GENERAL MONITORS

Model IR4000S CO$_2$

Single-Point Carbon Dioxide Monitor

Instruction Manual   **12-11**

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Special tools:

- 5mm Allen wrench for cover (included with unit)

- 0.1" flat-head screwdriver for wiring (included with unit)

- Adjustable wrench for conduit or cable gland connections (not included).

Mounting:

Allow convenient access to the front panel display and magnet switch input.

Leave sufficient room to attach cabling. Keep cable run distances below specified limits.

Although the Model IR4000S CO$_2$ is RFI-resistant, where possible, mount it away from heavy power cabling, radio transmitters, or similar equipment.

Where possible, locate the IR4000S CO$_2$ away from excessive heat and vibration and as free as possible from wind, dust, water, and direct sunlight.
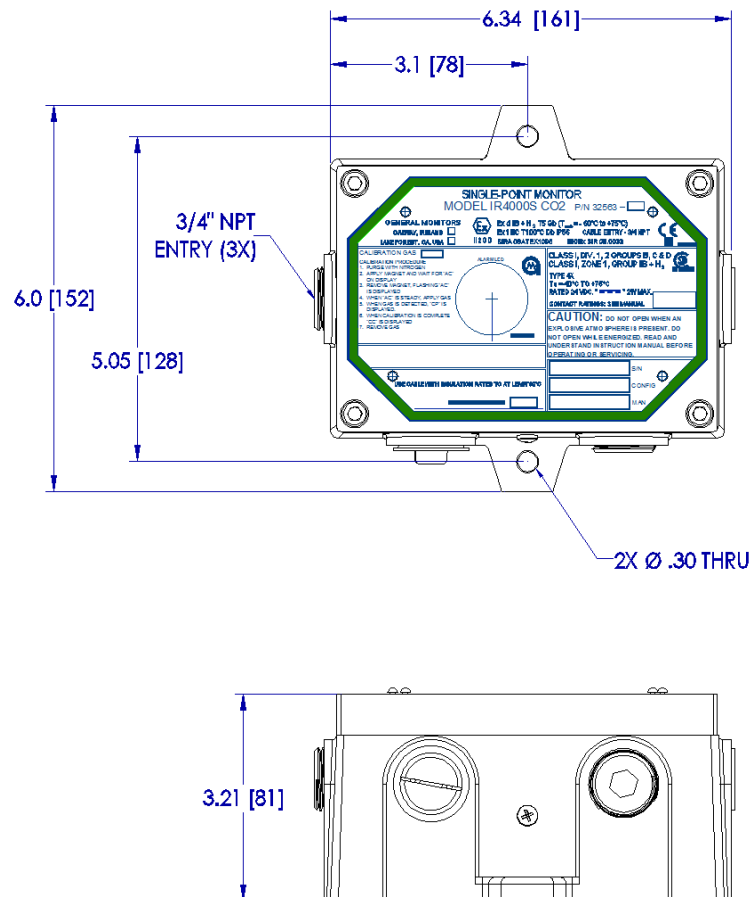
Figure 1: IR4000S CO$_2$ Outline and Mounting Dimensions, in inches [mm]

Cabling and Wiring

WARNING: Seal conduit entries per Class I hazardous location requirements. Under **NO** circumstances should equipment be connected or disconnected when under power. Equipment damaged in this manner is not covered under warranty.

CAUTION: Do not use a sealant that contains acetic acid. Use precautions to avoid equipment damage by static electricity.

- The cable **armor** must be connected to **safety earth** in the safe area.

- The cable screen (drain wire) must be connected to an instrument earth in the safe area.

- Three-wire shielded cable is recommended for power and signal connections.

- The push terminal blocks accept 24 AWG to 16 AWG stranded or solid wire (0.2 mm^2 to 1.5 mm^2). The screw terminal blocks accept 26 AWG to 14 AWG (0.14mm^2 to 2.5 mm^2).

- Power to the IR4000S CO$_2$ must remain OFF until all wiring is completed and the start-up readiness checklist has been verified. Wire installation order:

  1. Common (COM) and Field Ground (FG) wires

  2. Modbus (MOD), Analog (mA), CAL and relay wires (RLY, ALARM, WARN, and FAULT)

  3. 24 VDC power
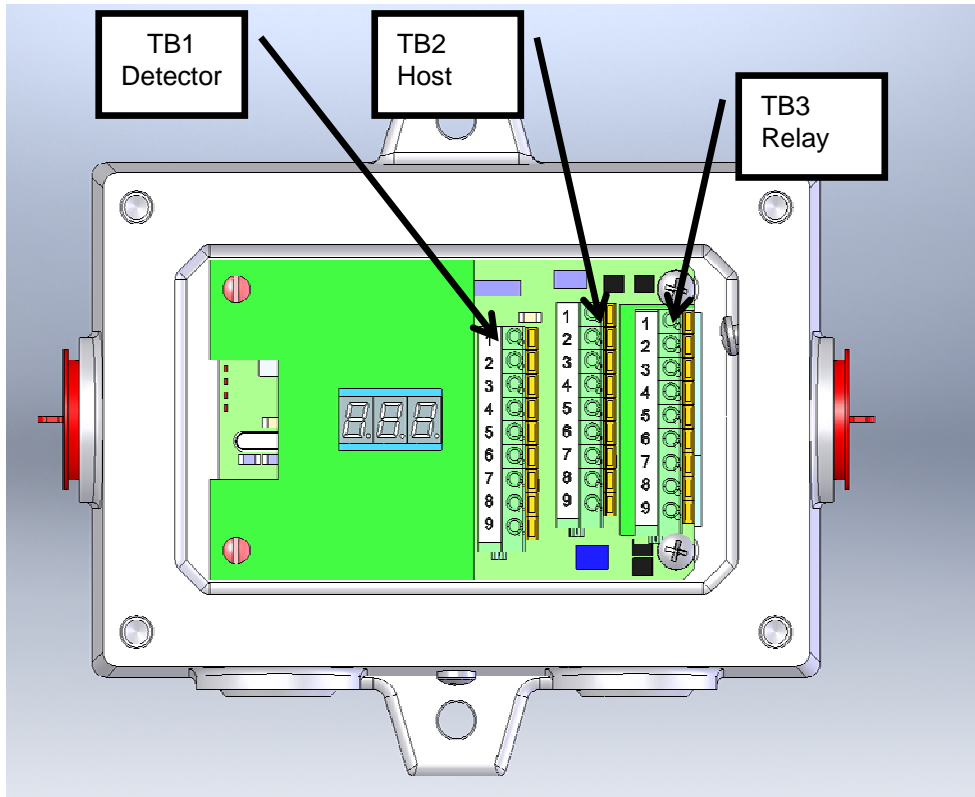
Figure 2: IR4000S CO$_2$ Terminal Block Connectors

TB1 - Detector Terminal	
Pin #	SIGNAL
1	4-20 mA IN
2	CAL IN
3	COM
4	FGND
5	IR700 MOD +
6	IR700 MOD -
7	COM
8	+24 V
9	+24 V

TB2 - HOST Terminal	
Pin #	SIGNAL
1	4-20 mA out
2	IR700 MOD -
3	IR700 MOD +
4	NOT USED
5	NOT USED
6	CAL/ARGC
7	RLY RST
8	COM
9	+24 V IN

TB 3 - Relay Terminal		
Pin #	DE-ENERGIZED	ENERGIZED
1	ALARM-NC	ALARM-NO
2	ALARM-C	ALARM-C
3	ALARM-NO	ALARM-NC
4	WARN-NC	WARN-NO
5	WARN-C	WARN-C
6	WARN-NO	WARN-NC
7	FAULT-NC	FAULT-NO
8	FAULT-C	FAULT-C
9	FAULT-NO	FAULT-NC

Applying Power

Before applying power for the first time, check the following:

- Verify that the junction box lid is securely installed, unless the area has been declassified.

- Inhibit any external devices, such as Trip Amplifiers, PLC devices or DCS systems.

