



PS-RFP-500-F (11-4-16)

# RFP-500 Series Process Raman Probes

*Robust probes for even the most demanding applications*



The RFP-500 Series has been developed specifically to meet the need for Raman probes capable of performing reliably under the harsh conditions common to most process environments. The probes in this series combine robust optical designs with a choice of 316 stainless steel or Hastelloy C-276 external construction and Axiom's proprietary welded metal window sealing technique<sup>1</sup>.

The extreme robustness of RFP-500 Series probes is accomplished by eliminating all fibers and other sensitive optics from the immersed portion of the probe and by employing a sapphire to metal window sealing technique that is virtually immune to thermal shock and to attack by most chemical systems. This technique employs a metal C-ring compressed at high pressure and welded in place. Since the required compliance is provided by the properly loaded C-ring, the seal can withstand virtually unlimited thermal cycling with no change in performance. This is in marked contrast to elastomeric seals, which tend to flow and set at high temperatures, and to sapphire to metal brazes, which often experience stress failures.

## PROBES FOR CLEAR LIQUID AND GAS STREAMS

Model RFP-540 has been configured to maximize the illuminated area and depth of field without sacrificing sensitivity.

These features provide a number of benefits, including, insensitivity to small scale sample inhomogeneity, reduced sample heating, and enhanced performance stability.

## PROBES FOR HIGHLY SCATTERING SAMPLE STREAMS

Model RFP-550 employs a unique dual-element objective lens design which provides very high collection efficiency for highly scattering samples such as powders, slurries, or emulsions. In addition, the position of its optical focus can be set by means of internal spacers at any point from near contact to approximately 1 mm from its window. This allows its performance to be optimized for the particular scattering diffusion depth of a specific sample stream.

## LABORATORY RAMAN PROBES

In addition to the RFP-500 Series, Axiom Analytical manufactures the RFP-400 Series of laboratory probes (See data sheet PS-RFP-400). These probes use the same basic optical design as the RFP-500 Series but in a smaller, less expensive package, making them ideal for use in a laboratory environment. In addition, RFP-400 Series probes are provided with interchangeable objective lens assemblies and immersion tips. These features provide the flexibility to meet diverse requirements.

## OPTIONS AND ACCESSORIES

### INTERCHANGEABLE FILTER MODULES

RFP-500 probes can be switched to operate with a selection of laser excitation frequencies by interchanging RFF-W Series Filter

Module, where "W" specifies the excitation frequency in nanometers.

## PROCESS PROBE RETRACTION MECHANISM

PRM Series retraction mechanisms provide a reliable means for retracting a probe from a process line or vessel for cleaning or background measurement. Both manual and pneumatic mechanisms are available.

## FEATURES:

- Withstands most aggressive chemistries
- Compatible with process temperatures to 350°C and pressures to 400 bar
- Withstands repeated thermal shock
- Interchangeable filters for application flexibility
- Large depth of field and illumination area (RFP-540)
- Large numeric aperture and adjustable focus (RFP-550)

## REFERENCES:

1. U.S. Patent No. 6,587,195 B1





### OPTION RFL, CUSTOM PROBE LENGTHS

RFP Series probes can be provided in a wide range of extended lengths with minimal loss in a signal level. Inquire with Axiom for price and delivery.

### OPTION RFB, BARRIER WINDOW

Provides an O-ring sealed transparent barrier between the immersed portion of an RFP-500 probe and the fiber connectors. This option allows the probe to be isolated from the fiber-optic conduit and vented to a vapor detector.

### OPTION RFSC, SECONDARY

#### CONTAINMENT

Provides a transparent barrier between the immersible portion of the probe and the main optical housing as well as provision for an isolated flow path for purge or pressurization gas within the probe.

#### VESSEL ATTACHMENT

RFP Probes can be provided with a variety of means for attachment to a reaction vessel, including welded-on flanges, pipe fittings, or port connectors. Inquire with Axiom for price and availability.

### FIBER-OPTIC CABLES

RFP-500 Series probes can be connected to a laser source and to a Raman spectrometer by means of a variety of different fiber-optic cables. The optimum cable numeric aperture for both the excitation and collection cables is 0.25. For optimum performance, the core diameter of the collection fiber should be at least four times that of the excitation fiber (e.g. 50 or 100 µm excitation and 300 or 600 µm collection).

### FDR-500 SERIES PROCESS RAMAN SPECIFICATIONS:

Spectral Range (Stokes Raman Shift):	150-4000+ cm <sup>-1</sup>
Standard Excitation Wavelengths:	785, 633, 532 nm (others available)
Immersible Length (standard):	30 cm
Immersion Shaft Diameter:	19 mm
Maximum Sample Temperature:	350 °C
Maximum Pressure:	400 bar
Wetted Metal:	316L stainless steel (Hastelloy C-276 Optional)
Window Material:	Sapphire
Window Seal:	Coated high-nickel alloy C-ring in permanent welded structure
Seal Coating:	Gold standard, PTFE optional
Excitation Fiber Connector:	FC
Collection Fiber Connector:	SMA
Conduit Termination Housing:	Standard
Spectral Range (Stokes Raman Shift):	150-4000+ cm <sup>-1</sup>

INDIVIDUAL MODELS	RFP-540	RFP-550
Objective Lens Design:	Conventional F:2	Dual-lens objective using truncated ball lens tip.
Optical Focus Offset:	8 mm	0.1 to 1 mm, internally set