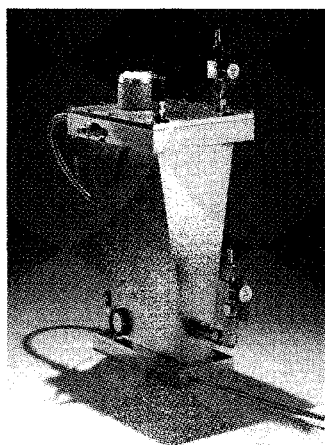


FINDING THE PATH

THE Pathfinder™

The Long Path Gas Cell for High Sensitivity Sample Analysis



Applications

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

The Standard

- 0.4 - 10 meter variable pathlength
- Pressurizable to 50 psig
- Heatable to 200° C
- Gold-coated SS mirrors
- All-metal, electropolished stainless steel
- Very high energy throughput
- Extremely chemically-inert

The Options

- Highly adaptive window port couplings
- Fixed or motor-driven pathlength (0.4 - 10 meters)
- Nickel-plated cell body and choice of internal or external heaters.
- Purgeable transfer tubes

The 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.

The Theoretical Solution

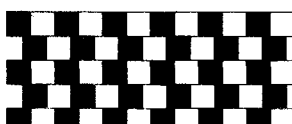
The most popular approach to sensitivity enhancement in the measurement of gas phase spectra is the use of a folded path, long path gas cell. Other newer methods, such as matrix isolation, have not attained the importance of long path gas phase measurements.

Designs of gas cells fall into two major categories, imaging and non-imaging. 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.

The 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.



CIC Photonics

TO OPTIMUM RESULTS

FINDING THE PATH

TO OPTIMUM RESULTS

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.

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	10.8*	11.6*	12.4*

* optional configuration

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.

The Pathfinder-EN™ comes equipped with transfer optics, pressure

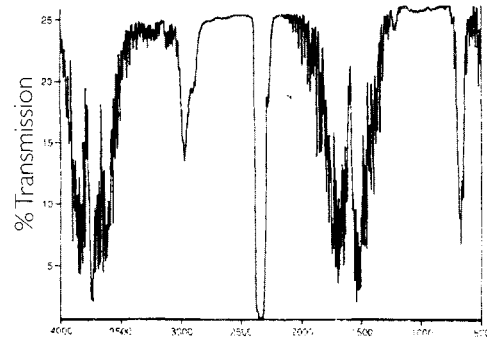
The Purchase Solution

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 (see separate data sheet).

Heated version (110 volt)	37B100EN
Unheated version	37B200EN
Temperature controller, dual	25B700
Nickel plating	37B610
AgCl windows assembly	37B620
Metal purge couplings	37B630
Gold wire gasket seals	37B640
CaF ₂ windows	37B506

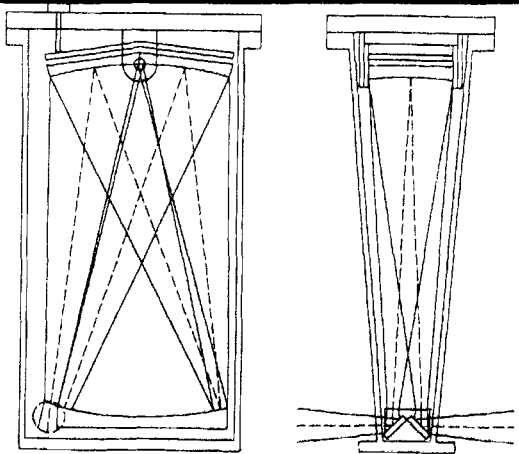
Spectrum of Atmospheric Absorbances



Wavenumbers

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

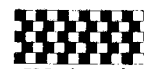
General Optical Layout



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.

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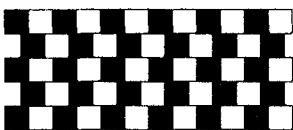
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