**Instruction Sheet**
PN 51A-4000/rev.C
January 2009

Model 4000

# Percent Oxygen Sensor

- STABLE, RELIABLE amperometric Oxygen Sensor
- LONG LIFE, LOW MAINTENANCE rechargeable sensor
- ROBUST DESIGN for harsh applications*
- RAPID CALIBRATION using ambient air
- COMPATIBLE WITH 5081-A, 1056 AND 1055 INSTRUMENTS

## APPLICATIONS

The Model 4000 sensor is used to monitor percent oxygen concentrations in gaseous streams. The most common use is to monitor oxygen headspace concentration for nitrogen blanketing applications. The sensors are also used in other applications where oxygen levels are controlled and monitored.

## FEATURES

The Model 4000 Series Percent Oxygen sensor is a membrane-covered amperometric sensor. The membrane consists of a gas permeable Teflon®[1] membrane stretched tightly over a gold cathode. A silver anode and an electrolyte solution complete the internal circuit. The sensor body is constructed of Ryton®[2], which can withstand exposure to hydrocarbons and other corrosive chemicals.

Gas permeates through the membrane, and the oxygen in the sample is reduced at the cathode. A voltage is applied across the cathode and anode, generating an electrical current that is directly proportional to the oxygen concentration in the sample. Since the rate of oxygen diffusion through the membrane is temperature dependent, the sensor response must be corrected for permeability caused by temperature. A Pt 100 RTD in the sensor accurately measures temperature, and the analyzer automatically performs the correction.

The sensor is easy to maintain. For calibration simply expose the sensor to ambient air and press the air calibration button. The analyzer measures the barometric pressure using an on-board pressure sensor and calculates the equilibrium solubility of atmospheric oxygen at the prevailing temperature and pressure. Replacing the membrane requires no special tools or fixtures. To replenish the electrolyte solution, unscrew the fill plug, add the reagent, and replace the plug.

### TYPES OF SENSORS:

**Rechargeable with a fast response flow assembly —** allows minimum volume gas flow that permits mounting sensor in a flowing gas stream. Sample is supplied at slightly above atmospheric pressure, flows through the assembly, and discharges to atmospheric pressure. Internal volume is low to minimize sensor response time. Refer to Figure 1 for mounting instructions.

**Rechargeable In-line flow —** In line pressure compensated flow assembly permits mounting the sensor in a variable pressure gas stream at pressures up to 50 psig. This may or may not include a gland on the sensor body. Refer to Figures 2, 3, and 4 for mounting instructions.

**RYTON is resistant to 30% sulfuric acid, 85% phosphoric acid, 30% sodium hydroxide, gasoline, aliphatic alcohols, esters, ethers, and ketones, as well as to aromatic amines. It is not particularly suited for service in strong oxidizing agents, aliphatic amines, chlorinated hydrocarbons, or aromatic nitrites, aldehydes, and nitro compounds.*

[1] Teflon is a registered trademark of E.I. du Pont de Nemours & Co.

[2] Ryton is a registered trademark of Chevron Phillips Chemical Company LP.

## SPECIFICATIONS

**Range:** 0-25% Oxygen

**Linearity:** For constant sample temperature after correction for sensor zero offset: ±1% of full scale

**Repeatability:** ± 0.1% of range

**Stability:**

Zero drift ± 0.25% $O_2$ per week @ 25°C;

Span drift ± 0.25% $O_2$ per week @ 25°C

**Response Time:** 90% in 20 seconds for a step change, using an equilibrated sensor at 25°C

**Sample Pressure:** 0 to 50 PSIG

**Sample Temperature:** 32 to 110°F

**Humidity:** up to 95% non-condensing

**Wetted materials:** Ryton®[1], Teflon®[2]

[1] Ryton is a registered trademark of Chevron Phillips Chemical Company LP.

[2] Teflon is a registered trademark of E.I. du Pont de Nemours & Co.

