

# AirHead Gas-Phase Probe

Raman Products Technical Note

Number 1255

## Key Issues

- **Optimized signal-to-noise performance for gas- and vapor-phase measurements**
- **Optional cross-flow cell**
- **Compact, easy to install**

## Introduction

Raman spectroscopy is a powerful tool for chemical analysis for several reasons: it exhibits high specificity, it is compatible with all physical phases of materials, no special preparation of the sample is needed, and the timescale of the experiment is short. Early research reports of gas-phase measurements date back to the 1950's. While Raman spectroscopy has been widely used to fundamentally characterize small molecules in the gas-phase, industrial applications of gas-phase Raman spectroscopy have been limited. The reason for this is that the experimental instrumentation used in the laboratory is not appropriate for analyzer installation in the field.

There are a number of gas-phase applications, which are not well served by existing analyzer technologies (too corrosive, too wet, too slow, etc.). Many of these applications could be addressed by Raman if suitable sampling technology existed. The AirHead™ gas-phase probe was designed as a tool for gas-phase monitoring in chemical processes by allowing low concentrations (100 ppm) of gases to be measured relatively quickly (minutes), and to operate reliably in process environments.

## Design

The design of the AirHead™ probe has been optimized to enhance sample signal-to-noise ratios and improve the analyzer's overall limit of detection (LOD). The AirHead™ probe also incorporates Kaiser's patented multipass approach (Patent 5,956,138) to further improve the analyzer's LOD.

The design of the AirHead™ probe is compatible with installations in classified environments by using hermetically sealed internal probe volumes and a low-profile ultra thin Teflon window seal. Kaiser's standard fiber-optic cable incorporating a single input

and single output fiber-optic cable allows the AirHead probe to be installed in a variety of locations and upto 30 meters from the analyzer baseunit.



Figure 1. AirHead™ probe.

## Probe Specifications

### Features:

- Common Specifications:
- Stainless Steel 316 Body
- Temp. Range: -30 to +100°C\* Standard RAMP <6 Degree C/MIN
- Max Temperature (Probe Tip): 100°C\*
- Max Temperature (Probe Rear): 80°C
- Pressure Range: Up to 650 PSI
- Integrated Probehead · Laser Wavelength - 532 nm
- Spectral Coverage: 175 cm<sup>-1</sup> - 4350 cm<sup>-1</sup>
- 5 Meter Fiber Optic Cable
- Mounting Options: ½" NPT or 1" Compression Mount

Recommended Particulate Filtration of Gas Stream to 1 micron or better (recommended multistage filtration)

Note: This probe can be used with CW lasers producing an output of up to 100mW. Use of this probe with laser powers greater than 100mW will invalidate Kaiser's product warranty.

Note\*: This probe can operate above 100°C to a maximum of 200°C but with a permanent increase in the probe background signal level when exposed to temperatures above 120°C.

### Analyzer Compatibility

The AirHead™ probe is available for all the current 532 nm **RAMANRXN SYSTEMS** analyzers, and all deployed analyzers with FC fiber connectors.

### Chemical Compatibility

Materials compatibility / chemical resistance is determined by the wetted parts of the probe. The wetted parts of the AirHead™ probe are sapphire, SS 316, Teflon, and glass-like substances.

### Installation & Service

The design of the AirHead™ probes allows them to be installed in a wide variety of plant locations including direct reaction insertion, side insertion, and sample loop. However the probe must be installed in a conditioned gas stream. The condition requires the gas to be brought down to within the probes pressure and temperature rating. In addition the stream must be filtered to remove particulate. Multistage filtration ending with either a 0.5 micron or 1 micron filter is required.

The geometry of the AirHead™ probe is very compact (10" long and 1.5" in diameter, see Figure 1) and is intended to be inserted into flow cells via either a standard ½" NPT port or a 1" compression mount.

There are no user serviceable parts in the AirHead™ probe. The probe is designed to be changed out if a need arises.

