

RAM 50 Series

Operation Manual



GfG Instrumentation

Worldwide Manufacturer of Gas Detection Solutions

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Introduction

The RAM 50 is designed to monitor the level of carbon monoxide in a respiratory air line and activate an alarm when the CO concentration exceeds the unit's preset alarm threshold. Your RAM 50, operated as described in this manual, should give you years of trouble-free operation.

The RAM 50 is offered in two versions:

- Model 1540 - air line monitor
- Model 1541 - air line monitor with built-in horn

Detection Principle

The RAM 50 CO monitor utilizes a semiconductor catalytic sensor. When a catalytic oxidation occurs at the surface of the sensor, the electron concentration in the catalytic material increases, decreasing the resistance of the sensor. The resistance change is measured by the RAM 50's integrated circuitry, converted to an equivalent gas concentration, and then displayed.

Although the sensor response is optimized for CO detection, it will respond to other oxidizable gases. Due to the nature of the semiconductor sensor used in the RAM 50, a proper level of humidity in the sampled air is required for accurate gas measurement; therefore, if the RAM 50 is used to monitor air lines where the air has been dried (less than 50% RH), a humidifying system (GfG part number 2610-001) should be used to supply water vapor to the air.

Overview

From the respiratory air line, the air enters the RAM 50's regulator filter where 99.99% of all oil and dirt are removed. Oil vapors and other liquids drop to the bottom of the bowl and are automatically drained. The air pressure is then reduced to 10 psi at the pressure regulator. After the gas passes through the check valve and the 1/16 I.D. tubing, its flow rate is set to 0.5 SCFH by the flow meter. The air then flows to the sensor assembly, where the sensor monitors the air before it is released into the atmosphere.

Description

The RAM 50 is housed in a polyester fiberglass NEMA-4 case. All of the electronic controls and indicators are mounted behind a window in the hinged door to protect the circuitry. A cover latch permits quick access to the interior for calibration or adjustment, and may be secured with a small padlock.

Switches

There are three switches that allow operator control of the RAM 50.

ALARM ON Switch (White)

The ALARM ON switch, when pressed, allows the alarm relay to charge. The red jewel light on the cover operates whether the ALARM ON switch is activated or not.

PURGE Switch (Yellow)

The PURGE switch initiates the purge cycle when pressed. During the purge cycle, the sensor temperature is elevated above its normal operating temperature to clean and condition the catalytic surface of the sensor, readying it for normal operation. The unit automatically goes into a purge cycle when the power is turned on or when power is restored after an interruption of more than two minutes.

TEST Switch (Orange)

The TEST switch connects a parallel resistance across the sensor to simulate a gas load. It is used to check circuit and alarm function or for a rough calibration check.

NOTE: The test switch should not be relied on to test for proper calibration and only serves as a meter and alarm test.

Indicators

There are four indicators that identify the status of the RAM 50:

Alarm (Red)

The red jewel alarm light on the cover goes on whenever the gas reading exceeds the alarm threshold (factory set to 10 ppm CO). It operates regardless of whether the ALARM switch is on or off. The bulb may be replaced by unscrewing the red jewel from the front of the case.

Alarm On (White)

The “alarm on” indicator shows that the ALARM ON switch is activated and serves as a pilot light to show that the unit and relays are fully operational. The switch is depressed during normal operation.

Purge (Yellow)

The purge indicator shows that the unit is going through a purge cycle. None of the alarms operate during the purge cycle, and the meter scale may indicate a reading while in purge.

Fault (Orange)

The fault indicator is lit when the basic sensor readout circuit is out of normal operating range. This condition could be caused by an open sensor circuit, heater failure or amplifier failure. The fault indicator and test switch functions are not related.

Controls

Three controls regulate the RAM 50's operational accuracy.

Calibration Control

The calibration control is used to set the unit's CO readout relative to a calibration gas. Under normal conditions, the calibration control should be the only control adjusted during calibration.

Alarm Set

The upper trim pot is used to set the alarm threshold. The alarm point may be set at any point on the meter and is factory set to 10 ppm.

Zero Control

The lower trim pot is used to set the circuit zero point. Normally, it should be adjusted only in clean air, and only if a large calibration adjustment has been made. The zero control is electronically independent of the calibration control, but a large calibration adjustment may change the clean air output voltage enough to require resetting the zero point.

