

MRLDS-CO2 Gas Detector Manual



026-1312 Rev 1





Emerson
1065 Big Shanty Road NW, Suite 100
Kennesaw, GA 30144 USA
770-425-2724 • www.emerson.com

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1 Overview

1.1. General Information

The MRLDS-CO₂ (P/N 809-1020) is a fixed gas detector that detects the presence of CO₂ refrigerant. The gas sensor can be used on a stand-alone basis or integrated into Controls or Building Management Systems (BMS).

The MRLDS-CO₂ can be used:

- In new buildings/areas that require continuous monitoring with high tech gas sensor transmitters.
- To add gas detection solutions to an existing system.

Typical detection applications include the detection of:

- Refrigerant gases
- Combustible gases
- Toxic gases and/or volatile organic compounds.

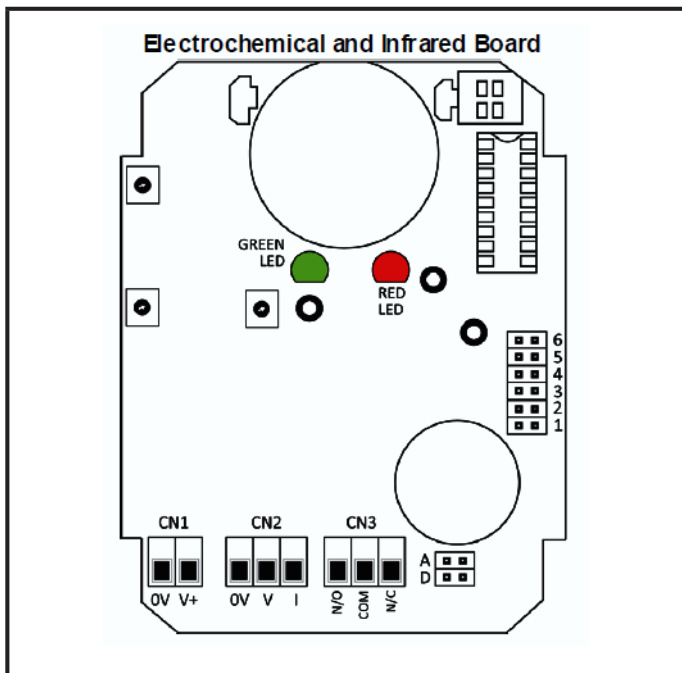


Figure 1-1 - MRLDS-CO₂ Sensor Board (EC, IR, and SC)

1.2. Technical Specifications

Specifications	Description		
Power Supply	12-24 VDC/VAC; 50-60 Hz; 2 W max. Power Consumption (12V); 136 mA (IR)		
Monitoring LEDs	Power: Green LED		Alarm: Red LED
Audible Alarm	Buzzer, enabled/disabled		
Relay Outputs	1 relay rated 1 A @ 24 VAC/VDC; Delay: 0, 1, 5, or 10 minutes		
IP Rating	IP66		
Temperature Rating	Sensor	IP66 Housing	
	IR and SC (all)	-40° to 122°F (-40° to 50°C)	
Humidity Rating	0-95% non-condensing		
Dimensions/ Weights per Enclosure Type (see Note below)	Housing	Dimensions	Weight
	IP66	6.89" x 6.5" x 3.29" 175 x 165 x 82 mm	1 lb 6 oz 629 g
	w/ Splash Guard	6.89" x 8.9" x 3.29" 175 x 225 x 82 mm	1 lb 9 oz 700 g
Approvals	CE; UL/CSA/IEC/EN 61010-1; EN 55011		

Table 1-1 - MRLDS-CO2 Technical Specifications

2 Installation and Wiring



WARNING: Explosion hazard! Do not mount the MRLDS-CO2 in an area that may contain flammable liquids, vapors, or aerosols. Operation of any electrical equipment in such an environment constitutes a safety hazard.



