



**GENERAL MONITORS**

# **SAFETY MANUAL**

## **IR5000 Open Path Hydrocarbon Gas Monitoring System**



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**Safety Manual**

**04-09**

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This manual describes the safety related information for the installation, operation, configuration, and maintenance of the IR5000 Open Path Hydrocarbon Gas Monitoring System.

For complete information regarding performance, installation, operation, maintenance, and specifications of the IR5000, please refer to the associated product manual.

General Monitors' mission is to benefit society by providing safety solutions through industry-leading products, services, and systems that save lives and protect capital resources from the dangers of hazardous flames, gases, and vapors.

The safety product you have purchased should be handled carefully, and installed and maintained in accordance with the IR5000 product instruction manual. Remember, this product is for your safety.



**WARNING:** TOXIC, COMBUSTIBLE, AND FLAMMABLE GASES AND VAPORS ARE VERY DANGEROUS. USE EXTREME CAUTION WHEN THESE HAZARDS ARE PRESENT.

## **INTRODUCTION**

### **General Description**

The General Monitors Model IR5000 Infrared Open Path System continuously monitors hydrocarbon gases in both the 0 to 5000 ppm•meter and 0 to 5 LEL•meter ranges and provides two 4-20 mA analog signals proportional to each of the above ranges and optional relay output. The IR5000 Heavy Hydrocarbon (propane) version monitors gases in both the 0 to 2000 ppm•meter and 0 to 1 LEL•meter ranges. This safety manual applies to both versions. The IR5000 uses a single beam source and detector to monitor gas concentrations, improving accuracy, reducing drift and improving immunity to false alarms. The IR5000 is regarded as a Type B field device per IEC 61508.

## INSTALLATION

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**NOTE:** Power should remain disconnected until all other wiring connections are made.

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For complete information on the installation of the IR5000 gas detector refer to the product instruction manual. Be sure to closely follow alignment instructions.

### Location Considerations

There are no standard rules for placement, since the optimum location varies with each application. Some factors to consider when selecting locations:

- The system should be accessible for occasional response checks. The line of sight between the Source and Receiver units should be free from objects that may block the beam (i.e. a parked truck or moveable machinery) and interruptions caused by frequent human or animal crossings. The Receiver unit should be mounted so that the display is visible to aid in alignment and so that direct sunlight does not enter the front window.
- Do not mount near strong magnetic fields or degradation of performance may result. Although the IR5000 is Radio Frequency Interference (RFI)resistant, it should not be mounted too close to radio transmitters or similar equipment.
- The units should be reasonably protected (i.e. covered by a hood if temperatures exceed the environmental specifications in the product instruction manual). Mount away from sources of excessive vibration and away from high voltage/high current power lines and from concentrated sources of heat.

If the open path length is less than 15 meters (<50 feet), an aperture plate is required.

It is important to obtain the highest alignment number possible within the allowed range. Alignment at high temperatures may result in alignment numbers at the low-end of the alignment range. Alignment at low temperatures may result in high alignment numbers.

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**NOTE:** Frequent inspection, cleaning, and sensitivity checking is suggested for detectors mounted in dirty environments.

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No special or additional detector mounting, wiring, power, or tool requirements exist beyond the standard installation practices documented in the IR5000 product instruction manual.



**CAUTION:** Acetic Acid will cause damage to metal components, metal hardware, ceramic IC's, etc. If damage results from the use of a sealant that outgases Acetic Acid (RTV), the two-year warranty will be void.



**WARNING:** Under NO circumstances should equipment be connected or disconnected when under power. This is contrary to hazardous area regulations and may also lead to

serious damage to the equipment. Equipment damaged in this manner is not covered under warranty.

## OPERATION AND MAINTENANCE

For complete operation, configuration, and maintenance information for the IR5000 refer to the product instruction manual.

Before applying power to the system for the first time, all wiring connections should be checked for correctness and the Receivers' housing cover should be securely fastened. Upon initial power-up, the Receiver will enter a two-minute set-up mode; the display will indicate "SU".

The IR5000 contains a heater circuit to remove condensation from the windows. The unit should be allowed to stabilize for approximately two hours before continuing with the setup mode.

The IR5000 is an intelligent sensor that performs internal diagnostics on critical faults every second and responds with 0 mA for an internal fault and 1.5 mA for a beam block fault. User selectable delays and current levels allow for system flexibility.