- Verify that the power supply is connected properly. The Model IR4000S CO$_2$ and IR700 are powered by +24 VDC (20 to 36 VDC voltage range). The IR4000S CO$_2$ will display a fault code if the power supply voltage is at or below 18 VDC.

- Power-up Sequence

    1. 000 and Alarm indicator

    2. All display elements (8.8.8.) and both Alarm and Warn indicators

    3. Software revision (for example revision A will display: r A)

    4. bSU (base Start Up)

    5. SU (IR700 Start Up)

    6. Gas concentration in 100 ppm

Please consult the remainder of the manual for more information on calibration, operation, and other product features.

1.0 Introduction

1.1 Protection for Life

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 this instruction manual. Remember, these products are for your safety.

1.2 Special Cautions and Warnings

This instruction manual includes numerous cautions and warnings that are included to prevent injury to personnel and prevent damage to equipment.

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

1.3 Installation, Operation, and Maintenance

Before power up, verify wiring, terminal connections and stability of mounting for all integral safety equipment.

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.

Periodic testing/calibrating should be performed per the manufacturer's recommendations and instructions.

When testing produces results outside of the manufacturer's specifications, re-calibration or repair/replacement of the suspect device(s) should be performed as necessary. Calibration check and 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 Product Description

Figure 3: IR4000S CO$_2$ Single-Point Monitor

2.1 IR4000S CO$_2$ Monitor

The Model IR4000S CO$_2$ Single-Point Monitor is a display and user interface for the Model IR700 point IR gas detector. The monitor allows local calibration and displays gas concentration. Relays are optional. The relays provide output for Alarm, Warn, and Fault conditions.

2.2 Features and Benefits

The IR4000S CO$_2$ system enhances the features and benefits of the IR700 in several important ways:

- Local interface provides ease of maintenance and accessibility

- Bright display permits clear indication

- Explosion-proof enclosure and magnetic interface allow installation and calibration in hazardous locations

- Optional 8 Amp relays expand system functions, potentially eliminating the need for additional equipment such as a PLC

3.0 Installation

⚠ **CAUTION:** The IR4000S CO$_2$ Single-Point Monitor 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.

⚠ Installation and Maintenance must be carried out by suitably skilled and competent personnel only.

Special Tools

- 5mm Allen wrench for lid (included with unit).
- 0.1" flat-head screwdriver for terminal block connections (included with unit).
- Adjustable wrench for conduit or cable gland connections (not included).

Installation Step	Refer to Section
1. Unpack the equipment and prepare for installation	Section 3.1
2. Attach each IR700 to a junction box or directly to the IR4000S CO$_2$	Section 3.3
3. Mount the IR700, IR4000S CO$_2$ units in place. (Steps 3 and 4 can be swapped if it is easier to attach cabling before the units are mounted in place.)	Section 3.2
4. Wire the IR4000S CO$_2$ to the IR700 and any remote devices	Section 3.3
5. Power on the equipment	Section 3.4
6. Gas check or calibrate the IR700	Section 4.2 or 4.4

Table 1: IR700/IR4000S CO$_2$ Installation Overview

3.1 Unpacking the Equipment

All equipment shipped by General Monitors is packaged in shock absorbing containers, which provide considerable protection against physical damage. The contents should be carefully removed and checked against the packing list.

If any damage has occurred or there is any discrepancy in the order, please notify General Monitors as soon as possible. All subsequent correspondence

with General Monitors must specify the equipment part number and the serial number. Both are on the cover of the IR4000S CO$_2$.

3.2 Mounting

Allow convenient access to the monitor in order to input local configurations and calibrate via the magnetic switch on the cover.

Leave sufficient room to attach cabling. Keep cable run distances below specified limits.

Although the Model IR4000S CO$_2$ is RFI-resistant, where possible mount it away from heavy power cabling, radio transmitters, or similar equipment.

Locate the IR4000S CO$_2$ away from concentrated sources of heat or light. It should be mounted in areas that are free from excessive vibration and as free as possible from wind, dust, water, and direct sunlight.
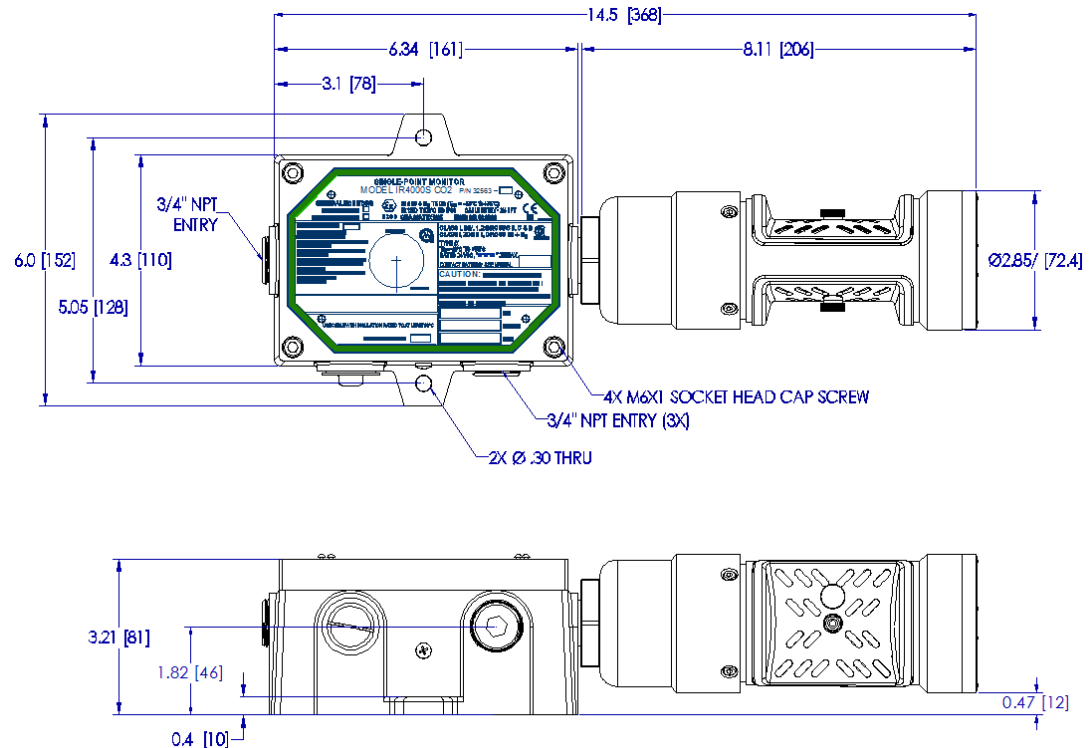
Figure 4. IR4000S CO$_2$ with IR700 Mounting Dimensions, in inches [mm]
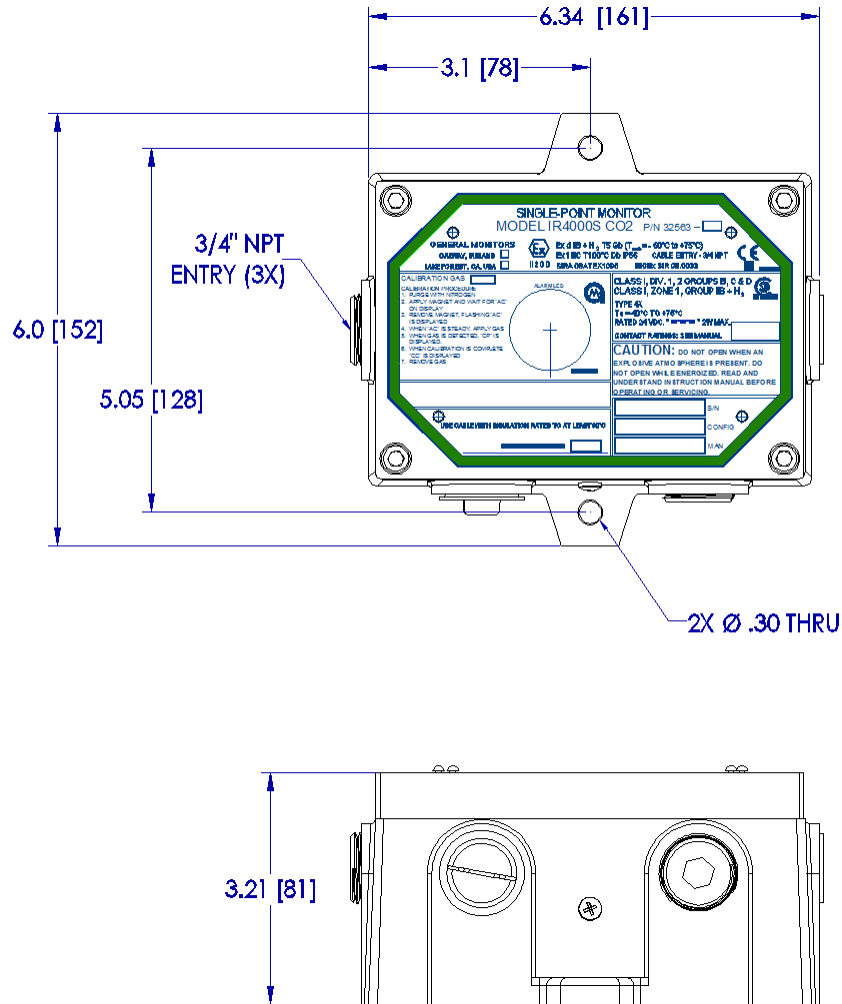
Figure 5: IR4000S CO$_2$ Outline and Mounting Dimensions, in inches [mm]

