GENERAL MONITORS

Model IR5000

Infrared Open Path Detector
For Hydrocarbon Gas
Applications

Instruction Manual **07-08**

Part No. **MANIR5000**
Revision **N/07-08**

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1.0 Warranty

General Monitors warrants the Model IR5000 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. General Monitors' personnel will make full determination of the nature of, and responsibility for defective equipment. 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.

NOTE - The Model IR5000 Infrared Open Path System is easy to install; however, this manual should be read and understood before attempting to operate the system.

As with other Infrared devices, the Model IR5000 does NOT detect Hydrogen gas.

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 merchantability 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 damages arising out of/or in connection with the use or performance of the product.

1.1 Warning

Warning: The Model IR5000 Open Path System contains components that can be damaged by static electricity. Special care must be taken when wiring the system to ensure that only the connection points are touched.

Warning: Toxic combustible and flammable gases & vapors are very dangerous. Extreme caution should be used when these hazards are present

1.2 System Integrity Verification

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

The safety products you have purchased should be handled carefully and installed, calibrated and maintained in accordance with the respective product instruction manual. Remember, these products are for your safety.

To ensure operation at optimum performance, General Monitors recommends that certain maintenance items be performed.

1.3 Commissioning Safety Systems

Before power up, verify wiring, terminal connections and stability of mounting for all integral safety equipment including, but not limited to:

- **Power supplies**
- **Control modules**
- **Field detection devices**
- **Signaling / output devices**
- **Accessories connected to field and signaling devices**

After the initial application of power and any factory specified warm-up period to the safety system, verify that all signal outputs, to and from devices and modules, are within the manufacturers' specifications. Initial calibration / calibration checking / testing should be performed according to the manufacturers' recommendations and instructions.

Proper system operation should be verified by performing a full, functional test of all component devices of the safety system, ensuring that the proper levels of alarming occur.

Fault/Malfunction circuit operation should be verified.

1.4 Periodic Testing/Calibration of Field Devices

Periodic testing/calibrating should be performed per the manufacturers' recommendations and instructions. Testing/Calibrating procedures should include, but not be limited to:

- **Verify zero reading**
- **Apply a known concentration of gas, or a simulated test device provided by the manufacturer**
- **Verify integrity of all optical surfaces and devices**

When testing produces results outside of the manufacturers' specifications, re-calibration or repair/replacement of the suspect device(s) should be performed as necessary. Calibration intervals should be independently established through a documented procedure, including a calibration log maintained by plant personnel, or third party testing services.

1.5 Periodic System Verification

The following system verifications should be performed at least annually.
Verify wiring, terminal connections and stability of mounting for all integral safety equipment including, but not limited to:

- **Power supplies**
- **Control modules**
- **Field detection devices**
- **Signaling / output devices**
- **Accessories connected to field and signaling devices**

Proper system operation should be verified by performing a full, functional test of all component devices of the safety system, ensuring that the proper levels of alarming occur.

Fault/Malfunction circuit operation should be verified.

Calibration intervals should be independently established through a documented procedure, including a calibration log maintained by plant personnel, or third party testing services.

2.0 Quick Start Guide

2.1 Receipt of Equipment

All equipment shipped by General Monitors is pre-packed in shock absorbing containers which provide protection against physical damage (original containers should be kept for future shipping or storage needs).

Shipping container 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 correspondence with General Monitors must specify the equipment part number and serial number.

The factory tests each unit; however, a complete system checkout is suggested upon initial installation to ensure system integrity.

2.2 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 Receiver Unit should be mounted so that the display is visible to aid in alignment.
- Do not mount near strong magnetic fields or degradation of performance may result.

The line of sight between the Source and Receiver Units should be free from:

- Items that may block the beam (i.e. a parked truck or moveable machinery).
- Interruptions caused by frequent human or animal crossings.
- The units should be reasonably protected (i.e. covered by a hood if temperatures exceed the specifications in Section 8.84
- The units are RFI resistant, but should not be mounted too close to radio transmitters or similar equipment.
- Mount the Receiver unit so that direct sunlight does not enter the front window.
- Locate the units away from concentrated sources of heat.
- Mount away from sources of excessive vibration and away from high voltage/high current power lines.
- If the path length is less than 15 meters (<50 feet), an aperture plate is required.

2.3 IR5000 Detection Method

The Model IR5000 uses a single beam, dual wavelength method of infrared absorption detection. One wavelength is where absorption of a specific gas (or gases) occurs, (the absorbing wavelength) and the other wavelength is adjacent to it (the reference

wavelength) but at a wavelength not absorbed by the gas (or gases). By comparing the signals from these two wavelengths the concentration of the gas can be measured (i.e. differential absorption technique).

The reference wavelength is chosen to compensate for interferences that can otherwise occur from atmospheric variation (e.g. humidity, rain, dust, snow, fog, steam, temperature, etc.).

NOTE - Extremely dense fog, steam or interruptions of the beam by a person or object, may cause the system to enter into a temporary "beam blocked" condition until the line-of-sight clears. This condition is signaled by 1.5mA output level so as to discriminate it from an instrument True Fault. If preferred, the menu allows a level of 0mA (Fault) to be selected.

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

2.3.1 Measurement Scale

With the Model IR5000 Open Path System, as there is no fixed path length, the reading is reported in concentration meters. The Model IR5000 reports concentrations in the ppm•meters range (highly sensitive to low levels of hydrocarbons) and the LEL•meters range (large hazardous levels of hydrocarbons). The Model IR5000 has one auto-ranging two-digit display; lighting an LED below the display for ppm•meters and above the display for LEL•meters differentiates the two ranges. In general, an open path monitor can give similar responses to large, low concentration gas clouds and small, high concentration gas clouds as shown in Figures 1 and 2. * 0 to 2000 ppm•meter and 0 to 1 LEL•meter on the Heavy Hydrocarbon (Propane) Unit.

Typical gas cloud configuration:

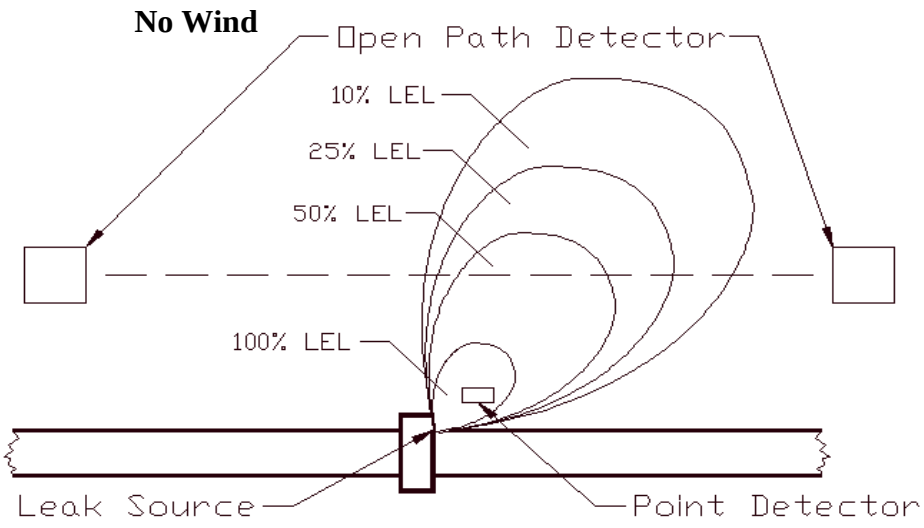

Figure 1 Indoor Gas Cloud

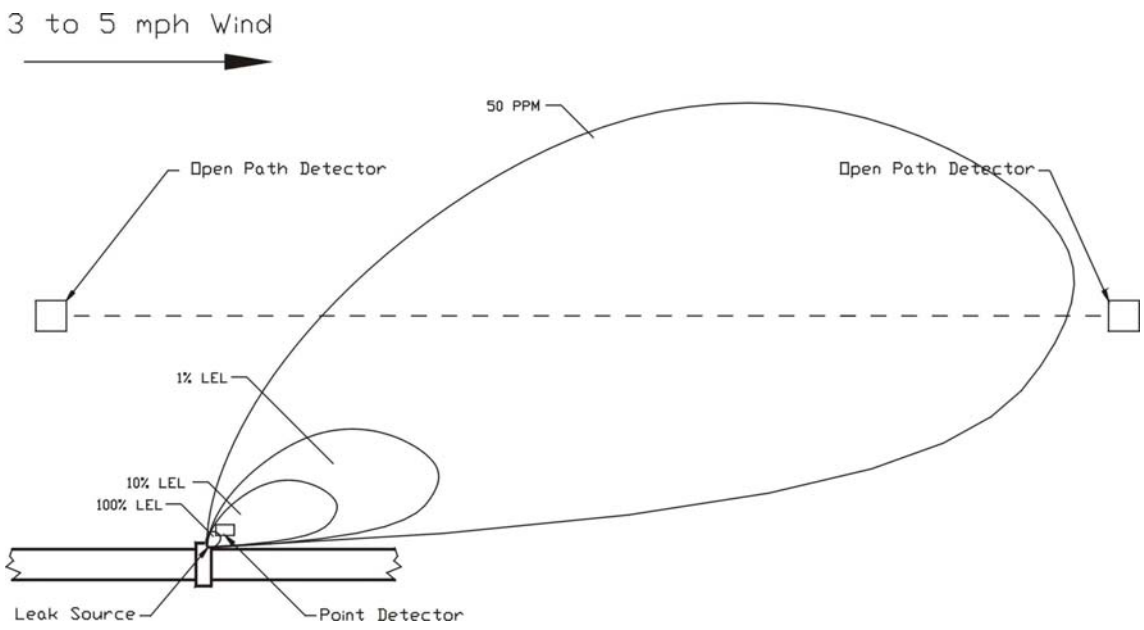

Figure 2 Outdoor Gas Cloud

2.4 System

2.4.1 Gas cloud measurements

Example readings of Methane gas clouds by the standard Model IR5000 are:

Size of gas cloud	IR5000 Display
50 ppm x 2 meters	100 ppm•meter
25 ppm x 4 meters	100 ppm•meter
10 ppm x 10 meters	100 ppm•meter
100 ppm x 5 meters	500 ppm•meter
50 ppm x 10 meters	500 ppm•meter
500 ppm x 5 meters	2500ppm•meter
100 ppm x 25 meters	2500ppm•meter
5% LEL x 1 meter	2500ppm•meter
1% LEL x 5 meters	2500ppm•meter
.5% LEL x 10 meters	2500ppm•meter

Table 1 Example Readings of Methane Gas Clouds)-5000 ppm meter range

Size of gas cloud	IR5000 Display
20% LEL x 1 meter	0.2 LEL•meter
10% LEL x 2 meters	0.2 LEL•meter
100% LEL x 2½ meters	2.5 LEL•meter
50% LEL x 5 meters	2.5 LEL•meter
100% LEL x 1 meter	1.0 LEL•meter
50% LEL x 2 meters	1.0 LEL•meter
25% LEL x 4 meters	1.0 LEL•meter
10% LEL x 10 meters	1.0 LEL•meter

Table 2 Example Readings of Methane Gas Clouds 0-5 LEL•meter range

2.5 Control Electronics

Both the Model IR5000 Source and Receiver units operate from a +24VDC (nominal) input. This unregulated +24volt source is fed to on-board power supplies that produce all of the necessary voltages for the Model IR5000 Source and Receiver units.

In normal operation the microprocessor program constantly monitors the two infrared wavelengths and performs mathematical operations on this information in conjunction with values obtained during the factory calibration process.

The microprocessor derives output information and feeds it to the digital to analog converter to produce two 4 to 20 milliampere (mA) signals that are proportional to the 0 to 5000 ppm•meters and 0 to 5 LEL•meters* concentration of gas at the sensor. The microprocessor program also monitors other conditions such as the supply voltage, the optical path integrity (beam block) and automatic gain control.

0 to 2000 ppm•meter and 0 to 1 LEL•meter on the Heavy Hydrocarbon (Propane) Unit.

2.6 System Mounting

The Model IR5000 units are shipped with the pan and tilt assembly already mounted.

After the mounting location has been established, mount the support arms. Apply Lithium grease on both taper joints before attaching the unit to the support arm. Add the supplied bolt and washer, do not tighten until unit is fully adjusted. If the bolt has been tightened and further adjustment is necessary, loosen the bolt two turns and tap the bolt head to release taper (see Figures 4 and 32)

Possible installation:

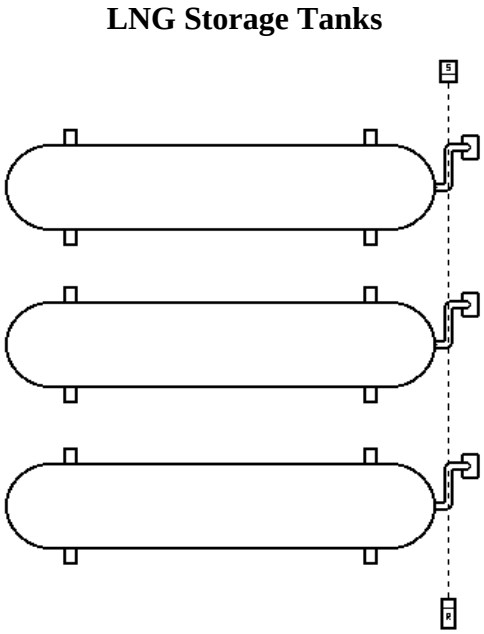

Figure 3 LNG Storage Tank Application

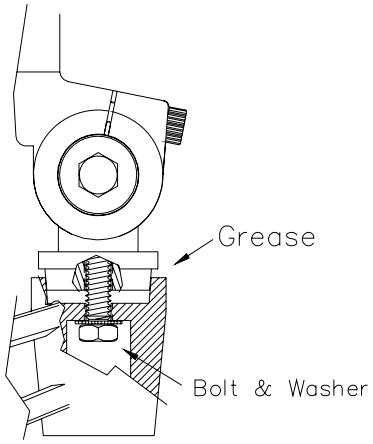

Figure 4 System Mounting Hardware

2.7 Conduit Sealing

Each conduit run from a hazardous to a non-hazardous location should be sealed so that gases, vapors and/or flames cannot pass from one electrical installation to another through the conduit system.

