GENERAL MONITORS
Model IR7000

Model IR7000

Infrared Point Detector For Carbon Dioxide Gas Detection Applications

Instruction Manual **06-00**

Part No. **MANIR7000**
Revision **C/06-00**

Warranty

General Monitors warrants the Model IR7000 to be free from defects in workmanship or material under normal use and service within two (2) years from the date of shipment. General Monitors will repair or replace without charge any such defective equipment found to be defective during the warranty period. Full determination of the nature of, and responsibility for, defective equipment will be made by General Monitors' personnel. Defective or damaged equipment must be shipped prepaid to General Monitors' plant or representative from which shipment was made. In all cases this warranty is limited to the cost of the equipment supplied by General Monitors. The customer will assume all liability for the misuse of this equipment by its employees or other personnel.

All warranties are contingent upon proper use in the application for which the product was intended and do not cover products which have been modified or repaired without General Monitors' approval or which have been subjected to neglect, accident, improper installation or application, or on which the original identification marks have been removed or altered. Except for the express warranty stated above, General Monitors disclaims all warranties with regard to the products sold, including all implied warranties of merchant ability and fitness and the express warranty stated herein are in lieu of all obligations or liabilities on the part of General Monitors for damages including, but not limited to, consequential dam ages arising out of/or in connection with the use or performance of the product.

Warning

The Model IR7000 Point IR Detector contains components which can be dam aged by static electricity. Special care must be taken when wiring the sys tem to en sure that only the connection points are touched.

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1.0 Introduction

1.1 General Description

The Model IR7000 Infrared Point Detector is a microprocessor based carbon dioxide gas detector. The General Monitors' Model IR7000 is calibrated at the factory and needs no routine field calibration. It is relatively maintenance free, requiring only a periodic cleaning of the windows to assure dependable performance.

The Model IR7000 Infrared Point Detector continuously monitors carbon dioxide gas in the 0-5000 parts per million (ppm) range and provides a 4 to 20mA analog signal proportional to the 0 to 5000 ppm concentration. A digital RS-485 output is also provided for informational/programming purposes.

Sensor data and status information from the Model IR7000 can be transmitted to a variety of General Monitors' read out units.

The Model IR7000 Infrared Point Detector operates from an unregulated +24 volt DC supply, which must be supplied by the customer, or is supplied by General Monitors' Model TA502A read out unit.

Figure 1

Introduction

1.2 Features and Benefits

This is a partial list of features and benefits for the Model IR7000 Infrared Point Detector:

No routine calibration required

Fail- to- safe operation

4-20 mA output

Mod bus communications link

Aluminum or Stainless Steel Housing

Heated optics to eliminate condensation

Dirty optics indication

Reading not affected by air velocity

Immune to typical poisons (e.g. silicones, halides, lead, sulfur)

Suitable for oxygen rich or deficient areas

Maintain over-range indications at high gas concentrations

TYPE 4x rating

1.3 Applications

This is a partial list of applications suitable for the Model IR7000 Infrared Point Detector:

Chemicals

Pharmaceuticals

Pesticides

Fertilizers

Agriculture/Horticulture (Green houses)

Food & Beverage Bottling Plants

Sewer Entry

Wastewater Treatment Facilities

Coal Gasification

Pulp & Paper

Metals

CO_2 Fire Suppressant Monitoring

2.0 Detector Assembly

2.1 Signal Processing

Most gases including carbon dioxide absorb infrared radiation in specific wavelengths or bands that are characteristic of the chemical structure of molecules in the gas. Gases, to be infrared active, must have an electric di-pole moment.

The Model IR7000 is based on measuring absorption of infrared radiation passing through a volume of gas. Absorption of the radiation follows the Beer-Lambert Law, which states “the transmittance T of radiation through an absorbing medium decreases exponentially by the product of the extinction coefficient A, the concentration C and the path length L”:

$$T = \exp(-ACL)$$

The Model IR7000 uses a dual source, single detector measurement method. One source operates at a wavelength where absorption of a specific gas (carbon dioxide in this case) occurs (the active wave length). The reference source operates at a wavelength that is adjacent to the active wavelength but not absorbed by the gas (or gases). By comparing the signals from these two sources the concentration of the gas can be measured using the differential absorption technique.