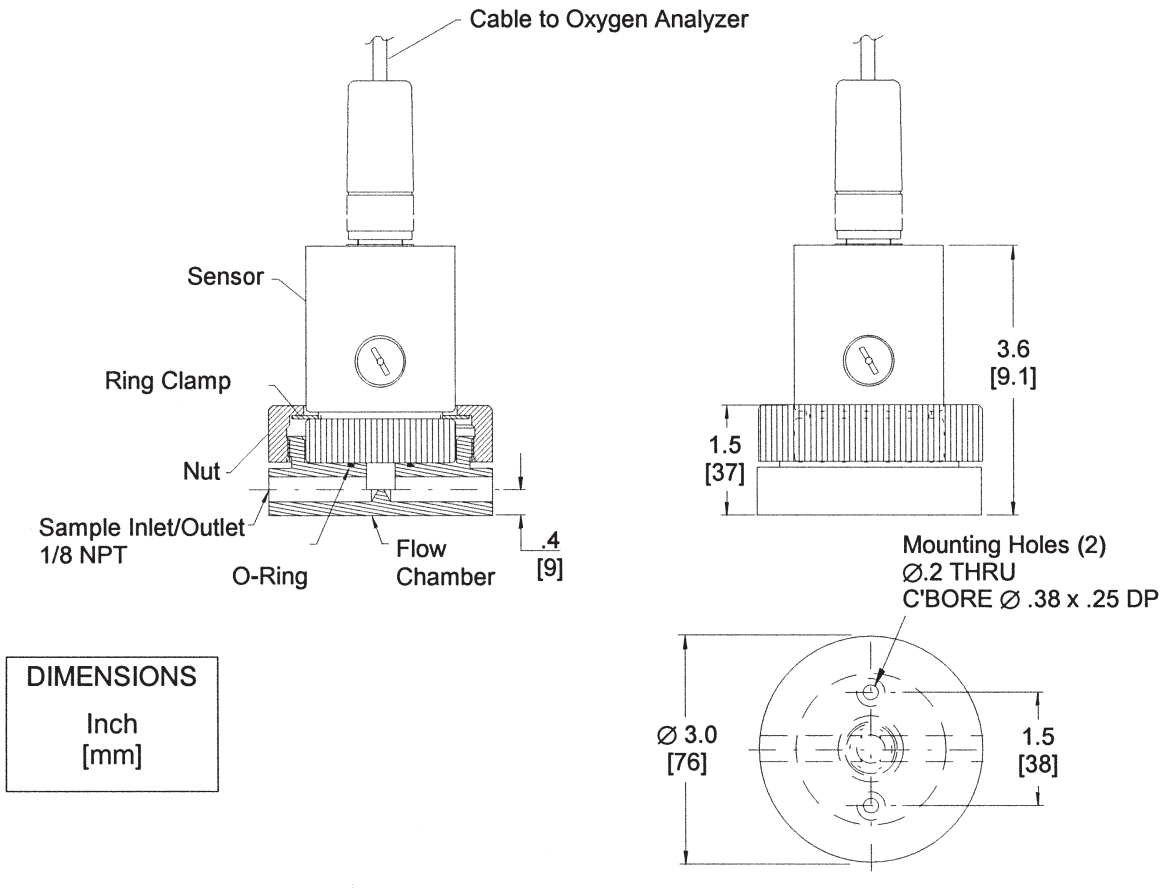


**FIGURE 1. Rechargeable Sensor with Fast Response Flow Assembly (6A00184G01)**

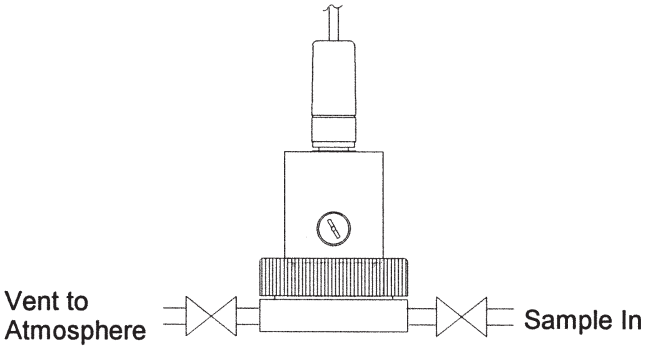


**FIGURE 2. Vertical Installation (Preferred)**

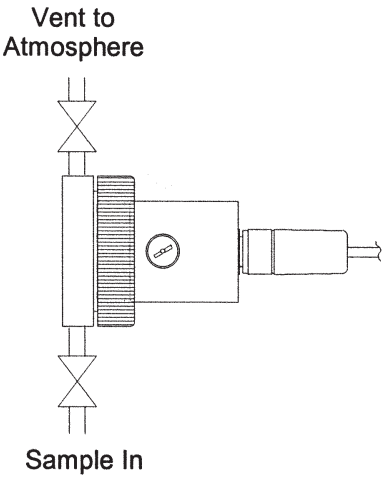


**FIGURE 3. Horizontal Installation**

## INSTRUMENT SET UP FOR % OXYGEN MEASUREMENT

For the 1055, access menu by selecting program, then measurement, configure Sensor 1. For manufacturer select Rosemount, for application select Other, for S1 Units select % sat.

For the 5081A, access the menu by using Program Key on the infrared remote. Select Display, Type=O2, Unit=%, Sensor=AdO.

