

# RAM 4021-1

## Operation Manual



**GfG Instrumentation**

Worldwide Manufacturer of Gas Detection Solutions



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## RAM 4021-1

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## **For Your Safety**

Like any piece of complex equipment, the GfG Instrumentation RAM 4021 series will do the job it is designed to do only if it is used and serviced in accordance with the manufacturer's instructions. All individuals who have or will have the responsibility of servicing the equipment must carefully read this manual.

The warranties made by GfG Instrumentation with regards to this instrument are voided if the product is not used and serviced in accordance with the instructions in this manual. Please protect yourself and others who depend on this instrument by following these instructions. The above does not alter statements regarding GfG Instrumentation's warranties and conditions of sale and delivery.

## **Description**

This unit is designed to provide continuous monitoring of the carbon monoxide levels in breathing air.

The instrument's electronics are enclosed in a NEMA-4X polycarbonate case. The case is corrosion resistant, positively pressurized by the compressor supply line, and sealed except for a bleed hole (to release the compressor's air). The unit operates on 110 VAC power. It comes equipped with a case-mounted horn that can be disconnected if it is not required.

Calibration adjustment controls are not necessary since they are automatically performed by the microprocessor.

The carbon monoxide chemical cell has a life expectancy of one to three years with a recommended 30-day calibration check. The oxygen sensor has a life expectancy of 12 to 18 months and may require periodic calibration.

## Setup Mode

By briefly pressing the bottom button (see Diagram on page 16) it is possible to cycle through the setup parameters. Each time the bottom button is pressed the display screen will identify the selected mode and indicate the current setup.

The following paragraphs outline the setup modes and options available. In each mode it is possible to change the setup using the top switch.

### Lights/Alarms

#### **YelLxx.x**

-Low oxygen alarm, factory set to 19.5% volume.

#### **YelHxx.x**

-High oxygen alarm, factory set to 22.0% volume.

#### **AutoC ON/OFF**

-Set to on, the oxygen sensor will auto-calibrate every 24 hours.

#### **CO Alm - XX**

-The alarm point in parts per million is displayed (i.e. CO ALM 10).

#### **Cal**

-The parts per million of carbon monoxide to be used for calibration is displayed (i.e. CO - 20).

**NOTE: This setup must be identical to the ppm concentration of the carbon monoxide calibration gas (5-100 ppm CO).**

The carbon monoxide test gas concentration may be set from 5 to 100 ppm and is factory set to 20 ppm. It is important to use the same test gas as the "CAL" setting, otherwise the calibration will fail due to the error protection feature.

**CAUTION:** Changing the calibration gas concentration to another value will require the instrument to be successfully zero and gas calibrated. Do not change the calibration gas concentration without having the proper equipment to perform a zero and gas calibration (see Calibration on page 5).

## CO # RLY

-The carbon monoxide alarm relay can be enabled (ON) or disabled (OFF) in this mode. The top switch will change this option.

Setting the relay ON or OFF permits any auxiliary device connected to the monitor to be shut off if it is not needed. During calibration it will be automatically shut off.

**Test Mode** Activates alarm, relays, LEDs, and solid squares on the LCD readout when the top switch is pushed.

The alarm horn and relays may be tested by pressing and holding the top switch while in alarm test setup mode. When testing an auxiliary horn, be sure the relay is turned ON.

## Operation

Plug the unit into a 110 VAC outlet and the display will show introductory messages and a warm-up countdown. If the unit does not power up, check the electrical connections and try re-plugging in the unit. If start-up does not occur, call the factory.

After the warm-up countdown, the instrument will display CO and O2 readings. The air regulator may be adjusted at any time to set the flow level from 0.5 to 0.9 CFH. If the **low flow** indication shows on the display, increase the flow to 1 CFH and then drop the flow to the operational range of .5 to .8 CFH.

**CAUTION:** If the unit is reading a carbon monoxide gas level, do not make any adjustments for a few hours until the unit has settled in. If calibration is attempted within the first fifteen minutes, a **TOO SOON** message will occur on the display.

If the carbon monoxide gas readings remain high or below zero (-0), re-calibration may be needed. We also recommend checking the compres-

sor's air intake, which may be the cause of high readings. Outside air intake is recommended, but can easily be contaminated by furnace exhaust, building vents, parking lots, etc. Intakes within the building are to be avoided because they often contain low ppm levels of carbon monoxide.