Applying Sealants to Conduit Entries

Please keep the following warnings and cautions in mind when you install the IR4000S CO$_2$, to make sure that the equipment maintains the appropriate seals for a Class I hazardous location.

WARNING: Each conduit run from an IR700 junction box or IR4000S CO$_2$ housing within a hazardous location (and from a hazardous to a non-hazardous location) must be sealed so that gases, vapors, and/or flames cannot pass beyond the seal. The purpose of seals in a Class I hazardous location is to prevent the passage of gases, vapors, or flames from one electrical installation to another through the conduit system. For information on Class I location seals, see NEC Articles 501-5 and 500-3d.

WARNING: Unused cable entry holes must be sealed with approved explosion-proof stopping plugs. Red caps supplied by General Monitors are for dust protection only, and must not be left on the unit when installed.

CAUTION: Acetic acid will cause damage to metal components, metal hardware, ceramic ICs, etc. If damage results from the use of a sealant that contains acetic acid (RTV silicone), the warranty will be void.

To prevent corrosion due to moisture or condensation, it is recommended that the conduit connected to the Model IR4000S CO$_2$ housing be sealed or contain a drain loop.

3.3 Cabling and Wiring

3.3.1 Cabling Safety Notices

CAUTION: The IR4000S CO$_2$ 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: Under **NO** circumstances should equipment be connected or disconnected when under power. This is contrary to hazardous area regulations and may also lead to serious damage to the equipment. Equipment damaged in this manner is not covered under warranty.

WARNING: For safety, ground cabling must always be connected first, before other cabling is connected. The 24 VDC power cabling should be connected last (and disconnected first). Power supply connections to the IR4000S CO$_2$ must remain OFF until all wiring is completed and the start-up readiness checklist has been verified. Refer to the manual for the power supply being used for instructions.

3.3.1.1 European Union (EU) Approved Cable Armor and Screens

Interconnecting cables must have an overall screen or screen and armor. Cables BS5308 Part 2, Type 2 or equivalent are suitable. Note that the terms 'screen' and 'shield' are equivalent for the purpose of this manual. The cable armor must be terminated in a suitable cable gland at the detector to ensure a positive electrical connection.

3.3.1.2 Cable Termination in Non-Hazardous Areas

The cable **armor** must be connected to **safety earth** in the safe area.

The cable **screen** (drain wire) must be connected to an **instrument earth** in the safe area.

The power supply **0V return** must be connected to an **instrument earth** in the safe area.

The interconnecting cables should be segregated from power and other noisy cables. Avoid proximity to cables associated with radio transmitters, welders, switch mode power supplies, inverters, battery chargers, ignition systems, generators, switch gear, arc lights and other high frequency or high power switching process equipment.

In general, maintain separation of at least 1 meter between the instrument and other cables. Greater separations are required where long parallel cable runs are unavoidable. Avoid running instrument cable trenches close to lightning conductor earthing pits.

Complete all cable insulation testing before connecting the cable at either end.

3.3.2 Wiring

Figure 6 shows the IR4000S CO$_2$ terminal block connectors TB1, TB2 and TB3, which hold the wiring that connects the IR4000S CO$_2$ to the IR700 (Detector), local alarms (Relay), and control room equipment (HOST). You must remove the cover from the IR4000S CO$_2$ enclosure to access these connectors. The inside of the cover includes a label that lists the function of each connector location.

WARNING: For safety, ground cabling must always be connected first, before other cabling is connected. The 24 VDC power cabling should be connected last (and disconnected first). Power supply connections to the IR4000S CO$_2$ must remain OFF until all wiring is completed and the start-up readiness checklist has been verified. Refer to the manual for the power supply being used for instructions.
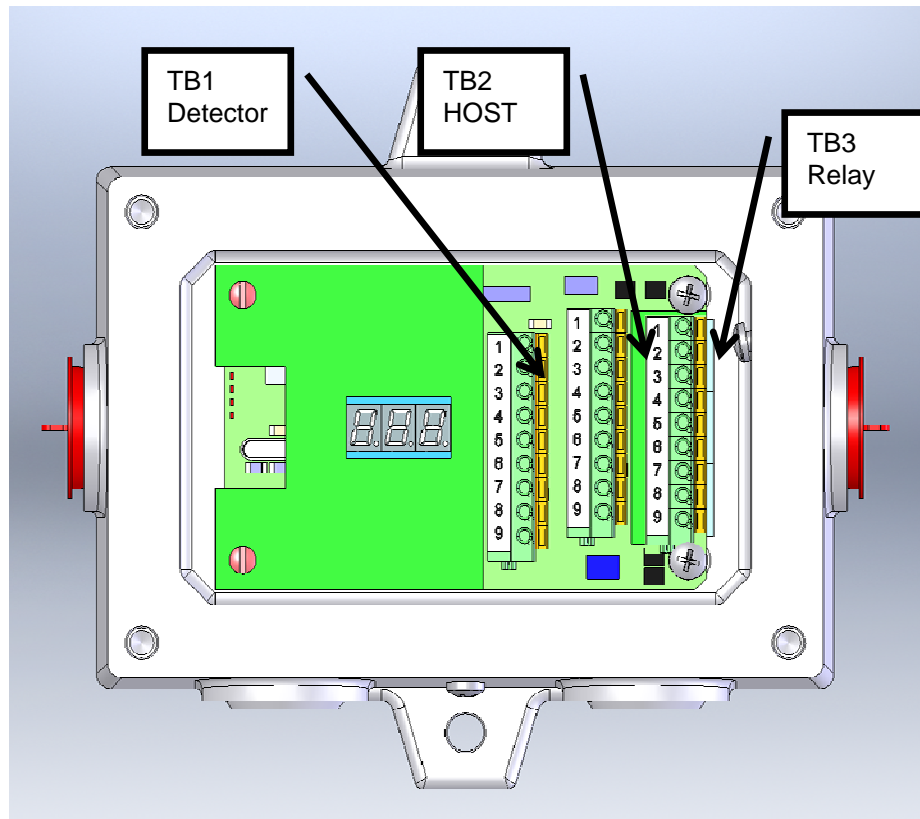

Figure 6: IR4000S CO$_2$ Terminal Block Connectors

TB1 - Detector Terminal		TB2 - Host Terminal		TB3 - Relay Terminal		
Pin #	SIGNAL	Pin #	SIGNAL	Pin #	DE-ENERGIZED	ENERGIZED
1	4-20mA IN	1	4-20mA out	1	ALARM-NC	ALARM-NO
2	CAL IN	2	IR700 MOD -	2	ALARM-C	ALARM-C
3	COM	3	IR700 MOD +	3	ALARM-NO	ALARM-NC
4	FRAME GND	4	NOT USED	4	WARN-NC	WARN-NO
5	IR700 MOD +	5	NOT USED	5	WARN-C	WARN-C
6	IR700 MOD -	6	CAL/ARGC	6	WARN-NO	WARN-NC
7	COM	7	RLY RST	7	FAULT-NC	FAULT-NO
8	+24V	8	COM	8	FAULT-C	FAULT-C
9	+24V	9	+24V IN	9	FAULT-NO	FAULT-NC

CAUTION: Contact with PCB components should be avoided to prevent damage by static electricity. All wire connections are made to the terminal blocks.

