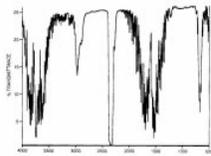
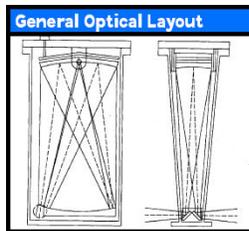


Pathfinder - EN™ 0.4 to 10 Meter Pathlength Gas Cell



Spectrum of Atmospheric Absorbances

Relative throughput of Pathfinder-EN™ at 10-meter pathlength. The spectrum shows atmospheric absorbance of water vapor and CO₂



General Optical Layout

The Pathfinder™ is a folded path gas cell. At the entrance of the cell, the beam is directed towards two objective mirrors at the end. The objective mirrors image the beam back onto the field mirror. By tilting the objective mirrors with an external calibrated dial, the pathlength is varied.

Applications

- Stack Gas
- Ambient Air
- Workplace Air
- Laboratory Gases
- Quantitative H₂O (*ppb*)
- Semiconductor Gas Quality
- Environmental VOC Emissions

Standard Specifications

- 0.4 - 10 meter variable pathlength in 0.8 meter increments
- Pressurizable to 50 psig
- Heatable to 300° C with Kalrez seals
- Gold-coated SS mirrors
- All-metal, electropolished stainless steel
- High energy throughput
- Extremely chemically-inert

Technical Problem

On a global basis, the chemical and environmental industries and multidisciplinary research scientists and engineers are now requiring more sensitive gas analysis instruments. Whereas trace gas sensitivities of *ppm* used to be adequate for the measurement of pollutants, stack gases, and laboratory research—current and emerging applications in semiconductor synthesis, earth surface vapor detection, and motor vehicle combustion analysis now demand *ppb* sensitivities. Since infrared spectroscopy can detect virtually all molecular species, there has been a vigorous emphasis by scientists and engineers on applying spectroscopic measurements in the gas phase. However, absorptions in the gas phase are significantly weaker than the condensed phase and the chemical species of current interest typically make up a small fraction of the total volume of gas, yielding concentrations in the *ppb* range.

Theoretical Solution

The most popular approach to sensitivity enhancement in the measurement of gas phase spectra is the use of a folded path, long path gas cell. Other newer methods, such as matrix isolation, have not attained the importance of long path gas phase measurements. Designs of gas cells fall into two major categories, imaging and nonimaging. Imaging cells are pertinent to your applications. There are single and multiple-pass imaging cells. Single-pass designs allow the beam to pass through the gas only once. The simplest of these is our 15-cm pathlength cell, the Scout™. It is used for relatively high concentrations of sample. Hollow metallic lightpipe designs have made longer pathlength single-pass cells possible. These are used predominantly in gas chromatograph/FT-IR interfaces and as process gas cells. Multiple-pass gas cells are all variations of the White design.

Product Solution

CIC Photonics introduced its first version of the White design, the Pathfinder, in 1989. The Pathfinder™ has proved itself in several applications by numerous industrial research scientists and engineers. The Pathfinder-EN™, the significantly enhanced long path gas cell, was introduced in late 1994 to meet the emerging demand for *ppb* sensitivities. The Pathfinder-EN™ can be supplied with either a fixed pathlength or a variable pathlength, from 0.4 to 10 meters. Heated and unheated versions are available. The cell's volume is 1.5 liters. The cell

can be pressurized to 10 atmospheres and heated to 200°C with optional heaters and insulation. Gas inlet and outlet are through stainless steel valves and fittings. The cell is constructed from electropolished 300 series stainless steel for strength and chemical inertness. The mirror substrates are polished stainless steel, coated with laser gold. Each spring, ball bearing and screw is stainless steel.

Design

The Pathfinder-EN™'s design achieves optimum balance between long pathlength, high throughput, and low volume, unlike many cells on the market which reduce optical throughput either by limiting the acceptance angle or the accepted field stop diameter. The Pathfinder-EN™ employs a linear pathlength adjustment. This feature eliminates the possibility of alignment and vibration problems which researchers encounter with other gas cells. The Pathfinder-EN™ is equally accurate at short and long pathlengths. Linear pathlength adjustment eliminates the need for a glass cell to check on cell operations. Glass cells are inappropriate for the many gas analysis applications where chemical resistance, heatability, and pressurability are important requirements. The Pathfinder-EN™'s all electropolished stainless steel construction is ideal for these applications.

The maximum number of passes attainable without vignetting is determined by the field stop of your spectrometer. With a 6-mm field stop, the cell will attain 12.4 meters without vignetting. With an 8-mm field stop, the maximum path without vignetting is 10 meters. At 12.4 meters, the beam encounters 62 reflections; at 10 meters, 50 reflections. Unless otherwise specified, the Pathfinder™ is aligned for 10-meter maximum pathlength.

Operation

Pathlengths of the Pathfinder-EN™ (in meters):

0.4	1.2	2.0	2.8
3.6	4.4	5.2	6.0
6.8	7.6	8.4	9.2
10.0			

Purchase Solutions

The Pathfinder-EN™ comes equipped with transfer optics, pressure relief valve, KBr windows and instruction manual. The heated version comes with installed external heater elements and insulation, and type K thermocouple sensors. Please specify your spectrometer manufacturer and model when ordering. Also required for the heated version is a type K calibrated meter or temperature controller.

Options

37B100EN	Variable pathlength, electropolished SS, Viton O-rings, KBr windows, unheated
37B500EN	Variable Pathlength, Ni-plated, ZnSe-AR windows, Kalrez seals, heated w/temperature controller
25B700W	Temperature controller, dual
37-Nickel	Nickel plating
37-CaF2	CaF2 windows
37B630	Metal purge couplings
37-BaF2	BaF2 windows