GENERAL MONITORS

Model IR5000

Infrared Open Path Detector
For Hydrocarbon Gas
Applications

Instruction Manual **12/03**

Part No. **MANIR5000**
Revision **K/12-03**

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.

Each unit is tested by the factory, however, a complete system check-out 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:

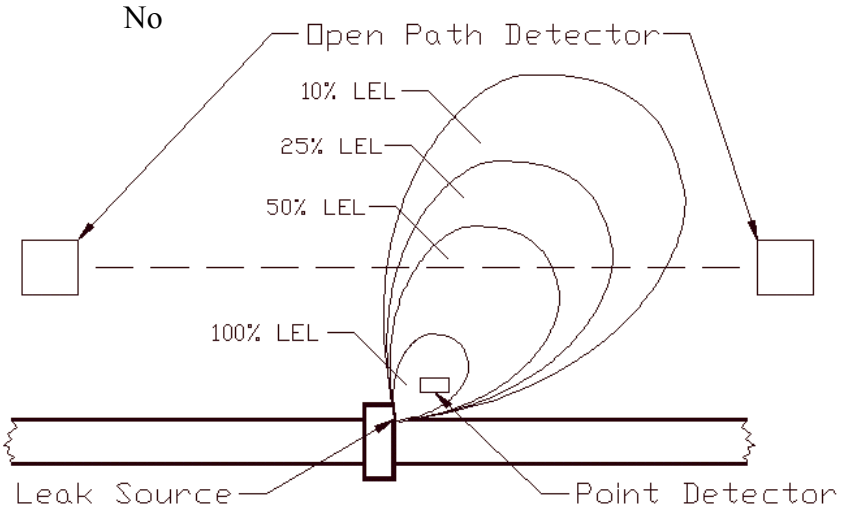


Figure 1 Indoor Gas Cloud

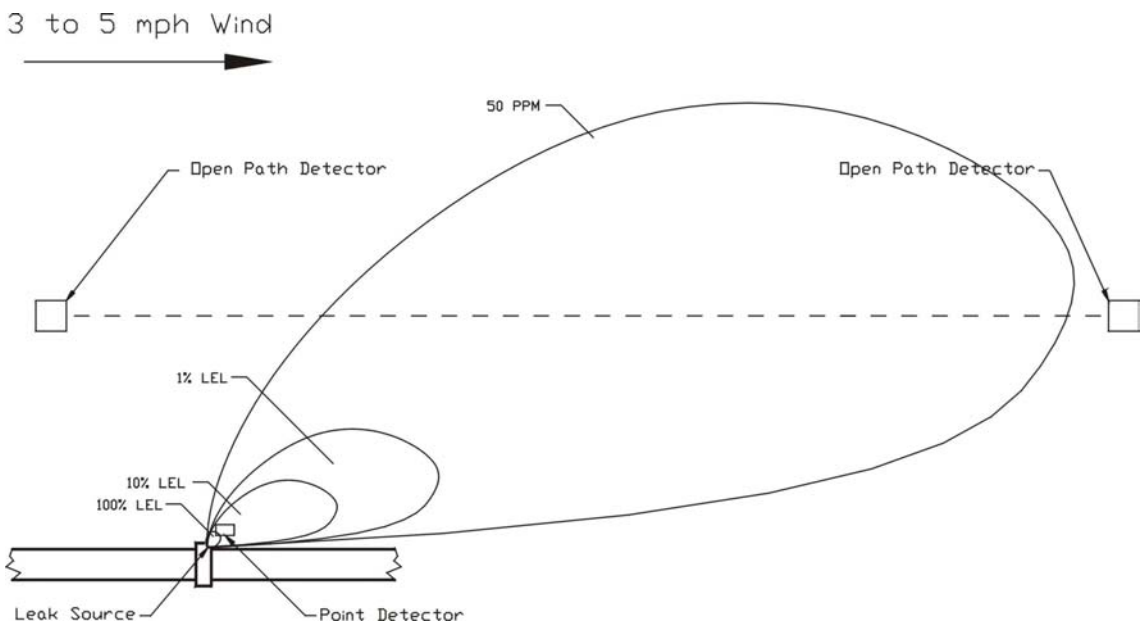


Figure 2 Outdoor Gas Cloud

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 +24 volt 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 4and 32