NOTE: It is recommended that you use three-wire shielded cable to make power and signal connections to the Model IR4000S CO$_2$. The push terminal blocks accept 24 AWG to 16 AWG stranded or solid wire (0.2mm^2 to 1.5 mm^2). The screw terminal blocks accept 26 AWG to 14 AWG (0.14mm^2 to 2.5 mm^2). You must strip each wire before wiring the IR4000S CO$_2$. Remove 3/8 to 1/2 inch (10 to 12 mm) of insulation.

To Attach Wiring to an IR4000S CO$_2$ Terminal Block:

1. Remove the IR4000S CO$_2$ enclosure cover by loosening the four captive screws and lifting the cover straight up.

2. For push terminals, insert a screwdriver into the orange tab and press down, opening the terminal. For screw terminals, turn the screw counterclockwise to open.

3. Insert the stripped wire into the terminal. For push terminals, release the orange tab to clamp the wire in the terminal. For screw terminals, turn the screw clockwise to clamp the wire. GENTLY tug on the wire to make sure it is locked securely in place.
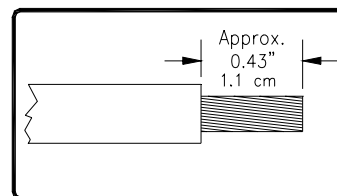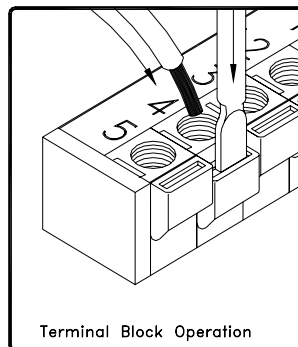
Figure 7: Push Type Terminal
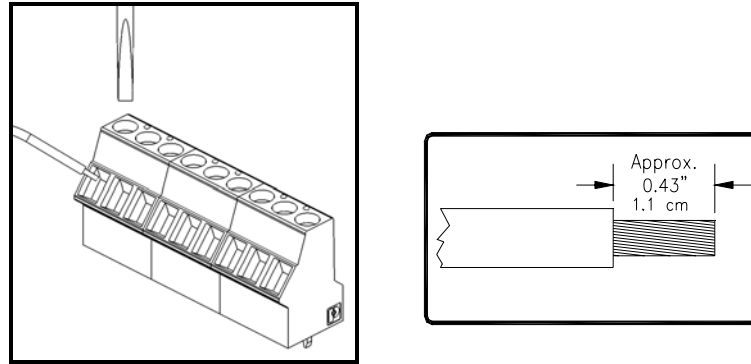
Figure 8: Screw Type Terminal

4. Connect the wires in the following order:

    - Common (COM) and Field Ground (FG) wires

    - Modbus (MOD), Analog (mA), CAL and relay wires (RLY, ALARM, WARN, and FAULT)

    - 24 VDC power

NOTE: If the 4-20 mA Out (TB-2, pin 1) is not being used, a jumper must be placed between TB-2, pin 1 and a COM pin, such as TB-1, pin 3 to complete the AO circuit.

5. When wiring is complete, replace the IR4000S CO₂ cover and tighten the four captive screws.
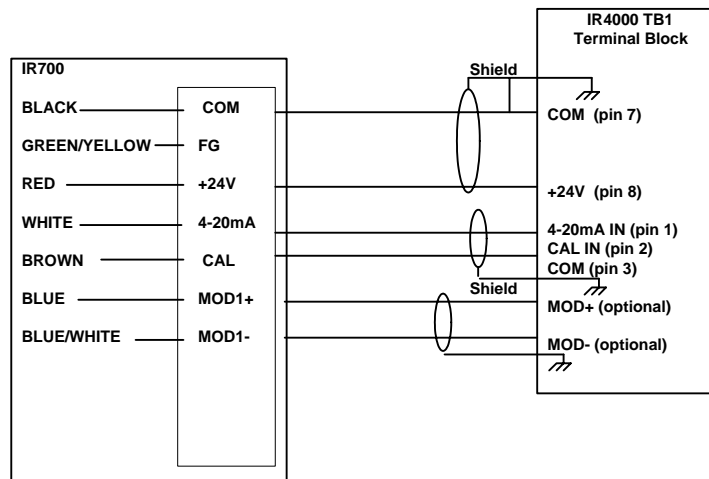
Figure 9: Connecting IR700 Signal Wires to the TB1 Block

3.3.3 Connecting Alarm Relay Devices to the TB3 Block

Terminal block TB3 contains the connections for the relay contacts for alarm equipment such as sirens. It is included on an optional circuit board module. The

functioning of the Alarm and Warn relay connections varies depending on whether the relays are configured as Energized or De-Energized.

NOTE: The default IR4000S CO$_2$ configuration menu setting for the Warn and Alarm relays is De-Energized. For further information, see relay configuration information in Section 4.5.1. The Fault relay is normally Energized. It will change state after power-up.

Use the following table as a guide for determining the Normally Open (**NO**) and the Normally Closed (**NC**) contacts for the Energized versus De-Energized settings.

Relay Type	TB3 position	De-Energized	Energized
Alarm	1	Normally Closed	Normally Open
	2	Common	Common
	3	Normally Open	Normally Closed
Warn	4	Normally Closed	Normally Open
	5	Common	Common
	6	Normally Open	Normally Closed
Fault	7	(Not Applicable:	Normally Open
	8	Fault Relay Always	Common
	9	Energized)	Normally Closed

Table 2: TB3 Relay Contacts Energized/De-Energized Settings

WARNING: Relay contacts must be protected against transient and over-voltage conditions (see Figure 10).
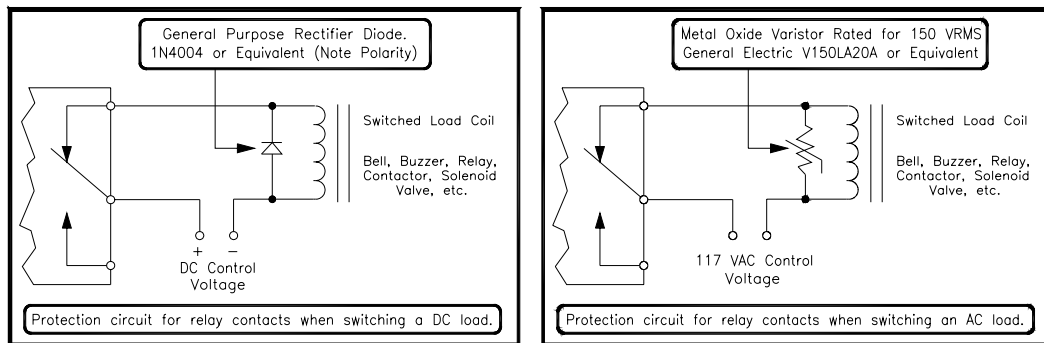
Figure 10: Relay Protection for DC and AC Loads

European Union (EU) Approved Applications: The ALARM relay contact ratings are 8 A, 30 VRMS / 42.4 V peak or 8 A @ 30 VDC resistive max.

North American Approved Applications: The ALARM relay contact ratings are 8 A @ 240 VAC and 8 A @ 30 VDC resistive max.

3.4 Applying Power and Starting Operation

Once the mounting, cabling and alarm relay installation is complete, your IR700/IR4000S CO$_2$ detection system is ready to begin the power-on sequence. Please review this section carefully before powering on your GM standalone detectors or your IR700/IR4000S CO$_2$ Monitor system.

