



# Optical Oxygen Sensors & Meters



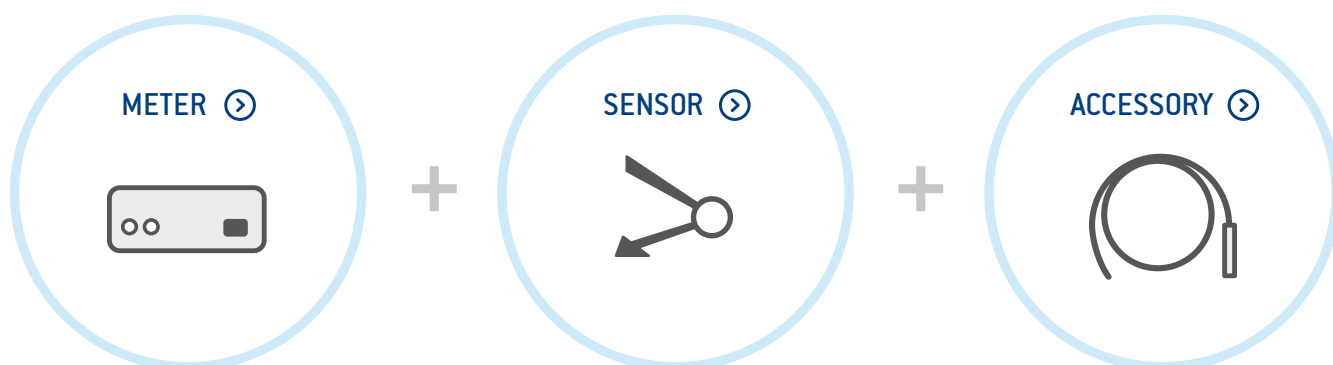
- Minimally invasive or even non-invasive measurement
- Pre-calibrated
- $\mu\text{L}$  up to  $\text{m}^3$  range
- Insertion in plant and animal tissue
- For microbial and cell culture



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## Functional Principle



# We bring to light what's inside...



## Products Made in Germany

PreSens offers a broad range of sensor systems for end users in Bioprocess Control, Biological & Environmental Research, the Food & Beverage industry as well as other industrial applications.

### We offer systems for

- Oxygen measurement in gases and liquids
- Non-invasive online pH, CO<sub>2</sub> and oxygen measurement
- Oxygen and pH sensors for single-use bioreactors
- Microsensors for pH and oxygen
- Process control in shake flasks incl. biomass monitoring
- Low-maintenance DO measurement for fermentation and bioreactor systems
- Online oxygen and pH measurement in disposables like multiwell plates and plastic bags
- Imaging solutions for 2D-mapping of oxygen-, pH-, and CO<sub>2</sub>-distribution

Our product range is constantly expanding.

## Company Profile

Based on research activities started in the 1980's PreSens Precision Sensing GmbH was founded in 1997 as a spin-off from the University of Regensburg, Germany.

The company combines long-time experiences of different researchers in the fields of electronic engineering and sensor development. Right from the beginning, microsensor systems were sold to customers in life sciences. Already in its first decade of operation PreSens became one of the leading companies in the field of chemical optical sensor technology. Together with its partners it offers full service in Europe, America and Asia.

## Service

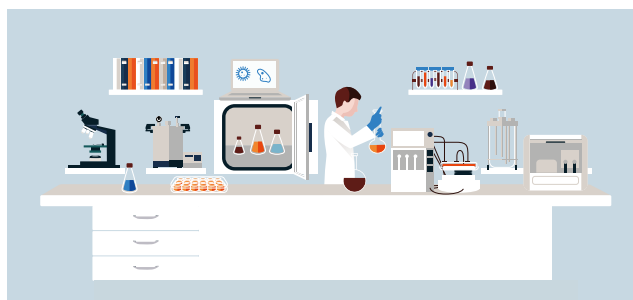
Furthermore, we are developers and manufacturers of opto-electronic OEM sensor components for companies in the field of medical equipment and process control.



Quality Management  
ISO 9001:2008  
EN ISO 13485:2012 + AC:2012  
Voluntary participation in regular monitoring

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# ...and work for the following industries.