**WARNING:** The IR5000 will not respond to gas leaks upon complete IR beam blockage. Interruptions of the IR beam will delay the response time of this unit, and thus lead to a potentially unsafe situation. The optical path should be checked for blockage and the windows cleaned periodically.

The Heavy Hydrocarbon version of the Model IR5000 Open Path System will perform accurately and reliably for propane gas detection applications in extreme industrial environments. However, there are certain conditions which need to be considered when using the gas detection system. Users are cautioned that under the following two situations both versions of the IR5000 could give a beam block indication rather than a gas reading or alarm: 1) a rapid and massive liquid propane release and 2) a rapid and massive buildup of a high concentration propane gas cloud. Refer to the IR5000 instruction manual for a discussion on these situations and suggestions for minimizing their effect.

Refer to the Troubleshooting Section in the IR5000 instruction manual in the event of a fault condition. In addition, spare parts should be on-hand to maintain the four hour repair time. Refer to the Spare Parts Section of the instruction manual for more information.

After the IR5000 has been initially aligned and calibrated, very little must be done to maintain the unit. Although calibration is not required, response should be tested from time to time using the Test Gas Filters designed for the IR5000. General Monitors recommends that a maintenance schedule be established and followed. If the IR5000 is operated under dusty or dirty conditions, the windows should be cleaned periodically. This is accomplished by gently wiping them with a soft, clean cloth, which has had a commercial window cleaning solution applied. The cleaning should be done in test mode to prevent false alarms.

## SPECIFICATIONS

Table 1 and Table 2 list specifications for the IR5000. For a complete list of specifications refer to the IR5000 instruction manual.

IR5000	
Instruction Manual P/N	MANIR5000
Operating Temperature Range:	-40°F to 140°F (-40°C to 60°C)
Humidity Range:	0 to 95% RH, non-condensing
Input Power:	
Range:	20 to 32 VDC
Source (nominal):	24 VDC @ 30 Watts
Receiver (nominal):	24 VDC @ 25 Watts

**Table 1 – Environmental/Electrical Specifications**

Mode	IR5000
Fault	0 mA
Test Mode	0 mA or 1.5 mA
Beam Block Fault	1.5 mA*
Standard Unit 0 to 5000 ppm•meter	4-20 mA
Heavy Hydrocarbon Unit 0 to 2000 ppm•meter	
Standard Unit 0 to 5 LEL•meter	4-20 mA
Heavy Hydrocarbon Unit 0 to 1 LEL•meter	
Over range	20.1 – 22 mA

**Table 2 – Analog Output Specifications (600 ohms max.)**

\* User selectable to 0 mA, 1.5 mA, or 2.0 mA. 1.5 mA is the default.

## CERTIFICATIONS AND FAILURE RATE DATA

The IR5000 has gone through rigorous reliability and functional safety assessments, which have resulted in the gas detector being certified to IEC 61508 Parts 1, 2, and 3, by FM Approvals. The reliability assessment is a failure rate prediction that assumes an average temperature of 40°C and an environmental factor equivalent to Ground Fixed. It is assumed that the IR5000 will be installed in a Safety Instrumented System (SIS) operating in a Low Demand environment per IEC 61508. Table 3 lists the Safety Integrity Level (SIL) parameters for the IR5000.

Field Device	IR5000 Analog Output	IR5000 Relay Output
FM Certificate	3034949-IR5000	3034949-IR5000
Product Life (Years)	18	18
$\lambda_{DD}$ (Fails per hour)	1.76E-6	1.68E-6
$\lambda_{DU}$ (Fails per hour)	8.5E-9	6.92E-8
Safe Failure Fraction (SFF)	>99%	98.5%
Safety Integrity Level (SIL)*	3	2
Diagnostic Test Interval	1 second (critical faults and beam block)	
Response Time (when exposed to full-scale gas concentration in ppm range)	T50 ≤ 8 seconds T90 ≤ 12 seconds	
Average Probability of Failure on Demand PFD <sub>avg</sub> 1001**	1.63E-5	8.25E-5

**Table 3 – SIL Parameters for IR5000**

\* Hardware Fault Tolerance (HFT) = 0

\*\* PFD<sub>avg</sub>1001 assumes a 4 hour repair time and 90 day proof test interval.

### Agency Approvals

The IR5000 has the following approvals:

- ATEX
- CSA
- CE
- Approved for Russia
- IEC 61508 per FM Approvals