3.4.1 Start-up Readiness Checklist

Prior to applying power to the system for the first time, check the following items for a stand-alone IR700 detector and for an IR4000S CO$_2$ monitor configuration.

NOTE: The +24 V wire(s) to the power supply (supplies) should be connected after the readiness checklist is verified, to protect the system from shorting. Since the IR700 and IR4000S CO$_2$ are designed to monitor continuously for carbon dioxide gas, they do not have power switches, to prevent accidental system shutdown.

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1. Verify that all the signal wiring (except for +24 VDC) is installed correctly:

2. Make sure that the IR4000S CO$_2$ and/or junction box lids are securely installed, unless the area has been declassified.

3. Make sure to inhibit any external devices, such as Trip Amplifiers, PLC devices or DCS systems until after the start-up sequence is completed.

4. Once you are ready to begin the start-up, verify that the power supply is connected properly. The IR4000S CO$_2$ and IR700 are powered by +24 VDC (20 to 36 VDC voltage range). The IR700 optional LED will output a low voltage fault at or below 18 VDC.

3.4.2 Start-up Process for an IR4000S CO$_2$ System

NOTE: Powering on and off of the IR4000S CO$_2$ and IR700 units is controlled from the external power supply; refer to the power supply manual for instructions.

If you have any problems in the start-up or testing of the detector system, please refer to Section 6.0 *"Troubleshooting"* or contact General Monitors Technical Support. The Model IR700 should be allowed to stabilize for approximately 60 minutes while each detector attains the proper operating temperature.

IR4000S CO$_2$ display sequence on power-up:

1. 000 and Alarm indicator

2. All display elements (8.8.8.) and both Alarm and Warn indicators

3. Software revision (example: r A)

4. bSU (base Start Up)

5. SU (IR700 Start Up)

6. Gas concentration in 100 ppm

If a fault code is displayed after power up, please refer to Section 6.0 *"Troubleshooting"*.

3.4.3 IR4000S CO$_2$ Start-up Operation and Configuration Tasks

In order to make sure that the IR700 detector and IR4000S CO$_2$ menu functions are working correctly, you should perform several tasks immediately after the system is powered on. This section points you to detailed instructions for completing several start-up operation and configuration tasks using the IR4000S CO$_2$ menu system.

1. **Zero each connected IR700.** Zeroing verifies proper operation with no gas present.

    - For instructions, see *Zeroing the IR700* in Section 4.3.

2. **Perform a gas check test for each connected IR700.** Verify that the IR700 is measuring a known ppm correctly by placing it in Gas Check Mode using the IR4000S CO$_2$ menu options.

    - You will need to use the GM Gas Check Kit (P/N 31478-1) to complete this task.

    - For instructions, see Gas Checking the IR700 in Section 4.2.

3. **(Optional) Configure additional IR4000S CO$_2$ settings, as needed.** You may wish to configure additional operating parameters directly after start-up, or you can use the default settings initially and change them later on.

    - For a summary of all the IR4000S CO$_2$ Menu Configuration options, see the topic Setup in Section 4.5.

4.0 Operation and Configuration

4.1 Overview

The Model IR4000S CO$_2$ Single-Point Monitor front panel includes a digital display, Alarm and Warn indicators. The panel displays a set of menu options that provide the user with the most flexible detector system possible.

Alarm Indicator

3-Digit LED Display

Warning Indicator

INFRARED GAS DISPLAY UNIT
MODEL IR4000
P/N 31840 – ☐ EExd IIB T5 (T$_{amb}$ = - 40° C to +75° C)
GENERAL MONITORS
Use cable with insulation rated to at least 110° C
LAKE FOREST, CALIFORNIA, USA ☐
RATED 24 VDC , "═══" 7 W MAX. , CONTACT RATINGS : SEE MANUAL

ZERO PROCEDURE :
1 ENSURE SENSOR IS IN CLEAN AIR
2 HOLD MAGNET ABOVE LOGO
   TO ENTER MENU.
3 WHEN "HD" IS DISPLAYED,
   APPLY MAGNET
4 SELECT DETECTOR # OR ALL
5 WHEN "HC" IS DISPLAYED,
   APPLY MAGNET
6 WAIT FLASHED "AC" WHILE ZEROING
CALIBRATION PROCEDURE :
1 WHEN "AC" STOPS FLASHING, APPLY MAGNET TO START
   GAS CALIBRATION IF DESIRED
2 APPLY GAS, DISPLAY CHANGES TO "CP"
3 REMOVE GAS WHEN "CC" IS DISPLAYED

CLASS I, DIV. 1
GROUPS B, C & D
CLASS I, ZONE 1, GROUP IIB + H$_2$
TYPE 4X WITH REMOTE SENSOR

CAUTION:DO NOT OPEN WHEN AN EXPLOSIVE GAS ATMOSPHERE IS PRESENT. DO NOT OPEN WHILE ENERGIZED. READ AND UNDERSTAND INSTRUCTION MANUAL BEFORE OPERATING OR SERVICING.

S/N
CONFIG
MAN

Figure 11: Front Panel Display and Indicators

The IR4000S CO$_2$ menus allow you to complete many operational tasks for the IR700.

- Reset Alarm and Warn relays

- Zero, calibrate, or initiate a gas check

- Select Alarm and Warn relay settings

NOTE: If you begin navigating within the IR4000S CO$_2$ menus, then leave the device idle without returning to normal operation, a timeout will occur after 15 minutes and the IR4000S CO$_2$ will display a fault code bF8. Reapplying the magnet to the GM logo will clear the bF8 fault.

IR4000S CO₂ MENU LEGEND

◇ XXX STATIC MENU OPTION	HM → HOLD MAGNET	T → TIMEOUT
◆ XXX FLASHING MENU OPTION	RM → REMOVE MAGNET	RG → GAS REMOVED
	M → APPLY MAGNET	AG → WAITING FOR GAS

Figure 12: IR4000S CO₂ Menu Structure

4.2 Gas Checking the IR700

You can 'gas check' an IR700 unit to verify response without tripping relays. During gas check mode, the Alarm and Warn relays are disabled.

