# GG-02 OXYGEN GAS SENSOR


## Installation and Operation Manual

CALIBRATION TECHNOLOGIES INC.
GAS DETECTION SPECIALISTS

## Warning

**Use this product only in the manner described in this manual. If the equipment is used in a manner not specified by Calibration Technologies, the protection provided by the equipment may be impaired.**

**This equipment should be installed by qualified personnel.**

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# General Description

This manual was written for the GG-O2-C version, covering oxygen ranges 0-25% and 15-25%.

The GG-O2-C sensor is a +24 VDC, three-wire, 4/20 mA sensor for oxygen which utilizes proven electrochemical sensor technology for fast and accurate monitoring of oxygen levels in ambient air. The industry standard linear 4/20 mA output signal is compatible with most gas detection systems and PLCs.

The GG-O2-C exhibits excellent accuracy and precision, with negligible response to common interference gases, dramatic changes in relative humidity or changes in barometric pressure. The sensor is temperature compensated throughout its operating range of -10°F to +125°F (-23°C to +52°C) to ensure accuracy during extreme temperature excursions.

The transmitter circuit board is sealed in potting compound, protecting sensitive electronic components and copper tracing from corrosion. The specially vented chemical-resistant polycarbonate or optional stainless steel enclosure protects the sensor from accidental damage, weather and direct hose-hits from clean-up crews.

# Installation

## Locating the sensor

One of the most important considerations when installing GG-O2-C sensors is that they must be easily accessible for calibration and maintenance.

For optimum personnel protection (representative concentration reading that an employee would be exposed to), mount the sensor at a height in the breathing zone of the employees. It would typically be about five feet off the ground, which also allows easy access. As a general rule of thumb, mount the sensor no further than 30 feet from potential leak sources.

## Installation Guidelines:

- Always mount the sensor vertically.
- Must be easily accessible for calibration and maintenance.
- Mount the sensor close to the potential leak source.
- For optimum personnel protection, mount sensor in the “breathing zone” (4’ – 6’ above floor).
- Take air movement and ventilation patterns into account.
- To prevent electrical interference, keep sensor and wire runs away from mercury vapor lights, variable speed drives, and radio repeaters.
- Protect sensor from physical damage (forklifts, etc).
- If mounting on a wall with studs, the mounting screws should be screwed into the studs.
- If mounting sensor outdoors, consider prevailing wind direction and proximity to the most likely source of leaks. Protect the sensor from sun and rain as much as possible.
- For highly critical locations more than one sensor should be installed in each room.
- Mount sensor enclosure through the mounting holes as shown in Figure 1.

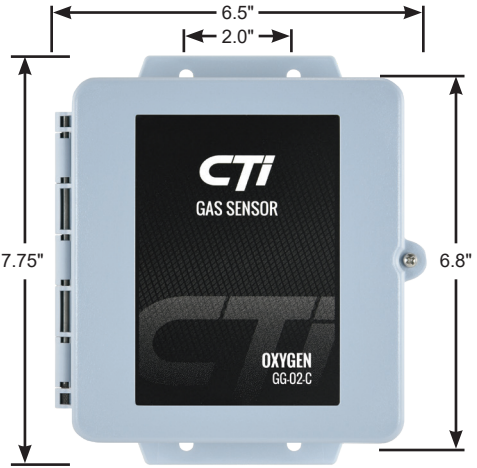



**Figure 1: Mounting Dimensions**

## Wiring

Electrical wiring must comply with all applicable codes.

**Electrical Power:** 24 VDC isolated, 350 mA.
**Output:** Linear 4/20 mA output. Monitoring equipment may have a maximum input impedance of 700 ohms.
**Cable Recommendation:** 20/3 shielded cable (General Cable C2525A or equivalent). Length of cable to sensor should be no greater than 1,500 feet.
**Monitoring:** Monitoring equipment must be configured to indicate a fault if the signal is below 1 mA. All signals over 20 mA must be considered high gas concentrations.

## Wiring Guidelines:

- Always use 3-conductor, insulate, stranded, shielded copper cable.
- Do not pull sensor wiring with AC power cables. This can cause electrical interference.
- If cable runs cannot be made without a splice, all splice connections should be soldered.
- Ground the shield at the main control panel. Connect the shield wire in the sensor terminal block labeled *SHLD*.
- Always disconnect power at the controller before performing any wiring at the sensor.
- To maintain NEMA/IP rating of the enclosure, conduit fittings of the same rating or better must be used.