The oxygen sensor may require manual calibration if the oxygen reading is greater than +/- 0.5% of 20.9% volume.

## Calibration

Although the unit is calibrated at the factory, it may require carbon monoxide recalibration due to handling. The only way to ensure that the sensor is operating properly is to test it with calibration gas.

### "ZERO/CAL" Adjustment for Carbon Monoxide

The carbon monoxide read-out (ppm) will be "0" in the absence of carbon monoxide. This "0" can be calibrated by flowing clean air over the sensor and activating the ZERO/CAL set switch.

The "ZERO/CAL" switch is activated through a small hole in the face of the unit using a bent paper clip or similar thin wire or tool.

Two methods are available to check or set the carbon monoxide ZERO/CAL.

With normal flow through the unit from a clean air supply depress the ZERO/CAL switch and hold until the carbon monoxide read-out stops flashing (about 3 seconds) and then immediately release the switch.

The auto zero process will begin immediately. If the supply air is clean the display will indicate **CO SET, END CALIBRATION** which indicates that a zero setting has been accepted and is now in use. If the supply line has more than a trace of carbon monoxide, the following messages will appear: **BAD O AIR, PREV CAL, END CAL**. The instrument is informing the user that it will not calibrate because of bad zero air and it will use its previously zeroed calibration setting.

The other method to zero the unit is to supply zero test gas (impurity free air) to the calibration port in the same manner as described above with calibration gas, and the unit will initiate its calibration gas routine. However, the unit expects that 20 ppm CO is being applied to the calibration port unless the zero switch is pushed. Check to see that the message says zero gas instead of calibration gas as the 60 second countdown proceeds. At any time during the countdown the zero switch may be pushed to calibrate the unit with zero gas. If the switch is not pushed, a cal fail message will appear, resulting in a return to the previous calibration. After the zero switch is pressed, a **ZEROING** message appears and then **RELEASE UNLESS ZERO INIT** message.

NOTE: Holding the zero switch for 15 seconds will reinitialize the unit. This step is used when replacing a sensor or as discussed in the troubleshooting section. Do not ZERO INIT unless instructed to do so in the troubleshooting section.

### Calibrating Carbon Monoxide Sensor with CO Test Gas (recommended every 30 days)

To calibrate the unit with carbon monoxide test gas, shut off the air from the compressor supply line with the regulator and a **LOW FLOW** message will appear. Assemble the calibration kit and connect the tank of test gas to the calibration port connector on the instrument. Open the gas valve (use only the fixed flow regulator provided with the calibration kit). The display will read "CAL GAS detected" and a 60 second countdown will begin.

If the compressor air supply line is not shut off, a message will appear: **SUPPLY OFF**. If such a message occurs, shut off the supplied air and then begin the calibration process again to activate the calibration port switch.

After 60 seconds some informational numbers may appear on the display of the monitor. These numbers are for factory evaluation and troubleshooting. If the correct calibration gas is being used and the monitor is working correctly it will automatically calibrate.

After the unit auto calibrates, a message will appear: **CO G SET**, indicating that the CO gain adjustment has been set for 20 ppm.

If an incorrect gas concentration is used or the sensor and/or instrument is not properly functioning, a message will appear: **CO G FAILED, PREV CAL, END CAL**. This affords improper calibration protection and an effort should be made to understand why it did not calibrate (see troubleshooting section for assistance).

After proper calibration, the next messages will be **REMOVE CALIBRATION GAS, END CAL, SUPPLY ON**. This prompts the calibrator to remove the test gas and turn the supply on at the regulator.

The oxygen sensor has a special AutoCal® mode that activates calibration every 24 hours. The instrument is shipped with this mode enabled. This function will reset the oxygen sensor to 20.9% volume. If the required adjustment is greater than +/- 0.5% volume, the unit will return to its previous calibration. If the oxygen sensor does not calibrate, a new sensor may be required. During the AutoCal® period, alarms will be deactivated for 15 seconds.

When oxygen levels of supplied air may not normally be 20.9% volume, or a 15 second alarm deactivation is a concern, the unit may be set to AutoCal® oxygen off.