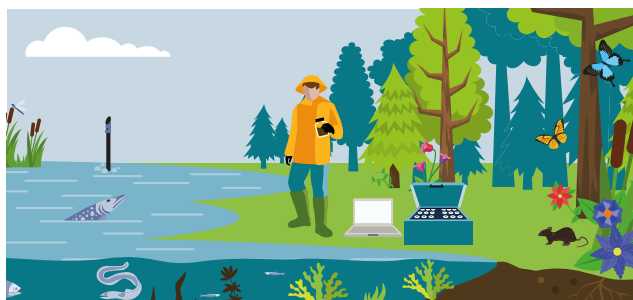
## Biotech & Pharma

Our Biotech & Pharma business field helps pharmaceutical companies such as Roche and DSM to improve their bioprocess development with PreSens sensors. With two decades of customer feedback our product development provides efficient solutions for your needs.



## Food & Beverage

A cooperation with the market leader for beverage filling systems, Kronen AG, Neutraubling, triggered our Food & Beverage business field in the late 1990's. PreSens supplies sensors for checking the oxygen-tightness of packaging and special systems for determining the penetrability of oxygen in PET bottles at companies such as Nestlé, Heineken or Danisco.



## Biology & Environmental

Our worldwide customer base in biological & environmental research has now grown to hundreds of users coming from the University of Alaska in Anchorage to the University of Wellington in New Zealand. For more than two decades we have delivered special sensor systems for various applications such as respirometry-, or environmental monitoring.



## Life Sciences & Medical Research

Our most recent business field arose from a cooperation with renowned medical technology manufacturers from the medical devices sector. PreSens supplies OEM parts, which are integrated into more complex medical systems. Microsensors, sensor spots, and imaging systems are applied in tissue engineering, microfluidics, and many other medical research fields.



## Industry & Technical

Robust probes with excellent long-term stability or sensors for contactless measurement find use in technical or industrial applications. Specially designed flow-through connectors for integration in pipes are already applied to monitor the oxygen content in liquids or gases. OEM sensor components can be designed to be integrated in customer systems.





# METERS

## Oxygen Meters

### Single- and Multi-channel Devices for Precise Oxygen Measurements

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The PreSens Fibox, Microx and OXY devices are precise fiber optic oxygen meters. They are used with non-invasive, micro-invasive, or invasive optical sensors. The portable systems with display have long-lasting batteries and immense storage capacity for prolonged computer-independent use. The tabletop meters are connected to a PC and controlled with an easy-to-use software. Some single-channel devices offer even analog outputs and a trigger input. The multi-channel meters allow simultaneous read-out of several oxygen sensors.

- For use with microsensors, non-invasive sensors & robust dipping probes
- Measure from 1 ppb to 100 % oxygen with one device
- Portable devices with long-lasting batteries
- Software included
- One calibration for a multitude of sensor spots

## Specifications

	Fibox 4 & Fibox 4 trace	Microx 4 & Microx 4 trace	Fibox 3 LCD trace	OXY Series
Specifications				
Oxygen sensors	FB 4: PSt3 FB 4 trace: PSt3, PSt6, PSt9	MX 4: PSt7 MX 4 trace: PSt7, PSt8	PSt3, PSt6, PSt9	OXY-4/-10 mini: PSt3 OXY-4/-10 trace: PSt3, PSt6 OXY-4/-10 micro: PSt1
Temperature sensor	Pt100 temperature connector (sensor not included)		Pt1000 temperature connector (sensor included)	-
Temperature performance	From 0 °C to + 50 °C, resolution: ± 0.1 °C		From 0 °C to + 50 °C, resolution: ± 0.1 °C, accuracy: ± 0.1 °C	-
Power supply	4 AA Nickel-metal hybrid cells (min. 2200 mAh) Use only supplied AC adapter (5VDC / min. 1 A) for recharging.		16.8 VDC / max. 2 A	110 - 230 VAC, 50/60 Hz, max. 40 vA (cable included)
Max. battery operating time	16 hrs. (3 sec. interval measurement, default LED intensity, display backlight OFF, at room temperature)		8 hrs. (sampling rate 1 sec.)	-
Temperature: operating / storage	From 0 to + 50 °C / - 20 to + 70 °C		From 0 to + 50 °C / - 10 to + 60 °C	
Relative humidity	Up to 80 % (non condensing)			
Dimensions	37 mm x 180 mm x 119 mm		215 mm x 120 mm x 95 mm	300 mm x 250 mm x 135 mm
Weight	0.65 kg (w/o batteries and protection kit) 0.78 kg (w/ batteries & protection kit)		1.65 k g	4-channel: 3.3 k g 10-channel: 3.9 k g
Digital interface	USB interface (cable included)		RS232 interface (cable included)	RS232 interface (with RJ connector to serial port, calbe included)
Analogue interface	-		Dual current outputs, 4 - 20 mA, with galvanic isolation, O <sub>2</sub> range programmable Dual voltage output, 0 - 10 V, with galvanic isolation, O <sub>2</sub> range programmable Dual voltage input, 0 - 10 V, with galvanic isolation, resolution: 12 bit, programmable	-
Display	3.5" color TFT, 320 x 240 Pixel		Dot matrix LCD, foil keyboard, 4 keys	-
Internal memory	4 GB memory (about 10,000,000 data sets) Export via included software		25,000 data sets Export via included software	-