The customer must connect a section of flex conduit to the Source and the Receiver units to allow movement of the units during alignment (see Figures 8 through 11).

General Monitors requires the use of a drain loop or conduit seal in the conduit to prevent moisture from entering the unit housing.

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.

2.8 Terminal Connections

To make the wiring connections to the Model IR5000, loosen the retaining screws at the bottom/rear of each unit using the supplied T-wrench, then unscrew the rear cover of the Source and Receiver housings. All output connections are made inside the Receiver housing (see Figures 8 through 11 for Terminal Block locations).

2.8.1 Terminal Block Operation

To connect wiring to the terminal block, insert a screwdriver into the orange tab and press down, opening the terminal (see Figure 7). Insert the wire into the terminal and release the orange tab, clamping the wire in the terminal. Check the clamp by GENTLY tugging the wire to ensure it is locked in

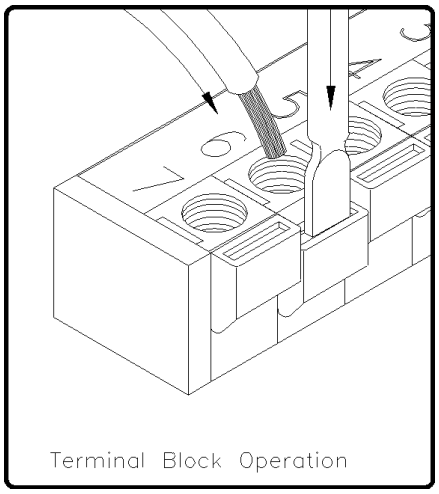

Figure 5 Terminal Block Operation Diagram

The terminal block is designed to accept 16 AWG to 22 AWG stranded or solid-wire (14 AWG wire can be used if it is carefully inserted). Each wire should be stripped as shown in Figure 8.

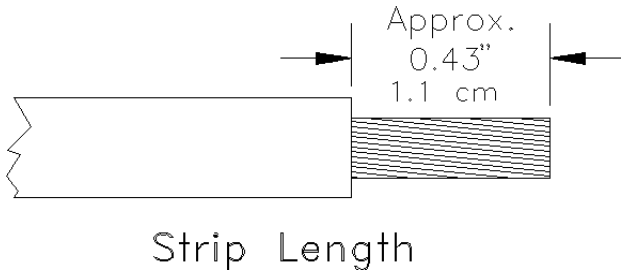

Figure 6 Wire Strip Length Diagram

Primary DC voltage power must be provided by the customer. Since the Model IR5000 Infrared Open Path System is designed to continuously monitor for leaks of combustible gas, a power switch is not included to prevent accidental system shutdown. Power must remain disconnected until all other wiring connections are made.

The Receiver and Source common must be connected to the chassis. Connecting the power supply common to earth-ground and connecting the earth-ground to the chassis accomplish this. To ground the Receiver and Source chassis, the earth-ground wire must be connected to the inside or outside chassis grounding screw (see Figure 6).

2.8.2 The terminal connections for the Input Power

Source:

- TB1-1 Common
- TB1-2 +24VDC

Receiver:

- TB4-6 Common
- TB4-5 +24VDC

The maximum distance between the Model IR5000 and the power source is specified in the Appendix (see Section 8.7.2).

(Two) 4 to 20mA output signals are provided by the Model IR5000 and can be sent to any industrial device that can accept a 4 to 20mA signal for computer based multi-point monitoring. The Analog Output Signals provide for a control room or other location to display indications of operation and alarm conditions. See Section 8.7.2 for the maximum distance between the Model IR5000 and the device connected to the Analog Output Signal.

NOTE: If either Analog Output is not being used, it must be jumpered to the common terminal.

2.8.2.1 The terminal connections for the Analog Output Signals

Receiver:

- TB4-4 LEL•meters Common
- TB4-3 LEL•meters Current Output
- TB4-2 ppm•meters Common
- TB4-1 ppm•meters Current Output

2.8.2.2 The terminal connections for an External Relay Reset Switch

Receiver:

- TB3-3 External Reset Switch
- TB4-6 Switch Common

The Model IR5000 provides external Reset Switch terminations to allow remote resetting of the alarms. Connect each end of a normally open SPST momentary switch to the above terminals. To reset a latched relay, simply press and release the switch.

2.9 Relay Output Connections

Inductive loads (bells, buzzers, relays, etc.) on dry relay contacts must be clamped as shown in Figure 7. Unclamped inductive loads can generate voltage spikes in excess of 1000 volts. Spikes of this magnitude may cause false alarms and contact damage.

NOTE - All relay states shown with power applied.

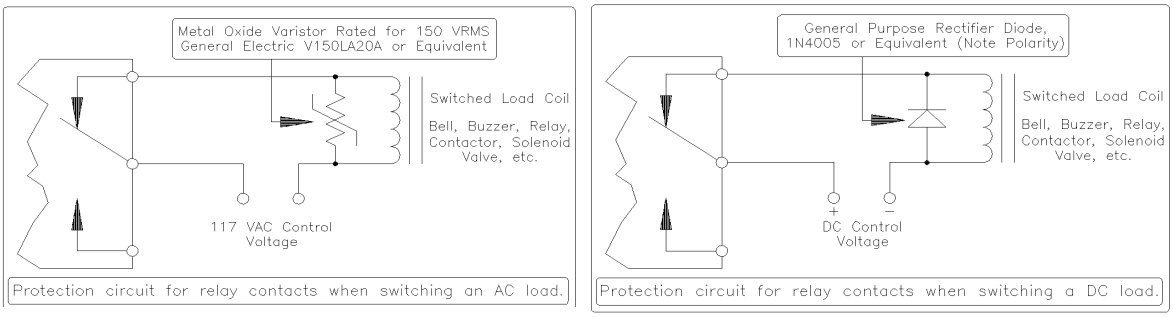

Figure 7 Relay Contact Protection for AC/DC Loads

2.9.1 (A3) Relay Contacts

Receiver:

- TB1-2 ALARM Common

De-Energized Relays Selected:

- TB1-3 ALARM Normally Open Contact
- TB1-1 ALARM Normally Closed Contact

Energized Relays Selected:

- TB1-1 ALARM Normally Open Contact
- TB1-3 ALARM Normally Closed Contact

Before making connections to these relay contacts, see Figures 8 through 11.

2.9.2 The terminal connections for the LEL•meters-Warn (A2) Relay Contacts

Receiver:

- TB1-5 WARN Common

De-Energized Relays Selected:

- TB1-6 WARN Normally Open Contact
- TB1-4 WARN Normally Closed Contact

Energized Relays Selected:

- TB1-4 WARN Normally Open Contact
- TB1-6 WARN Normally Closed Contact

Before making connections to these relay contacts, see Figures 8 through 11.

2.9.3 The terminal connections for the ppm•meters-Alarm (A1) Relay Contacts

Receiver:

- TB2-2 ALARM Common

De-Energized Relays Selected:

- TB2-3 ALARM Normally Open Contact
- TB2-1 ALARM Normally Closed Contact

Energized Relays Selected:

- TB2-1 ALARM Normally Open Contact
- TB2-3 ALARM Normally Closed Contact

Before making connections to these relay contacts, see Figures 8 through 11.

NOTE: The Energized/De-Energized option is software selectable (see Section 6.1).

2.9.4 The terminal connections for the FAULT Relay Contacts

Receiver:

- TB2-5 FAULT Common
- TB2-4 FAULT Normally Open Contact
- TB2-6 FAULT Normally Closed Contact

Before making connections to these relay contacts, see Figures 10 through 13.

NOTE: The FAULT Relay is energized and non-latching in normal operation. There are no software selectable options that are associated with the FAULT Relay.

2.9.5 General IR Source Brightness settings

General Guidelines: May be changed for varying applications.

Distance	Switch Position	Closed
5 to 6 meters	None	
9 meters	Pos 1, Pos 4	↑ Aperture Plate ↓
12 meters	Pos 1, Pos 2	
19 meters	Pos 1	
20 meters	Pos 1, Pos 8	
40 meters	Pos 1, Pos 2	
60 meters	Pos 1	
100 meters	Pos 1	
130 meters	Pos 1	

IR Source Terminal

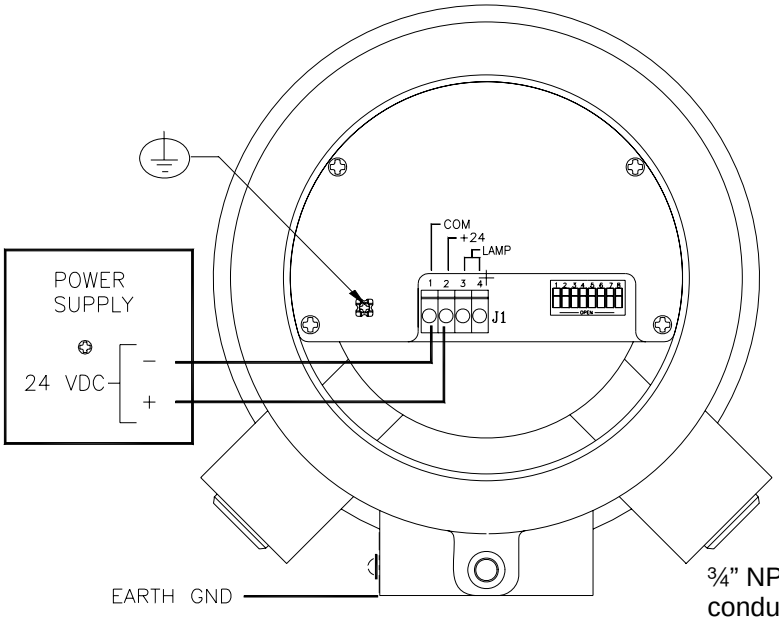

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Figure 8 Source - Terminal Block Location