#### Manual Calibration of Oxygen Sensor

To set the oxygen at 20.9% volume and carbon monoxide to zero, follow the instructions for “ZERO/CAL” adjustment for carbon monoxide below.

## Maintenance (qualified technicians only)

**NOTE:** Except for the sensors, all internal parts are to be serviced only by the factory or its authorized agents.

### Oxygen Sensor Replacement

The oxygen sensor output will eventually reach a low level where it will be unstable and calibration will not be possible. To replace the sensor, disconnect the power to the unit and remove the four corner screws and the electronics front cover. Next, remove the three screws that hold the sensor block and unplug the O<sub>2</sub> sensor from its socket. Replace with a new sensor. Reassemble the unit and reconnect it to the power source.

1. Push the top of the two set-up mode switches and the display will read **O2 XXX**.
2. Adjust the control pot to obtain a reading of **O2 200** (the control pot is located on the display board- right hand corner bottom pot).

Push the bottom setup switch to return the instrument to normal display mode.

1. Let the new sensor settle in for an hour prior to calibrating.
2. Follow ZERO/CAL instructions to reset the sensor to 20.9% volume.

### Carbon Monoxide Sensor Replacement

When CO test gas fails to show a gas response during calibration, a new sensor is required. Most CO sensors will last from one and a half years to three years.

To replace the sensor, disconnect the power to the unit and remove the four corner screws and the electronics front cover. Next remove the three screws that hold the sensor block and unplug the CO sensor from its socket. Install a new sensor after **being sure that the shorting wire is removed** from the new sensor. Reassemble the unit and reconnect it to power. Let the new sensor settle in for an hour before calibrating.

## A NEW SENSOR MUST BE INITIALIZED

When calibrating a new sensor, an initializing step is added to the procedure. This permits the sensor to be zero calibrated regardless of the background air and caution must be taken that the air is free of carbon monoxide. If the supply line is not CO free, then obtain a tank of impurity free air test gas from GfG (stock number 7802-006).

To initialize the unit, hold the ZERO/CAL switch for 15 seconds (airline OFF). During the fifteen seconds, messages will read: **ZERO CAL, RELEASE UNLESS ZERO INT, INIT-ING.** Release the zero set switch when INIT-ING appears and the display will read: **ZERO GAS REQUIRED.**

Supply clean air from either the supply line or calibration port and the unit will set its ZERO/CAL after 60 seconds. The instrument message will then read **CAL GAS REQUIRED.**

Supply 20 ppm calibration gas (or another value selected in the setup mode on the unit) until the display reads **END CAL, REMOVE GAS, SUPPLY ON.** After turning the air supply on, the unit will reset the error protection and monitor the carbon monoxide of the compressor air supply line.

## Troubleshooting

### Count Numbers

A number is displayed after CO calibration. This number is there to assist in troubleshooting in case zero or calibration fails or other malfunctions occur.

### Zero Fail During Calibration

If a failure occurs during CO zero calibration. A **BAD AIR** message occurs and the zero air should be checked for CO content. It may be a malfunctioning unit or during initial zero calibration (without the error protection), it could have been zeroed with a contaminated gas sample.

Another initialization with known zero air may solve the issue. If the monitor will not zero, the unit is malfunctioning; please call the factory for further instructions.

**CAUTION:** Be sure that the cylinder in use is “zero gas” impurity free air (standard air) when zero initializing.

### Calibration Gas Fail During CO Calibration

With 20 ppm CO calibration gas applied to the calibration port, the monitor should calibrate at the end of the 60 second countdown. If it does not, then use the appropriate procedure:

1. If the gas reading does not show any increase when the gas is applied, the sensor is probably expired or the test gas has a concentration of zero CO. Check the hose connections to assure that gas is flowing into the sensor chamber.
2. Check to make sure the calibration gas being used matches the gas indicated on the display of the monitor during the calibration countdown. Using a different concentration of calibration gas than is being shown on the display will result in a failure to calibrate (error protection). Also, make sure that the gas being used has not reached the expiration date or is very low in pressure.