### Fibox 4 & Fibox 4 trace

The wireless Fibox 4 and Fibox 4 trace are designed for easy handheld use with a robust splash-proof housing. The integrated long-lasting battery and immense storage capacity allow for prolonged computer-independent work.



### Microx 4 & Microx 4 trace

Microx 4 and Microx 4 trace are portable, multi-purpose meters for oxygen measurements in almost any application. They can be used with non-invasive sensors and robust probes as well as oxygen microsensors in different designs.



### OXY Series Multi-channel Meters

The OXY series multi-channel meters allow parallel read-out of up to 4 or 10 sensors simultaneously. OXY-4/-10 mini are for normal oxygen range measurements, while OXY-4/-10 trace additionally work with trace oxygen sensors. OXY-4/-10 micro are used with microsensors.



### Fibox 3 LCD trace

The Fibox 3 LCD trace is a portable oxygen meter with display, built-in data logger, rechargeable batteries and programmable analogue outputs. It can also be controlled via PC. The oxygen meter can be used with sensors for normal, trace, and ultra-low oxygen ranges.



# SENSORS

## Non-Invasive Oxygen Sensors

**Robust & in Real Conditions:  
Look into any Transparent Vessel**

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The non-invasive optical oxygen sensors measure the partial pressure of both dissolved and gaseous oxygen. They are fixed on the inner surface of the transparent glass or plastic material. The oxygen concentration can then be measured in a contactless and non-destructive manner from outside, through the wall of the vessel. Different coatings for different concentration ranges are available.

- Online monitoring without sampling
- Applicable from microliter scale to production scale
- Contactless & non-destructive measurement
- Pre-calibrated & ready-to-use
- Integrated in disposables
- For bags & single-use bioreactors
- For PET & glass bottles

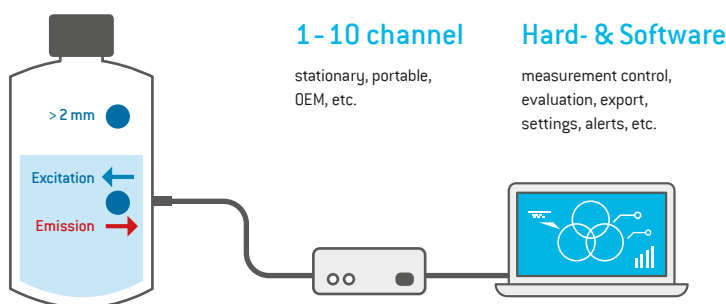
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## SPECS

NORMAL RANGE	0-100 % O <sub>2</sub>
TRACE RANGE	0-5 % O <sub>2</sub>
ULTRA TRACE RANGE	0-200 ppm

## SET-UP



## APPLICATION

### Plastic & Glass

from  $\mu$ L to production scale



### Indoor & Outdoor

Research & Industry



## O<sub>2</sub> Sensor Spots SP

O<sub>2</sub> sensor spots are mounted in transparent vessels and then read out contactless from the outside – through the container wall. The sensors are pre-calibrated and ready-to-use. Different sensor types for measurements in normal, trace and ultra-low oxygen ranges are available.



## 20 mL SensorVials SV

A 20 mL glass vial is equipped with an optical oxygen sensor stripe. The Vial Adapter holds the fiber in place and is adjustable in different heights. For stirred applications, vials are available where the sensor stripe does not reach all the way to the bottom.