IR SOURCE - TERMINAL BLOCK LOCATION

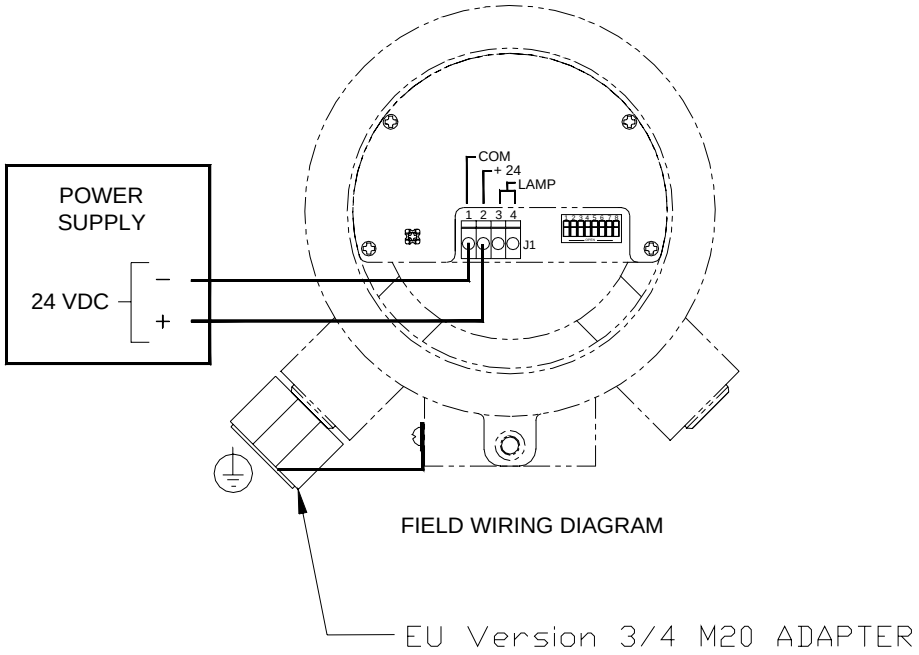


Figure 9 European Union Source - Terminal Block Location

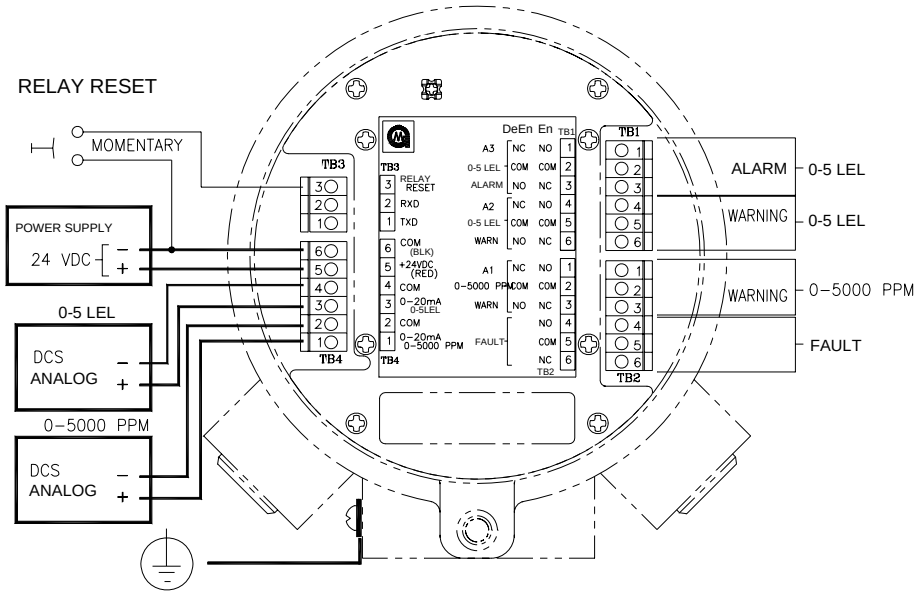


Figure 10 Receiver - Terminal Block Location

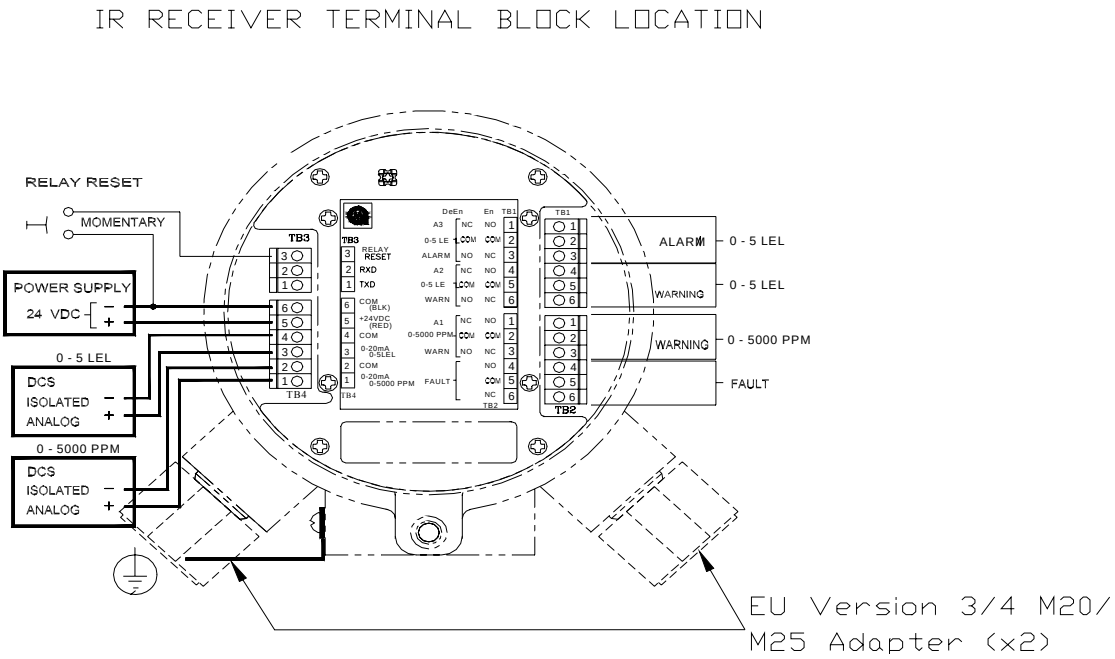


Figure 11 European Union Receiver - Terminal Block Location

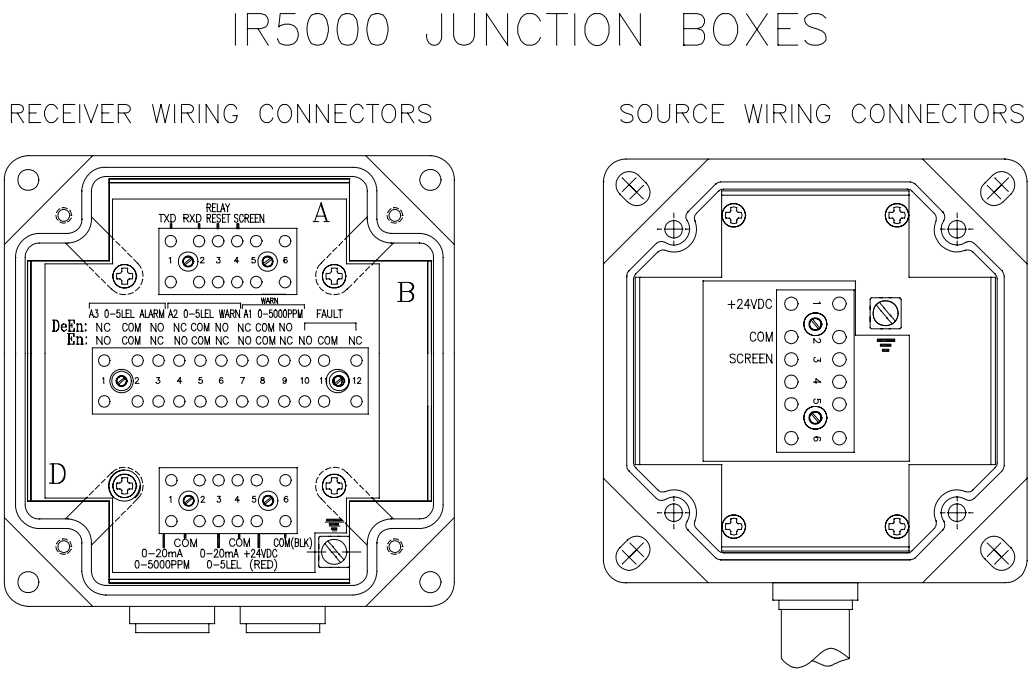


Figure 12 European IR5000 Junction Boxes

2.10 Applying Power & Alignment Mode

2.10.1 Setup Mode

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 Startup 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.

2.10.2 Alignment/Adjustment Mode

The unit now needs to be setup for the application. Place the magnet over the GMI logo on the rear of the Receiver Unit until two flashing bars appear "**- -**". Remove the magnet and wait for the Alignment/ Adjustment code "**AJ**" to appear (it will follow the Setup Mode code "**SE**" on the display). When "**AJ**" appears, re-apply the magnet until a number between 0 and 99 appears (this is the alignment code).

2.10.3 Alignment

To ensure optimal performance of the Model IR5000, the final alignment code must be between "**87**" and "**99**". To align the Source and Receiver Units, use the following guidelines:

1. Turn the Source unit's lamp to full power and perform a rough alignment by sight until a maximum number is displayed on the Receiver. Tighten the horizontal and

vertical adjustment screws on each unit. Set the Source unit's brightness as specified in Section 2.9.5

2. Loosen the Source unit's horizontal adjustment screw and move the unit from side to side until a maximum value is displayed on the Receiver unit. Tighten the horizontal adjustment screw and loosen the vertical adjustment screw. Move the unit up and down to obtain a maximum value on the display. Tighten the vertical adjustment screw.
3. Adjust the Receiver unit from side to side and then up and down to obtain a maximum display value, tightening the adjustment screws after each adjustment.
4. If a flashing "**99**" is displayed after alignment, reduce the Source lamp brightness. If a value lower than "**87**" is displayed after alignment, increase the Source lamp brightness (see Section 2.9.5).
5. Re-align the Receiver unit to obtain a maximum display value.

Repeat steps 4 and 5 each time the Source lamp brightness is changed.

If the unit is displaying a number less than "**87**" or a flashing "**99**", the IR5000 will not exit the alignment/adjustment mode.

DO NOT intentionally misalign the Model IR5000 to get below a flashing "**99**". Turn down the source lamp brightness. **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.

Once a number within the "**87**" to "**99**" range is attained, tighten the Source and Receivers' rear covers and verify that the alignment number has not changed. Apply the magnet until a flashing "**CP**" is displayed (Calibration in Progress Mode). Remove the magnet and the unit will set the "zero" value. After approximately 2 minutes, the unit will return to normal operation.

Ensure that there is no significant amount of background gas when the unit is setting the "zero" value, as this will alter the Model IR5000's performance. If there is normally gas present, try setting-up the IR5000 on a breezy day, as this will dissipate the gas. If the unit cannot set a "zero" value, an "**F8**" fault code will appear. The above procedure should then be repeated. If the unit fails to align properly, check the line of sight carefully, then contact your GMI representative or the factory direct.

2.10.4 Response Test

After initial alignment, a test of the IR5000 should be carried out using the Test Gas Filters Kit (P/N's 30878-1, 30878-2). Follow the testing instructions listed on the inside label of the filters.

NOTE: The instrument is now ready to operate! Please consult the manual for more information on the instrument's many features.

NOTE: If you have any problems in the setup or testing of the detector, please refer to the "Troubleshooting Section", or call the factory direct.

3.0 Introduction

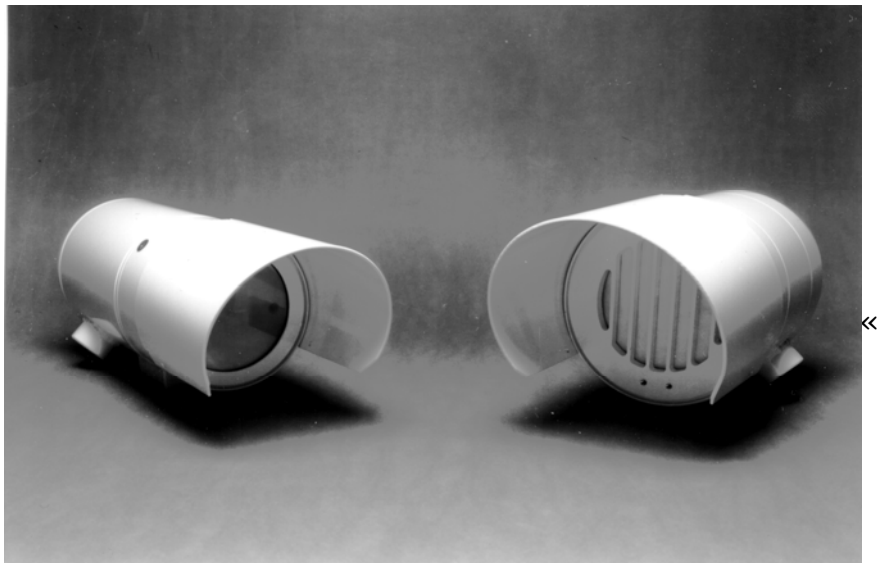
3.1 General Description

The Model IR5000 Infrared Open Path System is a microprocessor-based hydrocarbon gas detector (Figure 13). The system consists of an IR Source unit and a Receiver unit that may be placed from 5-130 meters (approx. 15-400 feet) apart. The General Monitors' Model IR5000 is calibrated at the factory and needs no further calibration. The sensitivity of the Model IR5000 can be checked by placing a Test Gas Filter in front of the Receiver unit. It is also relatively maintenance free, requiring only a periodic cleaning of the windows to assure dependable performance. The Model IR5000 Infrared Open Path System continuously monitors hydrocarbon gases in both the 0 to 5000 ppm•meter and 0 to 5 LEL•meter range*. It provides two 4 to 20mA analog signals proportional to each of the above ranges, in addition to a digital display and an A3 (LEL•meters-Alarm), A2 (LEL•meters-Warn), A1 (ppm•meters-Warn) and FAULT relay contacts.

The Model IR5000 Infrared Open Path System is easily aligned using the digital display and adjustable mounting arms, therefore not requiring any bulky setup equipment (e.g. Digital Volt Meters, Alignment Scopes, etc).

Sensor data and status information from the Model IR5000 can be transmitted up to 9000 feet to any industrial analog to digital (A/D) converter for use in multipoint computer-based monitoring. The Model IR5000 Infrared Open Path System operates from an unregulated +24 volt DC power supply, which must be supplied by the customer. The Model IR5000 Heavy Hydrocarbon unit (Propane) displays 0 to 2000 ppm•meter and 0 to 1 LEL•meter ranges.

Receiver »



« Source

Figure 13 IR5000 Receiver/ Source Unit

3.2 Features and Benefits

The advantageous features and benefits of the Model IR5000 Infrared Open Path System include:

- **Single detection beam:** Benefit - eliminates drift and false alarms.
- **Dual detection ranges (ppm•meters & LEL•meters):** Benefit - sensitive to low-level leaks.
- **Unitized design - digital readout, 4 relays and two 4 to 20mA outputs:** Benefit - wide variety of outputs.
- **Digital AutoTRACK alignment:** Benefit - easy, “no tools” alignment.
- **NEMA 4X, IP66 weatherproof rating:** Benefit - highly durable unit.
- **Fail-to-safe operation:** Benefit – no undetected faults.
- **Automatic gain control:** Benefit - compensates for dirty optics, rain and fog.
- **Power supply input reversal protection:** Benefit - protection against miss-wiring damage.

3.3 Applications

This is a partial list of applications suitable for the Model IR5000 Infrared Open Path System:

- **Drilling and production platforms**
- **Fuel loading facilities**
- **Compressor stations**
- **Liquefied natural gas/liquefied petroleum gas processing and storage facilities**
- **Wastewater treatment**
- **Gas turbines**
- **Tank farms**
- **Petrochemical plants**
- **Fence line monitoring**

4.0 IR5000 System

4.1 Infrared Detection Principles

4.1.1 Infrared Radiation

Most gases absorb infrared radiation. Infrared gas detection is based upon the fact that all hydrocarbon gases absorb infrared radiation of specific wavelengths or bands but with different degrees of absorption. The wavelength that these gases absorb radiation at is a characteristic of the gas (fingerprint) and the amount of absorption is a function of the gas concentration and the infrared beam's path length.

4.1.2 Beer-Lambert Law

The Model IR5000 is based on measuring absorption of infrared radiation passing through a volume of hydrocarbon 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)**

4.1.3 IR5000 Detection Method

The Model IR5000 uses a single beam, dual wavelength method of infrared absorption detection. One wavelength is where absorption of a specific gas (or gases) occurs, (the absorbing wavelength) and the other wavelength is adjacent to it (the reference wavelength) but at a wavelength not absorbed by the gas (or gases). By comparing the signals from these two wavelengths, the concentration of the gas can be measured (i.e. differential absorption technique).

The reference wavelength is chosen to compensate for interferences that can otherwise occur from atmospheric variation (e.g. humidity, rain, dust, snow, fog, steam, temperature, etc.).

NOTE: Extremely dense fog, steam or interruption of the beam by an object or person may cause the system to enter into a temporary "beam blocked" condition until the line-of-sight clears. This condition is signaled by 1.5mA output level so as to discriminate it from an Instrument true Fault. If preferred, the menu allows a level of 0mA (Fault) to be selected.

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

4.1.4 Measurement Scale

With the Model IR5000 Open Path System, as there is no fixed path length, the reading is reported in concentration•meters. The Model IR5000 reports concentrations in the ppm•meters range (highly sensitive to low levels of hydrocarbons) and the LEL•meters range (large hazardous levels of hydrocarbons). The Model IR5000 has one auto-ranging two-digit display; the two ranges are differentiated by lighting an LED below the display for ppm•meters and above the display for LEL•meters. In general, an open path monitor can give similar responses to large, low concentration gas clouds and small, high concentration gas clouds as shown in Figures 14 and 15.