Possible installation:

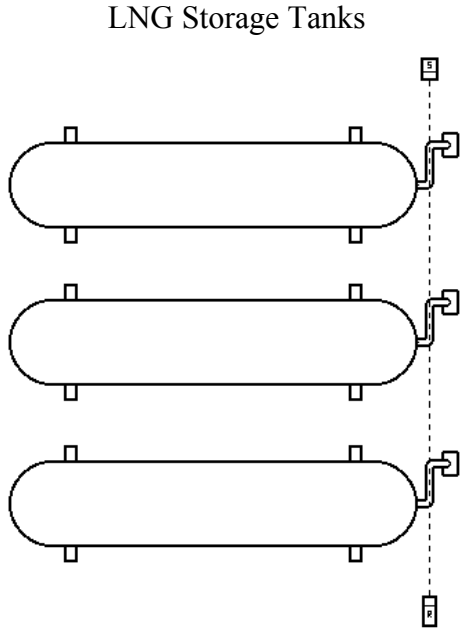


Figure 3 LNG Storage Tank Application

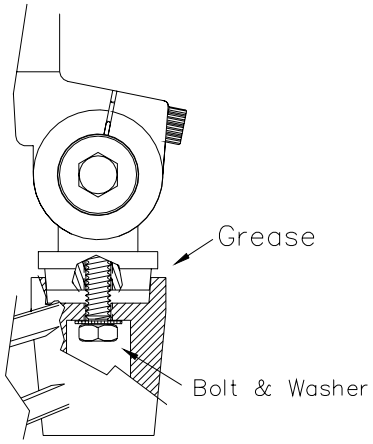


Figure 4 System Mounting Hardware

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

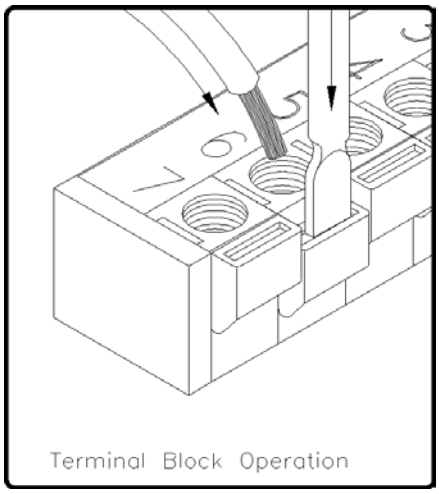


Figure 5 Terminal Block Operation Diagram

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.

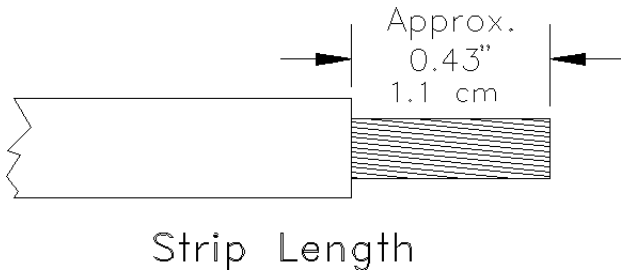


Figure 6 Wire Strip Length Diagram

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 +24 VDC

Receiver:

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

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.

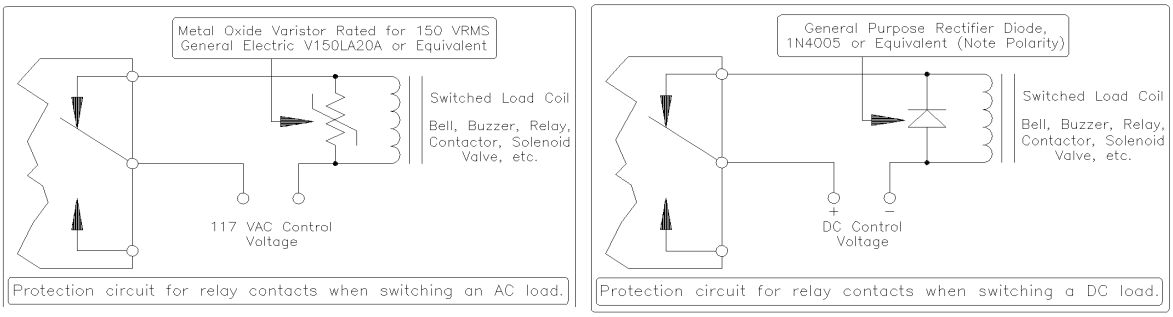


Figure 7 Relay Contact Protection for AC/DC Loads

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.

