



## Application Considerations

**Effect of Temperature:** All membrane clad electrochemical sensors are temperature dependent due to the expansion and contraction of the Teflon sensing membrane. As result more or less of the sample gas, including oxygen to be reacted, diffuses into the sensor. The oxygen sensor's electrical current signal output varies linearly with oxygen concentration. However, the signal output also varies with changes in ambient temperature, 2.54% of reading per degree C is typical. As a result, the expected life of oxygen sensors operated at temperatures above 25°C (77°F) will be reduced by the same 2.54% per degree C temperature coefficient.

The temperature dependent current signal output is compensated by using a resistor-thermistor network. With a proper resistor-thermistor network, the signal can be compensated to within  $\pm 5\%$  of the oxygen reading over the 5-45°C temperature range. This is the worst case situation when going from one extreme of the operating temperature range to the other. The error will be eliminated when the thermistor in the temperature compensation network and the electrolyte inside the sensor reach thermal equilibrium in approximately 45-60 minutes. This assumes the front and rear of the sensor are not exposed to different temperatures.

**Effect of Pressure:** Electrochemical sensors actually measure the partial pressure, not the percentage, of oxygen in the gas stream they are exposed to. These sensors are accurate at any pressure provided the pressure is constant and the analyzer has been calibrated at the same pressure as the sample gas to be measured. Calibrate at the temperature and pressure (altitude) at which the analyzer will be operated. While the sensor is not flow sensitive, avoid restrictions in the vent line which can generate back pressure resulting in erroneous readings or if removed too quickly (a finger pressed over the vent line) can damage the sensor.

**Effect of Humidity:** Electrochemical sensors are not affected by non-condensing relative humidity (RH). However, the use of a humidifier to introduce water vapor and increase the moisture level of the gas mixture does affect the oxygen concentration and the resultant reading displayed by the analyzer. The addition of water vapor increases the total pressure thereby diluting or decreasing the oxygen concentration of the gas mixture resulting in a lower oxygen reading. Learn more . . .

**Liquid/Moisture:** Condensation on the sensing surface of the sensor reduces the signal output by blocking the diffusion of oxygen into the sensor and is mistakenly categorized as a sensor defect. The reality, there is no damage to the sensor, simply remove the liquid and the signal output returns.



**Complete Coverage:** Signal output decreases 12mV to 10mV (17%) after 20 minutes.



**Partial Coverage:** No change in signal output.



**Orientation avoids the issue.**



**Effect of Anesthetic Agents:** The AII 2000 Series Oxygen Analyzers and Monitors utilize an electrochemical galvanic type oxygen sensor that has been characterized by its gas permeable sensing membrane that allows the gas to be analyzed to diffuse into the sensor where oxygen can be reacted. The displayed oxygen concentration of all sensors of this design decreases in the presence of anesthesia gases. EN 12598:1999/ISO 7767:1997 (E) established standards for the maximum error allowable over a given duration. The anesthetic agents listed (Halothane, Enflurane, Isoflurane, Sevoflurane and Desflurane) were vaporized into a gas stream of 30% oxygen / 70% nitrous oxide.

Gas	Test Level	Decrease in O <sub>2</sub> Reading
Helium	50%, Balance O <sub>2</sub>	0%
Nitrous Oxide	80%, Balance O <sub>2</sub>	0%
Carbon Dioxide	10%, Balance O <sub>2</sub>	0%
Halothane	4%	<-1.5%
Enflurane	5%	<-1.5%
Isoflurane	5%	<-1.5%
Sevoflurane	5%	<-1.5%
Desflurane	15%	<-1.5%

The errors listed were observed after a two (2) hour exposure period. The table above summarizes the performance of the AII 2000 Series electronics and AII-11-60 Oxygen Sensor. The above performances all meet or exceed the requirements established by EN 12598:1999/ISO 7767:1997 (E). Caution: Do not operate any device in the presence of flammable anesthetic agents such as Diethyl Ether or Cyclopropane.