**Terminal Block Plug (Field Wiring):**
SHLD: To case (earth) ground of monitoring equipment
GND: To ground terminal of power supply
+24V: To +24V terminal of power supply
SIG: To signal input of monitoring equipment

# Operation

## Start-up

Before applying power, make a final check of all wiring for continuity, shorts, grounds, etc.

The sensor can be immediately tested following power-up. Because sensors are normally located at a distance from the main unit, the test time required and accuracy of the response checks will be improved if two people perform the start-up procedures and use radio contact.

**Start-Up Test:**

1) One person exposes each sensor to nitrogen or 15% O2 calibration gas.

2) The second person stays at the control unit to determine that each sensor, when exposed to the gas, is connected to the proper input and responds, causing appropriate alarm functions.

## Calibration

A span calibration is recommended after initial installation to ensure accuracy in the new environment it is operating it. After the unit is installed and has been powered up for a minimum of 1 hour, the unit can be calibrated. There are two pots on the preamp that are used for calibration

**Note: Never measure sensor output in mA. Always use mVDC or VDC voltmeter settings on sensor test points (see Figure 2).**

Note: Adjusting the span to achieve a 20.9% reading can be done with calibration gas or in clean air.

**Span Calibration:**

- Apply 20.9% O2 span gas at 0.8 L/min.
- Once the output signal has peaked (or 2 minutes maximum), adjust the span pot until the correct output is achieved (see **Figure 2**).

Note: Calculated span values (see **Figure 2**)
0-25% range = 173.7 mV from Test [-] to Test [+]
15-25% range = 134.4 mV from Test [-] to Test [+]

Below are a few response characteristics which may be an indication that the gas sensor is at or near the end of its useful life. If any of these are observed, the cell should be replaced:

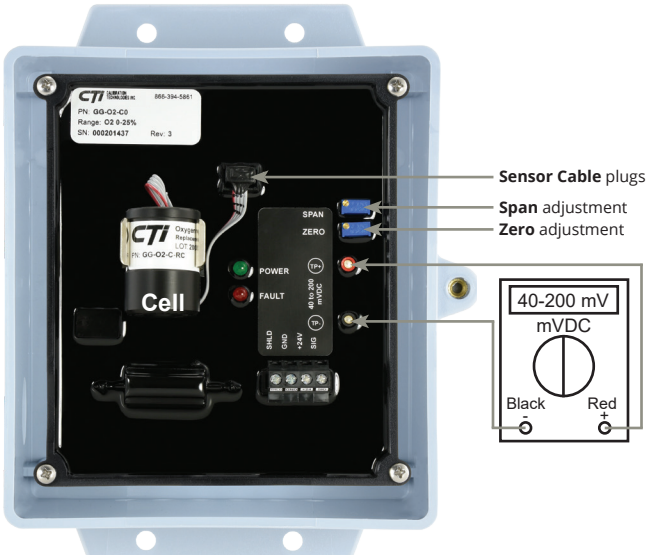
- Slow response to / recovery from calibration gas.
- Unable to achieve correct output during span adjustment.

**Zero Calibration:** DO NOT ADJUST THE ZERO POT WITHOUT CERTIFIED CALIBRATION GAS. If zero adjustment is required, use the following procedure:

- Apply zero calibration gas (nitrogen or 15% O2 depending on range of sensor) at 0.8 L/min.
- Once the output has settled (or 2 minutes maximum), adjust the zero pot until the sensor outputs 40 mV from Test [-] to Test [+] (see **Figure 2**).

| Range | Span to* |
|---|---|
| 0-25% ..... | 173.7 mVDC |
| 15-25% ..... | 134.4 mVDC |

*with 20.9% O2 calibrations gas or clean air




**Fault (red) LED:**

- On steady if supply voltage is less than 10VDC.

**Power (green) LED:**

- On steady to Indicate Power.
- Blinks once per second for 60 seconds during power-up.
- Blinks once per second continuously if supply voltage is too low.
- Blinks twice per second in calibration mode (4 minute timeout delay).