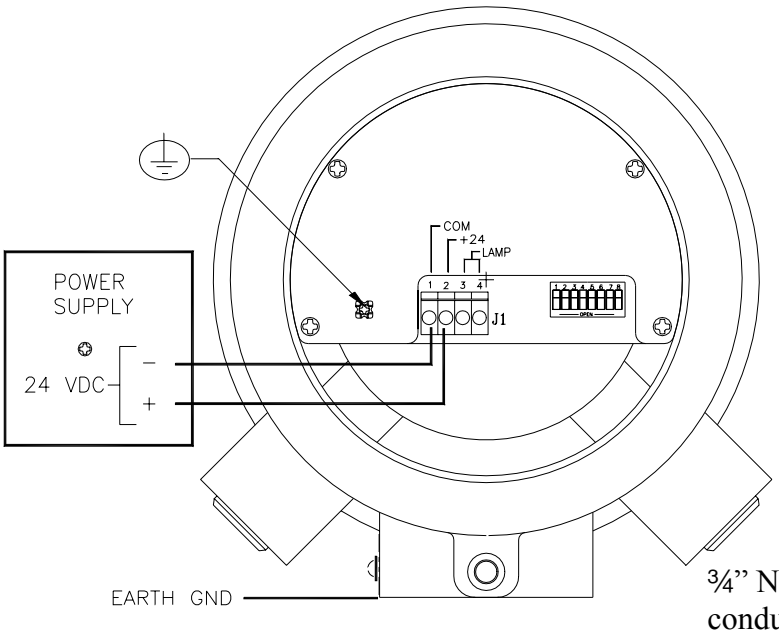
NOTE: The FAULT Relay is energized and non-latching in normal operation. There are no software selectable options that are associated with the FAULT Relay.

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	

IR Source Terminal



¾” NPT or M20x1.5 flexible conduit connections (2 places as required)

