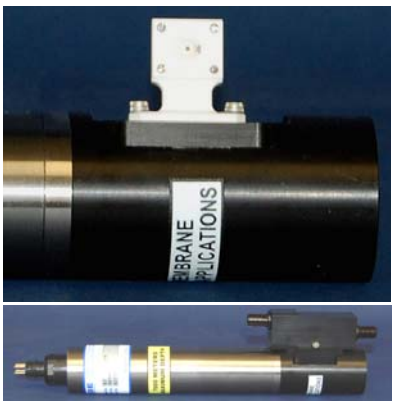
Sea-Bird Dissolved Oxygen Sensor

SBE 43



The SBE 43 sets the oxygen measurement standard for oceanographic research. The SBE 43 sensor is a complete redesign of the Clark polarographic membrane type, in which careful choices of materials, geometry, and sensor chemistry are combined with superior electronics interfacing and calibration methodology to yield major gains in performance.

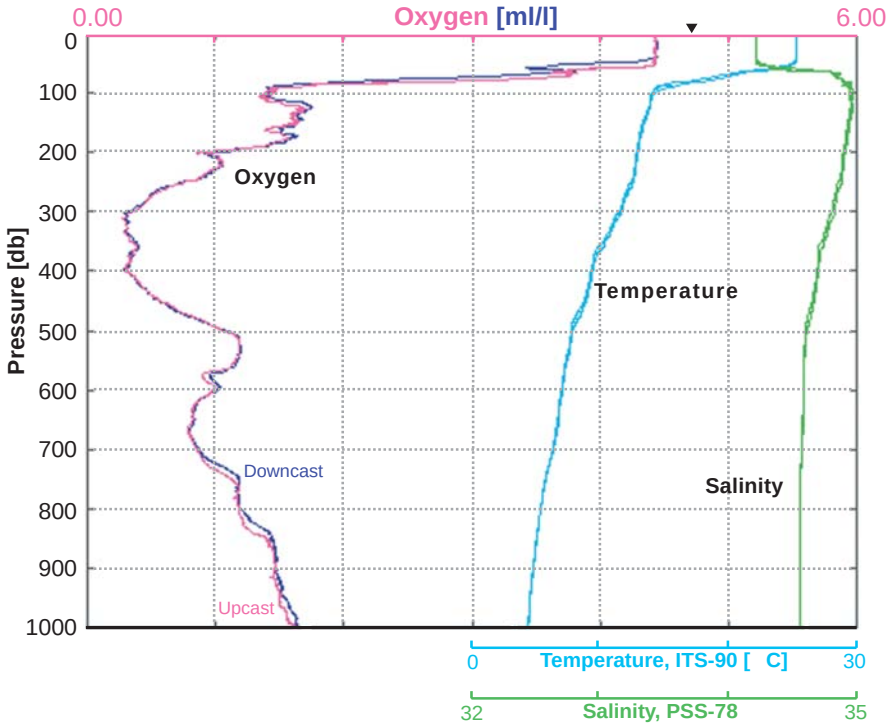
Calibration stability is improved by an order of magnitude, and the sensor requires less frequent calibration. Calibration drift is caused primarily by membrane fouling from ocean contaminants, and less so by chemical processes inside the sensor. If the membrane is kept clean, the sensor's improved chemical stability yields demonstrated calibration drift rates of less than 0.5% over 1000 hours of operation (*on* time).

Temperature response is dramatically improved. The chemical and physical processes that underlay the oxygen measurement are very sensitive to temperature. Accurate characterization of the internal sensor temperatures that control these processes, especially when water temperature is changing rapidly, is a key accomplishment of the design. Not only does the SBE 43 sensor measure temperature in the right place: the temperature equilibration time of the entire sensor head has been reduced to a few seconds, so it tracks changing water temperature much more faithfully.

Hysteresis is largely eliminated in the upper ocean (1000 meters) due to improved temperature response of the sensor. Residual mismatch between up and down casts in this part of the ocean is due to sensor alignment, correctable in post-processing. At higher pressures, changes occur in gas-permeable Teflon membranes that affect their permeability characteristics. These changes have long time constants, depend on the sensor's time-pressure history, and result in hysteresis at depths greater than 1000 meters. These effects are predictable and are also correctable in post-processing. The resultant SBE 43 measurement resolves oxygen features more precisely, reducing the ambiguity about locking measured sensor values to bottle Winklers.

Continuous polarization eliminates stabilization wait-time after power-up. The sensor is always ready for immediate use. Earlier sensors required several minutes to *polarize* following power-up. During that time, sensor readings were inaccurate. In the SBE 43, micropower electronics and an internal, five-year, board-mounted battery eliminate power-up delay.

Poisoning in hydrogen sulfide environments was a phenomenon common to early oxygen sensor designs that used silver as the cathode element. The SBE 43 uses a noble metal (gold) as the cathode and silver as the anode, and shows no degradation of signal or calibration when used for profiling in hydrogen sulfide environments.



Equatorial Pacific
2° 0.9' N, 110° 2.2' W
25 Oct 2000

24 Hz SBE 911*plus* data; oxygen measurements were time shifted 6 seconds relative to pressure to account for water transit time through TC Duct and plumbing. No other processing was performed.