Installation

The RAM 50 should be mounted in a vertical position for the flow meter to indicate the correct reading. The NEMA case provides four holes for mounting.

Connecting the Unit to the Air Line

Install a pipe fitting (such as a pipe tee) into the air line, supplying a small flow of air through the unit. Connect the small air flow line to the RAM 50's regulator by means of a male 1/8" NPT fitting.

Connecting the Unit to a Power Source

Plug the line cord into a suitable 110 VAC outlet or connect 110 VAC single-phase power to the terminals on the upper terminal block on the power supply board (TB1 - refer to figure 2). Strip the ends of the wire to 1/4" exposed conductor, slip the bare wire under the clamp plates provided on the terminals, and securely tighten the screws.

To convert to 12 VDC operation, connect the 12 VDC supply to the DC IN terminals (shown in figure 2).



CAUTION: REVERSING THE POLARITY WILL PERMANENTLY DAMAGE THE UNIT.

Connecting the Alarm Terminal Board

A conduit hole is provided in the bottom of the case for external alarm wiring. Remove the hole plug and insert an appropriate conduit fitting.

The relay outputs for connecting the external alarm are on the lower terminal board (TB2 - see *Figure 3* and *4*). These relays are rated at 2 amperes. If more current is required to operate the alarm or ventilating equipment, or alarms with different voltage requirements are used, these may be used as pilot relays, activating higher current or multiple input/output relays to control those devices.

Operation

Apply power to the unit (either 110 VAC or 12 VDC). The purge light should come on and remain lit for five to ten minutes. Press the TEST switch; the meter will increase and the alarm light will go on. Release the TEST switch and press the ALARM ON switch; the pilot light (white) will go on. Press the TEST switch again; the alarm relay will be engaged. This will be indicated by a click, the case mounted horn (1541 only) will sound and any external alarm will be activated.

Zeroing

Mechanical Zeroing of Meter

Before making any adjustments to the monitor, be sure the meter indicator (needle) is properly adjusted.

1. With no power applied to the RAM 50 monitor, locate the small black screw at the bottom part of the meter movement.
2. Using a suitable size screwdriver, adjust the black screw so the needle on the meter is in the center of the black zero indication. Do not over adjust.

Sensor Zeroing:

1. Attach the calibration connector to a cylinder of Zero Gas (Impurity Free Air, GfG # 7802-006).
2. Fully open the flow meter valve on the RAM 50 (Figure 1, item 7) to its maximum reading, so that the pressure from the gas cylinder will not build up in the flow meter and vinyl tube lines (a cylinder of gas may contain up to 500 psi when full).
3. Turn off the supplied air to the monitor from the compressor line by closing the regulator valve (Figure 1, item 3).
4. Attach the quick disconnect end of the calibration connector to its mate on the RAM 50 (Figure 1, item 10). Open the calibration connector valve gently until the flow rate reads approximately 0.5 SCFH on the flow meter valve (Figure 1, item 7).
5. Allow the gas to flow for approximately 1-2 minutes.
6. Adjust the zero control (Figure 1, item 16) until the meter display reads 0.

Calibration

The following procedure requires the use of GfG's calibration connector (part number 7701-001), and a known concentration of carbon monoxide in air, such as GfG's test gas (7802-001).

Adapter Preparation

Unlike ambient air, standard calibration gas mixtures are very dry. Attempting to calibrate the RAM 50 without humidifying these mixtures will cause a significant error to be introduced into readings of compressor air that has a normal level of humidity.

The GfG calibration adapter contains a humidifier for calibration gases. The sponge should be dampened with water. Distilled water is recommended so as not to introduce any potential contaminants into the calibration gas. Shake out any excess water before using the connector.

NOTE: At least 50% relative humidity must be provided to standard gases to avoid introducing error into RAM 50 calibrations.

Calibration Check Procedure

NOTE: Do NOT purge the RAM 50 prior to calibration. If the unit has just been purged, wait at least two hours for the sensor temperature to stabilize before attempting to calibrate it.

Gas Calibration

Calibration Check (bump test):

Refer to figure 1 for the location of controls and meters.