## Accessories and Field Replacement Parts

### Accessories

|   |          |
|---|----------|
| Calibration kit (includes calibration connector and 20 ppm test gas 34 L) | 7750-001 |
| High pressure regulator (5,000 PSI)                                       | 2605-002 |
| Remote horn – 110 VAC   | 1301-002 |

### Replacement Parts

|                           |          |
|---------------------------|----------|
| CO sensor – chemical cell | 5503-020 |
| Oxygen sensor             | 5701-011 |
| Regulator                 | 2608-013 |

### Test Gas

|                             |          |
|-----------------------------|----------|
| 20 ppm carbon monoxide 34 L | 7802-001 |
| Impurity free air 34 L      | 7802-006 |

## Equipment Technical Data

| <b>Gases Detected</b>                    | <b>Carbon Monoxide</b>                          | <b>Oxygen</b>                |
|--|---|------------------------------|
| Sensor                                   | Electrochemical cell                            | Electrochemical cell         |
| Meter scale                              | 0-100 ppm CO                                    | 0-25% volume                 |
| Response                                 | 90% maximum in 20 seconds                       | 95% in 15 seconds            |
| Accuracy expected sensor life            | +/- 1 ppm, *1-3 years                           | +/- 0.1% volume 12-18 months |
| Sensor warranty                          | 1 year  | 1 year                       |
| Operating temperature range (sample air) | +32 to 105°F                                    |                              |
| Factory set adjustable alarm points      | 5 ppm CO (Y)<br>10 ppm CO (H)                   | 19.5% low<br>23.5% high      |
| Inlet pressure range                     | 30 to 145 psig                                  |                              |
| Sample flow rate                         | 0.8 cubic feet of air per hour (scfh)           |                              |
| Relays                                   |   |                              |
| 1 – CO alarm                             | 250 VAC/30 VDC @                                |                              |
| 1 – Oxygen                               | 7 A   |                              |
| Power source                             | 110 VAC @ 1 A or 12 VDC - 24 VDC                |                              |
| Dimensions                               | 4x5.9x7.3 inches<br>(HxWxD)<br>(101x150x185 mm) |                              |

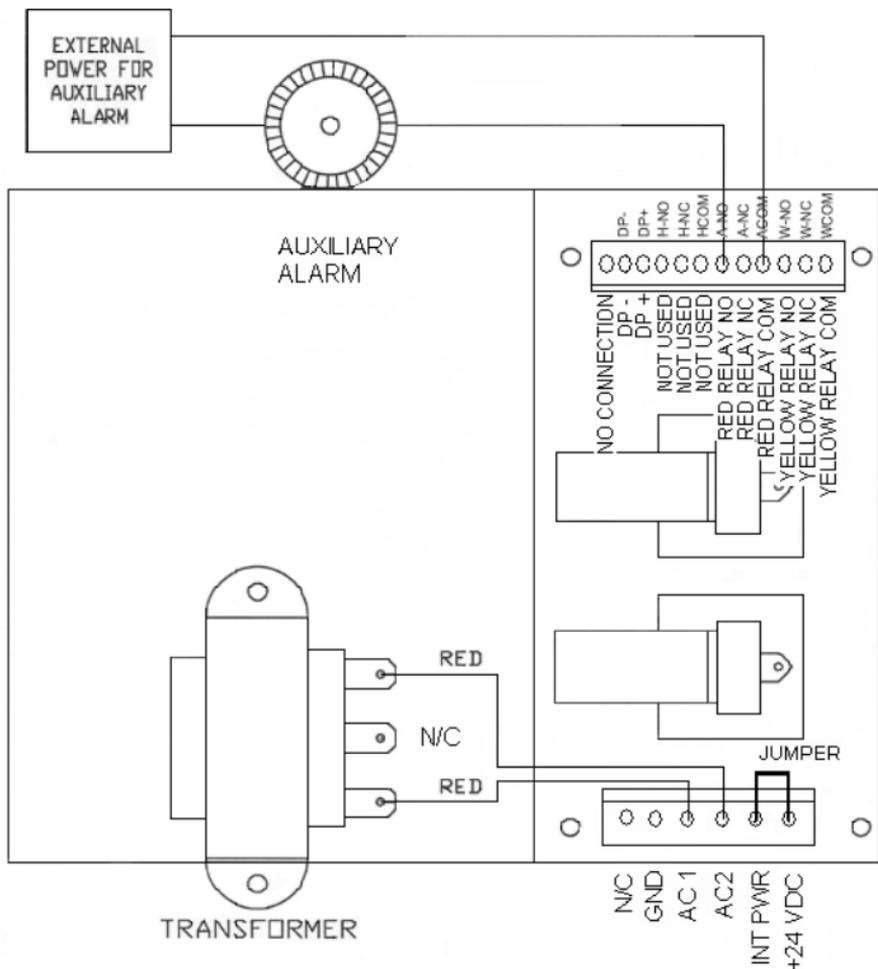
\* Depending on operating conditions.