CAUTION: The MRLDS-CO2 contains sensitive electronic components that can be easily damaged. Do not touch or disturb any of these components.



CAUTION: For AC-powered configurations, ensure that the AC neutral supply is not used as the ground reference for the analog outputs.



NOTE: The mounting location of the monitor should allow it to be easily accessible for visual monitoring and servicing.



NOTE: The monitor must be connected by a marked, suitably located and easily reached switch or circuit-breaker as means of disconnection.

Connect monitor power and signaling terminals using wiring that complies with local electrical codes or regulations for the intended application.



NOTE: This instrument can be equipped with a semiconductor sensor for the detection of refrigerant, combustible and VOC gases. Semiconductor sensors are not gas specific and respond to a variety of other gases including propane exhaust, cleaners, and solvents. Changes in temperature and humidity may also affect the sensor's performance.

2.1. General Placement Guidelines



NOTE: The MRLDS-CO2 should be installed plumb and level and securely fastened to a rigid mounting surface.

Sensors must be located within the appropriate wire lengths from the central control unit (if used).

In all cases the sensor supplied is designed for maximum sensitivity to a particular gas. However, in certain circumstances false alarms may be caused by the occasional presence of sufficiently high concentrations of other gaseous impurities. Examples of situations where such abnormalities may arise include the following:

- Plant room maintenance activity involving solvent or paint fumes or refrigerant leaks.
- Accidental gas migration in fruit ripening/storage facilities (bananas - ethylene, apples - carbon dioxide).
- Heavy localized exhaust fumes (carbon monoxide, dioxide, propane) from engine-driven forklifts in confined spaces or close to sensors.

Setting the alarm delay is recommended.

2.2. Components and Access Overview



NOTE: Only use three wires to connect the controller to the MRLDS-CO2. If there is a fourth wire, use this to double up on the 0V connection between the controller and the MRLDS-CO2. The 0V for the supply voltage and the 0V for the 4-20 mA output are common. The wiring is the same for the electro-chemical, semi-conductor, and infrared models. The controller wiring is the same for all controllers.

There is a five-minute power-up delay to allow the sensor to stabilize. Refer to **Figure 2-1** and for internal components wiring.