Typical gas cloud configuration:

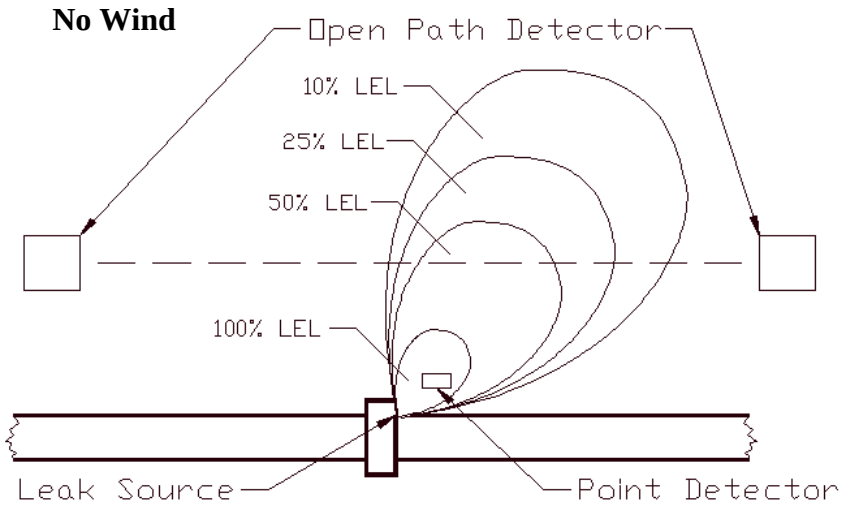


Figure 14 Indoor Gas Cloud

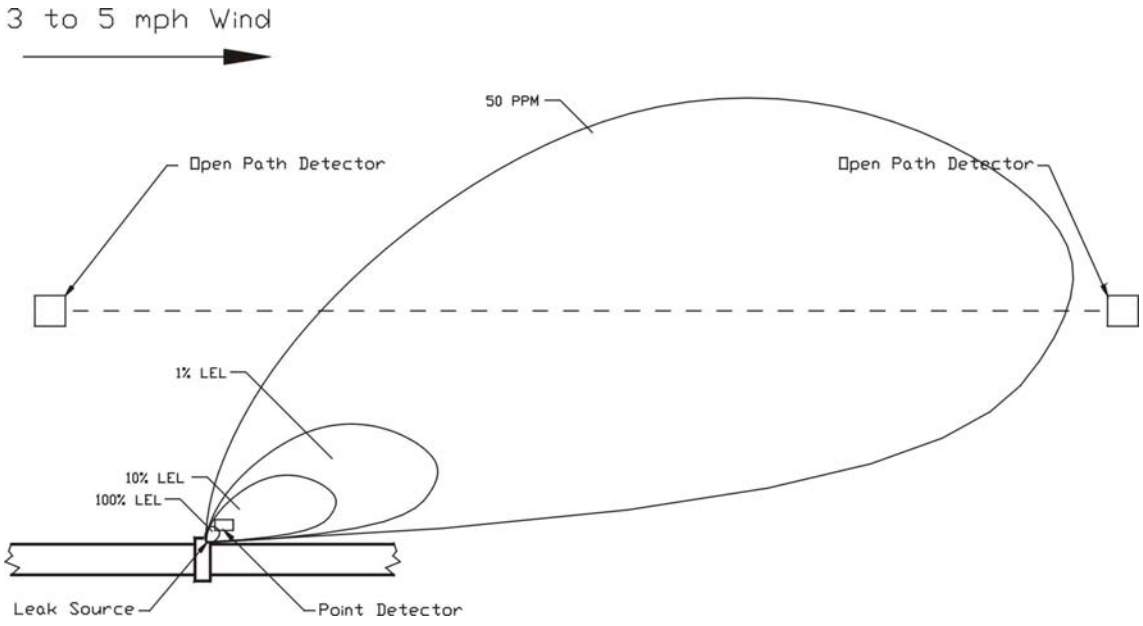


Figure 15 Outdoor Gas Cloud

4.1.5 System Gas cloud measurements

Example readings of Methane gas clouds by the standard Model IR5000 are:

Size of gas cloud	IR5000 Display
50 ppm x 2 meters	100 ppm•meter
25 ppm x 4 meters	100 ppm•meter
10 ppm x 10 meters	100 ppm•meter
100 ppm x 5 meters	500 ppm•meter
50 ppm x 10 meters	500 ppm•meter
500 ppm x 5 meters	2500ppm•meter
100 ppm x 25 meters	2500ppm•meter
5% LEL x 1 meter	2500ppm•meter
1% LEL x 5 meters	2500ppm•meter
.5% LEL x 10 meters	2500ppm•meter

Table 3 Example Reading of Methane Gas Clouds 0-5000 ppm meter range

Size of Gas Clouds	IR5000 Display
20% LEL x 1 meter	0.2 LEL•meter
10% LEL x 2 meters	0.2 LEL•meter
100% LEL x 2½ meters	2.5 LEL•meter
50% LEL x 5 meters	2.5 LEL•meter
100% LEL x 1 meter	1.0 LEL•meter
50% LEL x 2 meters	1.0 LEL•meter
25% LEL x 4 meters	1.0 LEL•meter
10% LEL x 10 meters	1.0 LEL•meter

Table 4 Example Reading of Methane Gas Clouds 0-5 LEL meter range

4.2 Control Electronics

Both the Model IR5000 Source and Receiver units operate from a +24VDC (nominal) input. This unregulated +24volt source is fed to on-board power supplies that produce all of the necessary voltages for the Model IR5000 Source and Receiver units.

In normal operation, the microprocessor program constantly monitors the two infrared wavelengths and performs mathematical operations on this information in conjunction with values obtained during the factory calibration process.

The microprocessor derives output information and feeds it to the digital to analog converter to produce two 4 to 20 milliampere (mA) signals that are proportional to the 0 to 5000 ppm•meters and 0 to 5 LEL•meters* concentration of gas at the sensor. The microprocessor program also monitors other conditions such as the supply voltage, the optical path integrity (beam block) and automatic gain control.

0 to 2000 ppm•meter and 0 to 1 LEL•meter on the Heavy Hydrocarbon (Propane) Unit.

5.0 Installation

5.1 Receipt of Equipment

All equipment shipped by General Monitors is pre-packed in shock absorbing containers, which provide protection against physical damage (original containers should be kept for future shipping or storage needs).

Shipping container 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 correspondence with General Monitors must specify the equipment part number and serial number.

Each unit is tested by the factory, however, a complete system check-out is suggested upon initial installation to ensure system integrity.

5.2 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 Receiver Unit should be mounted so that the display is visible to aid in alignment.
- Do not mount near strong magnetic fields or degradation of performance may result.
- The line of sight between the Source and Receiver Units should be free from:
- Items that may block the beam (i.e. a parked truck or moveable machinery).
- Interruptions caused by frequent human or animal crossings.
- The units should be reasonably protected (i.e. covered by a hood if temperatures exceed the specifications in Section 8.8.4).
- The units are RFI resistant, but should not be mounted too close to radio transmitters or similar equipment.
- Mount the Receiver unit so that direct sunlight does not enter the front window.
- Locate the units away from concentrated sources of heat.
- Mount away from sources of excessive vibration and away from high voltage/high current power lines.
- If the path length is less than 15 meters (<50 feet), an aperture plate is required.

5.3 System Mounting

The Model IR5000 units are shipped with the pan and tilt assembly already mounted.

After the mounting location has been established, mount the support arms. Apply Lithium grease on both taper joints before attaching the unit to the support arm. Add the supplied bolt and washer, do not tighten until unit is fully adjusted. If the bolt has been tightened and further adjustment is necessary, loosen the bolt two turns and tap the bolt head to release taper (see Figures 17 and 32). Possible installation:

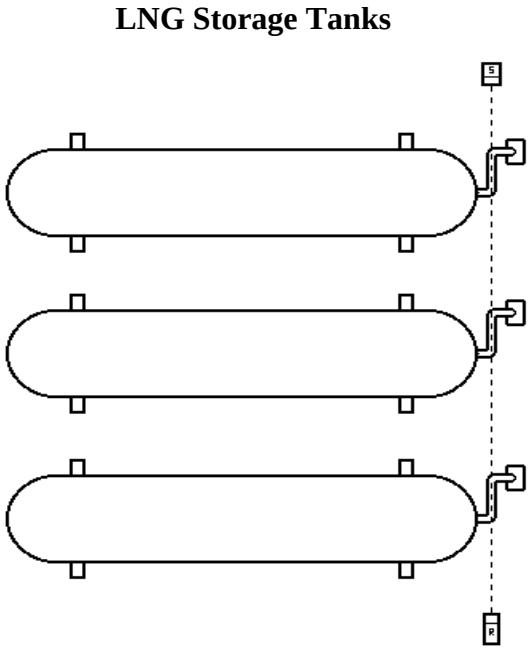


Figure 16 LNG Storage Tank Application Figure

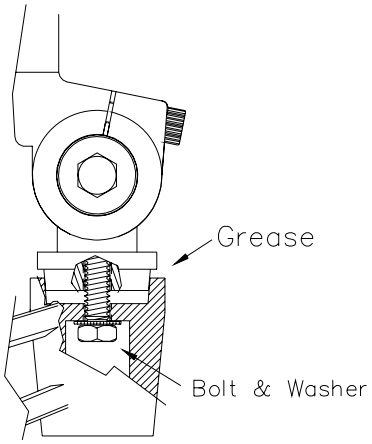


Figure 17 System Mounting Hardware

5.4 Conduit Sealing

Each conduit run from a hazardous to a non-hazardous location should be sealed so that gases, vapors and/or flames cannot pass from one electrical installation to another through the conduit system.

The customer must connect a section of flex conduit to the Source and the Receiver units to allow movement of the units during alignment (see Figures 26 and 27).

General Monitors requires the use of a drain loop or conduit seal in the conduit to prevent moisture from entering the unit housing.

⚠ **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.

5.5 Terminal Connections

To make the wiring connections to the Model IR5000, loosen the retaining screws at the bottom/rear of each unit using the supplied T-wrench, then unscrew the rear cover of the Source and Receiver housings. All output connections are made inside the Receiver housing (see Figures 21 through 24 for Terminal Block locations).

NOTE: Contact with printed circuit board (PCB) components should be avoided to prevent damage by static electricity.

5.5.1 Terminal Block Operation

To connect wiring to the terminal block, insert a screwdriver into the orange tab and press down, opening the terminal (see Figure 18). Insert the wire into the terminal and release the orange tab, clamping the wire in the terminal. Check the clamp by GENTLY tugging the wire to ensure it is locked in.

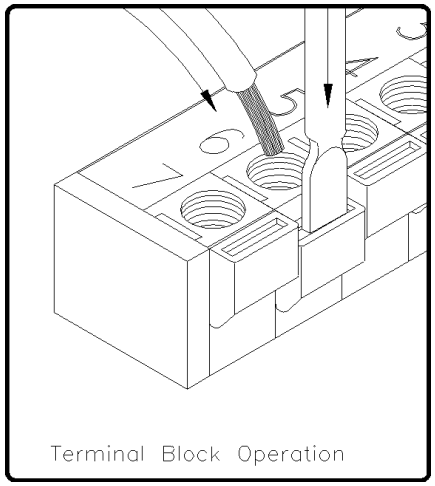


Figure 18 Terminal Block Operation

The terminal block is designed to accept 16 AWG to 22 AWG stranded or solid-wire (14 AWG wire can be used if it is carefully inserted). Each wire should be stripped as shown in Figure 19.

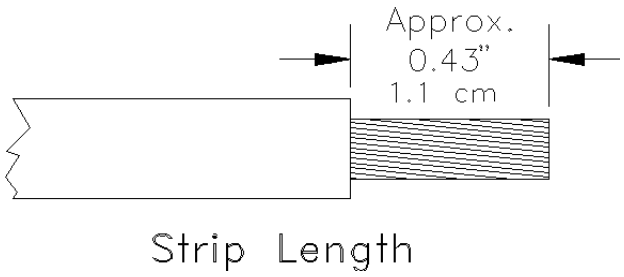


Figure 19 Wire Strip Length Diagram

Primary DC voltage power must be provided by the customer. Since the Model IR5000 Infrared Open Path System is designed to continuously monitor for leaks of combustible gas, a power switch is not included to prevent accidental system shutdown. Power must remain disconnected until all other wiring connections are made.

The Receiver and Source common must be connected to the chassis. Connecting the power supply common to earth-ground and connecting the earth-ground to the chassis accomplish this. To ground the Receiver and Source chassis, the earth ground wire must be connected to the inside or outside chassis grounding screw

5.5.1.1 The terminal connections for the Input Power

Source:

- TB1-1 Common
- TB1-2 +24VDC

Receiver:

- TB4-6 Common
- TB4-5 +24VDC

The maximum distance between the Model IR5000 and the power source is specified in the Appendix (see Section 7.1.4).

(Two) 4 to 20mA output signals are provided by the Model IR5000 and can be sent to any industrial device that can accept a 4 to 20mA signal for computer based multi-point monitoring. The Analog Output Signals provide for a control room or other location to display indications of operation and alarm conditions. See Section 7.1.4 for the maximum distance between the Model IR5000 and the device connected to the Analog Output Signal.

NOTE: If either Analog Output is not being used, it must be jumpered to the common terminal.

5.5.1.2 The terminal connections for the Analog Output Signals

Receiver:

- TB4-4 LEL•meters Common
- TB4-3 LEL•meters Current Output
- TB4-2 ppm•meters Common
- TB4-1 ppm•meters Current Output

5.5.1.3 The terminal connections for an External Relay Reset Switch

Receiver:

- TB3-3 External Reset Switch
- TB4-6 Switch Common

The Model IR5000 provides external Reset Switch terminations to allow remote resetting of the alarms. Connect each end of a normally open SPST momentary switch to the above terminals. To reset a latched relay, simply press and release the switch.

