



# OxyMicro Oxygen Meter

*A new generation of oxygen meters for fiber-optic microsensors*



**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

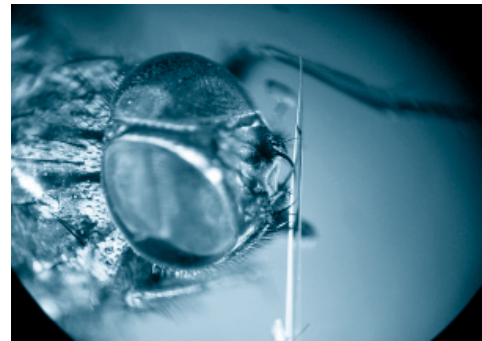
## Measuring Principle

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).

## 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

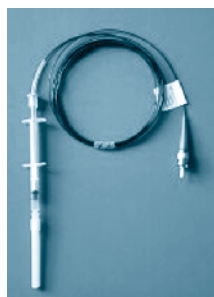
*Sensors and housings*

WPI fiber-optic oxygen microsensors are based on 140  $\mu\text{m}$  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
<b>Measuring Range</b>	0 - 45 mg/L 0 - 1013 hPa	0 - 500 % air-saturation 0 - 1013 hPa
<b>Response time (<math>t_{90}</math>)</b> for <i>tapered</i> sensors (tip diameter < 50 $\mu\text{m}$ ) <i>flat-broken</i> sensors (tip diameter 150 $\mu\text{m}$ )	< 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)
<b>Resolution</b> (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	
<b>Accuracy</b> (at 20° C)	$\pm$ 1% air-saturation	
<b>Temperature Range</b>	-10 to 50° C	
<b>Chemical Resistance</b>	Sensors can be used in methanol, ethanol and alcohol-water mixtures. Not useful in organic solvents, such as acetone or chloroform	
<b>Cross-Sensitivity</b>	<b>No interference</b> to carbon dioxide (CO <sub>2</sub> ), hydrogen sulfide (H <sub>2</sub> S), ammonia (NH <sub>3</sub> ), pH, and any ionic species like sulfide, sulfate or chloride. Only affected by gaseous sulfur dioxide (SO <sub>2</sub> ) and gaseous chlorine (Cl <sub>2</sub> ).	
<b>Calibration</b>	Two-point calibration <b>100% air-saturation</b> (air-saturated water, or water-saturated air) <b>0 % air saturation</b> (deaerated water)	
<b>Drift</b> <i>tapered</i> sensors (tip diameter < 50 $\mu\text{m}$ ) <i>flat-broken</i> sensors (tip diameter 150 $\mu\text{m}$ )	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)	
<b>Remote Sensing</b>	Fiber optic cable up to 60 m length available.	

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