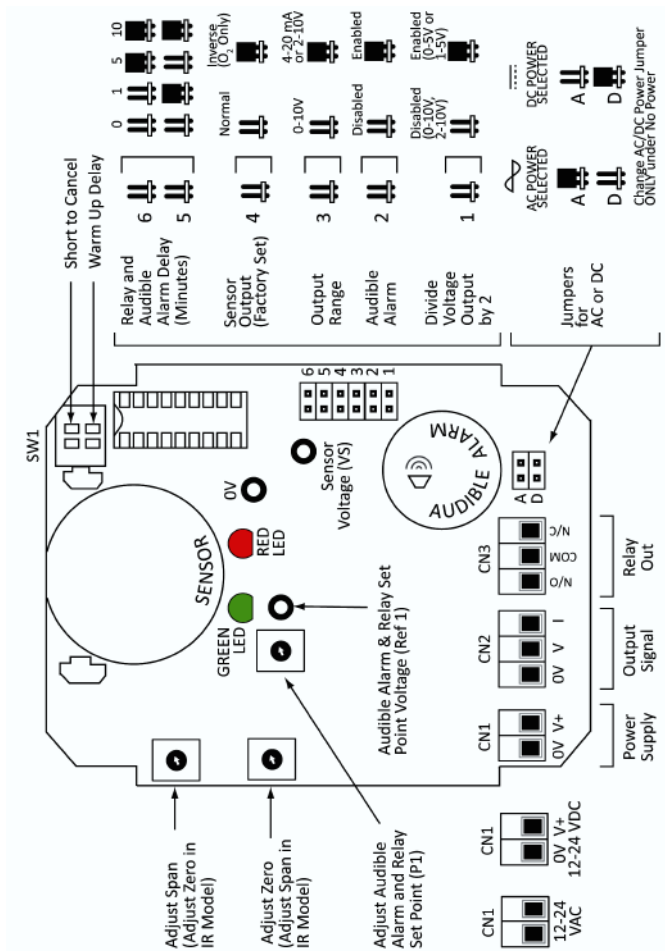


Figure 2-1 - EC or IR Sensor Components and Wiring

Components	Description
Enclosure Access	To open the standard sensor enclosure, turn the cable clamp 1/2 turn counter-clockwise to loosen the internal nut, depress the clip on top of the enclosure and open. Reverse to close. <i>Note: For the IP66 enclosure, use the four bolts on the front cover.</i>
Power	12-24V AC/DC, connect at positions 0V and +V at connector block CN1. - For AC: Jumper A is on, D is off. (See Figure 2-1). - For DC: Jumper A is off, D is on. (Default Factory Setting is AC.) Use two wires, typically 18 AWG (minimum).
Output	Connect the other two wires of the cable to terminal block CN2 positions 0V and V or I for voltage or current, respectively. - Connect 4-20mA at CN2 positions 0V and I - Connect voltage output at CN2 positions 0V and V
Relay Setpoint	P1 sets the trip point for the relay and audible alarm using the 0- 5V scale (measure at test points 0V and alarm test point TP1). Default factory setting is 50% of the range.
Time Delay	A time delay for the operation of the relay and audible alarm can be selected using jumpers JP5 and JP6. Default factory setting is zero.
Audible Alarm	The audible alarm can be disabled using jumper JP3. Default factory setting is enabled.

Table 2-1 - MRLDS-CO2 Components and Access Overview

2.3. Machinery Rooms

There is no absolute rule in determining the number of sensors and their locations. However, a number of simple guidelines will help to make a decision. Sensors monitor a point as opposed to an area. If the gas leak does not reach the sensor, no alarm will be triggered. Therefore, it is extremely important to select the sensor location carefully. Also consider ease of access for maintenance.

The size and nature of the site will help to decide which method is the most appropriate to use. Locations requiring the most protection in a machinery or plant room would be around compressors, pressurized storage vessels, refrigerant cylinders, storage rooms or pipelines. The most common leak sources are valves, gauges, flanges, joints (brazed or mechanical), filling or draining connections, etc.

- When mechanical or natural ventilation is present, mount a sensor in the airflow.
- In machinery rooms where there is no discernable or strong airflow, the options are:
 - Point Detection**, where sensors are located as near as possible to the most likely sources of leakage, such as the compressor, expansion valves, mechanical joints or cable duct trenches.
 - Perimeter Detection**, where sensors completely surround the area or equipment.
- For heavier-than-air gases such as halocarbon and hydrocarbon refrigerants such as R404A, propane, and butane sensors should be located near ground level.
- For lighter-than-air gas (for example, ammonia), the sensor needs to be located above the equipment to be monitored on a bracket or high on a wall within 12 in (300

mm) of (or on) the ceiling – provided there is no possibility of a thermal layer trapped under the ceiling preventing gas from reaching the sensor.



NOTE: At very low temperatures (for example, refrigerated cold store), ammonia gas becomes heavier than air.

- With similar density or miscible gases (for example, CO or CO₂), sensors should be mounted about head height (about 5 ft [1.5 m]).
- Sensors should be positioned just far enough back from any high-pressure parts to allow gas clouds to form and be detected. Otherwise, a gas leak might pass by in a high-speed jet and not be detected by the sensor.
- Make sure that pits, stairwells, and trenches are monitored since they may fill with stagnant pockets of gas.
- If a pressure relief vent (PRV) pipe is fitted to the system, it may be a requirement to mount a sensor to monitor this vent pipe. It could be positioned about 6 feet (2 m) above the PRV to allow gas clouds to form.
- For racks or chillers pre-fitted with refrigerant sensors, these should be mounted so as to monitor the compressors. If extract ducts are fitted the airflow in the duct may be monitored.