This method of gas detection comes under what is commonly known as the non-dispersive infrared (NDIR) absorption principle.

The reference wavelength is chosen suitable to compensate for any interference that can other wise occur from atmospheric variation
(e.g. humidity, dust, snow, fog, steam, temperature, etc.).

2.2 Control Electronics

The Model IR7000 operates from an unregulated +24VDC (nominal) in put, which is fed to an onboard power supply that produces all of the necessary voltages within the unit.

The microprocessor constantly monitors the infrared wavelengths and performs mathematical operations on these values in conjunction with values obtained during the factory set-up process.

The microprocessor generates output information and feeds it to the digital to analog converter to produce a 4 to 20 millampere (mA) signal that is proportional to the 0 to 5000 ppm concentration of gas at the sensor. The microprocessor program also monitors other conditions such as the supply voltage and the optical path integrity.

The Model IR7000 also provides a two-wire RS-485 addressable communications link conforming to the Modbus protocol that is used to monitor the IR7000’s status and settings in order to simplify installation and maintenance.

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3.0 Installation

3.1 Receipt of Equipment

All equipment shipped by General Monitors is packaged in shock absorbing containers, which provide considerable protection against physical damage. The contents should be carefully removed and checked against the packing list. If any damage has occurred or there is any discrepancy in the order, please notify General Monitors as soon as possible. All subsequent correspondence with General Monitors must specify the equipment part number and the serial number. Each Model IR7000 is completely tested by the factory; however, a complete system checkout is suggested upon initial installation and start-up to ensure system integrity.

Each Model IR7000 is completely tested at the factory. However, a complete system check-out is required upon initial installation and start-up to ensure system integrity.

3.2 Detector Location Considerations

There are no standard rules for detector placement, since the optimum detector location varies with the application. The customer must evaluate conditions at the facility to make this determination. If practical, the Model IR7000 Infrared Point Detector should be easily accessible for occasional integrity checks. The unit should be mounted horizontally so that dirt and dust do not build up on the windows (see Figure 4). Although the Model IR7000 Infrared Point Detector is RFI resistant, it should not be mounted close to radio transmitters or similar equipment.
Some other factors to consider when selecting a location for the IR7000:

Locate the Model IR7000 where prevailing air currents contain the maximum concentration of carbon dioxide gas.

Locate the Model IR7000 as near as possible to the likely source of a carbon dioxide leak.

Carbon dioxide is about 1.6 times heavier than air. If the area to be monitored for CO2 leaks is a confined space with relatively little or no prevailing air currents, the IR7000 should be located near the floor. Typically, how ever, it should be at least two feet above the floor to avoid any unnecessary splashdown by water hose clean-ups.

Observe the temperature range of the Model IR7000 and locate the unit away from concentrated sources of heat or light.

Mount the Model IR7000 away from sources of excessive vibration.

NOTE: The model IR7000 is factory calibrated and needs no routine calibration. However, if the model IR7000 is to be installed at altitudes greater than 1000 ft (308m) it must be re-calibrated on-site. See section 4.1.

Installation

3.3 Wiring Connections

To make the power and analog connections to the Model IR7000 Infrared Point Detector, see below:

WIRING CHART

TERMINAL	WIRE COLOR	SIGNAL
1	BLACK	COM
2	GREEN	FG
3	RED	+24V
4	WHITE	4-20mA
5	BLUE	CBUSS+
6	WHT/BLU	CBUSS
7	BROWN	CAL

Figure 2

The Model IR7000 Infrared Point Detector operates on nominal power of 24 VDC. Primary DC voltage power must be provided by the customer unless a General Monitors read out/relay display module with an internal power supply is used. Since the Model IR7000 Infrared Point Detector is designed to continuously monitor for carbon dioxide gas, a power switch is not included to prevent accidental system shutdown.

