
# Delta F nondepleting oxygen sensor

## Couloumetric electrochemical oxygen sensor

### Applications

The nondepleting oxygen cell is a couloumetric electrochemical oxygen sensor used for oxygen measurement in the following industries and applications:

**Petrochemical industry**

- Purity of olefins
- Gas production industry
- Purity monitoring of argon, hydrogen, nitrogen and helium

**Metals industry**

- $O_2$ atmospheres in heat-treating furnaces

**Semiconductor industry**

- Gas purity/trace $O_2$

### Features

- Used with moisture series analyzers to measure oxygen concentration in gases from trace to percent levels
- Ultralow range for ultrapure gas applications is sensitive to less than 5 ppb oxygen
- Sensors available for indoor/outdoor water- and dust-tight enclosures
- No gas scrubbing equipment needed for acid gas applications
- No periodic replacement or reconditioning of cells is needed
- Intrinsically safe option available for hazardous areas
- Optional VCR fittings for enhanced system cleanliness and leak integrity

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## Nondepleting oxygen cell with electrolytic oxygen sensor

### Periodic replacement and reconditioning eliminated

The sensor operates on a simple coulometric process in which oxygen in the sample gas is reduced in an electrochemical cell. Unlike conventional electrochemical oxygen cells, the electrodes in this advanced cell are nondepleting, so they don't undergo chemical changes as oxygen is measured. As a result, periodic cell replacement or conditioning is not required.

### Parts per billion oxygen measurement

For oxygen measurement in ultrapure gas applications, an ultralow range sensor that is sensitive to less than five ppb is available. The sensor is equipped with VCR fittings to ensure system cleanliness and integrity.

### Withstands acid gases

For most applications where acid gas constituents are present, the patented STAB-EL™ electrolyte option eliminates the need for troublesome gas scrubbing equipment by permitting direct exposure of the cell to the gas stream. These cells have a reputation for reliability in applications that are too difficult for most other oxygen sensors.

### Sensor placement

The basic sensor is available separately. It can be mounted in safe or hazardous areas, as it is an intrinsically safe device when connected to a Panametrics moisture analyser. However, for Type 4 applications requiring indoor/outdoor water- and dust-tight enclosures, an R4 sensor is available that is housed in a weatherproof enclosure with integral mounting flanges. For hazardous (classified) locations, an R7 sensor is available. It is housed in a flame-proof, aluminum electrical box that is rated for hydrogen service, but only for ATEX installations.

## Nondepleting oxygen cell specifications

### Overall

**Type**
Nondepleting couloumetric electrolytic oxygen sensing cell

**Available sensor ranges/accuracy**

- **ppb $O_2$ range**
  DFOX-1, 0 to 500 ppb/ 5 ppm/ 50 ppm, 1/4 VCR
  +/- 3% of reading or 25 ppb
- **ppm $O_2$ range**
  DFOX-9, 0 to 1/10/100 ppm, 1/4 VCR
  DFOX-2, 0 to 1/10/100 ppm, 1/8 compression
  +/- 3% of reading or 50 ppb

  DFOX-3, 0 to 10/100/1000 ppm, 1/8 compression
  +/- 3% of reading or 200 ppb

  DFOX-4, 0 to 100/1000/10,000 ppm, 1/8 compression
  +/- 3% of reading or 2 ppm

  DFOX-5, 0 to 50/500/5,000 ppm, 1/8 compression
  +/- 3% of reading or 1 ppm
- **% $O_2$ range**
  DFOX-6, 0 to 5%, 1/8 compression
  +/- 3% of reading or 10 ppm

  DFOX-7, 0 to 10%, 1/8 compression
  +/- 3% of reading or 20 ppm

  DFOX-8, 0 to 25%, 1/8 compression
  +/- 3% of reading or 50 ppm

**Sensitivity**
Less than 5 ppb (0 to 500 ppbv range)

**Response time**

- Fast response to $O_2$ change
- Equilibrium time is application specific

**Ambient temperature**
32°F to 120.02°F (0°C to 49°C)

**Background gas compatibility**

- STAB-EL® cell: All gas compositions including those containing "acid" gases such as $CO_2$, $H_2S$, $Cl_2$, NOx, $SO_2$, etc.

**Hazardous area classification**

- ATEX/IECEX intrinsically safe
- II 1G Ex ia IIC T5 Ga
- Tamb = −4°F to +122°F ( −20°C to +50°C )
- US/CAN Class I, Division 1, Groups A, B, C, D, T4
- ATEX Flameproof II 2 G Ex dIIC T6 Gb

**European compliance**
Complies with EMC Directive 2004/108/EC when connected to a moisture.IQ, Moisture Image® Series 1, Moisture Image® Series 2 or Moisture Monitor™ Series 3 analyzer

### Sample requirements

**Inlet pressure**
0.2 psig to 1.0 psig (0.013 barg to 0.06 barg) (standard range)

**Flow rate**
0.5 to 1.5 SCFH

**Moisture**
No limits (avoid condensation)

**Oil/solvent mist**

- Less than 0.5 mg/ft$^3$ (standard range)
- Greater than 0.5 mg/ft$^3$ (use filter)

**Solid particles**

- Less than 2.0 mg/ft$^3$ (standard range)
- Greater than 2.0 mg/ft$^3$ (use filter)

Panametrics, a Baker Hughes Business, provides solutions in the toughest applications and environments for moisture, oxygen, liquid and gas flow measurement. Experts in flare management, Panametrics technology also reduces flare emissions and optimizes performance.

With a reach that extends across the globe, Panametrics' critical measurement solutions and flare emissions management are enabling customers to drive efficiency and achieve carbon reduction targets across critical industries including: Oil & Gas; Energy; Healthcare; Water and Wastewater; Chemical Processing; Food & Beverage and many others.

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