2.4. Refrigerated Spaces

In refrigerated spaces, sensors should be located in the return airflow to the evaporators on a sidewall (below head-height is preferred), or on the ceiling, not directly in front of an evaporator. In large rooms with multiple evaporators, sensors should be mounted on the central line between two adjacent evaporators, as turbulence will result in airflows mixing.

2.5. Chillers

In the case of small water- or air-cooled enclosed chiller units, mount the sensor so as to monitor airflow to the extract fans. With larger models also place a sensor inside the enclosure under or adjacent to the compressors.

In the case of outdoor units:

- For enclosed air-cooled chillers or the outdoor unit for variable refrigerant volume and variable refrigerant flow (VRV/VRF) systems, mount the sensor so as to monitor airflow to the extract fan. With large units also place a sensor inside the enclosure under or adjacent to the compressors.

In the case of non-enclosed outdoor units:

- If there is an enclosed machinery section, mount a sensor there.
- In the case of units with enclosed compressors, mount sensors in the enclosures.
- Where there are protective or acoustic panels, mount the sensor low down under the compressors where it is protected by the panels.
- With air-cooled chillers or air-cooled condensers with non-enclosed condenser sections, it is difficult to monitor leaks in the coil sections effectively. With some designs it will be possible using an airflow sensor to monitor airflow to the start-up fans in the front or rear sections.
- If there is a possibility of refrigerant leaks into a duct or air-handling unit, install a sensor to monitor the airflow.

Weatherproof sensors should be used for unprotected outdoor applications.

2.6. Air Conditioning (Direct Systems VRF/VRV)

For compliance with EN378, at least one detector installed in each occupied space being considered and the location of detectors chosen in relation to the refrigerant, and also be located

where the refrigerant will collect from the leak. In this case refrigerants are heavier than air and detectors should have their sensors mounted low; for example, at less than bed height in the case of a hotel or other similar Category Class A spaces. Ceilings or other voids, if not sealed, are part of the occupied space.



NOTE: Monitoring the ceiling voids in a hotel room would not strictly comply with EN378.

DO Mount In-Room Sensors:

- At less than the normal height of the occupants. For example, in a hotel room this is less than bed height (between 8 and 20 inches [200 and 500 mm] off the floor).
- Away from drafts and heat sources like radiators, etc.
- To avoid sources of steam.

DO NOT Mount Sensors:

- Under mirrors.
- At vanity units.
- In or near bathrooms.

To clean, the faceplate should be lightly dusted.



NOTE: Do not spray the MRLDS-CO2 with cleaning or polishing aerosols.

2.7. Remote Sensor Head Installation

If you do not wish to surface mount the MRLDS-CO2, a brushed stainless steel faceplate is available. The remote sensor is mounted in an electrical back box (1.7 in) or (44 mm) deep to which the vented faceplate is fitted.



CAUTION: To avoid component mix-up, do not remove sensor boards from multiple units at the same time. Alternatively, label them or match the serial number on the main PCB and the remote sensor PCB when reinstalling.

1. Remove the connector from the sensor PCB to feed the cable through the housing.
2. Immediately refit the connector to the sensor board in the back of the box. The MGS and remote sensor must be kept together as they are calibrated together and are a matched pair.

To clean, the faceplate should be lightly dusted.



NOTE: Do not spray the MRLDS-CO2 with cleaning or polishing aerosols.

