Oxygen Meter

MO-200 Series

Oxygen Meter

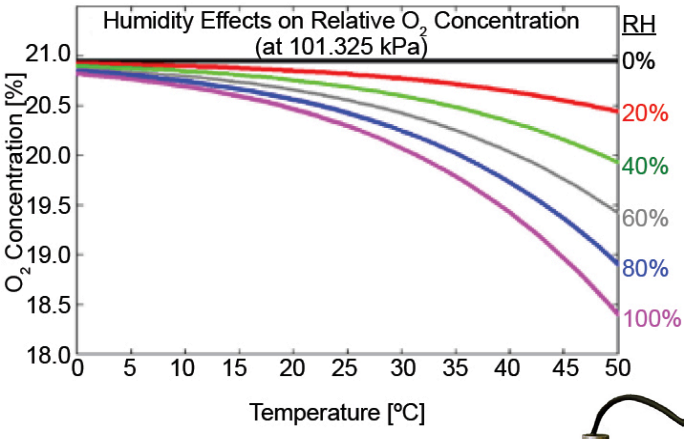
This sensor is a galvanic cell-type oxygen sensor that measures oxygen gas (O_2) in air. It has a lead anode, a gold cathode, an acid electrolyte, and a fluorine resin membrane. The current flow between the electrodes is proportional to the oxygen concentration being measure. An internal bridge resistor is used to provide an mV output linearly proportional to O_2. Unlike polargraphic oxygen sensors, galvanic cells do not require a power supply. The hand-held meter used to measure the sensor uses a 3 V coin cell battery.

The mV output responds to the partial pressure of oxygen in air. The standard units for partial pressure are kPa. However, gas sensors that respond to partial pressures are typically calibrated to read out in mole fraction of the gas in air, or units of moles of oxygen per mole of air. These units can be directly converted to % O_2 in air, or ppm O_2 in air. The concentration of oxygen in our atmosphere is 20.95%, and this precise percentage has not changed for decades. It is also constant across changing temperatures or pressures. This allows for precise calibration of the instrument.

Being a galvanic cell type sensor, a small amount of oxygen is consumed in the reaction in order to produce the current flow and subsequent mV output. The oxygen consumption was measured to be 2.2 µmol O_2 per day when the O_2 concentration was 20.95% (3240 mmol) at 23 C.

Humidity Changes

The graph below shows an example of humidity dependency. The sensor chemistry is not influenced by humidity, but its output decreases because O_2 is displaced by water vapor molecules in the air. The effect of humidity is larger at warmer temperatures because there is more water vapor in the air. To eliminate humidity effects, simply recalibrate.



For use in high humidity, such as soil, remove the head and take the calibration measurement over water in a sealed container as shown at right.

Effects on Output

For the most reliable measurements, the O_2 sensor is designed to be used in a vertical position, as shown. A flow-through or diffusion head is not required for making measurements.

Influences from Various Gases

The sensor is unaffected by CO, CO_2, NO, NO_2, H_2S, H_2, and CH_4. There is a small effect (approximately 1%) from NH_3, HCI, and C_6H_6 (benzene). The sensor is sensitive to SO_2 and can be damaged by O_3.

Temperature Sensitivity

A change in temperature changes the amount of O_2 available to the sensor and therefore changes the mV output that correlates to the atmospheric constant of 20.95%. Additionally, the sensor electronics have a small temperature dependence. To eliminate temperature effects, simply recalibrate.

Pressure Sensitivity

A change in barometric pressure changes the amount of O_2 available to the sensor and therefore changes the mV output that correlates to the atmospheric constant of 20.95%. To eliminate pressure effects, simply recalibrate.

Using the Meter

1) Press the power button to start. The meter will turn itself off two minutes after button is pushed to conserve battery.

2) To calibrate sensor: While sensor is in open air, press mode twice (RUN should be blinking), then while pressing sample, press mode once. Screen will display CAL during calibration. Calibration can be done in either SMPL or LOG mode. Recalibration should be done when significant changes in pressure, humidity, or temperature occur. See page 3 for further information about these effects on output. See page 10 for life expectancy.

3) To choose mode: To choose between SMPL and LOG modes push mode once and use the up and down arrows to make choice. Once desired mode is blinking press mode two more times to begin.

4) For automatic measurements: Use LOG mode (use step 3 to choose LOG mode). Meter will power on and off to record a measurement every thirty seconds.