5.5.2 Relay Output Connections

Inductive loads (bells, buzzers, relays, etc.) on dry relay contacts must be clamped as shown in Figure 24. Unclamped inductive loads can generate voltage spikes in excess of 1000 volts. Spikes of this magnitude may cause false alarms and contact damage.

NOTE: All relay states shown with power applied.

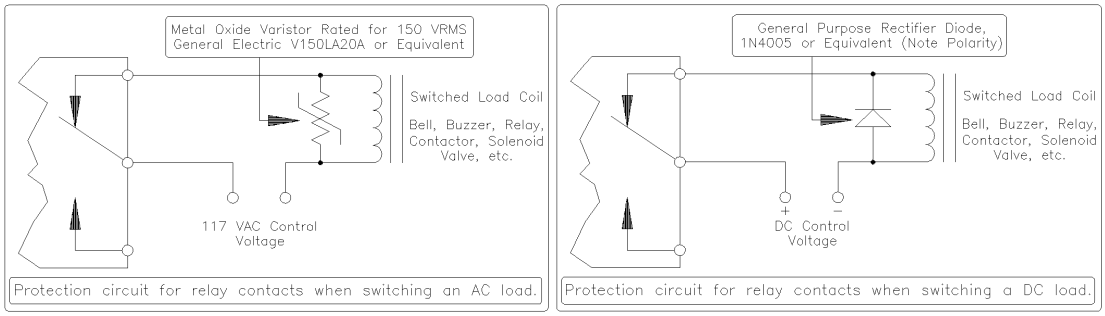


Figure 20 Relay Contact Protection for AC/DC Loads

5.5.2.1 The terminal connections for the LEL•meters-Alarm (A3) Relay Contacts

Receiver

- TB1-2 ALARM Common

De-Energized Relays Selected

- TB1-3 ALARM Normally Open Contact
- TB1-1 ALARM Normally Closed Contact

Energized Relays Selected

- TB1-1 ALARM Normally Open Contact
- TB1-3 ALARM Normally Closed Contact

Before making connections to these relay contacts, see Figures 25 through 28.

5.5.2.2 The terminal connections for the LEL•meters-Warn (A2) Relay Contacts

Receiver

- TB1-5 WARN Common

De-Energized Relays Selected

- TB1-6 WARN Normally Open Contact
- TB1-4 WARN Normally Closed Contact

Energized Relays Selected

- TB1-4 WARN Normally Open Contact
- TB1-6 WARN Normally Closed Contact

Before making connections to these relay contacts, see Figures 25 through 28.

5.5.2.3 The terminal connections for the ppm•meters-Alarm (A1) Relay Contacts

Receiver

- TB2-2 ALARM Common

De-Energized Relays Selected

- TB2-3 ALARM Normally Open Contact
- TB2-1 ALARM Normally Closed Contact

Energized Relays Selected

- TB2-1 ALARM Normally Open Contact
- TB2-3 ALARM Normally Closed Contact

Before making connections to these relay contacts, see Figures 25 through 28.

NOTE: The Energized/De-Energized option is software selectable (see Section 5.1).

5.5.2.4 The terminal connections for the ppm•meters-Alarm (A1) Relay Contacts

Receiver

- TB2-2 ALARM Common

De-Energized Relays Selected

- TB2-3 ALARM Normally Open Contact
- TB2-1 ALARM Normally Closed Contact

Energized Relays Selected

- TB2-1 ALARM Normally Open Contact
- TB2-3 ALARM Normally Closed Contact

Before making connections to these relay contacts, see Figures 25 through 28.

NOTE: The Energized/De-Energized option is software selectable (see Section 5.1).

5.5.2.5 The terminal Connections for the FAULT Relay Contacts

Receiver

- TB2-5 FAULT Common
- TB2-4 FAULT Normally Open Contact
- TB2-6 FAULT Normally Closed Contact

Before making connections to these relay contacts, see Figures 25 through 28.

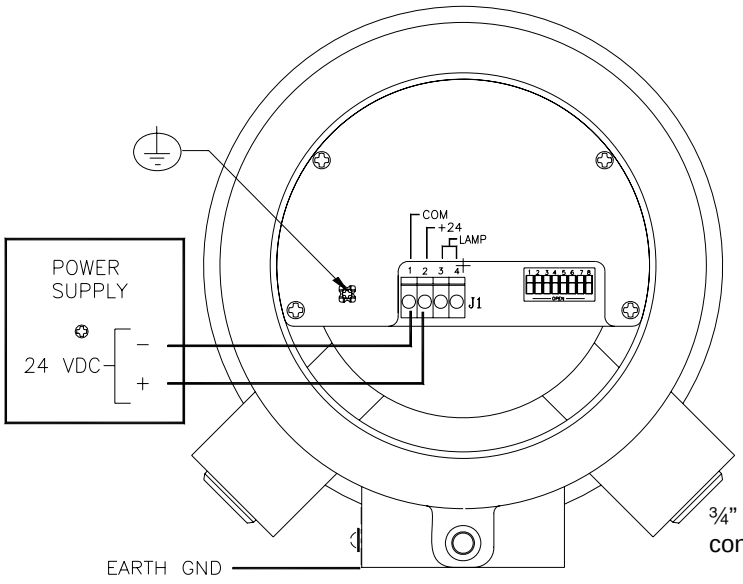
NOTE: The FAULT Relay is energized and non-latching in normal operation. There are no software selectable options that are associated with the FAULT Relay.

5.5.3 General IR Source Brightness settings

(General Guidelines: May be changed for varying applications.)

Distance	Switch Position	'Closed'
5 to 6 meters	None	
9 meters	Pos 1, Pos 4	↑ Aperture Plate ↓
12 meters	Pos 1, Pos 2	
19 meters	Pos 1	
20 meters	Pos 1, Pos 8	
40 meters	Pos 1, Pos 2	
60 meters	Pos 1	
100 meters	Pos 1	
130 meters	Pos 1	

IR Receiver Terminal Connections



Cover removed for clarity

Figure 21 Source - Terminal Block Location`

IR SOURCE - TERMINAL BLOCK LOCATION

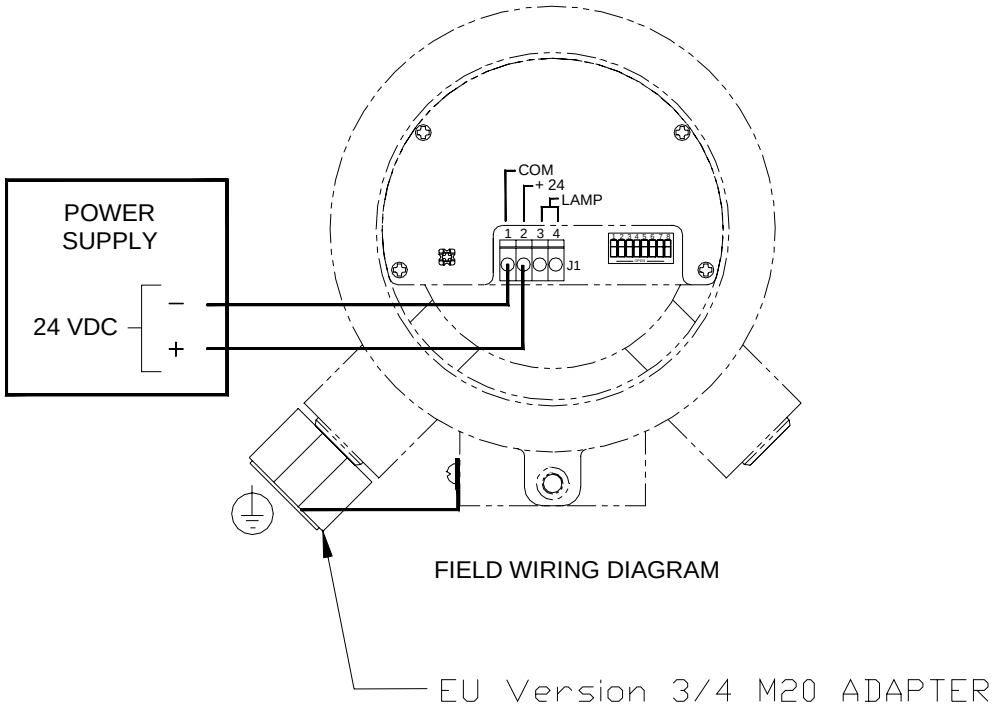


Figure 22 European Union Source - Terminal Block Location

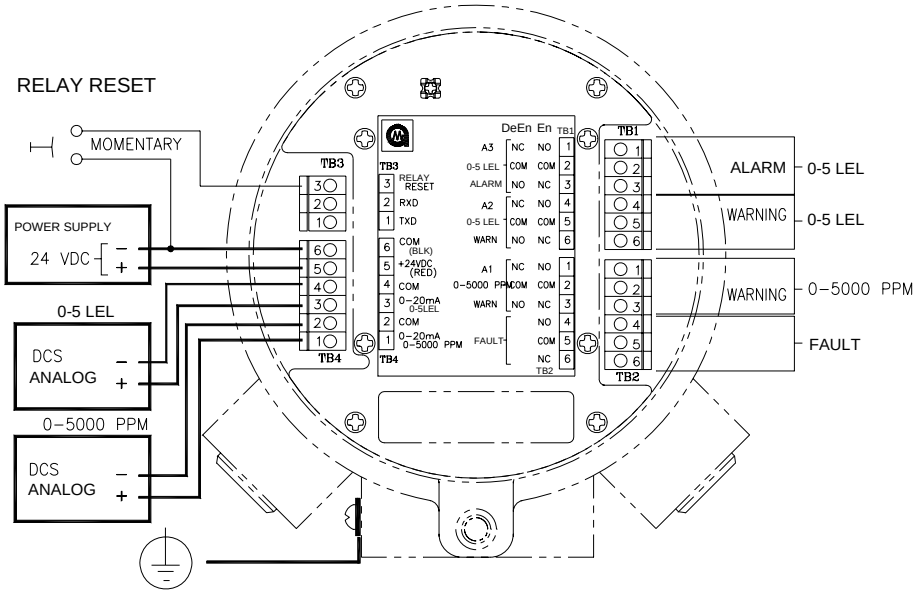


Figure 23 IR Receiver Terminal Block Location /Standard Unit Shown

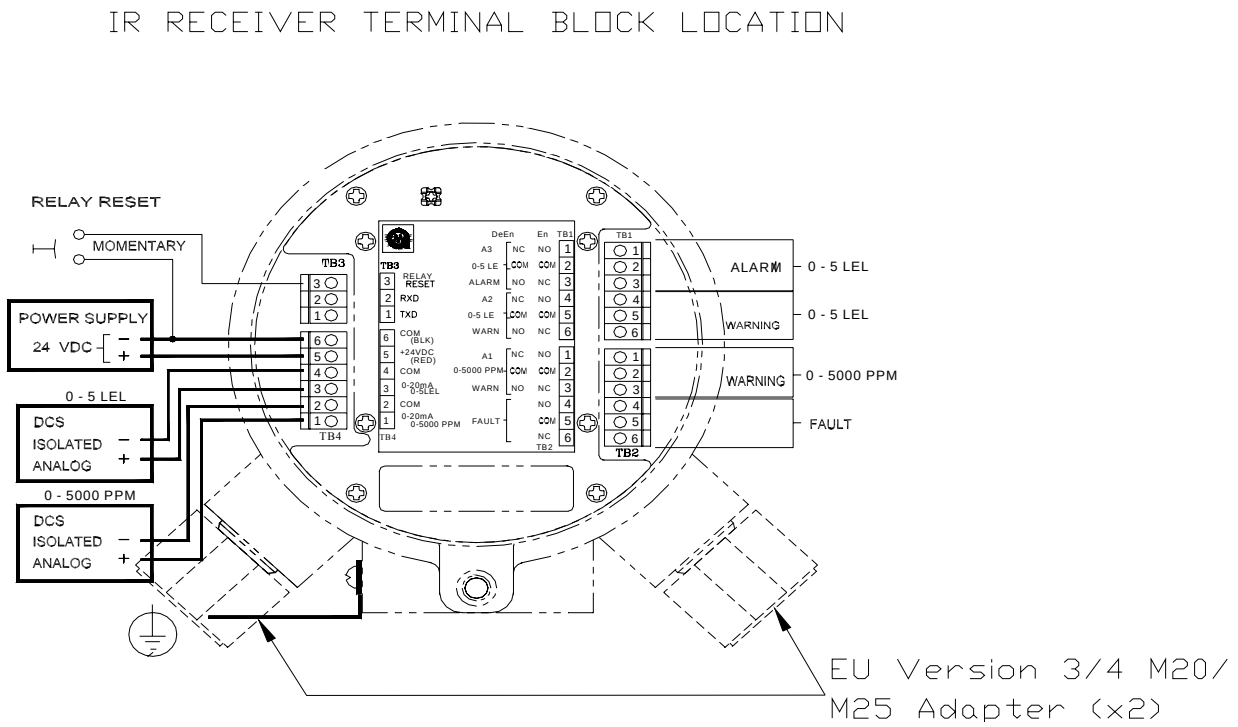


Figure 24 European Union IR Receiver Terminal Block Location

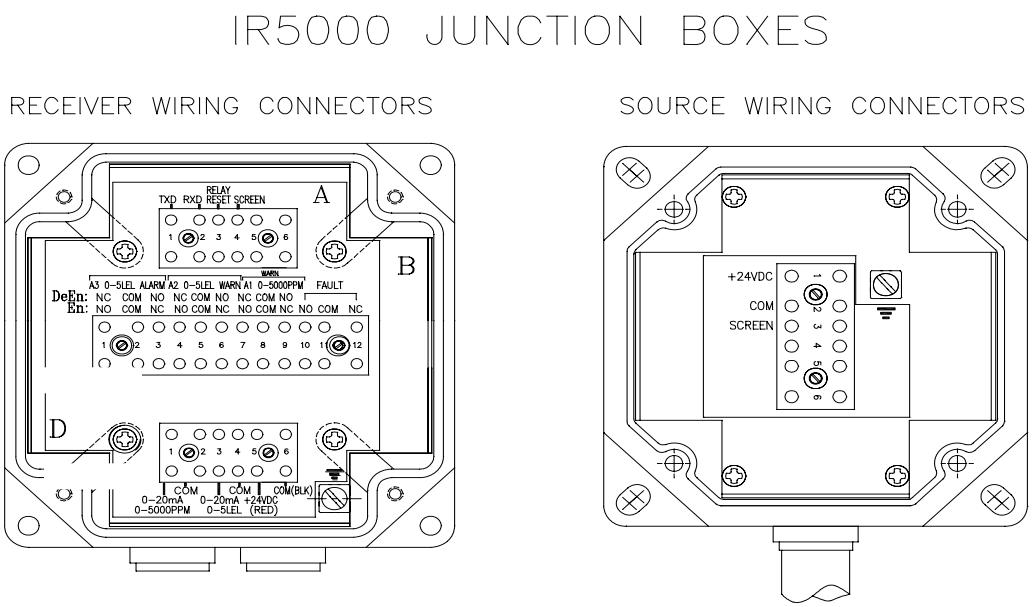


Figure 25 European Union IR5000 Junction Boxes

5.6 Applying Power & Alignment Mode

5.6.1 Startup Mode

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.