## Self-adhesive O<sub>2</sub> Sensor Spots SP-SA

The new self-adhesive technology simplifies the integration of these sensor spots. They can be mounted in transparent glass or plastic vessels. The self-adhesive spots type PSt7 and PSt8 can be read out with the Microx 4 & Microx 4 trace devices.



## D0 Nice Ports

These ports with integrated sensors are for customized applications in mixing or storage bags. The ports are made of polyethylene which allows easy welding with the cultivation bag. For contactless sensor read-out the port is connected to a polymer optical fiber.

## Examples for Applications



### Pharma Industry: Oxygen Monitoring in Bags

Bags and single-use bioreactors are in the process of revolutionizing the way biopharmaceuticals are manufactured. Our non-invasive oxygen sensors are the tools to make the cultivation vessels fully disposable. With non-invasive pH sensors also being available, the two key parameters oxygen and pH can be controlled online.



### Food & Beverage: Oxygen Permeation Measurement in PET Bottles

Non-invasive oxygen sensors measure both in liquid and in gaseous (headspace) phases. They perform through transparent materials up to a thickness of 10 mm and even through slightly opaque packaging. The sensor spot is read out via polymer optical fiber from the outside. Adjustable mountings and bespoke fixtures are available. This system allows even the parallel measurement of different bottles as the fiber can be moved from bottle to bottle.



### Bioprocess Development: Oxygen Monitoring in Shake Flasks

Shake flask cultures are widely applied in academic and industrial bioprocess development. Although  $O_2$  supply is one of the major issues in the cultivation of aerobic organisms, adequate methods for real monitoring of dissolved oxygen were missing, and sufficient  $O_2$  supply was usually assumed. PreSens non-invasive oxygen sensors integrated in shake flasks now enable online oxygen monitoring and give new insights into metabolic activities.



### Respiration & Photosynthesis: Oxygen Monitoring in Glass Vials

Determination of respiratory activity is often performed for water organisms such as invertebrates, larval stages or eggs, but also for bacteria, cell cultures, yeasts or fungi. For algae measurement of photosynthetic activity is of great interest. Using 20 mL SensorVials with an integrated sensor stripe oxygen can be measured simultaneously in the liquid sample and in the headspace. Autoclavable SensorVials for stirred and non-stirred applications are available.

