

IR 5000

OPEN PATH HYDROCARBON

GAS MONITORING SYSTEM



BERNT
MESSTECHNIK

IR 5000

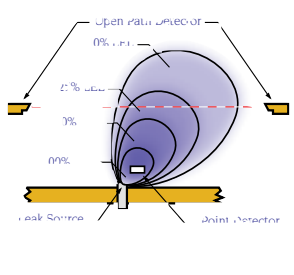
GAS DISPERSION

Gas leaks can either form a relatively stationary cloud or readily dissipate depending upon several factors such as wind, rate of leak, and weight of the leaked gas compared to air, to name just a few environmental factors.

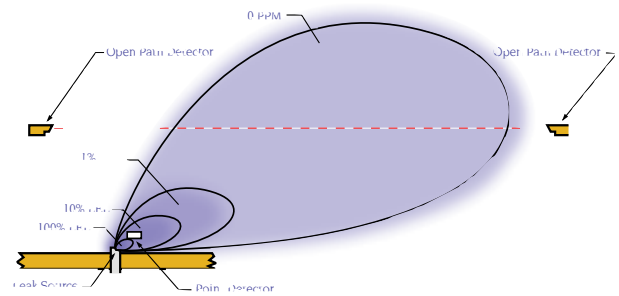
If a gas leak creates a cloud, it will generally have the following characteristics although there is no typical gas cloud. First, the highest gas concentration of a cloud is at the source and it decreases in concentration towards the edges. Secondly, the gas cloud shape is elongated or has an irregular pattern

effected by air currents. Even a mild wind (3-4 mph) can significantly change the shape of a cloud.

No Wind



3 to 4 MPH Wind



Typically, light gases like methane do not diffuse symmetrically but have a tendency instead to spread vertically rather than in a horizontal direction. Heavy gases tend to build up into a cloud, even in a calm wind. As wind increases in intensity, gas clouds will dissipate faster. This indicates that in outdoor environments, gas leaks can have very low gas concentrations. The General Monitors Model IR5000 can effectively detect gas leaks with its high sensitivity and operate as a hazardous situation monitor for higher gas concentrations. ■



SENSOR TECHNOLOGY

Open path IR gas detection is an effective means of measuring hydrocarbon gases using an infrared (IR) detection method based on absorption of IR radiation (3 to 4 micron range) as it passes through a volume of gas.

With an open path system, there is no definite fixed path length so the measurement is expressed as a product of the average gas concentration and the gas cloud width passing through the infrared path length. This means that a small dense cloud of hydrocarbon gas could give the same output signal as a large dispersed cloud if the product of the concentration

of the leak and the path length were the same. It is as though the system “counts” the number of hydrocarbon molecules in the path that absorb infrared radiation in a specific wavelength band.

The gas concentration measured by the Model IR5000 is an average measurement over the path length which includes gas. The output is expressed in ppm•meter (highly sensitive range) or LEL•meter (hazardous range).

Typical readings of methane (100% LEL methane in one meter = 50,000 ppm•meter = 1 LEL•meter) using the Model IR5000 open path gas detector which has two ranges are as follows:

GAS CLOUD		CALCULATION		
Concentration	Length	Concentration x Length=		Measurement
50 ppm	2 meters	50 x 2	=	100 ppm•meter
10 ppm	10 meters	10 x 10	=	100 ppm•meter
100 ppm	20 meters	100 x 20	=	2000 ppm•meter
10 % LEL	2 meters	.10 x 2	=	.2 LEL•meter
25% LEL	4 meters	.25 x 4	=	1 LEL•meter
100% LEL	1 meter	1 x 1	=	1 LEL•meter

Open path gas detection is recommended for large open areas or inaccessible locations where point monitoring can be considered impractical. It offers another solution to gas detection challenges, and should be used in combination with point gas detection due to its limitations in targeting specific locations of leaks. ■

IR5000 OPEN PATH HYDROCARBON GAS MONITORING SYSTEM

The Model IR5000 is composed of an infrared source unit and a microprocessor-based infrared detector receiver module. This Open Path Gas Monitoring System measures only infrared active gases, such as hydrocarbons, and the corresponding output of the system is expressed in equivalent parts-per-million in a path length of one meter (ppm•meter) and equivalent lower-explosive-level in a path length of one meter (LEL•meter), simultaneously.

The Model IR5000 utilizes a single beam, single source and single detector design to monitor gas concentrations. This technology provides improved accuracy, reduc-

One of the main advantages of the Model IR5000 is its simultaneous dual range detection of hydrocarbon leaks reaching low warning levels and catastrophic hydrocarbon leaks reaching hazardous levels.

