

A BREAKTHROUGH IN ENHANCED OXYGEN SENSING PERFORMANCE



THE NEW DF-300E SERIES AND E-SENSOR



THE DIFFERENCE
DELTA F

DELTA F DELIVERS A BREAKTHROUGH IN ENHANCED OXYGEN SENSING PERFORMANCE

For years, you have depended on Delta F for advances in oxygen analysis. We have consistently introduced technological advancements starting with our unique non-depleting coulometric sensor and built upon the expertise and experience we have accumulated in over 30 years of pushing the boundaries of oxygen analysis. Now we have reinvented our sensor technology from the ground up to develop a performance breakthrough in oxygen analysis with the DF-300E Series and our unique new enhanced performance E-Sensor.

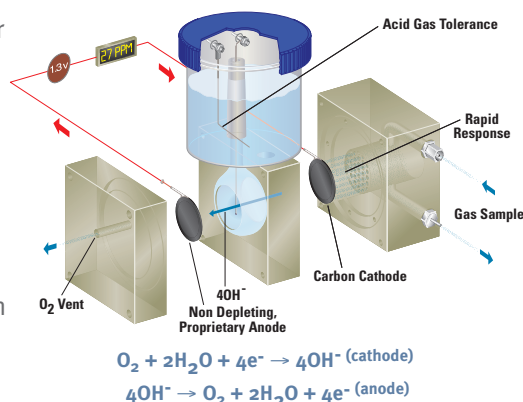
The E-Sensor - Enhanced Oxygen Analysis Performance

At heart the E-Sensor is the next evolutionary stage in Delta F's unique electrochemical sensor technology. Intensive research to identify and resolve performance-limiting elements in the sensor led to a new proprietary carbon-based cathode system, new proprietary anode system, new electrode fabrication processes, new sensor assembly and conditioning processes, and a new high purity electrolyte formulation. These enhancements are all embodied in the E-Sensor to deliver unsurpassed analytical performance, dependability and reliability.

The E-Sensor's new design and use of enhanced sensor materials significantly improves performance to deliver a price/performance breakthrough with:

- Faster purge down on initial start-up
- Faster recovery from upset
- Improved speed of response
- More stable baseline with improved temperature stability
- No need for customer "zeroing"
- Reduced fluid loss and accompanying maintenance
- Improved hardness and acid gas tolerance

For more detailed information on our E-Sensor and its performance, download our E-Sensor technical bulletin from www.delta-f.com.



How Enhanced Oxygen Analysis Can Improve Your Process and Yield

There are many industrial processes where even the slightest presence of oxygen can have a negative effect on process yield or quality. The expanded DF-300E series of oxygen analyzers with E-Sensor technology has the flexibility to apply its price/performance advantages across a wide range of applications.



Glovebox applications – where materials processing and experiments must be carefully controlled and performed under low oxygen conditions - for example in bio-research or nuclear applications.

E-Sensor Benefit	Electronics	Indust. & Spec Gas	OEM	Petro/ Processing	Glovebox	Heat Treating
Faster purge down on startup	MAJOR!	Secondary	MAJOR!	Secondary	Secondary	MAJOR!
Faster recovery from upsets	MAJOR!	MAJOR!	MAJOR!	MAJOR!	MAJOR!	MAJOR!
Faster speed of response	MAJOR!	MAJOR!	MAJOR!	MAJOR!	MAJOR!	MAJOR!
Lower baseline/no customer zero	MAJOR!	MAJOR!	MAJOR!	MAJOR!	MAJOR!	MAJOR!
Reduced water consumption	Secondary	Secondary	MAJOR!	Secondary	MAJOR!	Secondary
Improved acid gas tolerance	MAJOR!	Secondary	MAJOR!	MAJOR!	Secondary	MAJOR!

Metals/Heat Treating – metals processing, steel production, bright annealing, sintering, specialty welding – all require close analysis and control of oxygen levels.

Bulk Industrial and Specialty Gases - production of high purity gases, transportation of bulk industrial gases, gas cylinder certification, air separation unit control – requiring low level detection and control of oxygen.