For the 1056, access the menu by selecting program, then measurement, choose sensor 1 or 2 measurement = oxygen. In the “SN configure” screen, under “type” select “% 02 in gas” for “units” select “% oxygen in gas”.

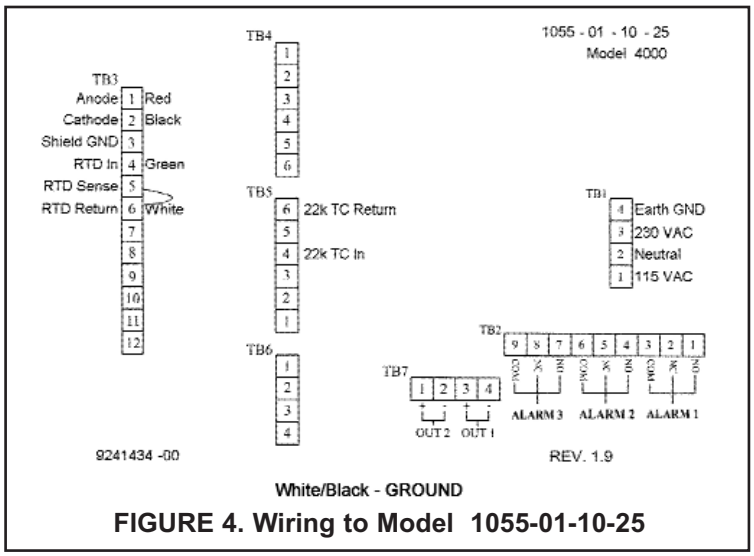


**FIGURE 4. Wiring to Model 1055-01-10-25**

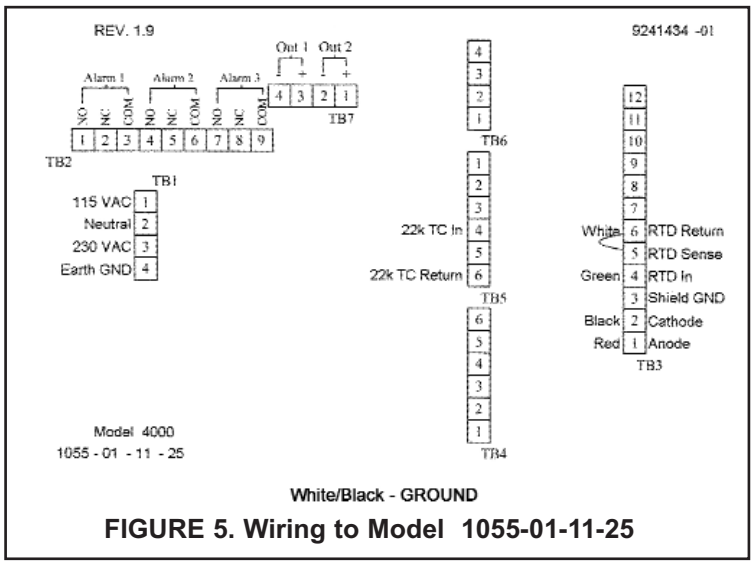


**FIGURE 5. Wiring to Model 1055-01-11-25**

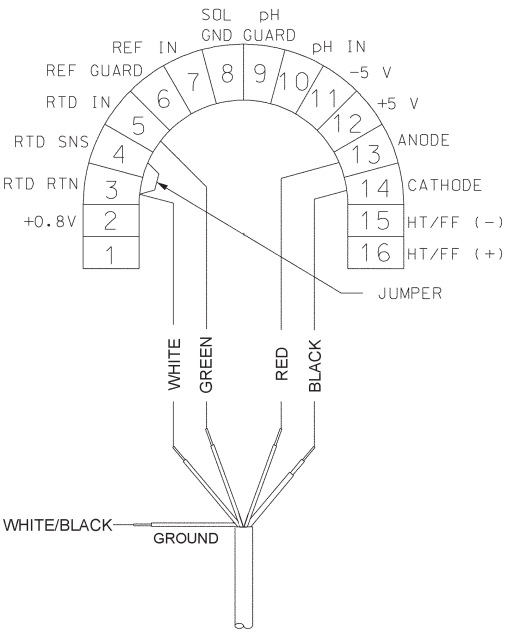


**FIGURE 6. Wiring to Model 5081**

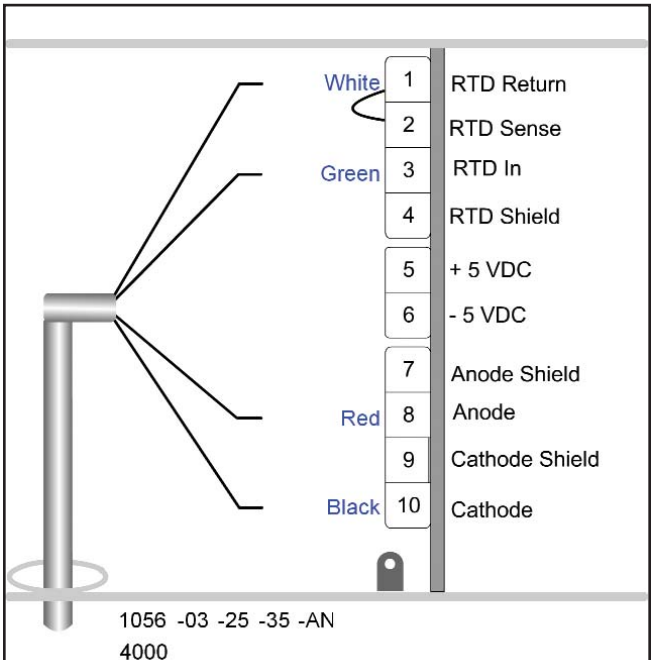


**FIGURE 7. Wiring to Model 1056**

## CALIBRATION

Air calibration is recommended. Using a certified span gas is an option, but since the concentration of oxygen in ambient air is close to 21% at sea level, this is the best solution. Refer to the instrument instruction manual for details on how to access the calibration menu.

Note: An “inprocess” calibration is required. Input 21% $O_2$ as the process concentration. For model 1056, air calibration can be performed.

## TROUBLESHOOTING

The most frequent fault is a progressive development of insensitivity of the sensor. If sensor calibration is sluggish, then the sensor should be recharged with new electrolyte and the membrane may need to be replaced. Listed below are some common troubleshooting techniques

| SYMPTOM | PROBABLE CAUSE | CORRECTIVE ACTION |
|---|---|---|
| Abnormally high oxygen readings (unable to calibrate) | 1. Hole in sensor membrane<br>2. Gold cathode loose<br>3. Open RTD | 1. Replace membrane<br>2. Replace sensor<br>3. Replace sensor |
| Abnormally low oxygen readings (unable to calibrate) | 1. High internal cell resistance<br>2. Membrane loose<br>3. Contaminated electrolyte<br>4. RTD shorted | 1. Replace sensor<br>2. Tighten cap / replace membrane<br>3. Clean / recharge sensor<br>4. Replace sensor |
| Sensor noisy (motion sensitive) | 1. Membrane loose<br>2. Low electrolyte level<br>3. Cathode contaminated | 1. Replace membrane<br>2. Fill properly<br>3. Replace sensor |
| Upscale reading with known oxygen-free sample | Gold cathode loose | Replace sensor |

## PROCEDURE TO RECHARGE THE SENSOR:

Refer to Figure 8 for an exploded view of the sensor.

1. Unscrew the knurled cap from the sensor body. Remove the membrane assembly. Empty all electrolyte from the sensor. Flush the sensor with distilled or deionized water to remove all particulate.