1. Attach the calibration connector to a cylinder of 20 ppm CO calibration gas (GfG # 7802-001).
2. Fully open the flow meter valve on the RAM 50 (Figure 1, item 7) to its maximum reading, so that the pressure from the gas cylinder will not build up in the flow meter and vinyl tube lines (a cylinder of gas may contain up to 500 psi when full).
3. Turn off the supplied air to the monitor from the compressor line by closing the regulator valve (Figure 1, item 3).
4. Attach the quick disconnect end of the calibration connector to its mate on the RAM 50 (Figure 1, item 10). Open the calibration connector valve gently until the flow rate reads approximately 0.5 SCFH on the flow meter valve (Figure 1, item 7).
5. Allow the gas to flow for approximately 1-2 minutes.
6. Note the meter scale reading. If the reading is within 2-3 ppm of the gas applied (17-23), the monitor is considered calibrated and no

adjustment is necessary. If the reading is within 4-7 ppm, make a slight adjustment using the calibration control (Figure 1, item 15). If the meter scale reading is off by more than 8 ppm, then use the following sensor calibration procedure to calibrate the RAM 50.

Refer to Figure 1 for the location of controls and meters.

Sensor Calibration (must be performed after replacing the sensor):

1. Attach the calibration adapter to a cylinder of 20 ppm CO calibration gas (GfG # 7802-001).
2. Fully open the flow meter valve on the RAM 50 (Figure 1, item 7) to its maximum reading, so that the pressure from the gas cylinder will not build up in the flow meter and vinyl tube lines (a cylinder of gas may contain up to 500 psi when full).
3. Turn off the supplied air to the monitor from the compressor line by closing the regulator valve (Figure 1, item 3).
4. Attach the quick disconnect end of the calibration connector to its mate on the RAM 50 (Figure 1, item 10). Open the calibration connector valve gently until the flow rate reads approximately 0.5 SCFH on the flow meter valve (Figure 1, item 7).
5. Turn control 15 (Figure 1) fully counterclockwise, and then turn control 16 (Figure 1) fully clockwise.
6. Allow the gas to flow for approximately 1-2 minutes, then turn control 15 clockwise until the meter reads 40. Now, turn control 16 counterclockwise until the meter reads 20.
7. Turn off the test gas cylinder and remove the calibration connector from the RAM 50.
8. Adjust the regulator valve (Figure 1, item 3) until the flow meter valve (Figure 1, item 7) reads between 0.5 and 0.8 SCFH.
9. Allow the RAM 50 to operate on supplied air for approximately 30 minutes, and then verify the gas calibration by doing a calibration check.

Sensor Replacement

Open the cover of the sensor assembly (Figure 1, item 8) by removing its two retaining screws. Remove the sensor by grasping it by the sides and gently pulling it out of its socket. Plug a new sensor into the socket, taking care not to press on its screen.

Replace the cover and put the RAM 50 through several successive purge cycles. Allow the unit to stabilize for approximately 24 hours, under power, before calibration. Calibrate the unit as described in the *Calibration* section.

Maintenance

The sensor should operate continuously for more than three years. However, it is recommended that the unit's calibration be checked at least once a month to ensure correct operation. While checking the calibration, the regulator filter should also be inspected to determine if it needs cleaning or replacement.

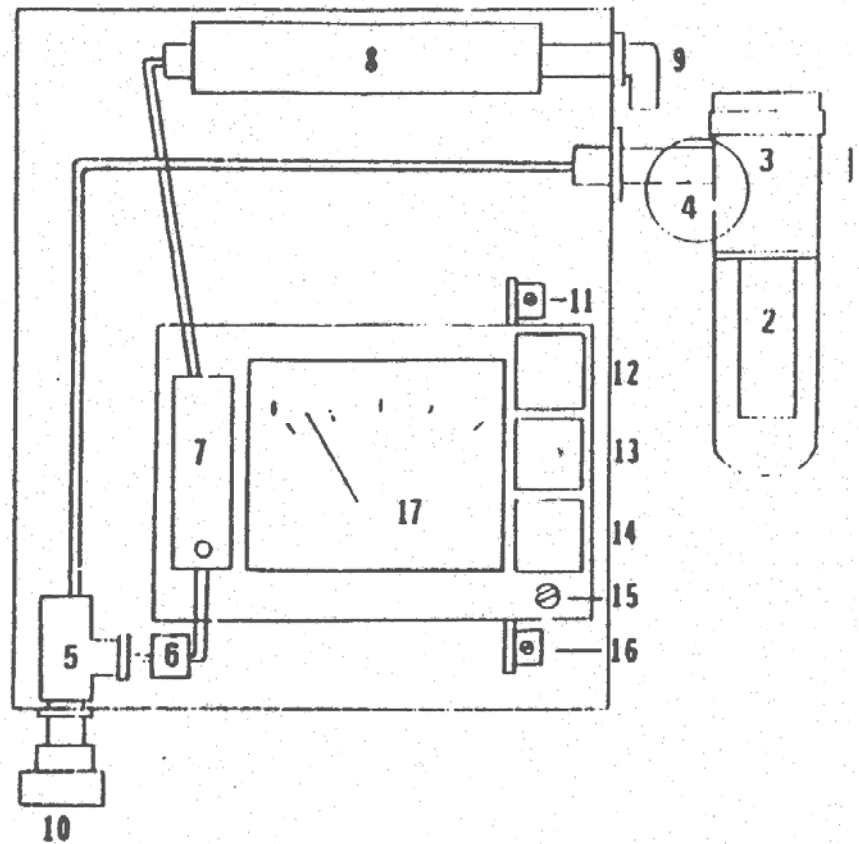
Humidifier (Optional)