Cover removed for clarity

Figure 8 Source - Terminal Block Location

IR SOURCE - TERMINAL BLOCK LOCATION

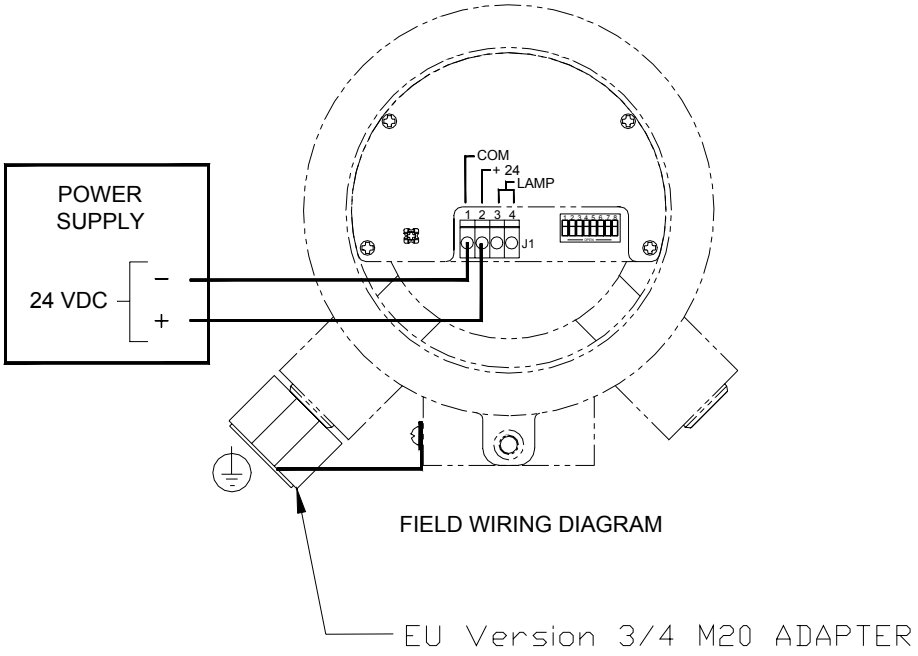


Figure 9: European Union Source - Terminal Block Location

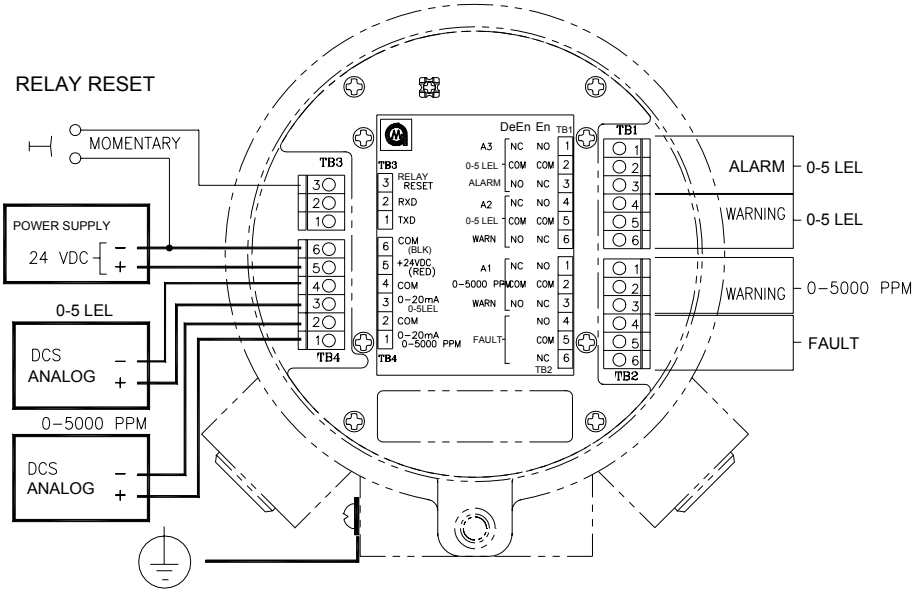


Figure 10 Receiver - Terminal Block Location

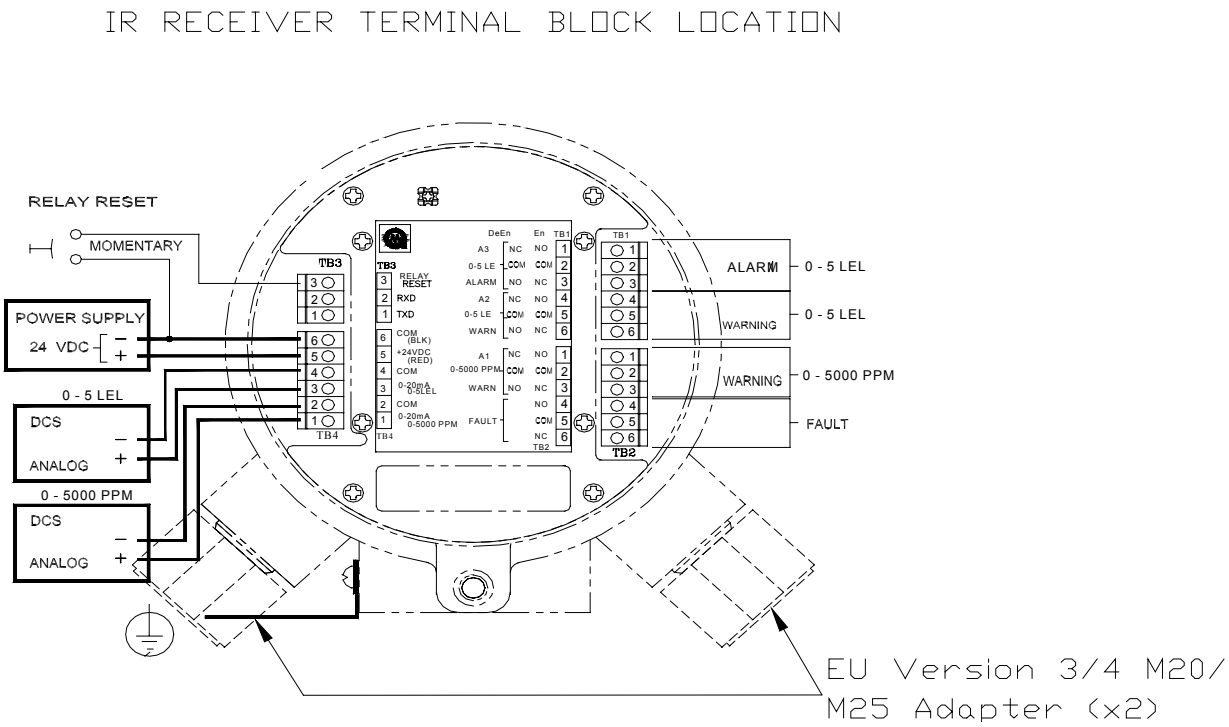


Figure 11 European Union Receiver - Terminal Block Location

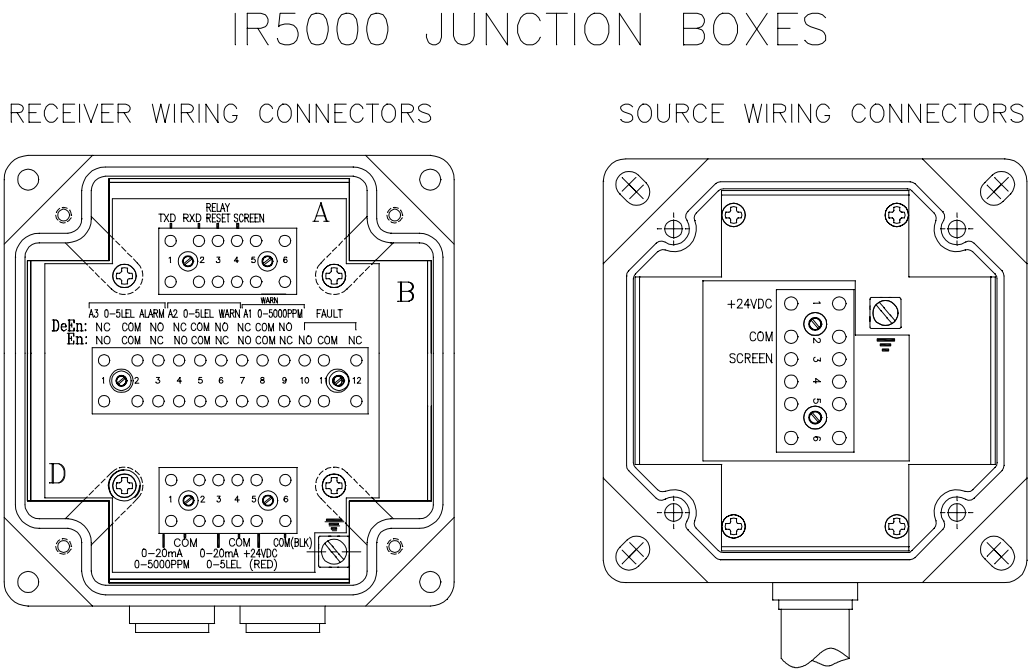


Figure 12 European IR5000 Junction Boxes

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 setup 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.

Worldwide Service is available by calling:

Lake Forest, California	Phone 949	+1-949-581-4464
(24 hr. service)	Fax	+1-949-581-1151
Houston, Texas	Phone	+1-281-855-6000
	Fax	+1-281-855-3290
Ireland Phone	Phone	+353-91-751175
	Fax	+353-91-751317
Singapore	Phone	+65-748-3488
	Fax	+65-748-1911
United Arab Emirates	Phone	+971-4-8815751
	Fax	+971-4-8817927
United Kingdom	Phone	+44-1625-619-583
	Fax	+44-1625-619-583