CAUTION – The analog output from the IR4000S CO$_2$ is directly connected to the IR700 being used and this analog output will indicate gas present when the IR4000S CO$_2$ is in Gas Ch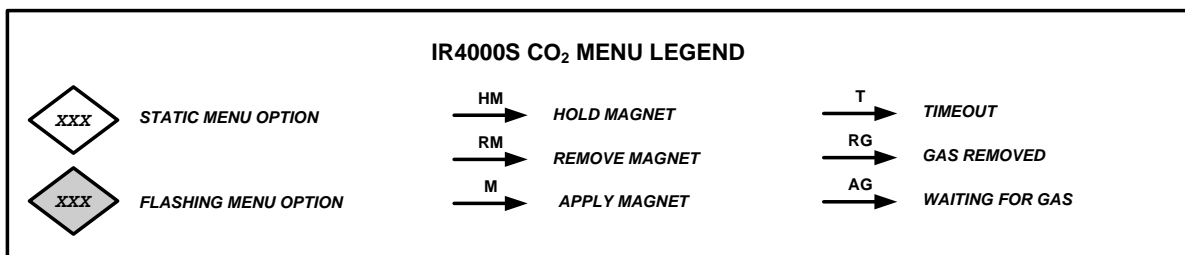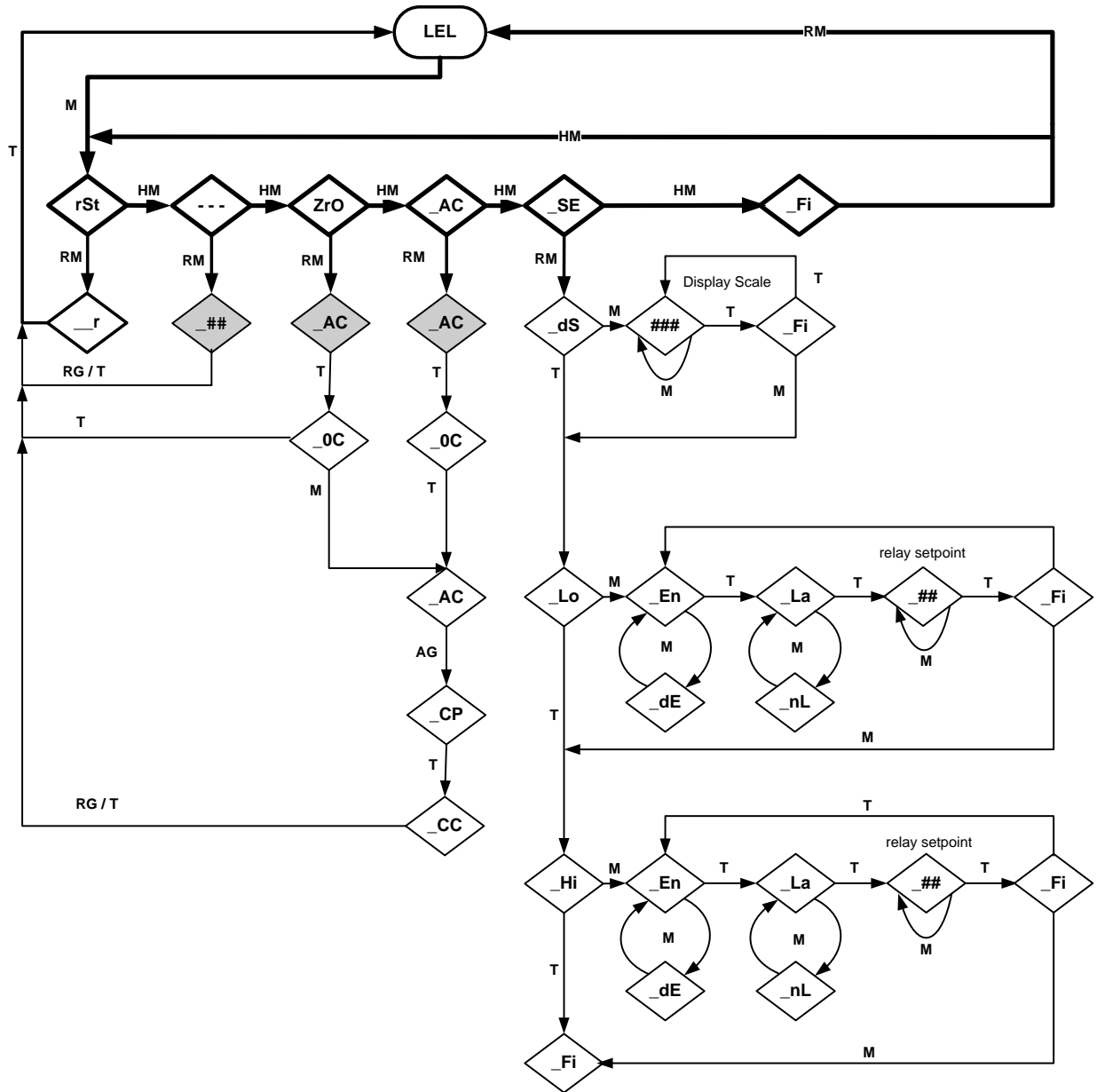eck Mode. Make sure that any equipment monitoring the analog output is in alarm bypass mode before performing a gas check.

To Gas Check the IR700 Unit:

4.2.1   Open the main menu. Place the magnet on the IR4000S CO$_2$ GM logo to access the main menu options.

4.2.2   Select Gas Check. Once the Gas Check (- - -) option appears, remove the magnet. The 100 ppm display will flash. Apply gas. After gas is removed, the IR4000S CO$_2$ will return to normal operation and display 100 ppm.

4.3 Zeroing the IR700

You can 'zero' the IR700 detector in order to eliminate any background gas fluctuations, using the **ZrO** option. During zeroing mode, the analog output for the IR700 is kept at 1.5 mA and the Alarm and Warn relays are disabled.

To Zero the IR700 Unit:

1. **Open the main menu.** Place the magnet on the IR4000S CO$_2$ GM logo to access the main menu options.

2. **Select zeroing.** Once the **ZrO** option appears, remove the magnet. **AC** (Automatic Calibration) will flash for 20 seconds. When zeroing is complete, the display shows zero complete by displaying **0C** for 10 seconds. The IR4000S CO$_2$ will then return to normal operation and display 100 ppm.

NOTE: Reapplying the magnet while **0C** is displayed will start the calibration cycle.

4.4 Calibrating the IR700

You can calibrate the IR700 which is connected to the IR4000S CO$_2$ unit in order to make sure the gas measurements are accurate. During calibration, the IR700 analog output is 1.5 mA in order to disable the Alarm and Warn relays.

Equipment required: Calibration cup, tubing, calibration gas tank with regulator.

To Calibrate the IR700 Detector:

1. The IR700 must be in a "no gas" condition initially; it will be zeroed as part of calibration.

2. **Open the main menu.** Place the magnet on the IR4000S CO$_2$ GM logo to move from normal operation to the main menu options.

3. **Select Automatic Calibration.** Once **AC** appears, remove the magnet. **AC** will flash, and zeroing will start. When zeroing is complete, **0C** will show on the display to confirm zero complete, then the display will change to **AC**.

$$AC$$

4. **Apply gas to the detector.** Apply a 50% full scale gas using a Gas Check Kit with portable purge calibrator equipment.

• The display will show a steady "**CP**" (Calibration in Progress). If the gas drops below 20% full scale, the display will revert to a flashing "**CP**".

$$CP$$

• In about one to two minutes, depending on gas flow, the IR700 will complete calibrating and display "**CC**" (Calibration Complete).

$$CC$$
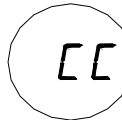
5. **Remove the gas.** You will continue to see "**CC**" until the gas gets below 5% of full scale. The unit will then return to normal operation.

   If the calibration does not proceed normally, such as if the gas was too low or too late in getting to the IR700, the IR700 will show a calibration fault.

NOTE:	Once gas has been applied, it is not possible to stop calibration. If no gas is applied for 12 minutes after calibration is selected from the IR4000S CO$_2$ menus, the detector automatically reverts to a fault condition. A fault also occurs if the gas is not removed within 12 minutes from the beginning of calibration. You must re-apply the magnet over the GM logo and recalibrate.

4.5 Setup

This section describes the tasks that you can accomplish using the **SE** (Setup) submenu, which provides numerous configuration options. The second half of the IR4000S CO$_2$ menu shows the **SE** (Base) submenu, which provides more configuration options.

Lo and Hi Submenus. These submenus configure the % full scale setpoint for the Warn and Alarm relays, as well as Energized/De-energized, and Latching/Non-Latching.

4.5.1 Configuring Warn and Alarm Relay Settings

The IR4000S CO$_2$ menus allow you to configure the following Alarm and Warn relay settings: Latching versus Non-Latching, Energized versus De-Energized, and the % full scale setpoint.

The default Warn relay settings are Non-Latching, De-Energized, 30% full scale setpoint.

The default Alarm relay settings are Latching, De-Energized, 60% full scale setpoint.

To Change the Warn and Alarm Relay Settings:

The steps to change the Alarm and Warn relay settings are the same.

1. **Open the main menu.** Place the magnet on the IR4000S CO$_2$ GM logo to move from normal operation to the main menu options.

2. **Select SE from the main menu.** Once the **SE** option appears, remove the magnet to open the **SE** submenu.

3. **Apply magnet to select Lo or Hi.** The **Lo** submenu includes options to configure the Warn relay settings; the **Hi** submenu includes identical options to configure the Alarm relay settings.

4. **Configure the settings for the Lo or Hi submenu.** Three relay settings will appear in turn for the **Lo** or **Hi** submenu. Once you select each setting using the magnet, you will move to the next setting, then to **Fi**nish.

   - The first relay setting is **En** or **dE** for energized or de-energized, respectively. Apply and remove the magnet to select **En** or **dE**.

- The second relay setting is **La** or **nL** for latching or non-latching, respectively. Apply and remove the magnet to select **La** or **nL**.