The Model IR5000's digital display incorporates an AutoRANGING design which displays the 0 to 5000 ppm•meter scale for methane until the gas concentration exceeds 5000 ppm•meter. Once the upper limit has been exceeded, the display scale automatically switches to the 0 to 5 LEL•meter measurement scale, (for methane).

Another advantage of the Model IR5000 is the AutoTRACK alignment which simplifies initial set-up and installation. By using the digital display as a position indicator, alignment is made easy. To align the source and receiver, the operator simply monitors the digital display for alignment cues which will direct the receiver to proper alignment with the source. The digital display will then prompt the operator when the unit is properly aligned. No additional tools or equipment are required for set-up and the housing remains closed.

The Model IR5000 provides multiple outputs for interface in a variety of applications. Alarm outputs include two 4-20mA signals and four

tion of sensor drift and improved immunity to false alarms.

The Model IR5000 source projects an infrared beam between 5 and 100 meters through the hazardous area being monitored to the IR5000 receiver. As the IR beam reaches the receiver, it passes through a focusing lens and then alternately passes through two narrow band IR filters. One IR filter is the active wavelength and the second IR filter is the reference wavelength. The IR5000 detector computes the ratio between the active and reference signals to provide an output that is proportional to the gas concentration in the beam path.

Digital Display



SPDT relays for warning, alarms and fault. Most options of the Model IR5000 including the relay options for alarm states and alarm set points are software selectable.

The Model IR5000 incorporates fail-to-safe design and micro-processor technology for advanced performance features and fault diagnostics. Included in the fault diagnostics is a continuous optical path check and fault alarms will occur if the optics are dirty (an automatic gain control will adjust for loss of signal due to dirty optics) or if the IR signal is weak or blocked or if an instrument malfunction occurs. To prevent nuisance faults, a 30 second time delay is incorporated to prevent fault activation caused

by temporary interruption of the detection beam such as people or vehicles.

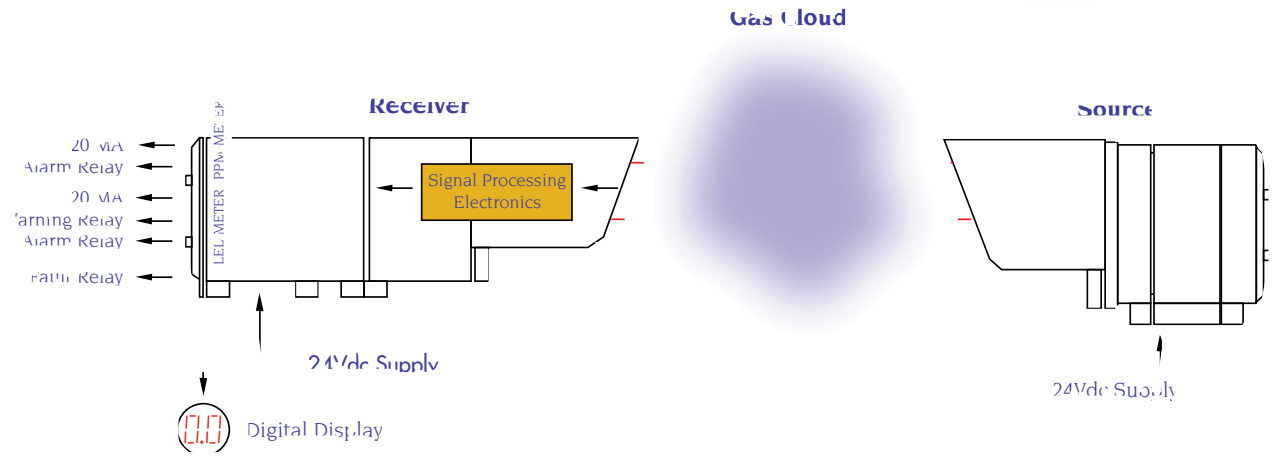
Although the Model IR5000 does not need to be field calibrated, an AutoZERO feature is provided to allow the operator to zero the instrument with no traditional zero & span adjustments.

The mechanical packaging of the Model IR5000 source and receiver units utilize a stand alone, unitized design and are available in aluminum or 316 stainless steel housings. Integral housing mounts provide alignment latitude for each source and receiver during installation.

Accessories for the Model IR5000 include test gas filters for system performance checkout and mounting arms for the source and receiver units. ■



IR5000 Open Path System



FEATURES

- Simultaneous dual range detection (0 to 5000 ppm•meter and 0 to 5 LEL•meter)
- AutoTRACK alignment allows for easy installation
- Digital display provides continuous readout of gas concentration and fault codes
- Fault diagnostics monitor nine different potential problems
- Multiple outputs:*
 - 0 to 5000 ppm•meter : 4-20 mA,
(1) SPDT relay
 - 0 to 5 LEL•meter : 4-20 mA,
(2) SPDT relays
 - Fault : (1) SPDT relay
- * For heavy hydrocarbon (propane) unit the ranges are 0 to 2000 ppm•meter and 0 to 1 LEL•meter
- Single detection beam technology which eliminates drift and false alarms
- Auto zero feature zeros background with no adjustments
- No field calibration required
- Continuous optical check for beam blockage and automatic gain signal reduction

APPLICATIONS

Open path gas detection complements point detection and can be used as a component in a total system solution.