**Figure 2: Sensor board components and zero/span adjustment**

# Maintenance

The GG-O2-C was designed for long life and minimal maintenance. For proper operation it is essential that the test and calibration schedule be adhered to. Calibration Technologies recommends the following maintenance schedule:

## Maintenance Guidelines:

- The sensor is shipped with a factory calibration. Sensor should be calibrated 6 months from purchase date.
- Calibrate the detector at least once every 6 months.
- Calibration should be performed with certified calibration gas. Calibration kits and replacement cylinders are available from Calibration Technologies.
- All tests and calibrations must be logged.
- Always disconnect power at the controller before performing any wiring at the sensor.

**Sensor Life:** These electrochemical cells are long-life sensors, but several things can cause the cell chemicals to become depleted including:

- a period of time
- exposure to high temperatures

Typical sensor life in 20.9% oxygen is three years. When the cell becomes depleted, a replacement cell can be obtained from Calibration Technologies. Simply unplug the cell's ribbon cable from the transmitter, pull the old cell from the spring clip, discard the old cell and replace it with a new cell. The sensor can be calibrated once the resting signal stabilizes, typically within a one hour warm-up period.

Part number for replacement cell: **GG-O2-C-RC**

## Specifications

**Input Power:** +24 VDC, 350 mA
**Detection Principle:** Electrochemical
**Detection Method:** Diffusion
**Gases:** Oxygen (O2)
**Ranges:** 0-25%, 15-25%
**Output Signal:**
Linear 4/20 mA (max input impedance: 700 Ohms)
**Response Time:**
$T_{50}$ = less than 30 seconds
$T_{90}$ = less than 60 seconds
**Accuracy:**
+/- 2% of value, but dependent on calibration gas accuracy and time since last calibration
**Zero Drift:** Less than 0.5% of full-scale per month, non-cumulative
**Span Drift:** Less than 0.5% per month
**Linearity:** +/- 0.5% of full-scale
**Repeatability:** +/- 1% of full-scale
**Wiring Connections:**
3-conductor, shielded, stranded, 20 AWG cable (General Cable C2525A or equivalent) up to 1500 ft.
**Terminal Block Plug (Field Wiring):** 26-12 AWG, torque 4.5 lbs-in.
**Temperature Range:** -10°F to +125°F (-23°C to +52°C)
**Humidity Range:** 5% to 100%RH (non-continuous condensing)
**Dimensions:** 7.7" high x 6.7" wide x 3.8" deep
**Weight:** 3.0 lbs
**Enclosure:** Injection-molded, NEMA 3RX washdown-duty, polycarbonate sensor housing with hinged lid and captive screw. For non-classified areas.
Optional 18 GA, NEMA 3RX washdown-duty stainless steel enclosure with hinged lid and captive screw. For non-classified areas.
**Certification:**
ETL Listed:
Conforms to UL 61010-1
Certified to CSA C22.2 No. 61010-1

## Limited Warranty & Limitation of Liability

Calibration Technologies, Inc. (CTI) warrants this product to be free from defects in material and workmanship under normal use and service for a period of 2 years (gas cell included), beginning on the date of shipment to the buyer. This warranty extends only to the sale of new and unused products to the original buyer. CTI's warranty obligation is limited, at CTI's option, to refund of the purchase price, repair, or replacement of a defective product that is returned to a CTI authorized service center within the warranty period. In no event shall CTI's liability hereunder exceed the purchase price actually paid by the buyer for the Product.

This warranty does not include:

a) routine replacement of parts due to the normal wear and tear of the product arising from use;

b) any product which in CTI's opinion, has been misused, altered, neglected or damaged by accident or abnormal conditions of operation, handling or use;

c) any damage or defects attributable to repair of the product by any person other than an authorized dealer or contractor, or the installation of unapproved parts on the product

The obligations set forth in this warranty are conditional on:

a) proper storage, installation, calibration, use, maintenance and compliance with the product manual instructions and any other applicable recommendations of CTI;

b) the buyer promptly notifying CTI of any defect and, if required, promptly making the product available for correction. No goods shall be returned to CTI until receipt by the buyer of shipping instructions from CTI; and

c) the right of CTI to require that the buyer provide proof of purchase such as the original invoice, bill of sale or packing slip to establish that the product is within the warranty period.

THE BUYER AGREES THAT THIS WARRANTY IS THE BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. CTI SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, WHETHER ARISING FROM BREACH OF WARRANTY OR BASED ON CONTRACT, TORT OR RELIANCE OR ANY OTHER THEORY.

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CALIBRATION TECHNOLOGIES INC.
*GAS DETECTION SPECIALISTS*

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