## Specifications

### For Fibox & OXY- Series

	Sensor Type PSt3		Sensor Type PSt6		Sensor Type PSt9
Specifications	Gaseous & Dissolved O <sub>2</sub>	Dissolved O <sub>2</sub>	Gaseous & Dissolved O <sub>2</sub>	Dissolved O <sub>2</sub>	Gaseous O <sub>2</sub>
Measurement range	0 – 100 % O <sub>2</sub> 0 – 1000 hPa	0 – 45 mg/L 0 – 1400 µmol/L	0 – 5 % O <sub>2</sub> 0 – 41.4 hPa	0 – 2 mg/L 0 – 56.9 µmol/L	0 - 200 ppmv O <sub>2</sub>
Limit of detection	0.03 % oxygen	15 ppb	0.002 % oxygen	1 ppb	0.5 ppmv O <sub>2</sub>
Resolution	± 0.01 % O <sub>2</sub> at 0.21 % O <sub>2</sub> ± 0.1 % O <sub>2</sub> at 20.9 % O <sub>2</sub> ± 0.1 hPa at 2 hPa ± 1 hPa at 207 hPa	± 0.004 mg/L at 0.091 mg/L ± 0.045 mg/L at 9.1 mg/L ± 0.14 µmol/L at 2.83 µmol/L ± 1.4 µmol/L at 283.1 µmol/L	± 0.0007 % O <sub>2</sub> at 0.002 % O <sub>2</sub> ± 0.0015 % O <sub>2</sub> at 0.2 % O <sub>2</sub> ± 0.007 hPa at 0.023 hPa ± 0.015 hPa at 2.0 hPa	± 0.0003 mg/L at 0.001 mg/L ± 0.0006 mg/L at 0.09 mg/L ± 0.010 µmol/L at 0.03 µmol/L ± 0.020 µmol/L at 2.8 µmol/L	10 ± 0.5 ppmv O <sub>2</sub> 100 ± 0.8 ppmv O <sub>2</sub> 200 ± 1.5 ppmv O <sub>2</sub>
Accuracy	± 0.4 % O <sub>2</sub> at 20.9 % O <sub>2</sub> ± 0.05 % O <sub>2</sub> at 0.2 % O <sub>2</sub>		± 1 ppb or ± 3 % of the respective concentration whichever is higher		± 2 ppmv O <sub>2</sub> or ± 5 % whichever is higher
Drift at 0 % oxygen	< 0.03 % O <sub>2</sub> within 30 days {sampling interval of 1 min.}		< 2 ppb within 30 days {sampling interval of 1 min.}		< 2 ppmv O <sub>2</sub> within 30 days {sampling interval of 1 min.}
Measurement temperature range	From 0 °C to + 50 °C		From 0 °C to + 50 °C		From 0 °C to + 40 °C
Response time (t <sub>90</sub> )	< 6 sec.	< 40 sec.	< 6 sec.	< 40 sec.	< 3 sec.
Properties					
Compatibility	Aqueous solutions, ethanol, methanol				Gas phase only
No cross-sensitivity	pH 1 – 14, CO <sub>2</sub> , H <sub>2</sub> S, SO <sub>2</sub> , Ionic species				CO <sub>2</sub> , SO <sub>2</sub>
Cross-sensitivity	Organic solvents, such as acetone, toluene, chloroform or methylene chloride, chlorine gas				Organic vapor, chlorine gas
Sterilization procedures	Steam sterilization, ethylene oxide (EtO), gamma-irradiation				-
Cleaning procedures	Cleaning in place (CIP, 2 % NaOH, 80 °C, 176 °F), 3 % H <sub>2</sub> O <sub>2</sub> , acidic agents (HCl, H <sub>2</sub> SO <sub>4</sub> ) max. 4 – 5 %				-
Calibration	Two-point calibration in oxygen-free environment (nitrogen, sodium sulfite) and air-saturated environment		Two-point calibration in oxygen-free environment (nitrogen) and a second calibration value optimally between 1 and 2 % oxygen		Two-point calibration in oxygen-free environment (nitrogen 6.0) and a second calibration value optimally between 100 and 200 ppm gaseous oxygen
Storage stability	24 months provided the sensor material is stored in the dark				

### For Microx 4 & Microx 4 trace

Specifications	Sensor Type PSt7		Sensor Type PSt8	
	Gaseous & Dissolved O <sub>2</sub>	Dissolved O <sub>2</sub>	Gaseous & Dissolved O <sub>2</sub>	Dissolved O <sub>2</sub>
Measurement range	0 - 100 % O <sub>2</sub> 0 - 1000 hPa	0 - 45 mg/L 0 - 1400 µmol/L	0 - 10 % O <sub>2</sub> 0 - 100 hPa	0 - 4.5 mg/L 0 - 140 µmol/L
Limit of detection	0.02 % O <sub>2</sub>	10 ppb	0.005 % O <sub>2</sub>	2 ppb
Resolution	± 0.01 % O <sub>2</sub> at 1 % O <sub>2</sub> ± 0.05 % O <sub>2</sub> at 20.9 % O <sub>2</sub>	± 0.005 mg/L at 0.4 mg/L ± 0.025 mg/L at 9.0 mg/L	± 0.002 % O <sub>2</sub> at 0.008 % O <sub>2</sub> ± 0.006 % O <sub>2</sub> at 2.5 % O <sub>2</sub>	± 0.7 ppb at 3 ppb ± 2.5 ppb at 1000 ppb
Accuracy	± 0.05 % O <sub>2</sub> or < 3 % rel.		± 3 ppb or < 3 % rel.	
Measurement temperature range	From 0 °C to + 50 °C		From 0 °C to + 50 °C	
Response time (t <sub>90</sub> )	< 3 sec.	< 10 sec.	< 3 sec.	< 10 sec.

## OEM Solutions for You

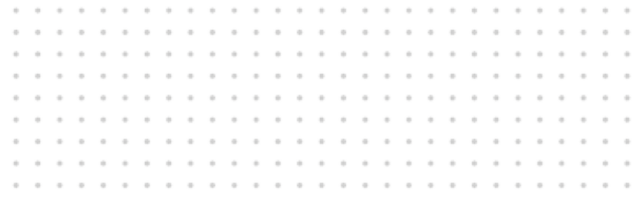


PreSens offers customized sensor technology solutions. Right from the beginning PreSens can be your partner while finding new approaches: from specifications to implementation up to production of your tool.