- The third relay setting is the % full scale setpoint. Available **Lo** setpoints are from 5 to the **Hi** setpoint in 5% full scale increments. Available **Hi** setpoints are from the **Lo** setpoint to 100% full scale. Apply and remove the magnet to select the setting. To finish and advance to the next option, apply the magnet when **Fi** (Finish) appears.

5. **Return to normal operation.** When Lo and Hi settings are completed, the IR4000S CO₂ will display **Lo**, **Hi**, and **Fi**. To return to normal operation, apply and remove the magnet when **Fi** (finish) appears.

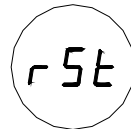## 4.6 Resetting the Relays (rSt)

NOTE: If the unit was ordered without relays, changing the relay settings will still affect the operation of the high and low LEDs on the display.

The **rSt** main menu option is provided to reset Warn and Alarm relays; if these relays are configured as latching, they must be manually reset after an Alarm occurs. The default setting for the IR4000S CO₂ Warn relay is non-latching, and the default setting for the Alarm relay is latching.

NOTE: Red indicators above and below the digital display are on when the Alarm and Warn relays are active. Latching relays can only be reset if the gas concentration has fallen below the respective relay setpoint.

To Reset the Relays:

1. **Open the main menu.** Place the magnet on the IR4000S CO₂ GM logo to move from the run display to the main menu options.

2. **Select the rSt option.** After a few seconds, the **rSt** main menu option appears. Remove the magnet to select this option.

The message **r** appears briefly to confirm that the relays are being cleared. Then the unit returns to the default normal operation.

Alternate Methods for Resetting the Relays

In addition to the **rSt** menu option, the relays can be reset by connecting a normally open switch between the IR4000S CO₂ terminal TB2-7 and TB2-8 (relay reset and COM) momentarily using a General Monitors explosion-proof switch (P/N 30051-1).

5.0 Maintenance

WARNING: Disconnect or inhibit external devices such as trip amplifiers, PLC's, or DCS systems before performing any maintenance.

NOTE: The system's full two-year warranty will be voided if customer personnel or third parties damage the system during repair attempts or maintenance activities.

5.1 Developing a Maintenance Schedule

Maintenance requirements will vary with each installation; General Monitors recommends that a schedule for periodic maintenance be established and followed, and that a maintenance logbook be kept for each unit in operation.

More frequent cleaning and calibration checks are recommended if the equipment is impacted by unusual environmental conditions such as mud collecting on the detector windows, detectors accidentally being painted over, etc.

General Monitors is not implying that the customer should expect problems with detector life or stability, but calibration checks ensure the integrity of the life protecting equipment.

5.2 Zeroing and Recalibration

For detailed instructions on initiating gas checks, zeroing and calibration using the IR4000S CO$_2$ menus, see Sections 4.2 - 4.4.

5.3 Lubricating Threads and Seals

If the neoprene rubber gasket (O-ring) in the cover of the IR4000S CO$_2$ enclosure is found dry, it should also be lubricated with the lubricant/sealant that is included with the IR700/IR4000S CO$_2$ units, or is available on order from General Monitors (P/N 2085).

As an alternative to grease, PTFE (Teflon) tape may be used provided that it complies with installation requirements.

5.4 Maintaining the X/P Integrity

The Model IR4000S CO$_2$ is rated explosion-proof for use in hazardous locations.

Before the cover of the IR4000S CO$_2$ is removed, or the cover bolts are loosened and power is to be left on, it is necessary to declassify the area. When replacing the cover, the gap between the lid and the housing should be less than .0015 inch (.038 mm). Make sure that the flame-path is clear of dirt and debris before

replacing the cover. Tighten the cover bolts to a torque setting of 50 inch-pounds. Use a feeler gauge to ensure the gap between the cover and the housing is less than .0015 inch (.038 mm).

There are four entry holes in the IR4000S CO$_2$ housing. These holes can be used to attach an IR700 unit directly, as well as for wiring conduits to alarm relays and control room equipment.

Each hole is tapped for ¾" NPT threads. If a particular entry hole is not used, it must be plugged during operation in the field. The factory installs plugs in the unused entry holes, except one. A red plastic cap is placed into the remaining hole and must be removed before conduit can be attached to the housing.

When an IR700 Gas Detector or other device is attached to the IR4000S CO$_2$ housing, it must be screwed into the housing using five to seven turns to ensure that the explosion-proof integrity of the housing is maintained.

5.5 Storage

The IR4000S CO$_2$ Single-Point Monitor should be stored in a clean, dry area, and within the temperature and humidity ranges noted for environmental specifications in Section 9.2.5. Insert red dust caps into any vacant cable entry holes.

6.0 Troubleshooting

CAUTION: Component level repair must be undertaken either by General Monitors personnel, or by competent, authorized service engineers. SMT PCB repair shall only be performed at a General Monitors facility. Failure to comply with this requirement will invalidate the warranty.

Be sure to inhibit or disconnect the external alarm wiring before making any check which might send the unit into alarm.

6.1 No Display on Power Up

If the display is not on after power is applied, make sure that the wiring is correct, especially the power wires, +24V and COM. Visually verify that insulation is above the terminal contacts. Gently pull each wire to assure adequate contact and insertion length.

6.2 IR4000S Fault Codes and Remedies

The Model IR4000S has its own separate set of fault codes that appear on the IR4000S 3-digit display. If the letter "b" precedes the two-digit fault code from F0-FF, then this indicates a base unit fault.

bF5 – Switch Error

The IR4000S CAL or RLY RST input is shorted to Common.

ACTION – Check system wiring.

bF6 – Low Supply Voltage

Indicates the IR4000S voltage input is at or below 18 volts.

ACTION – Check system wiring. Adjust power supply if necessary.

bF7 – Electronics Error

There is a problem with the electronics of the IR4000S.

ACTION – Check system wiring. If no trouble found, return the unit to the factory for service.

bF8 – Failure to complete setup

The setup menu timed out before a proper exit.

ACTION – Enter setup and verify that all settings are correct. Select "Fi" to exit setup.

bF9 – Gas check period exceeded

Gas check timed out.

ACTION – Purge the detector with clean air or nitrogen, to remove any residual gas from the gas check. Verify that the area around the detector is clear of gas and that all gas check sources have been shut off. When gas is no longer present, the fault will clear.

F3 –Detector Non-Critical Fault

Indicates the IR700 detector requires attention such as cleaning the windows.

ACTION – Remove the splash guard and carefully clean the detector windows with a soft, clean cloth or cotton swab that has had a commercial window cleaning solution applied; water or ethanol are examples of suitable solvents. If the fault persists, zero the detector.

F4 – Detector Communication Fault

Indicates that the IR4000S CO$_2$ monitor does not have mA input from the IR700 detector.

ACTION – Check the wiring between the detector and the monitor. The monitor requires a complete current loop circuit. The input current from the detector is connected to TB1 pin 1 and also the circuit is completed from TB2 pin 1 to ground. In most installations, the control room equipment is connected to TB2 pin 1 to complete the circuit, but if the monitor is used standalone then a load must be connected from TB2 pin 1 to TB1 pin 3.

F7 – Detector critical fault

F7 is caused by one or more of the following:

Fault F7 Cause	Action
Beam block	Inspect windows – clean them if necessary
Calibration gas left	Repeat calibration and remove calibration gas when calibration is complete
Calibration timeout	Repeat calibration with 50% full scale gas input; insure that gas reaches detector
Electronics failure	Inspect wiring – if no trouble found, return unit to factory for service
Excessive Negative Drift	Clean windows; zero the detector
Miswiring	Inspect and correct wiring

F8 – Fail to start zero

Indicates that the IR4000S CO$_2$ monitor does not detect the proper CAL signal or mA input of 1.5 mA from the IR700 detector.

ACTION – Check the wiring between the detector and monitor, particularly the connection of the CAL wire to CAL IN at TB1-2. Make sure that if the detector has HART, it is HART 1.25 mA. The HART 3.5 mA does not meet the 1.5 mA requirement for Zero and Cal with the IR4000S CO$_2$.