▼ surface oxsat = 4.7 ml/l

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Signal resolution is increased by on-board temperature compensation, and a CTD channel is made available for other purposes because there is no *temperature* output signal. Even when oxygen concentration is constant, the normal range of ocean temperatures causes the output of earlier sensors to vary by a factor of two. The SBE 43's internal temperature compensation eliminates this variation, allowing the sensor to pre-amplify the signal proportionately; resolution with existing CTD systems is correspondingly increased.

Effective bio-fouling strategies allow for longer moored deployments. Plumbing isolates the SBE 43 from continuous exposure to the external fouling environment; allows trapped water to go anoxic, minimizing electrolyte consumption between samples; and holds anti-foulant in the trapped water. The black plenum and installing black tubing blocks light, reducing in-situ algal growth.

A 5-year warranty backs the sensor's integrity. During the warranty period, one sensor re-charge (electrolyte refill, membrane replacement, and recalibration) will be performed at Sea-Bird free of charge.

Configuration Options

The SBE 43 **voltage output** sensor can be integrated with any Sea-Bird CTD that accepts input from a 0 - 5 volt auxiliary sensor (for example, SBE 9*plus*, 16/16*plus*/16*plus* V2, 16*plus*-IM/16*plus*-IM V2, 19/19*plus*/19*plus* V2, or 25). SBE 43 configuration choices include:

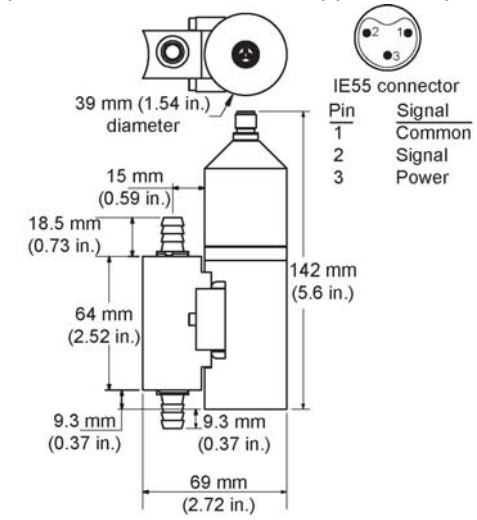
- Housing: 7000-meter titanium or 600-meter plastic housing
- Connector: XSG or wet-pluggable MCBH connector
- Membrane: 0.5-mil (fast response, typically for profiling applications) or 1-mil (slower response but more rugged for enhanced long-term stability, typically for moored applications)

The SBE 43**F frequency output** sensor can be integrated with an SBE 52-MP or used for OEM applications (requires OEM circuit board). The SBE 43F is available with a 600-meter plastic or 7000-meter titanium housing.

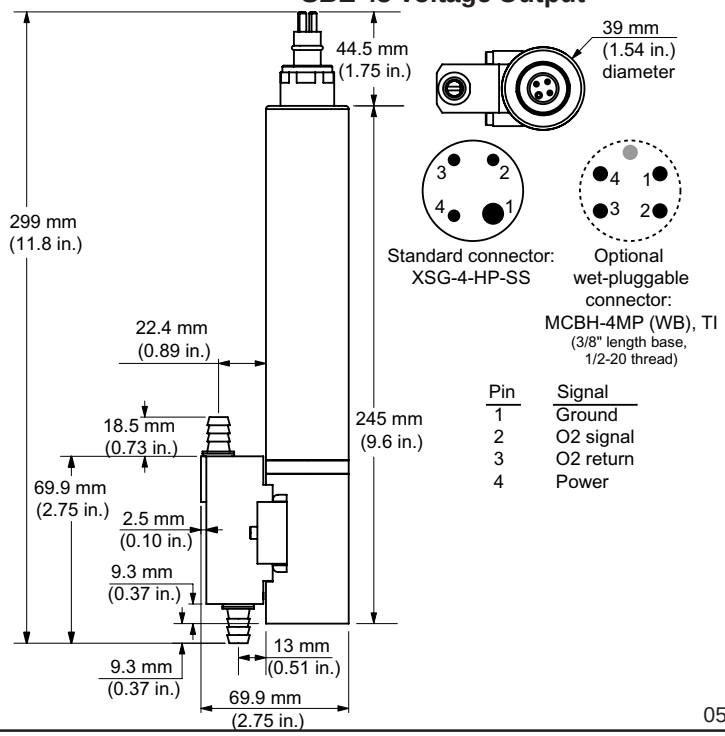
Specifications

Measurement range:	120% of surface saturation in all natural waters, fresh and salt
Initial accuracy:	2% of saturation
Typical stability:	0.5% per 1000 hours (clean membrane)
Input power:	6.5 - 24 VDC, 60 milliwatts
Output signal:	0 - 5 VDC (SBE 43), frequency (SBE 43F)
Housing/depth rating:	600-meter plastic or 7000-meter titanium housing (10,500-meter titanium housing available on request)
Weight (in air):	SBE 43 — 0.7 kg (1.5 lbs) with titanium housing, 0.5 kg (1.0 lb) with plastic housing SBE 43F — 0.4 kg (0.9 lbs) with titanium housing

SBE 43F Frequency Output Sensor
(for SBE 52-MP and OEM applications)



SBE 43 Voltage Output



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