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OxyMicro Oxygen Meter

A new generation of oxygen meters for fiber-optic microsensors



Measuring Principle

The OxyMicro measures the *luminescence lifetime* of the immobilized luminophore as the oxygen dependent parameter to avoid problems that are inherent with intensity based measurements. Lifetime based measurements are *not* affected by bending of the fiber or the optical properties of the sample (turbidity, refractive index, coloration).

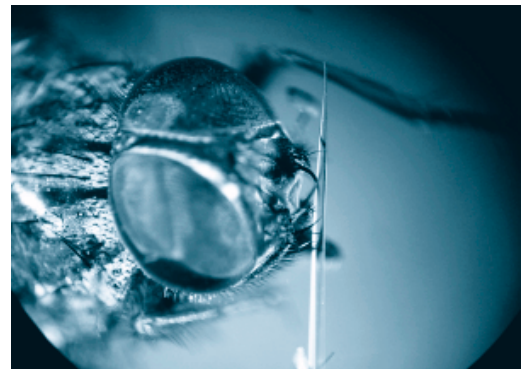
Small in size: The OxyMicro is a compact, easy to transport and completely PC-controlled oxygen meter for very small fiber-optic sensors

Novel technology: This technology is superior to conventional intensity based sensors in creating very stable, internal referenced values.

Stable signals: This enables a more flexible use of optical oxygen sensors in many different fields of interest.

Temperature compensation: The OxyMicro compensates for variations in the oxygen content of the sample caused by temperature variations.

Control: TTL trigger input and analog output



Possible Applications

Implantation into living animals

- measurement of oxygen concentration in an isolated heart of a rat
- implantation of oxygen microsensors in red muscle of trout measuring tissue oxygen saturation

Medical research

- cardiac valve muscle model; development of beta blockers

Biotechnology

- control of cell culture media

Profiling of biofilms and sediments

- oxygen profiles of a marine sediment
- oxygen profiles of soils
- profiling of tissues

Fiber-Optic Oxygen Microsensors

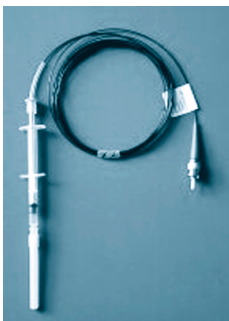
Sensors and housings

WPI fiber-optic oxygen microsensors are based on 140 μm silica waveguides. To protect the small glass-fiber tip against breaking, suitable housings and tubing around it, depending on the respective application, were designed.



Flow-Through Cell Housing

- miniaturized flow-through-cell with integrated oxygen microsensor
- connection via Luer-Lock adapters to tubings
- online monitoring
- *sterilizable* by autoclave (130°C, 1.5 atm)



Needle-Type Housing

- the glass fiber with its oxygen-sensitive tip is protected inside a stainless steel needle
- penetration probe for insertion into semi-solids such as sediments or biofilms
- penetration through septa

Implantable

- without any housings
- implantation into animal blood circuits
- soil implantation
- implantation in customer-made housings
- *sterilizable* by autoclave (130°C, 1.5 atm)



	Dissolved Oxygen	Gaseous Oxygen
Measuring Range	0 - 45 mg/L 0 - 1013 hPa	0 - 500 % air-saturation 0 - 1013 hPa
Response time (t₉₀) for tapered sensors (tip diameter < 50 μm) flat-broken sensors (tip diameter 150 μm)	< 3 s; (< 8 s with optical isolation) < 20 s; (< 40 s with optical isolation)	< 0.5 s (< 1 s with optical isolation) < 5 s (< 10 s with optical isolation)
Resolution (at 20° C)	60 \pm 0.3 hPa; 200 \pm 0.9 hPa; 500 \pm 3.6 hPa; 2.75 \pm 0.01 ppm; 9.00 \pm 0.04 ppm; 22.0 \pm 0.17 ppm 45.0 \pm 0.25 mmHg; 150 \pm 0.75 mmHg; 375 \pm 2.6 mmHg	
Accuracy (at 20° C)	\pm 1% air-saturation	
Temperature Range	-10 to 50° C	
Chemical Resistance	Sensors can be used in methanol, ethanol and alcohol-water mixtures. Not useful in organic solvents, such as acetone or chloroform	
Cross-Sensitivity	No interference to carbon dioxide (CO ₂), hydrogen sulfide (H ₂ S), ammonia (NH ₃), pH, and any ionic species like sulfide, sulfate or chloride. Only affected by gaseous sulfur dioxide (SO ₂) and gaseous chlorine (Cl ₂).	
Calibration	Two-point calibration 100% air-saturation (air-saturated water, or water-saturated air) 0 % air saturation (deaerated water)	
Drift tapered sensors (tip diameter < 50 μm) flat-broken sensors (tip diameter 150 μm)	1.6 % air-saturation (continuous sensor illumination; 100000 data points; measured at 100 % air-saturation, 20° C) < 0.4 % air-saturation (continuous sensor illumination; 100000 data points; measured at 100 % air-saturation, 20° C)	
Remote Sensing	Fiber optic cable up to 60 m length available.	



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