7.0 Modbus Interface

The IR4000S CO$_2$ does not have a built in Modbus interface. The Modbus signals from the single Modbus interface on the connected IR700 detector that is connected to the IR4000S CO$_2$ is passed through the IR4000S CO$_2$ and made available as MOD + and MOD – on TB2. Be aware that the commands are sent directly to the IR700 detector, not the IR4000S CO$_2$.

For details on the Modbus registers and a programming guide, a separate Modbus manual for the IR700 is available on General Monitors' website.

8.0 Customer Support

General Monitors provides extensive documentation, white papers and product literature for its complete selection of safety products. These documents are available online at our website - http://www.generalmonitors.com.

Contacting Customer Support

Worldwide Customer Service and Technical Support are available by calling one of several General Monitors offices, listed in the following table.

General Monitors Offices

AREA	PHONE/FAX/EMAIL
UNITED STATES Corporate Office: 26776 Simpatica Circle Lake Forest, CA 92630	**Phone: +1-949-581-4464 (24 hours)** Fax: +1-949-581-1151 Email: info@generalmonitors.com
Texas Office: 9776 Whithorn Drive Houston, TX 77095	**Phone: +1-281-855-6000** Fax: +1-281-855-3290 Email: gmhou@generalmonitors.com
IRELAND Ballybrit Business Park Galway Republic of Ireland	**Phone: +353-91-751175** Fax: +353-91-751317 Email: service@gmil.ie
MIDDLE EAST LOB12, #G20 P.O. Box 61209 Jebel Ali, Dubai United Arab Emirates	**Phone: +971-4-8143814** Fax: +971-4-8857587 Email: gmme@generalmonitors.ae
SINGAPORE No. 2 Kallang Pudding Rd. #09-16 Mactech Building Singapore 349307	**Phone: +65-6748-3488** Fax: +65-6748-1911 Email: genmon@gmpacifica.com.sg
UNITED KINGDOM Lyme Green Business Park Macclesfield, Cheshire, United Kingdom, SK11 OLR	**Phone: +44-1625-619-583** Fax: +44-1625-619-098 Email: info@generalmonitors.co.uk

9.0 Appendix

9.1 Warranty

General Monitors warrants the Model IR4000S CO$_2$ to be free from defects in workmanship or material under normal use and service within two (2) years from the date of shipment.

General Monitors will repair or replace without charge any such defective equipment found to be defective during the warranty period. Full determination of the nature of, and responsibility for, defective equipment will be made by General Monitors' personnel.

Defective or damaged equipment must be shipped prepaid to General Monitors' plant or representative from which shipment was made. In all cases this warranty is limited to the cost of the equipment supplied by General Monitors. The customer will assume all liability for the misuse of this equipment by its employees or other personnel.

NOTE: The Model IR4000S CO$_2$ Single-Point Monitor is easy to install; however, you should read and understand this manual before attempting to install or operate the device. It includes important safety information.

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.

9.2 Specifications

9.2.1 Agency Approvals

- CSA
- ATEX
- IECEx
- CE Marking

9.2.2 System Specifications

Electrical Classification:

CSA	Class I, Division 1, 2 Groups B, C, D and Class I, Zone 1, IIB+H$_2$, T5, Type 4X (Ta = -40°C to +75°C)
ATEX/IECEx	Ex d IIB + H$_2$, T5 Gb (Ta = -60°C to +75°C) Ex t IIIC, T100°C Db IP66

9.2.3 Mechanical Specifications

Length	6.5 inches (165 mm)
Width	6.0 inches (152 mm)
Height	3.21 inches (82 mm)
Weight	5.9 lbs. (2.7 kg) Aluminum 14.8 lbs. (6.7 kg) Stainless steel
Mounting Holes	5.05 inches (128 mm) (center to center)

9.2.4 Electrical Specifications

Input Power	
absolute min (V)	20
nominal (V)	24
absolute max (V)	36
Max. Wattage at 24 VDC (W)	2.0
Max. Current at 24 VDC (mA)	83
Display Accuracy (%)	±1
Relay Ratings	
VAC	8 A @ 250 V
VDC	8 A @ 30 V
Analog Input	
Input Range (mA)	0 – 21.7
Load	500 ohms max
Series resistance (ohms)	91±1

Display Response:	For milliampere input from 4 mA through 20 mA:
	Display in 100 ppm = Full scale gas x (mA input – 4) / 16
Status Indicators:	Warn and Alarm indicators and Fault codes
RS-485 Output:	Modbus RTU signals are passed through the IR4000S CO_2 from the attached IR700 detector unchanged.

Cable Length Requirements

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

The sample calculations are for reference only. Customers must derive the distance from supply to device based on cable specifications, expected maximum ambient temperature and cable temperature rise, estimated connection losses, allowances for error in distance measurement, and other variables particular to the customer installation.

Sample Calculations for Power Cable
V_supply = 24 VDC, V_device = 20 VDC, I_device_max_700 = 0.20 A, I_device_max_IR4000SCO2 = 0.083 A, cable resistance per meter = 9.00 ohms per meter at maximum ambient temperature for 2.5 mm^2 cable

Maximum distance from supply to Receiver = (1/2) x (V_supply – V_device) / (I_device_max x cable resistance per meter)

Maximum distance = (1/2) x (24 – 20) / (0.283 x 9.00 / 1000) = 790 meters

Sample maximum distances from supply to device

Max Wire Size	16 AWG	14 AWG	1.5 mm2	2.5 mm2
Typical Resistance	5.00 ohms / 1000 ft	3.00 ohms / 1000 ft	16.0 ohms / 1000 m	9.00 ohms / 1000 m
Distance	1410 feet	2360 feet	440 meters	790 meters

Sample Calculations for Analog Output Cable
Maximum load is 500 ohms. If the AO device has an input impedance of 400 ohms, the total cable resistance must not exceed 100 ohms, where maximum load = device load + cable resistance. For 16 AWG cable with resistance of 5 ohms / 1000 feet, the maximum distance from detector to AO input device is (Maximum load – AO device load) x (cable unit distance / cable unit resistance) / 2 = distance from detector to AO input device = (500 – 400) x (1000 / 5) / 2 = 10,000 feet.

AWG	OHMS/1000 FT	FEET	METERS
#20	11	4,550	1,390
#18	7	7,140	2,180
#16	5	10,000	3,050

RFI/EMI Protection: EN50270, EN 61000-6-4

NOTE: *European Union (EU) Approved Applications:* Power Supply noise and ripple voltage 1.0 Vpp max. The customer supplied Power Supply must comply with IEC 61010-1, limiting current to 8 A under Fault conditions, in order to comply with CE Marking requirements.

9.2.5 Environmental Specifications

Temperature Range	
Operating	-40°F to 167°F (-40°C to +75°C)
IR700 Operating	-40°F to 122°F (-40°C to +50°C)
Storage	-76°F to 185°F (-60°C to +85°C)
Humidity Range	10 to 95% RH non-condensing

9.3 Ordering Information

IR4000S CO$_2$ System Components

IR4000S CO$_2$ Model IR4000S CO$_2$ Single Point Monitor

MANIR4000S CO$_2$ Model IR4000S CO$_2$ Instruction Manual

IR700   Model IR700 Carbon Dioxide Gas Detector

MANIR700   Model IR700 Carbon Dioxide Gas Detector Manual

IR4000S CO$_2$ Spare Parts and Accessories

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

1. Part Number of Spare Part or Accessory

2. Description of Spare Part or Accessory

3. Quantity of Spare Part or Accessory

Replacement Parts

32491-6   Control Board Electronics, Push Terminal

32491-7   Control Board Electronics, Screw Terminal

32451-1   Output Board Electronics

32441-1   Display Board Electronics

32564-7   Enclosure Cover Assembly with Window

31195-2   Enclosure Base Assembly

30060-1   Calibration Magnet

925-5007   Cover Assembly, O-Ring

Accessories

31478-1   Gas Check Kit

Recommended Spare Parts for One (1) Year

30060-1   Extra Calibration Magnet (Qty. 1)

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.