3 Housing Dimensions

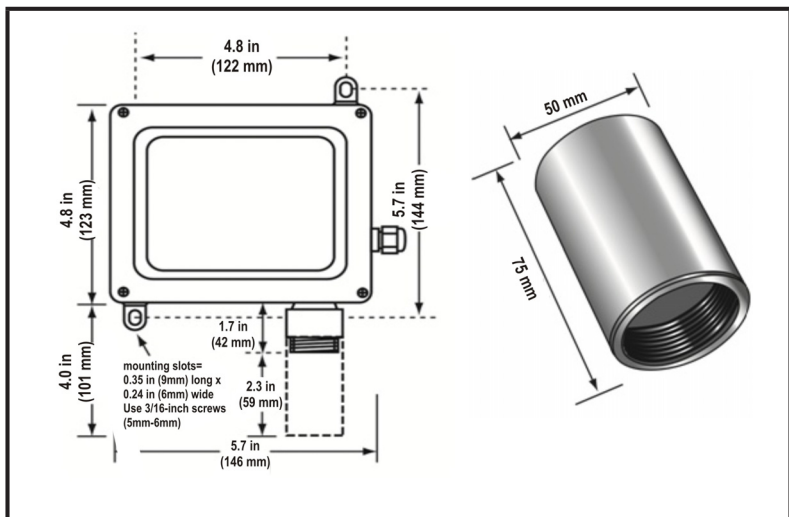


Figure 3-1 - IP66 Housing with Splashguard

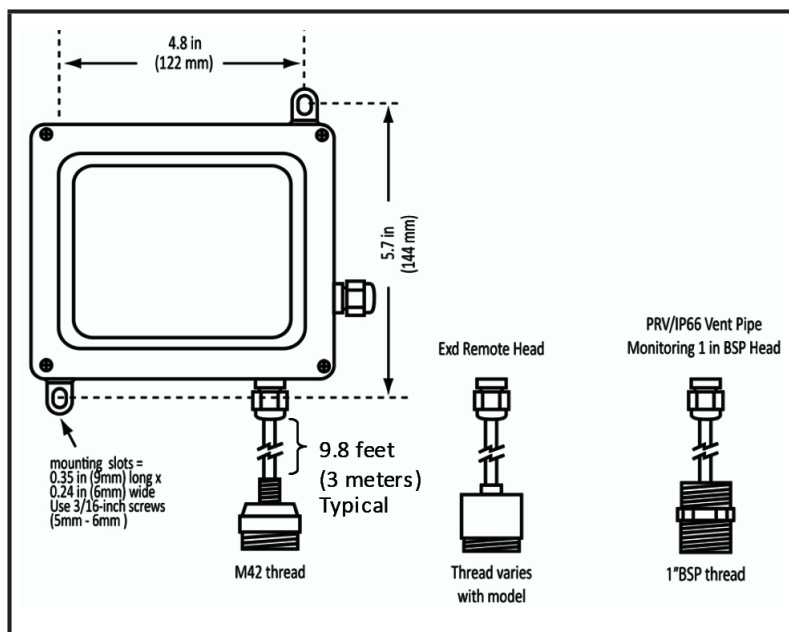


Figure 3-2 - IP66 Housing with Remote Sensor Head

For Dimensions and Mounting Locations, see *Figure 3-1*.



NOTE: For the EXd Remote Sensor Head and 16.4 ft. (5 m) cable, the thread varies based on the model.

4 Operation and Stabilization

the process can take up to 24 hours or more. Again, you may monitor the 0-10V output to follow the progress.

On powering up, the MRLDS-CO₂ will sense for the presence of gas after an initial warm-up delay of five minutes. The green LED will flash at one-second intervals during the warm-up.

In an alarm condition:

- Green LED stays on and the red LED will be on.
- Audible alarm operates (if not disabled and after delay, if option selected).
- Relay output activates (after a delay, if this option was selected).
- V or I output changes proportionally with gas concentration.

In a fault condition:

- Green LED will be off and the red LED will be on.
- Voltage or current fault output will activate:
 - 2mA on the 4-20mA output
 - 0.5V on the 1-5V output
 - 1.0V on the 2-10V output

Sensor Type	Stabilization Time
Electrochemical (EC)	20-30 seconds
Output	1-3 minutes
Relay Setpoint	2 minutes

Table 4-1 - Typical Time for Various Sensor Types

On power up, the electrochemical sensor outputs a signal voltage normally below the set alarm level. Semiconductors output over the + max scale, i.e., > 5V. Both move towards zero as they stabilize.