**Don't hesitate to ask for your individual solution:**  
[engineering@presens.de](mailto:engineering@presens.de)



[www.Presens.de/o2](http://www.Presens.de/o2)



# SENSORS

## Oxygen Flow-Through Cells

### Online Monitoring of Oxygen in Perfusion Systems

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Chemical optical oxygen sensors integrated in plastic or metal flow-through cells (FTCs) allow non-invasive online monitoring in perfusion systems or production lines. The sensors are either fixed to color coded sticks, which can be attached to flow-through cells of different sizes and shapes, or to optical exchange windows which are installed in the cell. A polymer optical fiber connects the sensor inside the flow-through cell to the respective oxygen meter. Plastic FTCs are made of polycarbonate and can be delivered beta-irradiated or untreated, while metal flow-through cells stand CIP or steam sterilization.

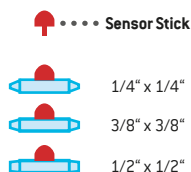
- Single-use & re-usable flow-through cells
- Metal flow-through cells for  $\mu\text{L}$  or production scale volumes
- Precise online monitoring of oxygen in liquids or gases
- Different sizes and shapes for various flow rates
- Easy connection to external tubing

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**Is your application missing?** Contact us and we find your customized solution!

## SPECS

Different sizes  
for various flow rates

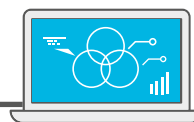


1 - 10 channel

stationary

Hard- & Software

measurement control,  
evaluation, export,  
settings, alerts, etc.



## APPLICATION

Cell Culture  
Perfusion Bioreactor  
Environmental Research  
Animal Physiology

Indoor

Research & Industry



### O<sub>2</sub> Flow-Through Cell FTC

An oxygen sensor stick is delivered in a T-cell made of polycarbonate. A polymer optical fiber connects the sensor to the oxygen meter. This FTC can be delivered in different sizes (1/4" x 1/4", 1/2" x 1/2", and 3/8" x 3/8") for different flow rates.



### O<sub>2</sub> Microsensor Integrated in Metal Cell FTCM

A microsensor is integrated in a stainless steel tee with connectors for 1/16" steel tubing. The inner volume of 2.1 µL is extraordinarily small. It is suited for all applications where only small volumes or low flow rates are applied.



### Autoclavable O<sub>2</sub> Flow-Through Cell FTC-YAU

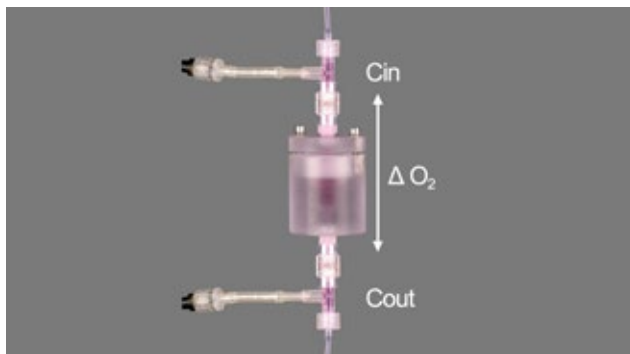
A glass tube with an inner diameter of 2 mm is coated with an optical oxygen sensor at its inner wall. The volume for liquid inside the FTC is about 100 µL. This type of oxygen flow-through cell is autoclavable.



### O<sub>2</sub> Probe Integrated in Metal Cell FTM

A robust oxygen probe is integrated in a metal flow-through cell. The FTM can be integrated in pipes with an outer diameter of 6 mm (or other diameters, using the respective adapter). It stands cleaning in place (80 °C, 2 % NaOH) and pressure up to 15 bar.

## Examples for Applications



### Online Oxygen Measurement in Perfusion Systems

Beta-irradiated and pre-calibrated oxygen and pH flow-through sensors can be integrated into perfusion systems. This allows easy control of process parameters in perfusion reactors. Typically, Luer connectors are used, though different sizes for larger flow rates are also available.



### In-line Oxygen Measurements in the Brewing and Beverage Industries

Even low concentrations of oxygen influence the shelf life and the taste of certain beverages. Due to the exceptionally low detection limit and outstanding accuracy of PreSens trace oxygen sensors integrated in flow-through cells, the quality of oxygen-sensitive products such as beer, wine and soft drinks is secured. The optical sensors inside the FTMs have – compared to standard electrodes – a very fast response time and they are very easy to maintain.