Chemical/Petrochemical - control of unde-



sirable oxidation during steam cracking of hydrocarbon feedstocks, quality assurance of polyolefin production, quality control and process performance enhancement of plastics such as polyethylene, polypropylene, polyesters and other polymers – oxygen analysis improves both quality and processing performance.

Electronics and Semiconductors – production furnaces, chip fabrication, heat treating for silicon wafers, leadless soldering, ceramic production – oxygen control is key for greater yield and better quality yield with fewer defects and less scrap.

The DF-300£ Product Family

The DF-300£ Series of Analyzers

– The Right Analyzer for Your Application

In addition to providing enhanced performance, the DF-300£ Series offers a wide range of analyzers to meet your specific application requirements. Each member of the DF-300£ family delivers:

- Lowest available detection levels
- Elimination of false low readings and periodic sensor replacement
- Unmatched reliability and stability
- Fast response so you can react to problems immediately
- Compact and modular design to fit into your plant and process easily
- Affordable choices that easily justify implementation – including the availability of our £-Sensor and models with our solid state coulometric sensor



The DF-310£

– Flexible, Adaptable Oxygen Analyzer

The DF-310£ with the £-Sensor is a flexible and adaptable O₂ analyzer ready to handle almost any application. The DF-310£ packs analysis power into a compact package and is available in 24 VDC and 110VAC and 220 VAC versions.

The DF-310£ delivers:

- Accuracy: the greater of ± 3 reading or $\pm 0.02\%$ Range
- Ranges from 0-0.5 ppm to 25%
- Instantaneous response to oxygen change
- Fast response: typically less than 10 seconds to read 90% of a step change
- Background gas compatibility including N₂, H₂, CO, freons, hydrocarbons, etc.
- Stab-EL™ option removes acids and ionic impurities from the electrolyte that could affect sensor performance
- Optional battery back-up for extended use and process protection

DF-320 £ – O₂ Analyzer for Hazardous Areas

The DF-320£ is specifically designed for the rigors of harsh and hazardous environments. It can handle Class I, Div 2, Groups A,B,C,D, and ATEX Zone 2 certification, where potential explosions are a possibility – for example in natural gas lines or LNG storage, etc.

- Designed to handle Class I Div. 2
- Best analyzer for harsh or hazardous environments.

DF-330£- Solid State Coulometric Sensor

The DF-330£ provide an ideal oxygen analyzer for many industrial applications where very fast response is essential. The DF-330£ uses a unique solid state coulometric sensor with a solid electrolyte to deliver fast response across a wide measurement range.



The DF-330£ features:

- Exceptionally fast response – ppm levels from air in 5 minutes
- The ability to be mounted in-situ or in flow-through applications
- Quick recovery down to low levels after exposure to air
- Good low-end sensitivity plus a wide measurement range
- Consistent accuracy from sub-atmospheric pressure to 100 psig

DF-340£ and the new DF-370£ Designed for the Dirty Work

The DF-340£ provides a tough, durable NEMA 4x version of the standard DF-310£ that is protected by a dustproof, waterproof enclosure with the sensor in a Nema 7 enclosure



The DF-370£ provides the same hard working, industrial strength analyzer, in a NEMA 7 enclosure with the option to also place a remote sensor in a NEMA 7 enclosure.

The DF-340£ and DF-370£ provide the ultimate in O₂ sensing for harsh and hazardous environments where enclosure is required.

Performance

Accuracy: (at constant conditions)

Standard Models: the greater of $\pm 3\%$ Reading or 0.5% of Range

High Resolution Models: the greater of $\pm 3\%$ Reading or 0.02% of Range (except for 310-H00100: $\pm 3\%$ Reading or 50 ppb)

Oxygen Sensitivity

Lowest detectable change 3 ppb (310E-H0050M model)

Low detection limit 3 ppb (310E-H0050M model)

Response Time

Responds instantaneously to O₂ change. Typically less than 10 seconds

to read 90% of a step change. (Equilibration time depends on specific conditions.)