5.6.2 Alignment/Adjustment Mode

The unit now needs to be setup for the application. Place the magnet over the GM logo on the rear of the Receiver Unit until two flashing bars appear "**- -**". Remove the magnet and wait for the Alignment / Adjustment code "**AJ**" to appear (it will follow the Setup Mode code "**SE**" on the display). When "**AJ**" appears, re-apply the magnet until a number between 0 and 99 appears (this is the alignment code).

5.6.3 Alignment

To ensure optimal performance of the Model IR5000, the final alignment code must be between "**87**" and "**99**". To align the Source and Receiver Units, use the following guidelines:

1. Turn the Source unit's lamp to full power and perform a rough alignment by sight until a maximum number is displayed on the Receiver. Tighten the horizontal and vertical adjustment screws on each unit. Set the Source unit's brightness as specified in Section 5.5.3.
2. Loosen the Source unit's horizontal adjustment screw and move the unit from side to side until a maximum value is displayed on the Receiver unit. Tighten the horizontal adjustment screw and loosen the vertical adjustment screw. Move the unit up and down to obtain a maximum value on the display. Tighten the vertical adjustment screw.
3. Adjust the Receiver unit from side to side and then up and down to obtain a maximum display value, tightening the adjustment screws after each adjustment.
4. If a flashing "**99**" is displayed after alignment, reduce the Source lamp brightness. If a value lower than "**87**" is displayed after alignment, increase the Source lamp brightness (see Section 5.5.3).
5. Re-align the Receiver unit to obtain a maximum display value.

Repeat steps 4 and 5 each time the Source lamp brightness is changed.

If the unit is displaying a number less than "**87**" or a flashing "**99**", the IR5000 will not exit the alignment/adjustment mode.

DO NOT intentionally misalign the Model IR5000 to get below a flashing "**99**". Turn down the source lamp brightness. **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.

Once a number within the "**87**" to "**99**" range is attained, tighten the Source and Receivers' rear covers and verify that the alignment number has not changed. Apply the magnet until a flashing "**CP**" is displayed (Calibration in Progress Mode). Remove the magnet and the unit will set the "zero" value. After approximately 2 minutes, the unit will return to normal operation.

Ensure that there is no significant amount of background gas when the unit is setting the "zero" value, as this will alter the Model IR5000's performance. If there is normally gas present, try setting-up the IR5000 on a breezy day, as this will dissipate the gas. If the unit cannot set a "zero" value, an "**F8**" fault code will appear. The above procedure should then be repeated. If the unit fails to align properly, check the line of sight carefully, then contact your General Monitors representative or the factory direct.

5.6.4 Response Test

After initial alignment, a test of the IR5000 should be carried out using the Test Gas Filters Kit (P/N's 30878-1 and 30878-2). Follow the testing instructions listed on the inside label of the filters.

5.7 Operational Cautions

WARNING: During operation, the line of sight between the source and the receiver should be free from blockage caused by frequent human or animal crossings. 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 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 one needs to account for, when designing the gas detection system. Users are cautioned that under the following two situations the Heavy Hydrocarbon IR5000 could give a beam block indication rather than a gas reading or alarm:

5.7.1 A rapid and massive liquid propane release

A sudden release of large amount of liquid propane can form very cold gas clouds due to cooling resulting from gas expansion and liquid propane evaporation. This is an intrinsic problem for all open path optical detection technologies. Installing the Model IR5000 at a distance (~10 meters) away from potential liquid propane leakage will reduce this problem.

5.7.2 A rapid and massive buildup of a high concentration propane gas cloud

For example, a propane gas cloud greater than 18 LEL-meter very rapidly and completely placed in the gas path can indicate beam block instead of a gas reading.

5.7.3 Solutions to guard against these situations

- Using complementary point detectors (e.g. Models IR2100, S4000C, or S4100C) at potential sources of leaks of high concentration liquid propane, and

- Using beam block signal as an alarm. To reduce the number of false alarms due to physical beam block, there are user selectable time delays for the presence of beam block. A signal will then be given if a beam block exceeds this time-period.

The ppm•meter range of the IR5000 Heavy Hydrocarbon Open Path Monitor should be used as a warning that there is a gas-leak. This may allow action to take place before a leak reaches a hazardous level, while the LEL•meter range should be used for action taken for a high gas alarm.

Please review our Technical Bulletin on this subject for further details.

6.0 Operation

6.1 Output Options

The Model IR5000 allows the user to configure the units' outputs via a magnetically sensitive reed switch. To activate the reed switch, place the magnet supplied with the Model IR5000 over the General Monitors logo on the label of the Receiver unit for approximately five seconds. Remove the magnet when the flashing bars appear. The display will cycle between the options until the magnet is re-applied, thereby accepting the current option. These options are:

"**- -**" - Test Gas Mode

"**SE**" - Setup Mode

"**AJ**" - Alignment/Adjustment Mode

"**Fi**" - Finish, return to normal operation

6.2 "- -" Test Gas Mode

Apply the magnet when the flashing bars are showing and the unit will enter the Test Gas Mode. While the unit is in this mode the optical faults and relays will be inhibited, the analog signals will drop from 4mA to 1.5mA (0mA optional) and the display will flash.

This mode allows the user to check the IR5000's response to gas cells without activating the relays. After verifying the response (see Section 5.6), remove the gas, the unit will return to normal operation If the gas is not removed after 5 minutes, the unit will revert to fault condition. If left in this mode for 5 minutes without gas, the unit will return to normal operation automatically.

To abort Test Gas Mode before the gas has been applied, reapply the magnet and the unit will return to normal operation.

6.3 "SE" Setup Mode

Apply the magnet when "**SE**" is showing and the unit will enter the Setup Mode.

This mode allows the user to change various attributes concerning the analog and relay outputs. Following is the order in which the options are displayed (to change, apply magnet when the desired option is showing):

Display - Description

bb - Beam Block and High IR settings

- **5** to **60** - Seconds before analog output changes.
- **0, 1.5** – **2.0mA** - Analog output value during beam block.
- **0** to **60** - Minutes before entering optical fault.
- **Fi** - Exits the current option and goes on to next.

01 - Analog #1 (0-5000 / 0-2000 ppm•meters)

on or **oF** - On or Off*

If turned off, the ppm•meters range, including A1 relay, will not be available. Unit will only display LEL•meters range.

- **0** or **1.5** - mA signal output during Test Gas, Setup, Adjustment and Startup Modes
- **Fi** - Exits the current option and goes on to next.

02 - Analog #2 (0-5 / 0-1 LEL•meters)

- **0** or **1.5** - mA signal output during Test Gas, Setup, Adjustment and Startup Modes.
- **Fi** - Exits the current option and goes on to next.

A1* - Alarm Relay #1 (0-5000 / 0-2000 ppm•meters)

- **En** or **dE** - Energized or De-energized.
- **LA** or **nL** - Latching or Non-Latching.
- **2000** to **4500** - Alarm level, increments by 500 or
- **800** to **1800** - Alarm level, increments by 200.
- (Value increments each time magnet is applied)
- **Fi** - Exits the current option and goes on to next.

A2 - Warn Relay #2 (0-5 / 0-1 LEL•meters)

- **En** or **dE** - Energized or De-energized.
- **LA** or **nL** - Latching or Non-Latching.
- **0.5 (0.1)** to **A3** - Alarm level, increments by 0.5 (0.1).
- (Value increments each time magnet is applied)
- **Fi** - Exits the current option and goes on to next.

A3 - Alarm Relay #3 (0-5 / 0-1 LEL•meters)

- **En** or **dE** - Energized or De-energized.
- **LA** or **nL** - Latching or Non-Latching.
- **A2** to **4.5 (1.8)** - Alarm level, increments by 0.5 (0.1).
- (Value increments each time magnet is applied)
- **Fi** - Exits the Setup Mode, saves the current settings and returns to normal operation.

Fi Exits the Setup Mode, saves the current settings and returns to normal operation.

6.3.1 Setup Mode Options Sheet

SE - Apply Magnet when this code is showing to enter Setup Mode.

bb - Apply magnet when this code is showing to alter the options for Beam Block

5 to **60** - Select how many seconds before sending beam block fault _____

0, 1.5 or **2.0** - Select analog output value during beam block fault _____

0 to **60** - Select minutes of beam block before sending optical fault _____

Fi - Exits Beam Block setup.

01 - Apply magnet when this code is showing to alter the options for Analog Output #1

on or **oF**f - Select whether 0-5000 (0-2000) ppm•meters range is available _____

0 or **1.5** - Select analog output level for Test Gas Mode _____

Fi - Exits Analog Output #1 setup.

02 - Apply magnet when this code is showing to alter the options for Analog Output #2

0 or **1.5** - Select analog output level for Test Gas Mode _____

Fi - Exits Analog Output #2 setup.

A1 - Apply magnet when this code is showing to alter the options for Alarm Relay #1

En or **dE** - Select whether relay is Energized or De-energized _____

LA or **nL** - Select whether relay is Latching or Non-latching _____

2000 to **45**00 (**8**00 to **18**00) - Select where relay alarm level is set

(in ppm•meters) _____

Fi - Exits Warn Relay #1 setup.

A2 - Apply magnet when this code is showing to alter the options for Warn Relay #2

En or **dE** - Select whether relay is Energized or De-energized _____

LA or **nL** - Select whether relay is Latching or Non-latching _____

0.5 (**0.1**) to **A3** level - Select where relay alarm level is set (in LEL•meters) _____

Fi - Exits Warn Relay #2 setup.

A3 - Apply magnet when this code is showing to alter the options for Alarm Relay #3

En or **dE** - Select whether relay is Energized or De-energized _____

LA or **nL** - Select whether relay is Latching or Non-latching _____

A2 level to **4.5** (**0.8**) - Select where relay alarm level is set (in LEL•meters) _____

Fi - Saves changes and exits Setup Mode.

Fi - Apply magnet when this code is showing to save changes and exit Setup Mode.

NOTE: Values in parentheses are for the Heavy Hydrocarbon (Propane) unit.

6.4 "AJ" Alignment/Adjustment Mode

Apply the magnet when "**AJ**" is showing and the unit will enter the Alignment/Adjustment Mode.

This mode allows the user to re-align the Model IR5000 and set a new "zero" value. This mode is covered in Section 5.6 (Applying Power).

6.5 "Fi" Finish

Apply the magnet when "**Fi**" is showing and the unit will exit the Options Mode, save any changes that were made and return to normal operation. This is the only way changes made in setup mode will be saved.

6.6 Maintenance

After the Model IR5000 has been initially aligned, 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 (see Section 5.6 for details).

If the Model 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.

NOTE: The IR5000 will see alcohol and other cleaning solvents.

6.7 Display and Fault Codes

The display codes during normal operation are:

SU Start-Up - This is displayed immediately after power is applied and lasts for approximately two minutes.

SF Re-Start from an optical Fault - This is displayed when an optical Fault condition has been corrected.

0-50 Steady Numeric Indications - This is displayed when a concentration of gas is detected in the operational mode. Lower LED is lit when displaying ppm meters, upper LED is lit when displaying LEL meters.

0-50 Flashing Numeric Indications - This is displayed when a concentration of test gas is at the detector in the test gas mode. Lower LED is lit when displaying ppm meters; upper LED is lit when displaying LEL meters.

Other codes that can appear on the display are Fault codes, which are listed on the following page.

6.8 PPM & LEL Negative Drift Faults

The PPM negative drift fault occurs when the IR5000 is zeroed with a small background gas and strong wind conditions dissipate the remaining gas. Such conditions will cause the PPM range current to go to a fault condition (0.0mA).

A LEL negative drift is an IR5000 source or receiver problem. It is unsafe to use the IR5000 in this condition. A LEL negative drift causes both currents go to zero and the

fault relay to de-energize. The LEL negative drift may occur when the system is first installed and not yet zeroed.

Negative drift on the PPM range is not a dangerous condition as with a LEL negative drift. The PPM negative drift does not put the IR5000 into a total fault. It will however return the PPM current to zero.

The following table summarizes the IR5000 action:

Condition	PPM current	LEL current	Fault relay	Remarks
Normal	4.0 ma	4.0 ma	Energize	
Unit Fault	0.0 ma	0.0 ma	De-energize	After time delay
Negative PPM	0.0 ma	4.0ma	Energize	After time delay
Negative LEL	0.0 ma	0.0 ma	De-energize	After time delay

Table 5 PPM & LEL Faults

6.9 Troubleshooting

If equipment or qualified personnel required to troubleshoot are not available, it is recommended that the defective unit be returned to General Monitors for repair.

