arbor, Michigan.

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