2. Place a piece of adhesive tape over the breather hole in the pressure compensation diaphragm port (not the slotted fill plug).
3. Examine the cathode for staining or uneven coloration, which indicates the cathode should be rejuvenated. Also inspect the grooves that surround the cathode for any deposited material, which will typically be white to gray in color. Most of these deposits are water soluble and can be removed via a water jet from a squeeze bottle. Any insoluble deposits may be removed with a toothpick, but care must be used to avoid deforming the grooves.
4. Disassemble the membrane assembly. Remove the retainer from the holder by placing your finger into the center hold of the holder and pressing your fingernail against the inner edge of the retainer. Remove and discard the old membrane.
5. Verify that the o-ring is properly positioned in the associated groove holder.
6. Holding a single membrane by the edges only, place it across the membrane holder and snap the retainer in place.
7. Using a sharp razor blade, carefully trim away excess membrane around the edges. Take care that the razor blade does not cut into the edges of the membrane assembly.
8. Set the sensor body on a flat surface with the cathode facing upward. Verify that the o-ring is properly positioned around the cathode. Pour the electrolyte over the cathode / central post assembly so it runs down into the sensor electrolyte well. Fill the well to a level flush with the top of the sidewall. Put the membrane assembly directly onto the cathode so that the face of the holder fits against the o-ring in the end of sensor body. The membrane is now in place.
9. Carefully place the cap on the sensor body. Screw the cap on, finger-tight only. Then lay the sensor on its side with the side port up. Remove the side port screw, rubber pressure-compensating diagram, and washer. Add electrolyte, if necessary, to bring the level even with the shoulder. With the side port still facing up, tighten the cap further until it is snug and the membrane is stretched taut across the cathode. Any excess electrolyte displaced from the well may now be removed by blotting with a tissue.
10. Insert the new rubber diaphragm into the side port, place the new washer over the diaphragm, and secure the side port screw. Do not overtighten the screw.
11. Inspect the sensor for possible leaks or damage to the membrane.
12. Remove the adhesive tape in step 2. The sensor is now ready for operation.