The Model IR5000 can be used in applications where a single monitor can cover a line of several potential leak sources. For example, a row of valves or pumps. The Model IR5000 can also be used for perimeter monitoring which assures greater coverage over wider areas than point detection. For example, fence line monitoring, tank farms, gas spheres or process areas of refineries.

Other applications for the Model IR5000 include ones which are environmentally unfriendly to point gas detection. Poisons, water spray, and extreme temperatures are typical problems where open path gas detection can be used.

- Sensor immune to poisons
- Fail-to-safe detection
- High sensitivity leak detection
- Hazardous level detection
- "No tools" adjustment
- Local indication of gas
- Easy troubleshooting
- Various alarm options
- Low maintenance
- Easy installation

SPECIFICATIONS

SYSTEM

Sensor Type:	Infrared absorption
Ranges:	"Light Hydrocarbon Methane" unit 0 to 5000 ppm•meter and 0 to 5 LEL•meter
Path Length:	5 to 100 m (16 to 328 ft)
Response Time:	T50 ≤ 4.5 seconds and T90 ≤ 8 seconds when exposed to full scale gas concentration in ppm range
Repeatability:	± 10% of last reading for each scale
Linearity:	± 10% over full scale for each scale
Calibration:	No traditional calibration required Field background zero adjustment provided
Warranty:	Two years
Modes:	Test gas, setup, alignment
Optional:	"Heavy Hydrocarbon Propane" unit 0 to 2000 ppm•meter and 0 to 1 LEL•meter detection ranges

MECHANICAL

Housing Size:	
Source:	6.4" Dia x 12.0" Length (163mm Dia x 305mm Length)
Receiver:	5.4" Dia x 16.7" Length (137mm Dia x 424mm Length)
Enclosure Material:	Copper-free Aluminum or 316 Stainless Steel
Weight:	
Source:	10 lbs (5 Kg) Aluminum 28 lbs (12.7 Kg) Stainless Steel
Receiver:	9 lbs (4.1 Kg) Aluminum 25 lbs (11.3 Kg) Stainless Steel
Mount:	11 lbs (5.0 Kg) Stainless Steel only
Conduit Entries: (2)	Aluminum: 3/4 NPT Stainless Steel: M20 x 1.5-6H

ENVIRONMENTAL

Operating Temperature:	-40°F to +140°F (-40°C to +60°C)
Operating Humidity:	0 to 95% RH (Non-condensing)
Vibration:	Per ISA/CSA C22.2 No 152 and BS2011 Part 2.1 standards
Weatherproof rating:	Type 4X, IP66
Certification:	Class I, Div. 1, Groups C & D / EExd IIB T4 CSA-CUS, ATEX & GOST
Accessories:	Test gas filters Mounting arm

ELECTRICAL

Operating Voltage: 24 VDC nominal, 20-32 VDC range
Power Consumption:

Source:	24 VDC @ 1.25 amp (Maximum)	
Receiver:	24 VDC @ 1.05 amp (Maximum)	
Outputs:	Two (2) analog signals and four (4) SPDT relays	
Analog Signals: 600 ohm load max.		
0 mA	0-5000 ppm•meter	0-5 LEL•meter
1.5 mA	Malfunction	Malfunction
	Beam Block	Beam Block
	or test gas	or test gas
4-20 mA	0 - 5000 ppm•meter	0 - 5 LEL•meter
20-22 mA	Overrange	Overrange

Relays:

Four (4) SPDT 5 amp @ 30 VDC res. max; 250 VAC;
ppm Alarm; LEL Warning; LEL Alarm and Fault

Software Selectable:

Latching/Non-Latching Warning and Alarm
Energized/De-Energized Warning and Alarm
Warning & Alarm level set-points

Digital Display:

Two digit, seven segment (auto range change)
LED indication of scale displayed

Fault Codes:

- F1 - Close to minimum signal level
- F2 - Timing error
- F3 - Low IR energy
- F4 - High IR energy
- F5 - Large sudden change (blockage) 30 second Fault delay
- F6 - Low voltage
- F7 - Internal system failure
- F8 - Failed to zero/Excessive negative drift due to
background gas changes
- F9 - Open current loop(s)

Standard

Configuration: IR5000-2-2-1-01-01-0