If the optional humidifier is used, it must be filled with clean water as required (distilled water is preferred).

Alarm and Indicator Lights

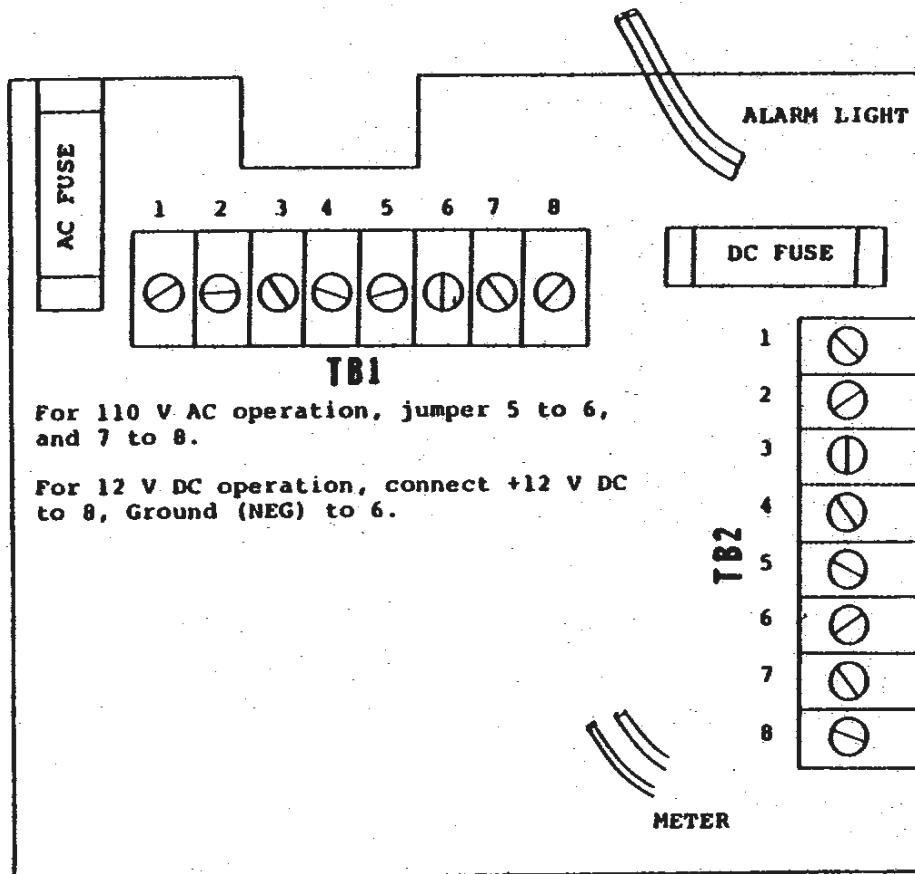
To replace the alarm light, unscrew the red jewel from the front of the case and insert a new bulb (GfG part number 2401-002) into the socket. To replace the indicator light bulbs, pull up the colored covers over the illuminated switches with your fingers or a thin bladed screwdriver. Be careful not to lose the white plastic light diffusers or film legends. Push a short length of 1/4" diameter vinyl tubing over the end of the wedge base bulb and pull the bulb out. Insert the bulbs (GfG part number 2401-001), using the same piece of tubing as a tool.