## 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.

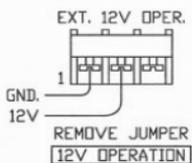
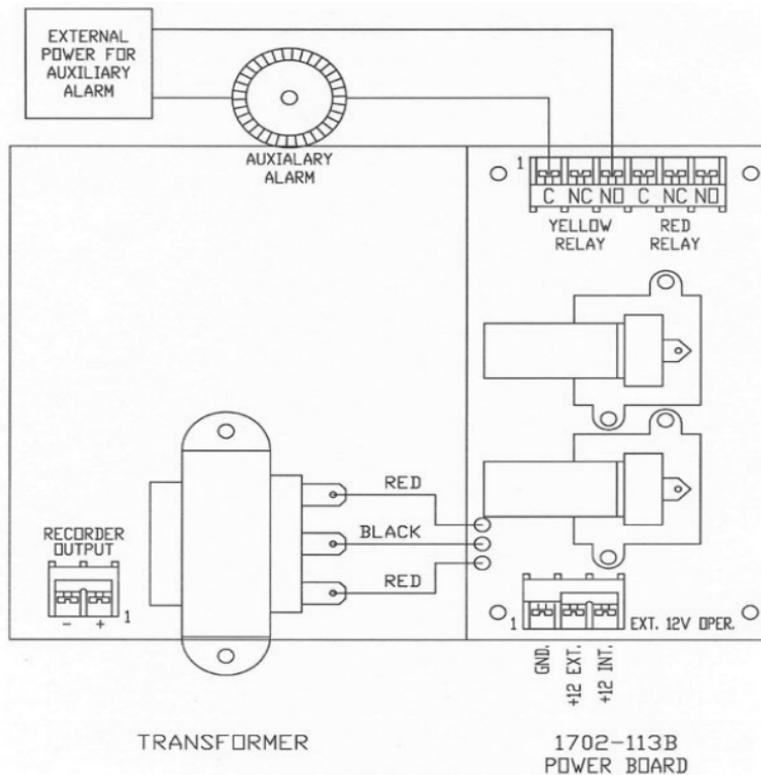
This warranty does not extend to any products that have been subjected to misuse, neglect, accident, or unauthorized modifications; nor does it extend to products used contrary to the instructions furnished by us or to products that have been repaired or altered outside of our factory. No agent or reseller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

## New Style

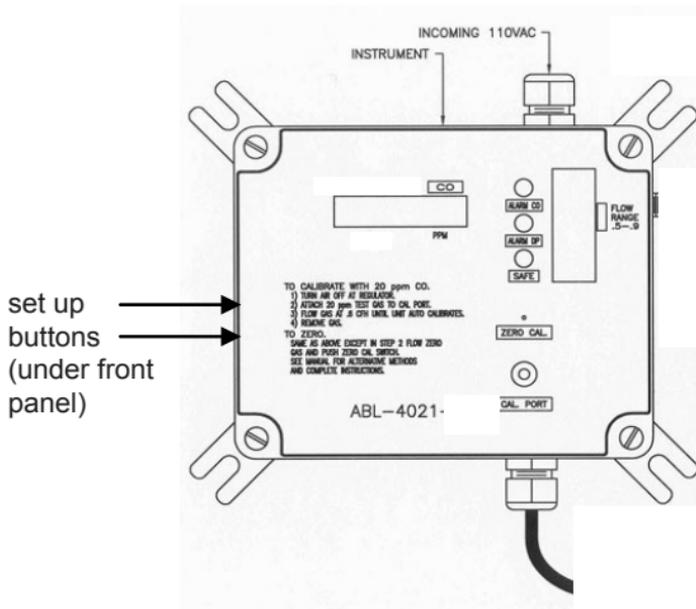


NOTE: Optional GfG remote horn part number 1301-002

# Old Style



## 4021-1 Diagram







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