CAUTION: General Monitors' warranty will be voided if damage results from repair attempts other than routine replacement of recommended spare parts. Repairs performed by persons other than General Monitors' authorized personnel may void the warranty. Please read the warranty statement carefully (see inside front page). A defective IR5000 Infrared Open Path System should be returned to the factory for repair even if the warranty has expired. A complete written description of the problem should be included with all returned equipment.

The Model IR5000 Infrared Open Path System will indicate a fault code number on the two-digit display as an aid to troubleshooting. The following list identifies the Fault codes, gives a description of the Fault and indicates the corrective action that should be taken:

Multiple Faults will result in alternating fault codes being displayed. All faults have a 10-second delay before activating, unless otherwise noted.

F1: The Receiver Unit is seeing less than optimum infrared from the Source Unit. The unit's windows should be cleaned and optical path checked for blockage.

F2: Motor stalled. Timing error will try to restart the motor for up to five minutes. The unit must be sent in for repair.

F3: The infrared source is too dim. The unit's optical path should be checked for blockage and/or windows cleaned. If this continues, the unit should be returned for repair. Activates Fault relay after user defined Beam Block time-out period.

F4: This code is displayed if there is excess infrared energy being received by the Receiver Unit. This may occur if there is a bright IR source in line with the detector window.

F5: This code is displayed when there is a sudden large change in the infrared energy being received by the detector. This will occur during the cleaning of the optics, or if any obstruction is placed in the optical path.

NOTE: Heavy Hydrocarbon IR5000: If the unit attains a ppm warn level, then goes into an F5 fault within 2 seconds, the unit will activate the LEL alarm relay and Analog Output will go to 20.0mA as this situation is indicative of a catastrophic Propane leak.

F6: The unit is receiving a low line voltage. This will be displayed if the Receiver unit is being supplied with less than 18VDC.

F7: Internal system failure. The unit must be returned for repair.

F8: The unit failed to acquire a zero during alignment/adjustment mode or is responding to a loss of background gas. Attempt to re-zero by re-entering alignment/adjustment mode.

Another reason for this error can be Test Gas Time Out. Remove the gas and apply the magnet to clear the fault.

F9: Open current loop. One or both of the Analog Outputs are open. These must be jumpered, if not being used.

During the **F1**, **F6** and **F9** faults, the unit will attempt to output an alarm if gas is present.

7.0 Appendix

7.1 Specifications

7.1.1 System Specifications

Sensor Type

Infrared Absorption Type

CAUTION: Hydrogen (H_2) gas cannot be detected by the Model IR5000.

7.2 Warranty

Two Years

7.3 Fault Codes

F1, F3, F4 - Low/High IR concentrations

F2 - Timing/Motor failure

F5 - Sudden Change in IR energy

F6 - Low DC supply voltage

F7 - Internal system failure

F8 - Zeroing time-out/Background gas change

F9 - Open current loop

7.4 Response Time

When exposed to full-scale gas concentration in ppm range

T50 $\leq$ 8 seconds & T90 $\leq$ 12 seconds

7.4.1 Linearity

$\pm$10% over full-scale

@ 25°C & 0% Blockage

7.5 Path Length

5 to 130 meters (16 to 426 feet)

7.6 Approvals

CSA, ATEX & CE approved.

Propane applied to Heavy Hydrocarbon unit.

7.7 Mechanical Specifications

Receiver Unit:

Length	16.7 inches/424 mm
Diameter	5.4 inches/137 mm
Weight	9 lbs/4 kg

Source Unit:

Length	12 inches/305 mm
Diameter	6.4 inches/163 mm
Weight	10 lbs/5 kg

7.7.1 Weatherproof Protection (Both):

IP66, Type 4X Enclosure

7.7.2 Electrical Specifications

Electrical Classification

- CSA = Class I, Division 1, Groups C and D
- ATEX = EExd IIB T4 Tamb = -40°C TO +60°C

7.8 Power

- 24VDC @ 30Watts (nominal) - Source
- 24VDC @ 25Watts (nominal) - Receiver
- 20 to 32VDC range (maximum)

7.8.1 Contact Relay Ratings

- 4 SPDT,
- 5A @ 250VAC,
- 5A @ 30VDC,
- Resistive Max

7.8.2 Analog Signal Output (600 ohms max.)

Range	0-22mA
Malfunction or PPM Neg. Drift	0mA**
Beam Block	1.5mA (std)/ User selectable
Test Gas	1.5mA (std)/ User selectable

0 to 5000 ppm•meters Proportional over full scale	4-20mA (01)
0 to 5 LEL•meters Proportional over full scale	4-20mA (02)
Overrange	20-2 mA

*0 to 2000 ppm•meters and 0 to 1 LEL•meters on Heavy Hydrocarbon (Propane) unit.
** PPM Range Negative Drift only causes the ppm current to go to zero.

7.8.3 Recommended Cable Lengths

It is the responsibility of the facilities engineer to comply with all regulatory, legal and safety issues concerning appropriate wiring for the facility.

Power cable between 24VDC power supply and IR5000 receiver.
The maximum typical current to the IR5000 receiver is 0.9Amps. Annealed copper wire characteristics are incorporated in Table 6 for ambient temperature of 80º C which is the worst case condition.

AWG	FEET	METERS
#20	166	50
#18	264	80
#16	421	128
#14	669	204

Table 6 Recommended Power Cable distance between 24VDC Power Supply and IR5000 Receiver. Minimum Voltage at the receiver is 20V

Power cable between 24VDC power supply and IR5000 sensor.
The maximum typical current to the IR5000 source is 1.4 Amps. Annealed copper wire characteristics are incorporated in Table 7 for ambient temperature of 80º C which is the worst case condition.

AWG	FEET	METERS
#20	107	32
#18	170	51
#16	270	82
#14	430	131

Table 7 Recommended power cable distance between 24VDC power supply and IR5000 source. Minimum voltage at the IR5000 source is 20V.

Analog Output Signal – Recommended cable length between the IR5000 device and an external device with an internal input impedance of 250ohms. Analog current is 4 to 20mA. Annealed copper wire characteristics are incorporated in Table 8 for ambient temperature of 80º C which is the worst case condition.

AWG	FEET	METERS
#20	2400	730
#18	3800	1158
#16	5200	1585
#14	9000	2743

Table 8 Recommended Cable Length for Analog Output between IR5000 and a device with an input impedance of 250ohms.

7.8.4 Environmental Specifications

Operating Temperature Range

-40°F to +140°F -40°C to +60°C

Operating Humidity Range

0 to 95% Relative Humidity (non-condensing)