If sensors have been in long-term storage or the detectors have been turned off for a long period, stabilization is much slower. However, within 1-2 hours, sensors should have dropped below the alarm level and be operational. You can monitor progress exactly by monitoring the 0-10V output. When the output settles around zero the sensor is stabilized. In exceptional circumstances

5 Configurations

5.1. Overview

Function	Description
Time Delay	Available on the audible alarm and relay to avoid false alarms. This is set with jumpers. The default delay is 0 minutes. You may wish to set to 15 minutes during start up and/or construction if you may have volatile organic compound (VOC) fumes, paint, etc. in the rooms. See Figure 2-1 for setting the jumpers.
Audible Alarm	The units have an internal audible alarm. You can disable this by using the jumper, but the default setting is “enabled” in compliance with EN378. See Figure 2-1 for setting the jumpers.
Output	Decide which output is required: 4-20mA, 1-5V, 0-10V, relay outputs, etc. See Figure 2-1 for setting the jumpers.

Table 5-1 - MRLDS-CO2 Functions

$$\text{Alarm Point Voltage} = \text{Alarm Value} \times \frac{5V}{\text{Max Range}}$$

$$\text{Alarm Point Voltage} = 100 \text{ ppm} \times \frac{5V}{1000 \text{ ppm}} = 0.5V$$

So the alarm relay setting is 0.5 Volts.

5.2. Adjusting the Alarm Relay Setpoint

This process is the same for all versions using Pot P1 and test points 0V and REF1.

Adjusting the Alarm Relay:

1. Locate Pot P1 and use it to adjust the setpoint at which the relay activates.
2. Monitor the output between test points 0V (negative) and REF1 (positive) until the correct setting is reached. See example below.

Example: For a sensor range of 0-1000 ppm, calculate the voltage to set the relay at 100 ppm.

6 Functional Tests and Calibration

6.1. Introduction

To comply with the requirements of EN378 and the European F-GAS regulation, sensors must be tested annually. However, local regulations may specify the nature and frequency of this test.



CAUTION: Check local regulations on calibration or testing requirements.



CAUTION: The MRLDS-CO2 contains sensitive electronic components that can be easily damaged. Do not touch or disturb any of these components.



NOTE: The MRLDS-CO2 is calibrated at the factory and is not required to be calibrated at the time of installation.



NOTE: If the MRLDS-CO2 is exposed to a large leak it should be tested to ensure correct functionality by electrically resetting the zero setting and carrying out a bump test. See procedures below.



NOTE: Annual checks and gas calibration is recommended. Sensor replacement every three years or as required is also recommended. Calibration frequency may be extended based on application, but should never exceed two years.



NOTE: In applications where life safety is critical, calibration should be done quarterly (every three months) or on a more frequent basis. Emerson Retail Solutions is not responsible for setting safety practices and policies. Safe work procedures including calibration policies are best determined by company policy, industry standards, and local codes.



WARNING: Failure to test or calibrate the unit in accordance with applicable instructions and with industry guidelines may result in serious injury or death. The manufacturer is not liable for any loss, injury, or damage arising from improper testing, incorrect calibration, or inappropriate use of the unit.



NOTE: Before testing the sensors on-site, the MRLDS-CO2 must have been powered up and allowed to stabilize.



NOTE: The testing and/or calibration of the unit must be carried out by a suitably qualified technician, and must be done:

- In accordance with this manual.
- In compliance with locally applicable guidelines and regulations.

Suitably qualified operators of the unit should be aware of the regulations and standards set down by the industry/country for the testing or calibration of this unit. This manual is only intended as a guide and, insofar as permitted by law, the manufacturer accepts no responsibility for the calibration, testing, or operation of this unit.

