

### Multi Gas Fiber Coupled Gas Cells for Remote Optical Gas Sensors and Calibrators

Gas cells are precision filters whose absorption wavelengths depend on specific molecular energy level transitions. Our multi-gas cells employ a mixture of gases to obtain broad coverage of multiple bands.

Our standard mixtures include a dual-gas cell ( $H^{12}CN$  and  $^{12}CO$ ), a tri-gas cell ( $H^{12}CN$ ,  $^{12}CO$ ,  $^{13}CO$ ), and a quad-gas cell ( $H_2O$ ,  $^{12}C_2H_2$ ,  $^{12}CO$ ,  $^{13}CO$ ). Absorption depths and linewidths depend upon the quantity of each gas in the cell and its concentration relative to other gases. Refer to the next page for more information on these mixtures.

Gas cells are hard-sealed for long life and feature advanced optical design for very low level of interference artifacts. These multi-gas cells are multi-path and use folded optics to achieve 80cm path length in one fifth of the space.

Cells may be ordered fully fiber-coupled (FCAPC, SCAPC, FCPC, SCPC or no connectors) or with a photodetector output for direct board mount.

Additional gases and pressures available. Please contact us.

### Specifications<sup>1</sup>

#### Line Data:

Dual:  $H^{12}CN + ^{12}CO$  1519-1598 nm

Tri:  $H^{12}CN + ^{12}CO + ^{13}CO$  1519-1633 nm

Quad:  $H_2O + ^{12}C_2H_2 + ^{12}CO + ^{13}CO$  1350-1633 nm

Line depth ( $^{12}CO @ 1568 \text{ nm}$ )<sup>2</sup>

Dual 0.8 dB, typ.

Tri, Quad 0.4 dB, typ.

Linewidth ( $^{12}CO @ 1568 \text{ nm}$ )<sup>3</sup>

Dual 28 pm typ.

Tri, Quad 17 pm typ.

Temperature Dependence <0.01 pm/°C

Custom Pressures / Mixtures Please inquire

#### Gas Cell:

Cell Transmission >45%; fiber to fiber

Spectral ripple (P-P) <0.1dB P-P in any 2nm span

Cell Lifetime >10 years

Operating temperature 0°C to +65°C

Storage temperature -40°C to +100°C

Connector Type FCAPC, SCAPC, FCPC, SCPC, none, PD (photodetector)

#### Photodetector:

Net Responsivity >0.5 A/W

Capacitance (0V) 4 typical pF

Shunt Resistance >5 MΩ

1. 25 °C; Specifications subject to change without notice.

2. Reporting strongest CO line. CO isotopologues are weakest gases in mixture.

3. CO isotopologues have lowest linewidths.

NOTE: Using low resolution instruments could understate absorption if linewidth is narrow.



### Features

- Hermetic seal, >10 year life
- Wedged windows and coated optics for minimum interference artifacts
- Folded optics for compact design
- Custom pressures and options available
- Low cost
- Broad frequency band coverage

### Applications

- Remote optical gas sensing system
- Tunable laser calibration
- OSA or tunable filter calibration
- Wavelength/frequency locking
- Chemical detection systems