Range Ranges are available from 0-0.5 ppm to 100%

Ambient Operating Temperature

DF-310E, 320E, 340E, 370E: 32° to 113° F (0° to 45° C)

DF-330E: 32° to 176° F (0° to 80° C)

Background Gas Compatibility

Basic Sensor:

All inert and passive gases including N₂, H₂, CO, freons, hydrocarbons, etc.

Sensor with Stab-EL™ Option:

Neutralizes trace contaminants including acids such as CO₂, H₂S, Cl₂, NO_x, SO_x, etc. (Consult Delta F for concentration limits)

Solid State Sensor:

Not compatible with gases containing hydrocarbons, combustibles, H₂, CO, NO₂, S or Pb

Gas Sample Conditions

Sample Pressure

Operating limits for DF-310E, 320E, 340E, 370E:

0.2 to 1.0 psig (1.03 to 1.08 Bar) – Standard

15-25 psig with welded sample inlet (orifice restricted)

2.0 psi vacuum to 0.2 psig (.88 to 1.03 Bar) use pump

1.0 to 10 psig (1.08 to 1.7 Bar) use valve (standard) or regulator (optional)

Above 10 psig (1.7 Bar) use regulator

Sensor overpressure damage limit: 10 psig (1.7 Bar)

Operating limits for DF-330E:

300 Torr to 100 psig (17 Bar)

Return Pressure:

Limits Atmospheric Vent (optimal)
+5 psig (1.36 Bar) to -5 psig (0.67 Bar)
(no limits for DF-330E)

Flow Rate:

1.0 to 3.0 SCFH (0.5 to 1.5 slpm)
(ambient to 3.0 SCFH for DF-330E)

Temperature (Gas Sample)

0° to 150° F (-17.8° to 66° C)
(except 32° to 176° F (0° to 80° C) for DF-330E)

Moisture:

No limits (avoid condensation)

Oil/Solvent Mist:

< 0.5 mg/ft³ (standard)

> 0.5 mg/ft³ – use filter

Solid Particles:

< 2 mg/ft³ (standard)

> 2 mg/ft³ use filter

Gas Flow System

Construction Materials:

300 Series stainless steel

Gas Connections:

1/8" compression tube fittings

VCR compatible (optional for DF-310E and DF-320E
except standard for 310E-H0050M and 320E-H0050M)

Construction

Enclosures:

NEMA 1, NEMA 4, NEMA 7
Remote NEMA 4, NEMA 7 or sensor bracket
(optional for DF-310E and DF-340E)

Weight:

10 lbs. (4.52 kg.) (NEMA 1)

Dimensions:

8.32" W x 7.75" H x 7.91" D
(21.1 cm W x 19.7 cm H x 20.1 cm D)

Electrical

Power Input

110 VAC, 220 VAC and 22-28 VDC (optional), 1 Amp (max)

Output Signals

Isolated 0 - 5, 10 VDC AND

Isolated 4-20, 2-20 mA DC (optional)

User adjustable to 10% of Full Scale to Full Scale (Std Res)

User adjustable to 1% of Full Scale to Full Scale (High Res)

User selectable Output Freeze during Calibration

Alarms, audible/visual

4 Oxygen (optional)
(adjustable set-point)

Electrolyte Condition (standard)

Temperature (optional)

Low Flow (optional)

Alarm Relays

4 independently assignable relays
to Alarms, In-Calibration, Sensor Off and
Expanded Range Scale (optional)

0.3 Amps at 30 VDC

Failsafe Action

Display:

Supertwist LCD graphics

Certifications:

ATEX Class1, Division II (DF-320E)



Configuration and Installation

Delta F provides comprehensive assistance for a broad variety of application problems including measurements of semiconductor specialty gases. Depending on the model, Delta F analyzers can be configured to provide a wide choice of outputs for data collection and process control systems. Most Delta F analyzers can be configured for remote operation and all can be ordered with classified area enclosures. Contact your Delta F representative for an Applications Data Sheet and pricing information.



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