The frequency and nature of testing or calibration may be determined by local regulation or standards.

EN378 and the F-GAS Regulation require an annual check in accordance with the manufacturer's recommendation.



NOTE: For improved accuracy and response, the instrument should be zeroed and calibrated in the environment in which it is being installed.

There are two concepts that need to be differentiated:

- **Bump test** - Exposing the sensor to a gas and observing its response to the gas. The objective is to establish if the sensor is reacting to the gas and all the sensor outputs are working correctly. There are two types of bump test:

- Quantified - A known concentration of gas is used.
- Non-Quantified - A gas of unknown concentration is used.
- **Calibration** - Exposing the sensor to a calibration gas, setting the “zero” or standby voltage to the span/range, and checking/adjusting all the outputs, to ensure that they are activated at the specified gas concentration.



CAUTION: Before you carry out the test or calibration:

- Advise occupants, plant operators, and supervisors.
- Check if the MRLDS-CO2 is connected to external systems such as sprinkler systems, plant shut down, external sirens and beacons, ventilation, etc. and disconnect as instructed by the customer.
- Deactivate alarm delays if selected at JP5, JP6 as per Figure 2-1.
- For bump test or calibration the MRLDS-CO2 should be powered up for 24 hours. The instrument should be fully stabilized per Section 4.



NOTE: Procedures for bump test and calibration vary depending on the sensor technology used and the gas in question.



NOTE: Do not pressurize the sensor.



NOTE: For semiconductor sensors, you MUST use calibration gas in a balance of air (not N₂).



NOTE: After a semiconductor or electrochemical sensor is exposed to a substantial gas leak, the sensor should be checked and replaced if necessary.



NOTE: To test the audible alarm and/or relay function, check if the delay is set to zero and expose to gas. You can mute the audible alarm by removing jumper 3.

6.2. Bump Testing

After installation, the units should be bump tested. Expose the sensors to test gas (NH₃, CO₂, etc.). The system will alarm when the test gas ppm value is above the alarm level. The gas should put the system into alarm and light the red LED. The delay prevents the audible alarm from sounding and the relay from switching (if delay is set).

With a bump test you can see the functions of the sensor - the red LED will light, the relay and audible alarm will function, and the output selected (0-10V, for example) will show the gas level. Ideally bump tests are conducted on site in a clean air atmosphere.



NOTE: Prior to carrying out a bump test, check and adjust the zero setting as described in the Calibration section.

Bump Testing Using Calibration Gas Cylinder:

1. Remove the enclosure lid of the gas detector (not in an exhaust area).
2. Connect a voltmeter to monitor sensor response (in Volts DC). Monitor the response between pins 0V and VS.
3. Expose the sensor to gas from the cylinder. You can place the entire MRLDS-CO2 into a plastic bag or use a plastic hose/hood to direct gas to the sensor head. A response of above 80% is acceptable.



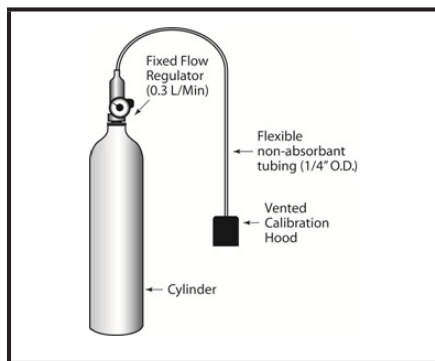


Figure 6-1 - Gas Cylinder and Test Hardware

Gas ampoules are convenient and inexpensive alternatives to using gas cylinders for bump testing.