### Ordering Information (example)

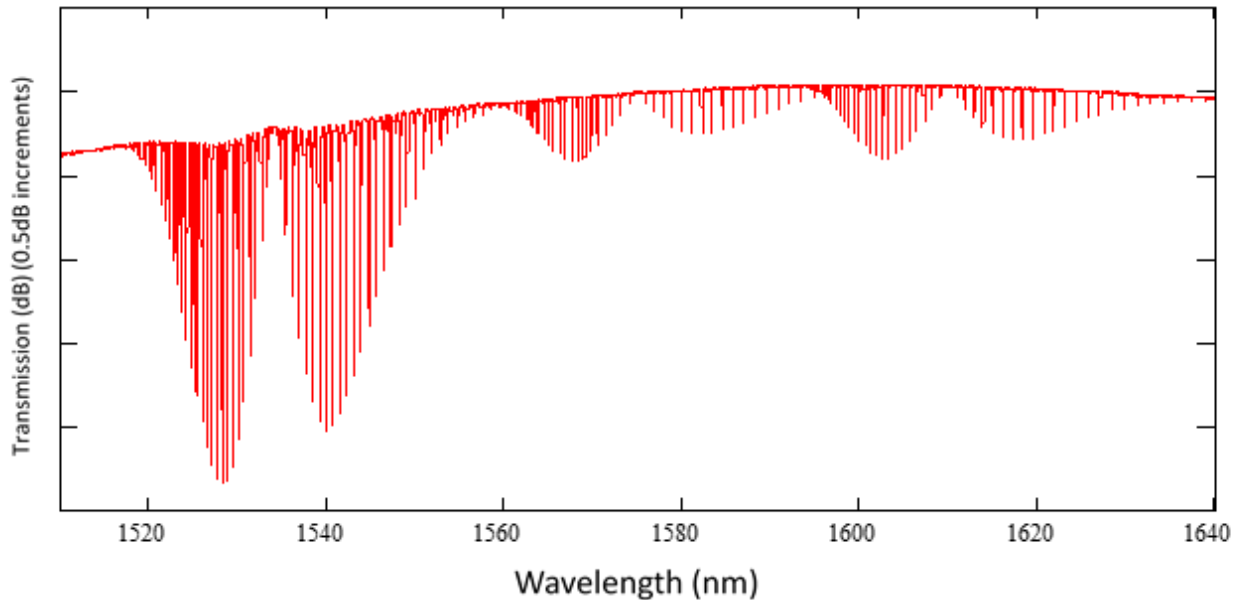
#### Tri-H(80)-5/150/150-FCAPC

Dual  
Tri  
Quad

H(80): Multi-pass  
housing

Pressure  
(Torr)

Connector type  
(include /PD for  
photodetector)



Sample transmission spectrum for a standard tri-gas cell (5 Torr H<sup>12</sup>CN + 150 Torr <sup>12</sup>CO + 150 Torr <sup>13</sup>CO)

### Designing your multi-gas cell

Carbon monoxide is usually the determining factor in designing a multi-gas cell due to its relatively weak absorption and narrow linewidth. A multi-gas cell with both isotopologues (<sup>12</sup>CO and <sup>13</sup>CO) will exhibit smaller absorption depth than if only a single isotopologue of CO is present. Linewidth can also be a design consideration. Refer to the chart below as a reference:

Width \ Depth	0.8dB	0.4dB
	28pm	600 Torr <sup>12</sup> CO OR <sup>13</sup> CO.
17pm	300 Torr <sup>12</sup> CO OR <sup>13</sup> CO.	150 Torr <sup>12</sup> CO AND 150 Torr <sup>13</sup> CO

### Sample Combinations

- 5 Torr H<sup>12</sup>CN + 300 Torr <sup>12</sup>CO
- 5 Torr H<sup>12</sup>CN + 150 Torr <sup>12</sup>CO + 150 Torr <sup>13</sup>CO
- 10 Torr H<sup>12</sup>CN + 300 Torr <sup>12</sup>CO + 300 Torr <sup>13</sup>CO
- 4 Torr H<sub>2</sub>O + 2 Torr <sup>12</sup>C<sub>2</sub>H<sub>2</sub> + 150 Torr <sup>12</sup>CO + 150 Torr <sup>13</sup>CO

### NIST Traceability

The resulting absorption spectra exhibited by Wavelength References Gas Cells are determined by fundamental molecular energy level transitions that have been well characterized by standards bodies such as NIST and stored in spectroscopic databases such as HITRAN. Direct traceability to NIST is available for <sup>12</sup>C<sub>2</sub>H<sub>2</sub>, H<sup>13</sup>CN, <sup>12</sup>CO and <sup>13</sup>CO. In general the presence of gases at a specified pressure and temperature guarantees repeatable absorption spectra characteristics.

### Material Handling

Safety is always an appropriate concern. Occupational Safety & Health Administration (OSHA) lists Permissible Exposure Limits (PELs) over an 8-hour period of 11mg/m<sup>3</sup> for HCN and 55 mg/m<sup>3</sup> for CO. Our higher pressure cells contain a maximum of 57mg CO and 0.8mg HCN. This would correspond to exposures of approximately 13mg/m<sup>3</sup> and 0.2mg/m<sup>3</sup> over an 8-hour period (lower pressure cells would contain even less). These levels are well within the permissible exposure limit. Therefore, no special provisions are necessary for the handling of these cells, and they may be shipped by any customary means