NOTE: O_2 Meter units are % concentration.

5) For manual measurements: Use SMPL mode (use step 3 to choose SMPL mode). Press sample when you want to take a measurement. Store up to 99 manual measurements. When 99 measurements are taken in SMPL mode, no more SMPL measurements can be stored.

6) To reset meter: From LOG or SMPL mode, press mode twice (RUN should be blinking), then while pressing down, press mode once. **CAUTION, this will erase ALL measurements.**

7) To review data: Press up/down. To exit and return to present conditions and the capability to take measurements press sample.

8) In LOG mode, every 30 minutes it will average the 60 30-second measurements taken and store the average. 99 30-minute averaged measurements can be stored. Every 48 measurements (making a 24 hour period) the meter will also store a daily average. In addition, 99 daily averages can be stored and are available for download only, these measurements are not viewable on the meter LCD. All measurements taken in LOG mode will continue to be stored, eliminating the oldest measurement. To keep data, switch out of log mode.

(SMPL) 99 Sample Measurements	(LOG) 99 Log Measurements	(LOG) 99 Daily Averages Measurements
Viewable on meter LCD & downloadable		Downloadable Only

Cleaning

Debris on the meter is a common cause of low readings. Salt deposits can accumulate on a sensor from evaporation of sprinkler irrigation water and dust, which can accumulate during periods of low rainfall. Salt deposits should be dissolved and removed with vinegar and a soft cloth or q-tip. Dust and other organic deposits are best removed with water, rubbing alcohol or window cleaner.

Error Codes

The most common error code is Error 4. The meter will display this error code on the screen if the battery voltage is too low.

To replace the battery, unscrew the back area on the meter. Then use a pair of tweezers to gently remove the battery and replace it with a new one. Screw the back cover back on the meter, but be careful not to over-tighten as it can affect the LCD screen.

Characteristics

Zero Offset

The mV output in ultra-pure nitrogen gas (0.000% O_2) is typically 2% of the output in 20.95% O_2. Precise measurements of hypoxic and anaerobic conditions can be made by making a periodic zero calibration of the sensor with ultra-pure nitrogen gas.

Life Expectancy

The life expectancy of the sensor is expressed in %-follows:

[Oxygen Concentration (%) x Exposure Time (hours)]

Accordingly, the life of an Apogee oxygen sensor is 900,000 hours or approximately 5 years of continuous use at 20.95% oxygen at 20 C.

Storage Temperature

The life of the sensor can be extended by storage at a lower temperature. For example, a sensor stored at 0 C will have a life expectancy approximately twice that of a sensor stored at 20 C. Below -20 C the electrolyte will freeze. This does not damage the sensor, but to resume measurement the electrolyte must be thawed. Maximum storage temperature is 60 C.

Shock and Vibration

The sensor is resistant up to 2.7 G of shock. However, vibration may influence the sensitivity of the sensor and should be minimized.

Specifications

Memory
- 99 manually stored data points
- Automatically store 99 consecutive 30 minute averages
- 99 daily averages

Diffusion Head
- 3.5 cm tall; 3.5 cm diameter
- 125 mesh screen
- Creates air pocket

Flow-Through Head
- 3.2 cm long by 3.2 cm diameter
- 1/8" barbed adapters
- For hose connections

Mass
- Meter: 80 g
- Sensor and wire: 175 g

Range
- 5 to 100% O_2

Response Time
- 14 seconds

Stability
- ± 0.1% O_2 under stable atmospheric conditions

Repeatability
- ± 0.1% O_2

Input Power
- CR2320 3 V coin cell battery

Operating Environment
- 0 to 50 C
- < 90% non-condensing relative humidity up to 30 C
- < 70% relative humidity from 30 to 60 C
- 60 to 150 kPa

Display
- 4.2 by 2.8 cm

Meter Dimensions
- 11.8 by 5.9 by 1.4 cm

Gas Effect
- CO_2, CO, NO, NO_2, H_2S, H_2, CH_4 - No effect
- NH_3, HCI, C_6H_6 (Benzene) - <1%

Cable
- 2 meters of shielded, twisted-pair wire
- Foil shield
- Santoprene jacket
- Longer cable lengths are available in multiples of 5 meters

Warranty
- 1 year against defects in materials and workmanship

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