Figure 1



- | | |
|--------------------------------|---|
| 1. Air inlet (1/8" female NPT) | 10. Quick disconnect test gas fitting |
| 2. Coalescing filter | 11. Alarm set adjustment |
| 3. Regulator | 12. Illuminated alarm circuit |
| 4. Regulator gauge | 13. Illuminated purge switch |
| 5. Check valve | 14. Illuminated fault light and test switch |
| 6. Air fuse | 15. Calibration control |
| 7. Flow meter value | 16. Zero control |
| 8. Sensor assembly | 17. CO level meter |
| 9. Air outlet to atmosphere | |

Figure 2



AC Fuse 1 ampere 3 AG (AGC)

DC Fuse 2 1/2 ampere 3 AG (AGC)

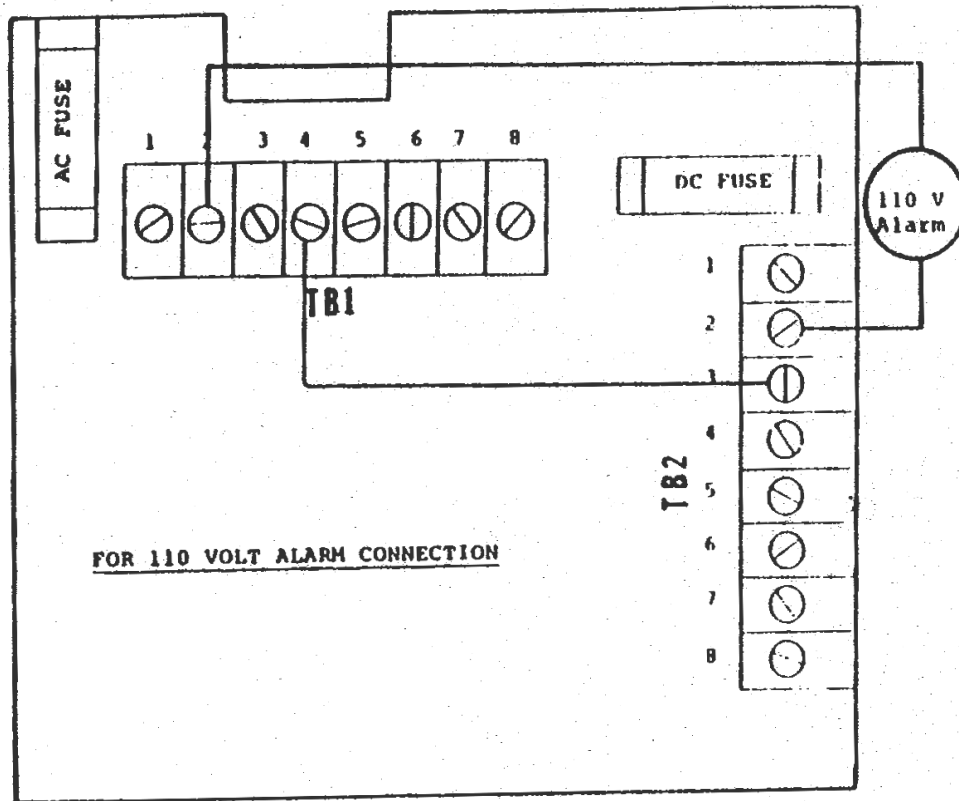
TB1

1. Safety ground IN
2. 110 VAC low IN
3. 110 VAC high IN
4. 110 VAC high fuse out
5. 12 VDC ground out
6. 12 VDC ground in
7. 12 VDC positive out
8. 12 VDC positive in

TB2

1. Alarm NC
2. Alarm NO
3. Alarm common
4. + Recorder out, 0-1mA
5. - Recorder out, 0-1 mA
6. Fault common
7. Fault NO
8. Fault NC