Bump Testing Using Calibration Gas Cylinder:

1. Make sure that both the ampoules and the calibration beaker are clean and dry.
2. Unscrew the beaker hold screw and place the ampoules so that it sits in the base of the beaker (see **Figure 6-2**).
3. Tighten the wing-nut-screw onto the ampule without breaking it.
4. Remove the enclosure lid of the gas detector.
5. Connect a voltmeter between pins 0V and VS to monitor sensor response (in Volts DC).
6. Place the beaker over the sensor head using the multi sensor adaptor to fit the sensor, or, if an EXd, IP66 or Remote sensor head version, screw the beaker on the remote sensor head M42 thread or M35 thread adaptor. It should be as tight fitting as possible to allow maximum gas exposure.
7. Tighten the wing-nut screw onto the ampoule until it shatters allowing the gas to diffuse in the beaker. It should be left in place for approximately five minutes.
8. The voltage output will increase. This confirms that the sensor is responding. A response equivalent to at least 50% (typically) of the test gas will confirm that the system is in order if tested with the unit's specified span gas.
9. Remove the beaker from the sensor. Carefully remove any ampoule remains from the gas detector and beaker.



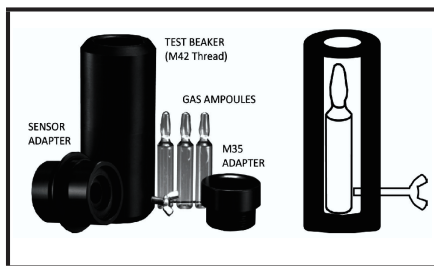


Figure 6-2 - Gas Ampoules for Bump Testing

6.3. Calibration Overview

There are two adjustments required: zero and span. They are monitored at 0V and VS using a 0-5V scale. If the sensor range is 0-1000 ppm, then 5V=1000 ppm.

A calibration kit is available that consists of a calibration gas cylinder, a flow regulation valve with flexible non-absorbent tubing and vented calibration hood.

Tools required:

- Gas cylinder with the appropriate gas and concentration.
- A voltmeter (crocodile clips recommended).
- Screwdriver (depending on housing).

6.4. Calculating Calibration Voltage

Sensor outputs are linear. As long as the gas cylinder is of known concentration, it can be calibrated to any desired range.

Example: For a sensor range of 0-1000 ppm and a cylinder of the target gas at 800 ppm:

$$\text{Voltage} = \frac{\text{Target Gas Value}}{\text{Sensor Range}} \times \frac{5V}{1000 \text{ ppm}} = 4V$$

$$\text{Voltage} = 800 \text{ ppm} \times \frac{5V}{1000 \text{ ppm}} = 4V$$

So the output voltage signal should be adjusted to 4V.

6.5. Calibrating Infrared (IR) Sensors

To calibrate Infrared (IR) Sensors:

1. Locate Pot VR203, which is used to adjust the zero point.
2. Monitor the output between 0V (negative) and VS (positive).
3. Expose the sensor to pure 99% nitrogen or until output is stable (approximately three minutes).
4. Adjust Pot VR203 to 0V or slightly positive (0.01 V is acceptable).
5. Locate Pot VR202, which is used to calibrate the range (span) of the sensor.
6. Monitor the output between 0V (negative) and VS (positive).
7. Expose the sensor to calibration gas and allow to stabilize (approximately three minutes).
8. Adjust pot VR202 to the voltage calculated in **Section 6.4., Calculating Calibration Voltage**.

7 Troubleshooting

Symptom	Possible Cause(s)
Green and Red light off	• Check power supply. Check wiring. • MRLDS-CO2 was possibly damaged in transit. Check by installing another MRLDS-CO2 to confirm the fault.
Red light on, green LED off (indicates a fault)	• The sensor may be disconnected from printed circuit board. Check if the sensor is properly inserted into board. • The sensor element has been damaged or has reached end-of-life and needs to be exchanged. Contact Emerson Retail Solutions for instructions and support.
Alarms in the absence of a leak	• If you experience alarms in the absence of a leak, try setting an alarm delay. • Perform a bump test to ensure proper operation.

Table 7-1 - Troubleshooting MRLDS-CO2

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