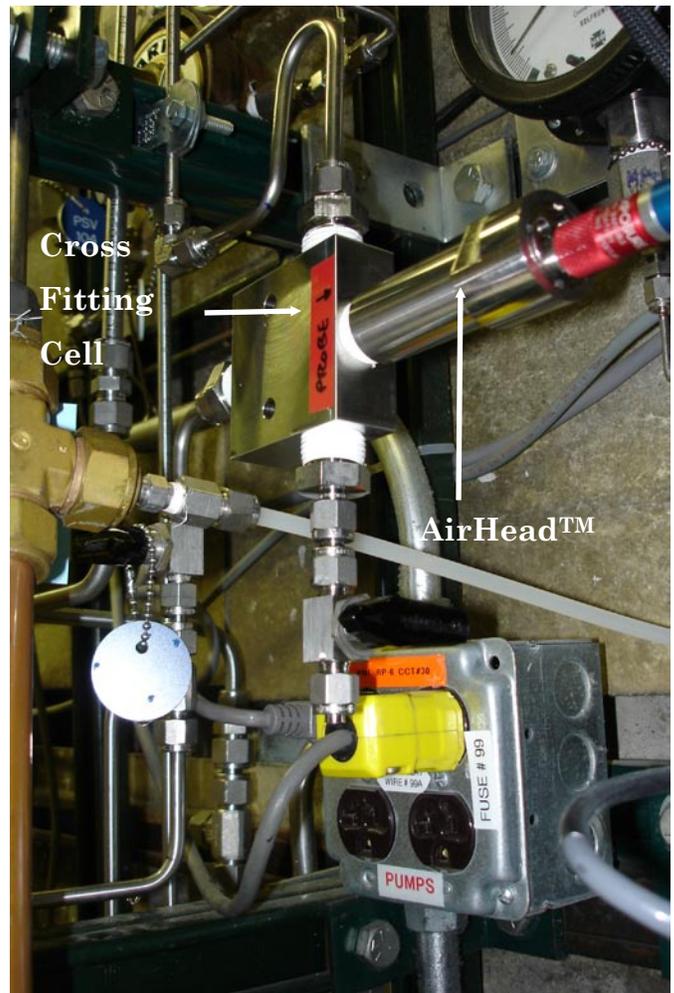


Figure 2. Installed AirHead™ probe in a gas-stream conditioning line with the AirHead™'s crossflow cell.

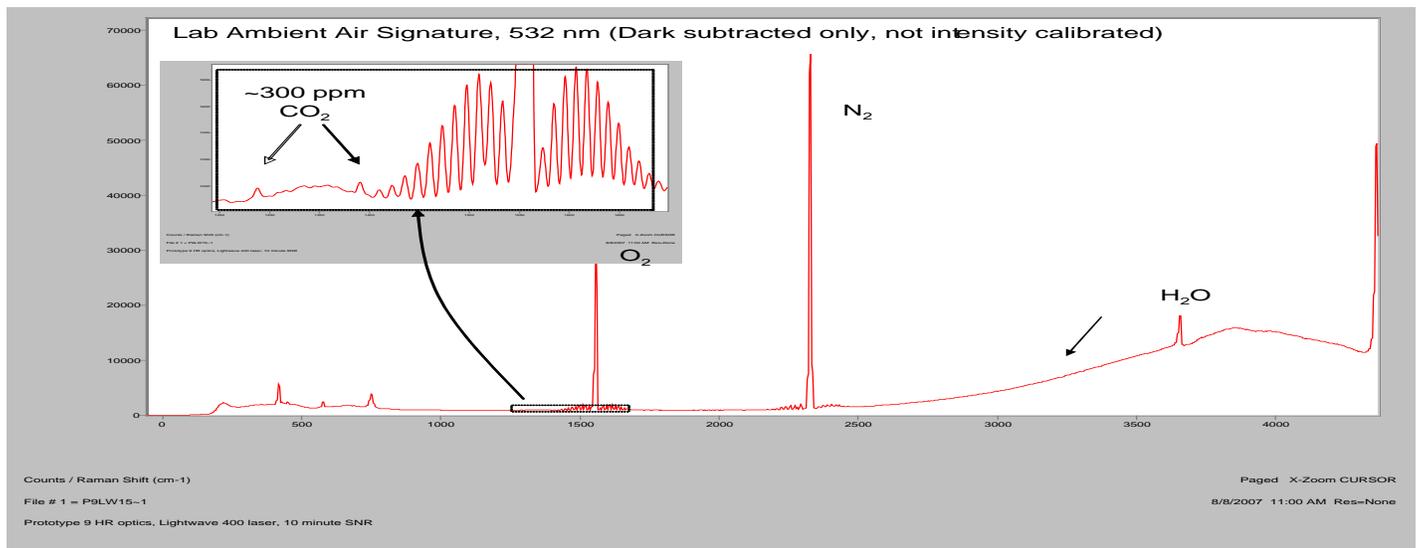


Figure 3. AirHead™ representative spectrum of ambient air.

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