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

The maximum distance between the Model IR7000 and the power source is specified in the Appendix (see section 5.1.3).

Power Connections

To supply power to the Model IR7000 connect the red lead from the IR7000 to the +24 VDC terminal on the power supply. Connect the black lead from the IR7000 to the power sup ply Common. Refer to the manual of the power source being used, for more detailed instructions.

NOTE: *If the Model IR7000 is being used with a +24V power supply and an industrial analog to digital (A/D) converter, then the negative supply (Common) of all three must be connected.*

An internal diode protects the sys tem in the event of in advertent sup ply reversal.

4- 20mA Out put

A 4 to 20mA output signal is provided by the Model IR7000 and can be sent to a General Monitors read out/relay display module or any industrial device that can accept a 4 to 20mA signal, for computer based multi-point monitoring. The Analog Output connection provides a signal for use in displaying ppm readings, special operation or fault conditions. The maximum distance between the Model IR7000 and the device connected to the Analog Output Signal is specified in the Appendix (see section 5.1.3).

To access the 4-20mA signal, connect the white lead from the IR7000, to the signal-in terminal of the input unit. Refer to the manual of the display or other device being used, for detailed instructions. Connect the black lead from the IR7000, to the device Common. The Common connection serves both the Analog Signal and the Power connections.

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Modbus Interface

To access the Modbus (Modbus-RTU) interface, connect the blue lead from the IR7000 to the RS-485 BUSS(+) terminal and the blue/white lead to the RS-485 BUSS(-) terminal on the customer's Modbus capable device. For a description of the data available from the IR7000 and the programming interface, please refer to Appendix B.

Magnetic Switch

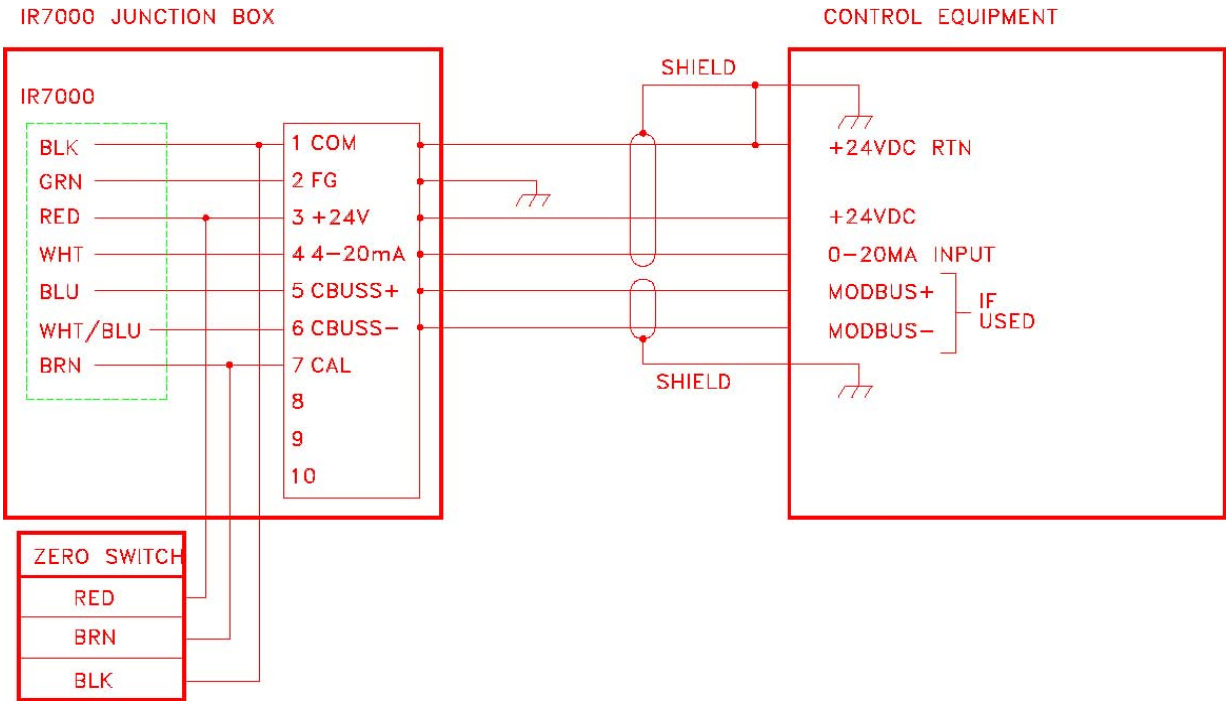
The Model IR7000 also provides a lead for connecting a +24 VDC powered magnetic switch. The brown lead from the IR7000 must be connected to the powered side of the switch so that when the switch is activated, the brown lead is grounded. General Monitors can supply a junction box with integral magnetic switch to ease connection of the IR7000 in the field (see Figure 4).

