

Glovebox and environmental chamber solutions

The Glovebox

Many materials and chemicals are sensitive to air and require tightly controlled environments containing low levels of oxygen and humidity during manufacture or research. Schlenk flasks are relatively inexpensive and can be used for handling air-sensitive chemicals but you run the risk of breaking glassware under positive pressure and you are limited to the volumes of the available glassware. Air-sensitive chemicals are most easily manipulated in a steel glovebox purged with inert gas such as nitrogen or argon.

For labs that continually work with air sensitive chemicals, gloveboxes that maintain low oxygen and humidity levels for long periods of time are essential. These gloveboxes need to have very low oxygen leak rates which are indicated by the ISO 10648-2:1994 Classes; Classes 1-4 with Class 1 having the lowest leak rate.



The most efficient method of moisture and oxygen removal is via evacuation of the air inside the glovebox and refilling it with ultra-pure inert gas. For best results several vacuum-refill cycles need to be performed. Some gloveboxes also have equipment that can recirculate the gas through a regenerating catalyst system to minimize the cost of the inert gas. These catalysts often require hydrogen gas mixtures, that removes trace oxygen from the recycled gas. In these installations electro-chemical sensors are preferable to zirconium-oxide sensors (any H₂ and O₂ will burn on the sensor causing a false low oxygen reading).

The Environment

According to Environmental Health & Safety (EH&S) departments, using pyrophoric chemicals in the presence of oxygen or humidity is a fire hazard! Many EH&S departments require gloveboxes when handling solid pyrophoric materials like alkali metals and metal hydrides. Quite a few air-sensitive chemicals degrade in oxygen levels above 10 ppm O₂, so tight control is required during analytical chemical experiments with sub-molar amounts of chemicals as any degradation can affect the results.

The Oxygen Analysis Equipment

Due to the stringent environments that are needed to perform air sensitive chemistry, glove boxes need robust oxygen analyzers that have the capability to:

1. **Measure** 0-10ppm O₂ accurately (± 0.2 ppm).
2. **Withstand** vacuum-refill cycles.
3. **Pull** a sample when pressure inside the glove box is small or slightly negative (± 0.1 psig).

All: Sensor Technology

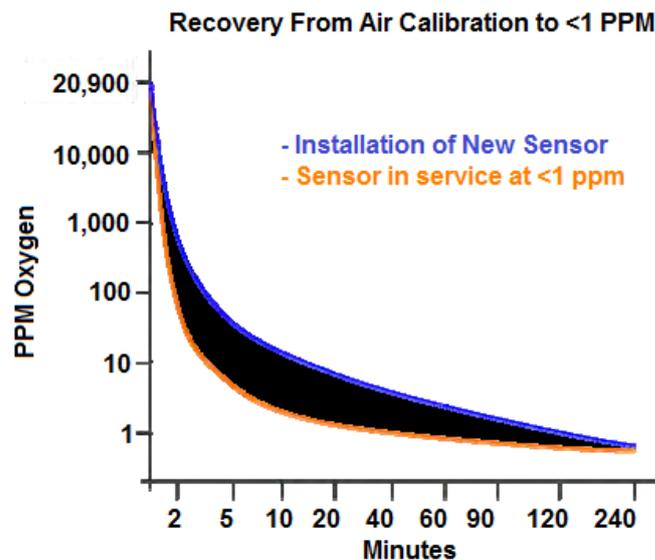
AII sensors are designed to offer 24 months of service when operated below their maximum stated oxygen concentrations at 25°C and atmospheric pressure. We have two classifications of sensors that are typically utilised in glovebox applications.

Galvanic % Oxygen Sensor

Exhibit superior performance, reliability, extended life and extended operating temperature range which are critical to meeting the need for oxygen measurements imposed by today's industrial process.

Galvanic Trace PPM Oxygen Sensor

Exhibit excellent stability at low PPM oxygen levels, faster recovery from excursions to high oxygen concentrations and a longer service life than traditional sensors.



XLT Sensor Option

For applications with a background gas containing more than 0.5% CO₂, the specially designed XLT sensor should be selected. With most standard electrochemical sensors an alkaline electrolyte is used, and this is neutralised over time when exposed to acidic gases, such as CO₂. To combat this, AII developed the XLT sensor with a special electrolyte formula.

Instruments for monitoring O₂ in gloveboxes

There are many glove box accessories available from AII ranging from transmitters with KF40 flanges for direct mounting to portable analyzers with internal sample pumps for extracting a sample.

The **GPR-1500GB** and **GPR-2500GB** have been recently updated to allow three methods of sampling:

- KF40 Flange mounting.
- Flow-through sensor.
- Remote sensor on a lead.

This gives great flexibility of installation. There is a calibration stand that allows a span gas to be introduced to the chamber without contaminating the process. It can also be utilised to lock the sensor in a sample of low ppm O₂ to maximise the lifespan when the glovebox is not in use.

The GPR-1200 with its isolation/bypass valve allows multiple samples containing trace O₂ to be analysed in a relatively short period, increasing productivity.



GPR-1500 GB

O₂ PPM monitor for glove boxes

- Lowest Range: 0-10 ppm O₂.
- Place sensor in shut valves when performing vacuum-refill cycles.



GPR-2500 GB

O₂ Percent monitor for glove boxes

- Lowest Range: 0-1% O₂.
- Place sensor in shut valves when performing vacuum-refill cycles.

Process connections for external analyzer installation



flow-through sensor housing



KF40 flange connection

Portables for multiple/intermittent glovebox sampling



GPR-1200

Portable O₂ PPM Analyzer

- Lowest Range: 0-10 ppm O₂.
- Optional integral data logger.
- Optional integral pump.
- ATEX version available for use in hazardous areas.



GPR-2000

Portable O₂ Percent Analyzer

- Lowest Range: 0-1% O₂.
- Optional integral pump.
- ATEX version available for use in hazardous areas.

Typical Glovebox Uses:

- Lithium battery research and production
- Crystal mounting
- Tissue study
- Assembly inspection
- Wire bonding
- Micro laser welding
- Semiconductor probing
- Thin film deposition
- Inkjet deposition
- Spin coating air sensitive materials

Industry links

American Glovebox Society

<https://www.gloveboxsociety.org/>

labmanager.com

<http://www.labmanager.com/vendor-list/2010/01/glove-boxes-manufacturer-list#.WprroEx2u-8>