



**GENERAL MONITORS**

# **SAFETY MANUAL**

## **IR5500 and IR5000 Infrared Open Path Hydrocarbon Gas Monitoring Systems**



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**Safety Manual**

**08-10**

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This manual describes the safety related information for the installation, operation, configuration, and maintenance of the IR5500 and IR5000 Open Path Hydrocarbon Gas Monitoring System.

For complete information regarding performance, installation, operation, maintenance, and specifications of the IR5500 and 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 IR5500 and 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 IR5500 and IR5000 Infrared Open Path Systems continuously monitor hydrocarbon gases and provide a 4-20 mA analog signal proportional to the LEL gas concentration and optional LEL relay output. Both systems have Heavy Hydrocarbon (propane) versions monitor gases in the 0 to 1 LEL•meter range. This safety manual applies to all versions. The IR5500 and IR5000 use a single beam source and detector to monitor gas concentrations, improving accuracy, reducing drift and improving immunity to false alarms. The IR5500 and IR5000 are regarded as Type B field devices per IEC 61508.

The safety function of the IR5500 system does not include:

- HART communication
- RS-485 Modbus communication

The safety function of the IR5000 system does not include:

- RS-485 Modbus communication

## INSTALLATION



**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.

For complete information on the installation of the IR5500 and IR5000 systems refer to the respective 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 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 IR5500 and IR5000 are 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.

An aperture plate is required if the open path length is less than 15 meters (IR5000) or less than 20 meters (IR5500, standard range).

It is important to obtain the highest alignment number possible within the allowed range. For the IR5000 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 systems 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 IR5500 and IR5000 product instruction manuals.

## OPERATION AND MAINTENANCE

For complete operation, configuration, and maintenance information for the IR5500 and 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 IR5500 and IR5000 contain 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 IR5500 and IR5000 are intelligent sensors that perform 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 (see Table 2). User selectable delays and current levels allow for system flexibility.



**WARNING:** The IR5500 and IR5000 do 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 IR5500 and IR5000 open path systems 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 IR5000 system. Users are cautioned that under the following two situations 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. The IR5500 detects and recognizes both situations and forces the analog output, and optional relay output, to over-range.

Refer to the Troubleshooting Section in the IR5500 and IR5000 instruction manuals 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 IR5500 and IR5000 have 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 detectors. General Monitors recommends that a maintenance schedule be established and followed. If the detectors are 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 IR5500 and IR5000. For a complete list of specifications refer to the product instruction manuals.

	IR5500	IR5000
Instruction Manual P/N	MANIR5500	MANIR5000
Operating Temperature Range:	-67°F to 149°F (-55°C to 65°C)	-40°F to 140°F (-40°C to 60°C)
Humidity Range:	0 to 95% RH, non-condensing	0 to 95% RH, non-condensing
Input Voltage:	20 to 36 VDC	20 to 32 VDC
Supply Power Source:	With Heater – 11 Watts No Heater – 8 Watts	24 VDC @ 30 Watts, nominal
Supply Power Receiver:	With Relays and Heater: 11.5 W Relays, No Heater: 8 W No Relays, with Heater: 9 W No Relays, No Heater: 6 W	24 VDC @ 25 Watts, nominal

**Table 1 – Environmental/Electrical Specifications**

Mode	IR5500 (non-HART)	IR5500 (HART)	IR5000
Fault	0 mA	1.25 or 3.5 mA	0 mA
Startup	0 mA	1.25 or 3.5 mA	0 or 1.5 mA
Set up	1.5 mA	1.5 or 3.5 mA	0 or 1.5 mA
Gas Check	0 or 1.5 mA	1.5 or 3.5 mA	0 or 1.5 mA
Beam Block	2 mA	2 or 3.5 mA	0, 1.5, or 2 mA
<u>Standard Unit</u> 0 to 5 LEL•meter	4-20 mA	4-20 mA	4-20 mA
<u>Heavy Hydrocarbon Unit</u> 0 to 1 LEL•meter	4-20 mA	4-20 mA	4-20 mA
Split Range	4-12 mA for 0-5000ppm•m (methane) or 0-2000 ppm•m (propane) 12-20 mA for 0-5 LEL•m (methane) or 0-1 LEL•m (propane)	4-12 mA for 0-5000ppm•m (methane) or 0-2000 ppm•m (propane) 12-20 mA for 0-5 LEL•m (methane) or 0-1 LEL•m (propane)	(Not Available)
Over range	21.7 mA	21.7 mA	20.1 – 22 mA

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

## CERTIFICATIONS AND FAILURE RATE DATA

The IR5500 and IR5000 have gone through rigorous reliability and functional safety assessments, which have resulted in the gas detectors as 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 IR5500 and 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 both systems.

Field Device	IR5500 Analog Output	IR5500 Relay Output	IR5000 Analog Output	IR5000 Relay Output
FM Certificate	3040176-IR5500	3040176-IR5500	3034949-IR5000	3034949-IR5000
Product Life (Years)	10 - 12*	10 - 12*	18	18
$\lambda_{DD}$ (FIT)**	14.6E3	14.6E3	1.76E3	1.68E3
$\lambda_{DU}$ (FIT)	102	407	8.5	69.2
Safe Failure Fraction (SFF)	>99%	97%	>99%	98.5%
Safety Integrity Level (SIL)***	3	2	3	2
Diagnostic Test Interval	30 minutes for memory faults, 1 - 30 seconds for all other faults		1 second (critical faults and beam block)	
Response Time (when exposed to full-scale gas concentration in ppm range)	T90 ≤ 10 seconds		T50 ≤ 8 seconds T90 ≤ 12 seconds	
Average Probability of Failure on Demand PFD <sub>avg</sub> 1001****	1.7E-4	5.04E-4	1.63E-5	8.25E-5

**Table 3 – SIL Parameters for IR5500 and IR5000**

\* IR5500 Transmitter flash lamp typical life of 3 – 4 years

\*\* FIT = Failures in 1E9 Hours

\*\*\* Hardware Fault Tolerance (HFT) = 0

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

IR5500	IR5000
ATEX	ATEX
CSA	CSA
CE	CE
IEC 61508 per FM Approvals	IEC 61508 per FM Approvals
FM	
IECEX	
HART Communication Foundation	

**Table 4 – Agency Approvals**