3.4 Applying Power

Before applying power to the system for the first time, all wiring connections should be checked for correctness. Upon initial power-up or after a fault condition has been corrected the unit will enter a start-up mode for 120 seconds before returning to normal operation (Analog output will be 0mA).

After power is applied, the Model IR7000 should be allowed to stabilize for 30 to 60 minutes while the unit attains proper operating temperature.

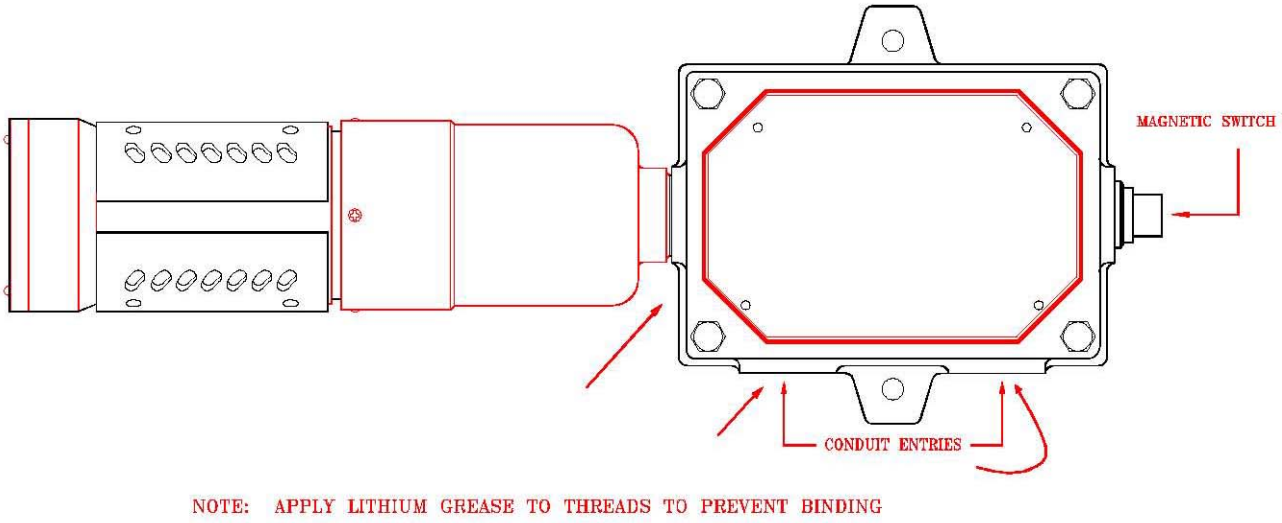
NOTE: When connecting the Model IR7000 to a safety system, the +24V (Red) wire should be the last wire connected and first wire disconnected when re moving unit to protect the system from shorting.