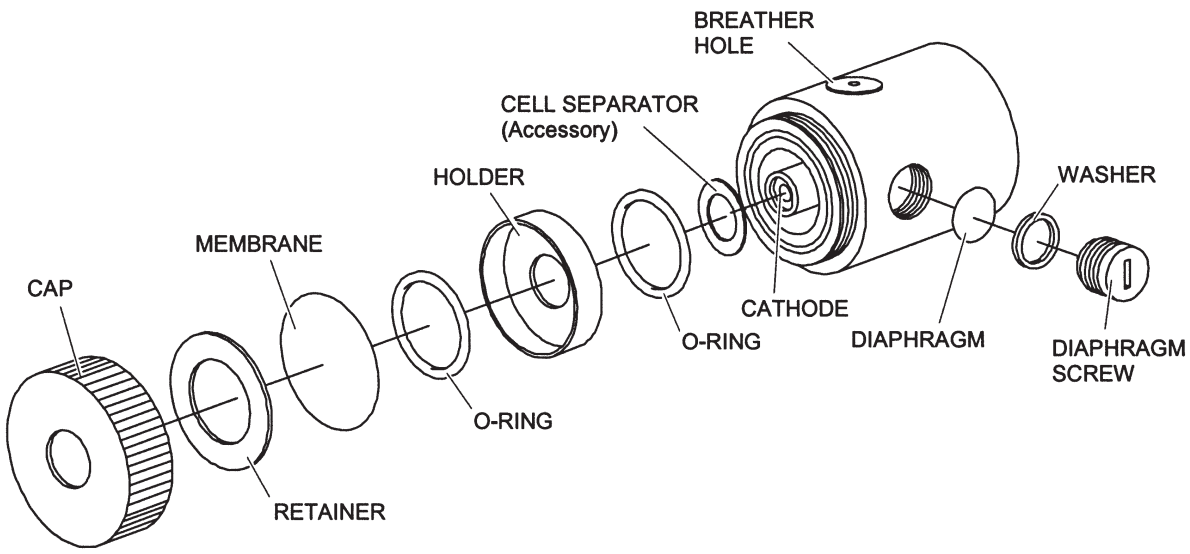


**FIGURE 8. Rechargeable Sensor — Exploded View (6A00181G01)**

## ORDERING INFORMATION

**The Model 4000 sensor** is housed in a molded Ryton®[1] body for insertion or in line flow installations. A Pt 100 allows for accurate temperature compensation. The Model 4000 amperometric sensor provides real time measurement, excellent performance,a nd reliability in various detection and analysis applications.

| MODEL 4000 PERCENT OXYGEN SENSOR | |
|---|---|
| **PART #** | **DESCRIPTION** |
| 6A00181G01 | Percent Oxygen Sensor, Rechargeable, Ryton®[1] |
| 6A00182G01 | Percent Oxygen Sensor with Gland, Rechargeable, Ryton®[1] |
| 6A00184G01 | Percent Oxygen Sensor with Fast Response Flow Assembly, Rechargeable, Ryton®[1] |

[1] Ryton is a registered trademark of Chevron Phillips Chemical Company LP.

## ACCESSORIES

| PART # | DESCRIPTION |
|---|---|
| 6A00195G01 | Cable, 10 ft |

## SPARE PARTS

| PART # | DESCRIPTION |
|---|---|
| 6A00194G01 | Rebuild Kit |

*The right people,*
*the right answers,*
*right now.*

**ROSEMOUNT ANALYTICAL**
CUSTOMER SUPPORT CENTER
**1-800-854-8257**

*ON-LINE ORDERING NOW AVAILABLE ON OUR WEB SITE*
http://www.raihome.com

*Specifications subject to change without notice.*

PlantWeb

EMERSON
Process Management

Credit Cards for U.S. Purchases Only.

VISA MasterCard American Express Cards

**Emerson Process Management**

**Liquid Division**
2400 Barranca Parkway
Irvine, CA 92606 USA
Tel: (949) 757-8500
Fax: (949) 474-7250

http://www.raihome.com

EMERSON
Process Management