Figure 3



110 VAC External Alarm Connection Diagram

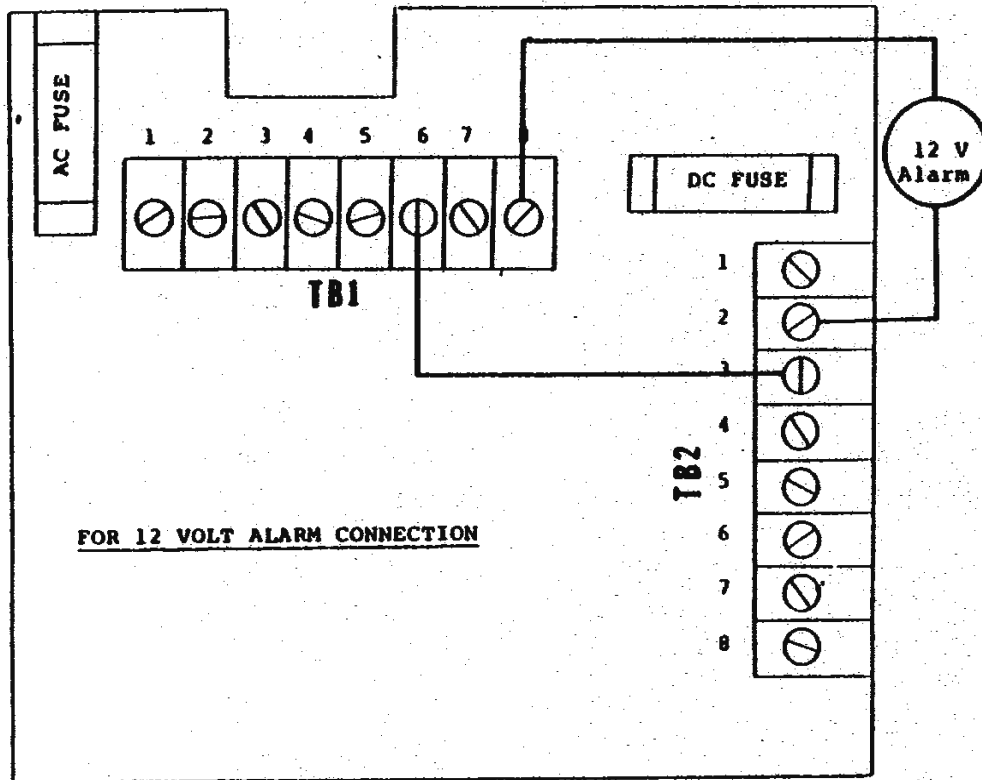
TB1

1. Safety ground in
2. 110 VAC low in
3. 110 VAC high in
4. 110 VAC high fuse out
5. 12 VDC ground out
6. 12 VDC ground in
7. 12 VDC positive out
8. 12 VDC positive in

TB2

1. Alarm NC
2. Alarm NO
3. Alarm common
4. + Recorder out, 0-1 mA
5. - Recorder out, 0-1 mA
6. Fault common
7. Fault NO
8. Fault NC

Figure 4



12 VDC External Alarm Connection Diagram

TB1

1. Safety ground in
2. 110 VAC low in
3. 110 VAC high in
4. 110 VAC high fuse out
5. 12 VDC ground out
6. 12 VDC ground in
7. 12 VDC positive out
8. 12 VDC positive in

TB2

1. Alarm NC
2. Alarm NO
3. Alarm common
4. + Recorder out, 0-1 mA
5. - Recorder out, 0-1 mA
6. Fault common
7. Fault NO
8. Fault NC

Troubleshooting

Over the years, GfG Instrumentation distributors and personnel have assisted customers with RAM 50 installations that appeared to be malfunctioning. The following troubleshooting steps include the most common problems that may be encountered in a RAM 50 installation. They are listed in order of frequency.

1. READING IS TOO HIGH - unit alarms during OFF shifts or when breathing air is not in use

The RAM 50 is designed for continuous use. When it is not in use, it should be shut down both electrically and pneumatically. It is particularly important that the air flow is not stopped if the unit still has power; stopping the air flow may harm the sensor, as the heat from the sensing element will not be diverted and the increasing residual temperature will result in an elevation of the readings. This process may take many hours, but eventually the unit will alarm. Properly utilized, the RAM 50 should be kept in operation 24 hours a day with a continuous air sample. When interrupted operations (1-shift) occur normally, simply shut the unit off electronically until it is needed again. When the unit is turned off frequently, there should be an allowance for a 15-20 minute start-up time (PURGE cycle).