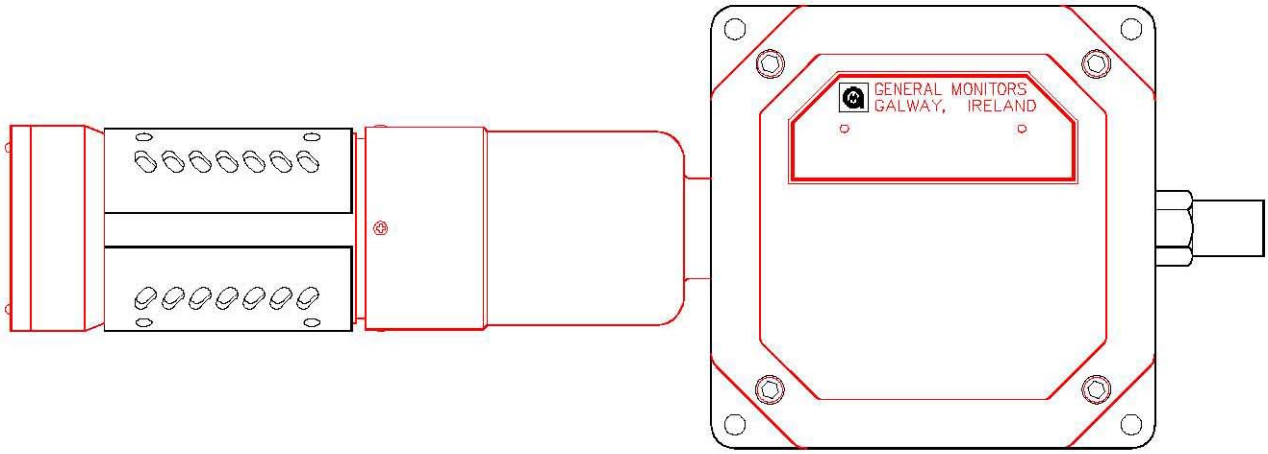
Installation

Figure 4

US Junction Box



European Junction Box



4.0 Operation

4.1 Zeroing and Re-Calibration

The Model IR7000 is calibrated at the factory and needs no routine calibration. However, if it is necessary for field personnel to calibrate the unit, a re-calibration sequence is included. The Model IR7000 may also be 'zeroed' to eliminate any background gas fluctuations. The check kit 31478-1 is required. The zeroing/re-calibration procedure is as follows (refer to Figure 5):

1. To insure a true zero and maintain IR7000 accuracy, the IR7000 must be purged with nitrogen for a sufficient time to remove all naturally occurring carbon dioxide.
2. Apply the General Monitors magnet, which was included with the unit, to the Magnetic Switch Assembly for approximately three seconds. The LED in the switch will light to show proper placement. Remove the magnet and the LED will flash on for one second and off for one second to indicate that the unit is attaining a zero value.
3. When the unit has finished zeroing, the LED will turn on and flash off quickly once per second for 30 seconds. If a complete re-calibration is required, apply the magnet and the unit will enter the re-calibration mode (if the magnet is not applied, the unit will re turn to normal operation). The LED will flash off quickly once every half-second while the unit is waiting for gas to be applied.
4. Apply 2500 ppm CO_2 calibration gas. When the unit is seeing gas, the LED will flash on for a half-second every one and one-half seconds.
5. Once re-calibration has been completed, the LED will turn on and flash off once every second. Remove the gas and the unit will return to normal opera ion once the gas has fallen below 1000 ppm (20% FS).

If an error occurs during the zeroing/re-calibration sequence, the LED will flash on and off rap idly.