7.8.5 Vibration Specification

BS2011 Part 2.1 and ISA/CSA C22.2 No. 152

7.9 Engineering Documentation

7.9.1 Outline - Source Unit

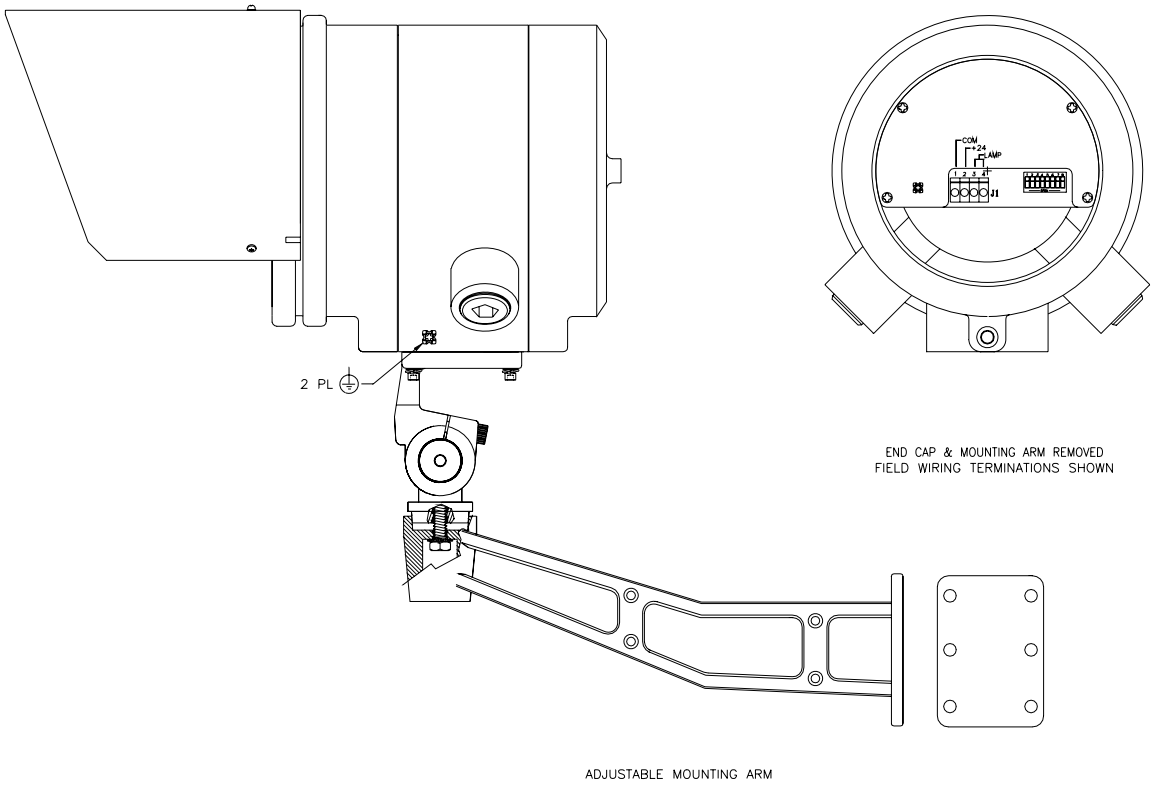


Figure 26 Outline Drawing, Source

7.9.2 Outline - Receiver Unit

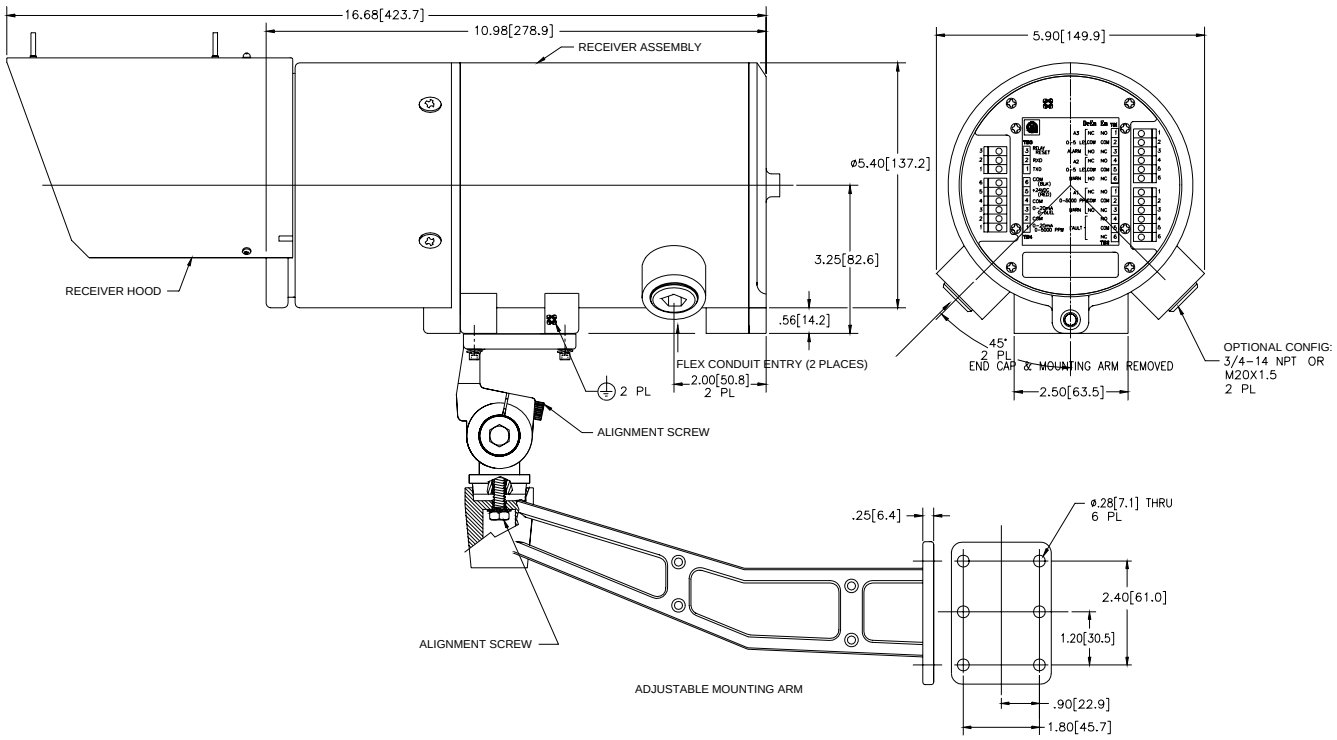


Figure 27 Outline Drawing, Receiver

7.9.3 Outline – Source & Receiver European Units

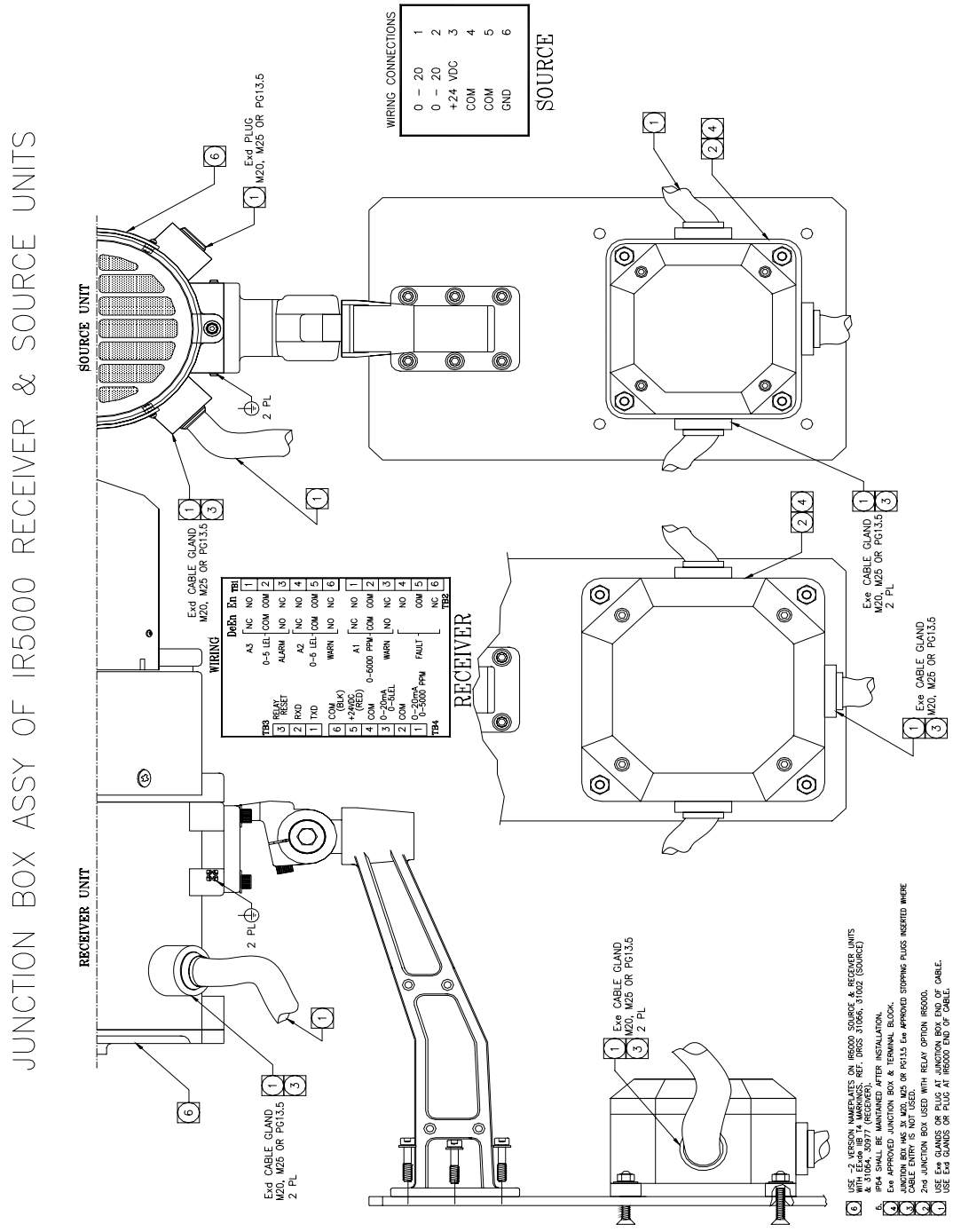


Figure 28 Junction Box Assembly of IR5000 Receiver & Source European Units

7.9.4 IR5000 Block Diagram

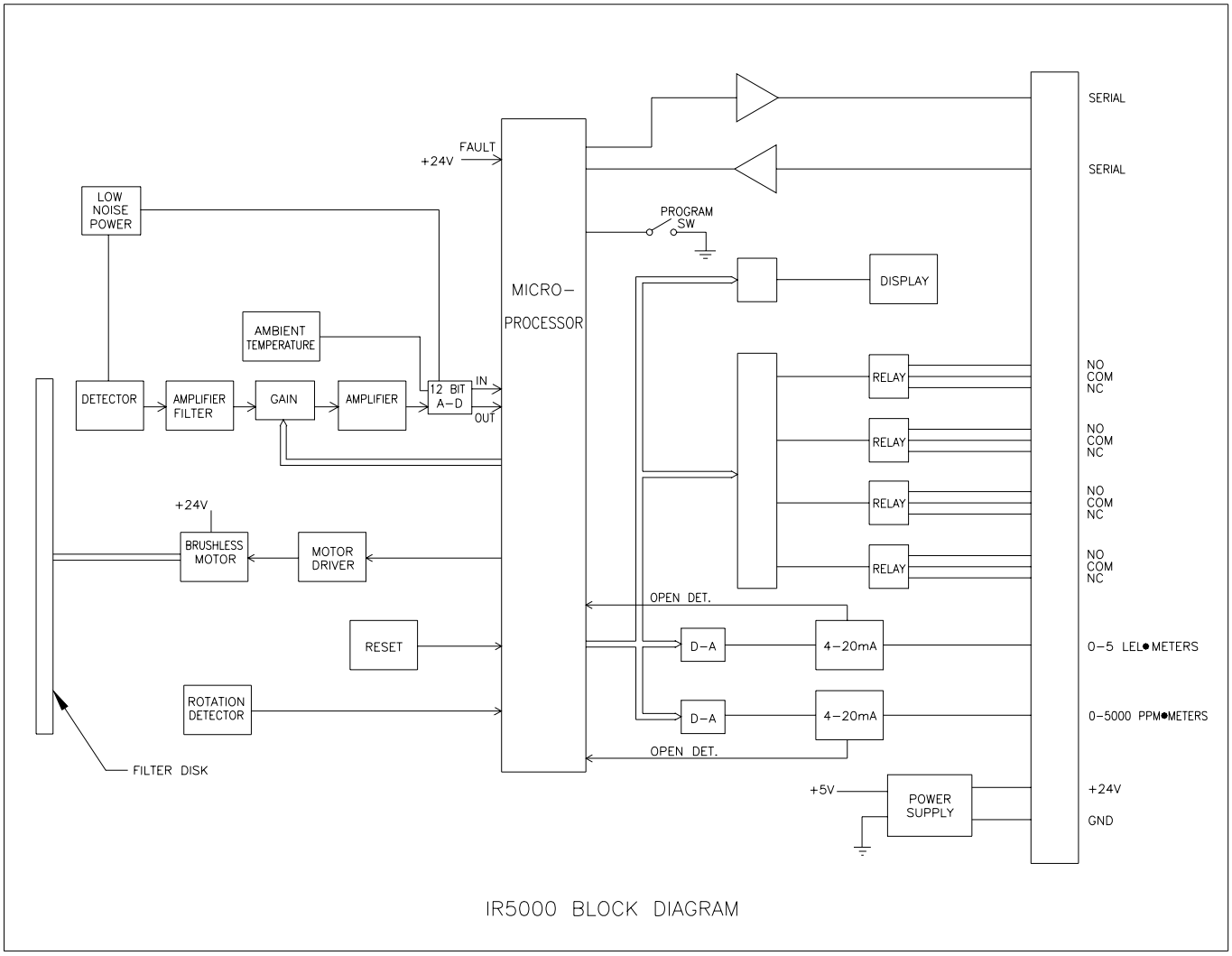


Figure 29 IR5000 Block Diagram

7.9.5 Grounding Connections

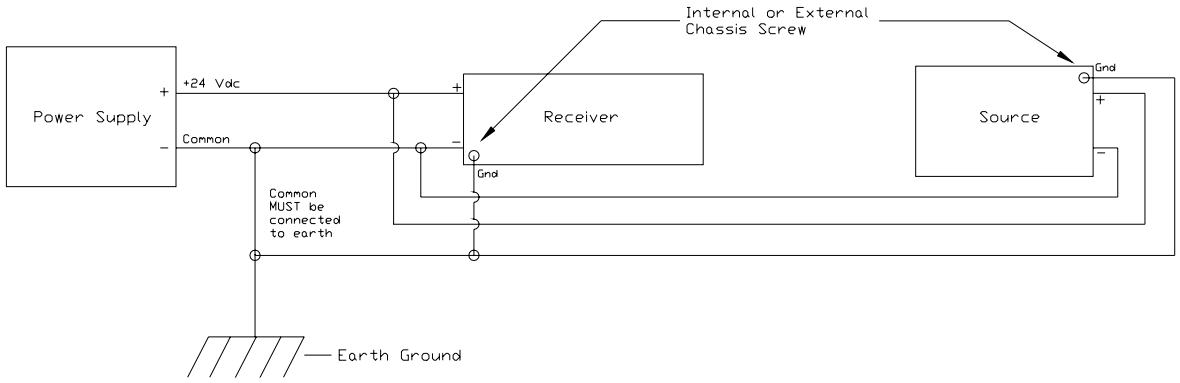


Figure 30 Grounding Connections

7.9.6 Mounting Arm

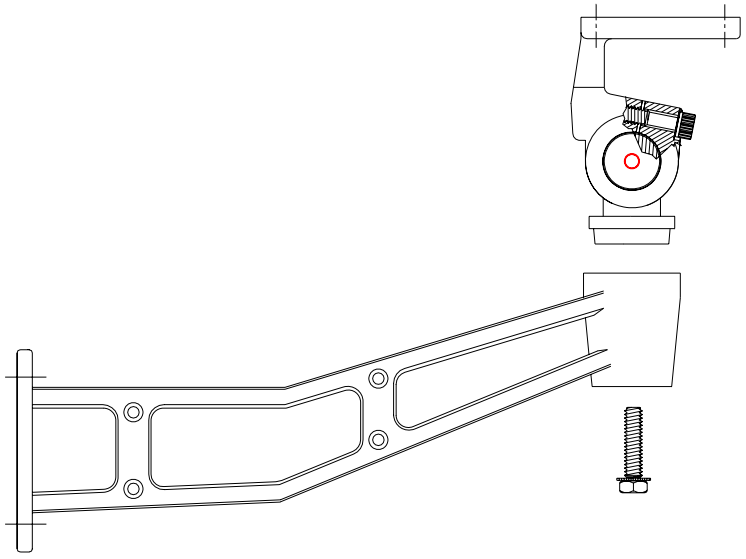


Figure 31 Mounting Bracket Assembly

7.9.7 Aperture Plate

Used on the Source Unit for 5-20 Meter installations.

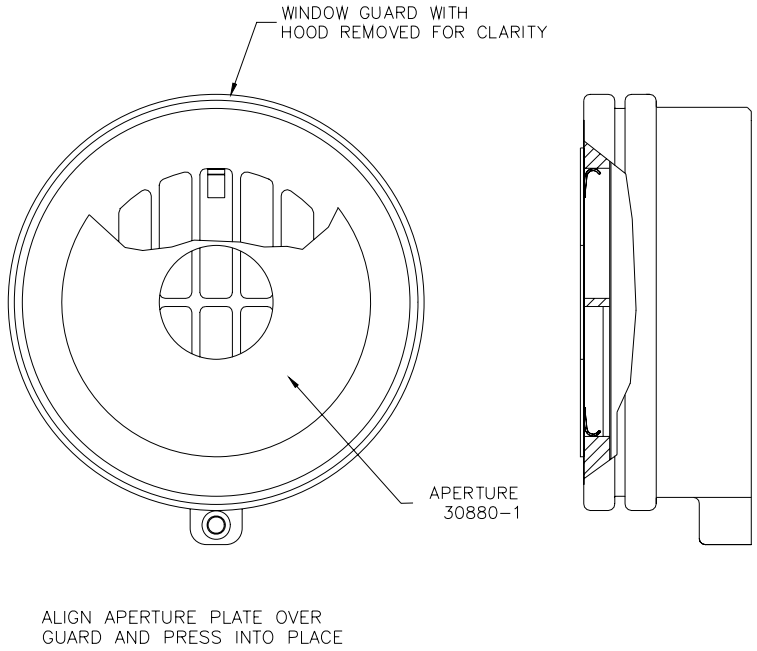


Figure 32 Aperture Plate

7.10 Ordering Information

7.10.1 System Components

Instruction Manual - Model IR5000; Part Number: MANIR5000

7.10.2 Spare Parts

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

- Part Number
- Description
- Quantity

30878-1 Test gas filter set (standard unit)

30878-2 Test gas filter set (heavy HC unit)

30985-1 Mounting arm

30960-1 Source unit →

30900-1 Receiver unit →

Contact Sales Representative or factory for assistance when ordering

31080-1 Test gas filter set (standard unit)

31080-2 Test gas filter set (heavy HC unit)

NOTE: 31080-1 and 31080-2 are the upgrades of 30878-1 and 30878-2; respectively. 30878-1 and 30878-2 are still available for older units.

Recommended Spare Parts for one (1) Year:

Qty.	Part#	Description
1	31037-1	Magnet Assembly

7.10.3 Accessories

30880-1: Aperture Plate: Used on the Source Unit for 5-20 Meter installations (see Figure 32)

7.11 General Monitors' Offices

Area	Phone/Fax/Email
UNITED STATES	
	Toll Free: +1-800-446-4872
Corporate Office: 26776 Simpatica Circle Lake Forest, CA 92630	Phone: +1-949-581-4464 Fax: +1-949-581-1151 Email: info@generalmonitors.com
9776 Whithorn Drive Houston, TX 77095	Phone: +1-281-855-6000 Fax: +1-281-855-3290 Email: gmhou@generalmonitors.com
UNITED KINGDOM	
Heather Close Lyme Green Business Park Macclesfield, Cheshire, United Kingdom, SK11 0LR	Phone: +44-1625-619-583 Fax: +44-1625-619-098 Email: info@generalmonitors.co.uk
IRELAND	
Ballybrit Business Park Galway, Republic of Ireland	Phone: +353-91-751175 Fax: +353-91-751317 Email: info@gmil.ie
SINGAPORE	
No. 2 Kallang Pudding Rd. #09-16 Mactech Building Singapore 349307	Phone: +65-6-748-3488 Fax: +65-6-748-1911 Email: genmon@gmpacifica.com.sg
MIDDLE EAST	
LOB12, #G20 P.O. Box 61209 Jebel Ali, Dubai United Arab Emirates	Phone: +971-4-8815751 Fax: +971-4-8817927 Email: gmme@emirates.net.ae

Table 9 GM Locations

7.12 Other Sources of Help

General Monitors provides extensive documentation, white papers, and product literature for the company's complete line of safety products, many of which can be used in combination with the FL4000. Many of these documents are available online at the General Monitors website at http://www.generalmonitors.com.

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.