2. READING IS TOO HIGH - Constant or cyclic in nature

Most often, a properly installed RAM 50 which reads too high is in fact “reading” air contamination from carbon monoxide or hydrocarbon oils. In most cases, the compressor is functioning properly, but the intake air to the compressor is contaminated. The most common sources of contamination are noted below:

- A. Compressor intake is inside a building where fuel-burning trucks and Hi-Lo’s are in use.
- B. Process and maintenance materials are stored in the proximity of an internal compressor intake.
- C. Compressor intake is outside of the building but downwind of or in close proximity to contaminated vents.

NOTE: Cyclic high readings are commonly caused by this problem. Do not overlook nearby buildings that may be venting paint fumes, heat treatment fumes, engine exhaust, etc.

- D. The pipe dope on the plumbing has not hardened. Teflon tape pipe seal is the preferred thread seal to avoid air contamination.
- E. Oil has accumulated in the air lines and is releasing hydrocarbon fumes.

3. READING HIGH OR LOW - Instrument not responding

The factory calibrated unit may have been “re-adjusted” sometime during unpacking or installation. Where there are questions about calibration, we recommend that the unit be checked as outlined in this manual.

4. INSTRUMENT IS NOT RESPONDING

Humidity and humidification can result in two problems. It is possible that the air is too dry (50% humidity by volume is recommended). Humidity should be introduced for proper instrument accuracy.

NOTE: Air this dry is not suitable for your breathing apparatus.

A GfG humidifier (part number 2610-001) will correct this problem for the instrument UNLESS it is installed backwards, which will fill the unit with water and damage the sensor.

5. HUMIDIFIED SYSTEM READS TOO HIGH

Well water and city water both can contain low levels of measurable contaminants. Use distilled or deionized water in humidifiers if your local water is producing a reading.

6. INSTRUMENT'S REMOTE APPARATUS NOT FUNCTIONING

Hookups to remote alarms or readouts are common. Incorrect hookup can result in a variety of problems which can be damaging to the monitor. If the unit has external devices, it is imperative that installation be reviewed to determine if it is, or temporarily was, defective. Fuses and diodes protect the basic circuits, but in some cases, the units are damaged and require electronic repair.

7. INSTRUMENT NOT FUNCTIONING

Infrequently, an instrument may be damaged or defective. The two known causes for new installation failures result from handling in transit to your job site or actual “infant failure” of solid state devices.

The RAM 50 is a very durable instrument and will seldom be damaged except by clearly negligent handling; look for physical damage to the case. In the case of solid state “infant failure”, we observe established procedures of run-in and seasoning. Incidence of “infant failure” is very low.

Over 90% of all troubles will be corrected by thorough evaluation and correction of the first three items on this list. After thorough evaluation of those items and the others listed, you may wish to contact your distributor or GfG directly.

Replacement Parts and Accessories

Description	Part Number
Bulb, LED alarm light	2401-002
Bulb, illuminated switch	2401-001
Calibration connector	7701-001
Calibration gas – carbon monoxide (CO) 20 ppm / air / steel / 34 L	7802-001
Calibration gas – zero gas (impurity free air) steel / 34 L	7802-006
Calibration kit – includes fixed flow regulator, calibration adapter, tubing, test gas cylinder and carrying case	7701-002
Filter element, replacement	2609-015
Horn, remote 110 VAC (model 1540 only)	1301-002
Horn, remote 12 VDC (model 1540 only)	1301-001
Horn, replacement (model 1541 only)	1301-010
Humidifier	2610-001
Regulator with filter and gauge	2608-001
Regulator, mini-filter	2608-004
Regulator - on/off (1.0 lpm)	7750-004
Regulator, high pressure (5,000 psi)	2605-002
Sensor – carbon monoxide (CO)	5501-001

NOTE: Please refer to part number when ordering.

Warranty

GfG Instrumentation warrants our products to be free from defects in material and workmanship when used for their intended purpose, and agrees to remedy any such defect or to furnish a new part (at the option of GfG Instrumentation) in exchange for any part of any product that we manufacture that under normal use is found to be defective; provided that the product is returned, by the purchaser, to GfG's factory, intact, for our examination, with all transportation costs prepaid, and provided that such examination reveals, in our judgment, that it is defective.

This warranty does not extend to any products that have been subjected to misuse, neglect, accident, or unauthorized modifications; nor does it extend to products used contrary to the instructions furnished by us or to products that have been repaired or altered outside of our factory. No agent or reseller of GfG Instrumentation may alter the above statements.



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