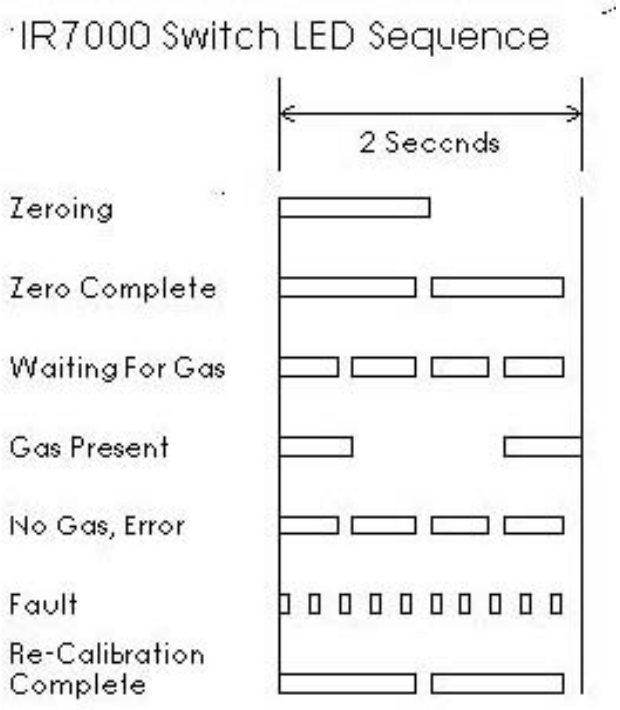


Figure 5

While in the zeroing/re-calibration mode, the analog output signal will be held at 1.5mA.

Operation

4.2 Maintenance

Although the Model IR7000 is calibrated at the factory and fails-to-safe, periodic cleaning and integrity tests are required to ensure proper operation.

The windows should be cleaned by gently wiping them with a soft, clean cloth, which has had a commercial window cleaning solution applied. Integrity checks can be performed using the General Monitors Gas Check Kit (P/N 31468).

General Monitors recommends that a maintenance logbook be kept for each unit in operation. Since maintenance requirements will vary with each installation, this maintenance record will help to develop an efficient schedule for periodic maintenance of the Model IR7000.

NOTE: Gassing into the screened splashguard will not provide a stable or accurate reading.

Do not clean the windows while the unit is zeroing or in re-calibration mode.

The unit must be re-zeroed after the windows have been cleaned.

If an optical fault still occurs after cleaning and re-zeroing is complete, the unit must be returned to the factory for service.

5.0 Appendix

5.1 Specifications

5.1.1 System Specifications

Detector Type: Infrared absorption
Detector Life: Greater than 5 years
Measuring Range: 0 to 5000 ppm CO_2

Accuracy @ 25º C:
± 5% FS<2500 ppm
± 10% FS>2500 ppm

Read out/Relay Display Module
TA502A Single Channel, Zero Two Series

Malfunctions Monitored
Re-calibration Error
EPROM Checksum Error
Optics Failure/Blockage
Low Supply Voltage
EEPROM Checksum Error
Reference or Active Lamp Failure
Open Analog Output Loop
Heater Failure
Time to Re-zero unit

Response Time
With 5000 ppm CO_2Applied
T50<7 seconds & T90<15 seconds

Approvals
CSA, CE Marking

5.1.2 Mechanical Specifications

Length: 10.2 in (259 mm)
Diameter: 2.9 in (74 mm)
Weight: 3 lbs (Al) 1.35 kg
6 lbs (SS) 2.7 kg
Mounting: 3/4" NPT threads
Enclosure:
Aluminum or Stainless Steel
Explosion proof, TYPE 4x

5.1.3 Electrical Specifications

Electrical Classification
Class I, Division 1, Groups B, C and D

Power
24 VDC @ 0.4 amp (nominal)
20 to 36 VDC range

Ana log Signal Output (600 ohms max @ 24VDC)

Range	0 to 22mA
Fault	0mA
Gas Check & Zero	1.5mA
Dirty Optics	2mA
Zero Reading	4mA ± 0.2mA
0 to 2000 ppm	4 to 20mA prop.
Over range	20 to 22mA

Mod bus Output: Link up to 128 units.

RFI/EMI Protection:
Complies with EN50081-2, EN50082-2

Appendix

Recommended Cable Lengths:

Power - The maximum distance between the IR7000 and the Power Source varies according to the wire size. (10-ohm loop resistance at 24 VDC)

22 AWG	285 feet	85 meters
20 AWG	450 feet	135 meters
18 AWG	720 feet	220 meters
16 AWG	1145 feet	345 meters
14 AWG	1830 feet	555 meters

Analog Output Signal - The maximum total distance between the IR7000 and a device with a 300-ohm input impedance varies according to the wire size.

22 AWG	800 feet	243 meters
20 AWG	1200 feet	365 meters
18 AWG	1900 feet	579 meters
16 AWG	2600 feet	792 meters
14 AWG	4500 feet	1371 meters

5.1.4 Environmental Specifications

Operating Temperature Range
-40°F to +122°F -40°C to +50°C

Operating Humidity Range
5 to 100% Relative Humidity *(non-condensing)*

Storage Temperature Range
-58°F to +140°F -50°C to +60°C

Appendix

5.2 Engineering Documentation

5.2.1 Outline & Dimensional Drawing

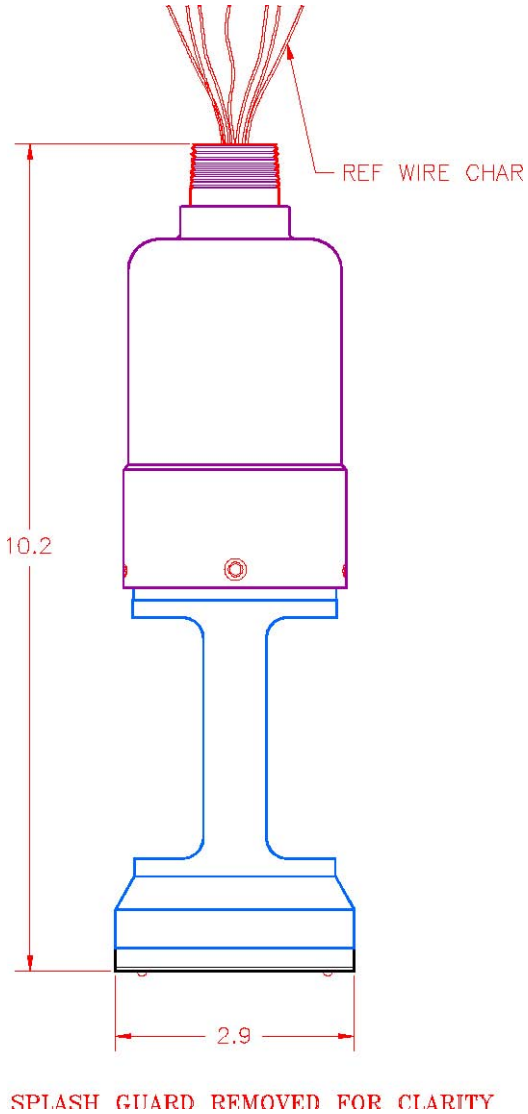


Figure 6 Outline & Dimensional Drawing

Appendix

5.3 Ordering Information

5.3.1 System Components	Part Number
Model IR7000 Infrared Point Detector for Carbon dioxide.	IR7000-300-101-111
Instruction Manual - Model IR7000	MANIR7000
Model IR7000	
TA502A	TA502A-321-100-437

Appendix

Ordering Information (cont'd)

5.3.2 Spare Parts and Accessories

To order spare parts and/or accessories, please contact your nearest General Monitors' Representative or General Monitors directly and give the following information:

1 Part Number

2 Description

3 Quantity

Recommended Spare Parts for One (1) Year:

31037-1 Double Magnet Assembly

Accessories:

Junction Box - Housing used to facilitate field wiring and provide a magnetic switch. CSA (P/N 31305-1)

Flow Block (P/N 31420-1) - Used to connect the IR7000 to a gas sampling system.

Duct Mount Plate - Used to facilitate mounting in ventilation systems. US Version (P/N 31306-1)

Splash Guard - Used in areas where occasional moisture may occur. Indoor Version (P/N 31465-1) Outdoor/Remote Gassing Version (P/N 31466-1)

Gas Check Kit (P/N 31478) Gas bottles regulators and cup.

ADDENDUM
Product Disposal Considerations

This product may contain hazardous and/or toxic substances.

EU Member states shall dispose according to WEEE regulations. For further General Monitors' product WEEE disposal information please visit:
www.generalmonitors.com/customer_support/faq_general.html

All other countries or states: please dispose of in accordance with existing federal, state and local environmental control regulations.