### pH and pO<sub>2</sub> Control in a Bioreactor via FTCs in a Bypass

The flow-through cells with oxygen and pH sensors can also be installed in a bypass of a bioreactor. Connected to an oxygen and pH meter their signal can be used for regulation of oxygen and pH levels inside the bioreactor.

## Specifications

### For Fibox & OXY- Series

	Sensor Type PSt3	Sensor Type PSt6
<b>Specifications</b>		
Measurement range	0 – 45 mg/L 0 – 1400 µmol/L	0 – 2 mg/L 0 – 56.9 µmol/L
Resolution	± 0.004 mg/L at 0.091 mg/L ± 0.045 mg/L at 9.1 mg/L ± 0.14 µmol/L at 2.83 µmol/L ± 1.4 µmol/L at 283.1 µmol/L	± 0.0003 mg/L at 0.001 mg/L ± 0.0006 mg/L at 0.09 mg/L ± 0.010 µmol/L at 0.03 µmol/L ± 0.020 µmol/L at 2.8 µmol/L
Accuracy	± 0.4 % O <sub>2</sub> at 20.9 % O <sub>2</sub> ± 0.05 % O <sub>2</sub> at 0.2 % O <sub>2</sub>	± 1 ppb or ± 3 % of the respective concentration whichever is higher
Drift at 0 % oxygen	< 0.03 % O <sub>2</sub> within 30 days (sampling interval of 1 min.)	< 2 ppb within 30 days (sampling interval of 1 min.)
Measurement temperature range	From 0 °C to + 50 °C	From 0 °C to + 50 °C
Response time (t <sub>90</sub> )*	< 30 sec.	< 40 sec.
<b>Properties</b>		
Compatibility	Aqueous solutions, ethanol, methanol	
Cross-sensitivity	Organic solvents, such as acetone, toluene, chloroform or methylene chloride Chlorine gas	
Sterilization procedures**	Steam sterilization (only FTC-YAU) Ethylene oxide (EtO) Irradiation	
Calibration	Two-point calibration in oxygen-free environment (nitrogen, sodium sulfite) and air-saturated environment	Two-point calibration in oxygen-free environment (nitrogen) and a second calibration value optimally between 1 and 2 % oxygen
Storage stability	Irradiated FTC: 18 months provided the sensor is stored in the dark Untreated FTC: up to 5 years provided the sensor is stored in the dark	

\*equilibrated FTC with physiological solution and sufficient flow rate (min. 15 mL/min) at 37 °C

\*\*recalibration may be required

### For Microx 4 & Microx 4 trace

	Sensor Type PSt7
<b>Specifications</b>	
Measurement range	0 - 45 mg/L 0 - 1400 µmol/L
Limit of detection	10 ppb
Resolution	± 0.005 mg/L at 0.4 mg/L ± 0.025 mg/L at 9.0 mg/L
Accuracy	± 0.05 % O <sub>2</sub> or < 3 % rel.
Measurement temperature range	From 0 °C to + 50 °C
Response time (t <sub>90</sub> )	< 10 sec.





# SENSORS

## Oxygen Probes for Industrial Applications

**Robust with Excellent Long-term Stability –  
for Process Conditions & Autoclavable**

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Oxygen probes measure the partial pressure of both dissolved and gaseous oxygen. The oxygen sensor coating is integrated into high grade stainless steel fittings. The optical oxygen probes show an excellent long-term stability and stand rough process conditions. PreSens oxygen probes operate in industrial process control and various research applications. Used as dissolved oxygen probes these sensors are ideally suited for trace oxygen measurements in the brewing and beverage industry. Certain probe models – equipped with standardized threads – are compatible with most bioreactors and port adapters and can be applied for dissolved oxygen measurements in large-scale cell or microbial cultures.

- Oxygen in-line measurement in stainless steel fermenters
- In-line measurement of trace oxygen in brewing and beverage industries
- Small in size for environmental applications
- Autoclavable, SIP (130 °C, 1.5 atm) & CIP (80 °C, 2 % NaOH)
- Probe is polarization free
- No membrane cleaning and replacement necessary
- No electrolyte solutions to replenish
- Pressure resistant
- Long shelf life

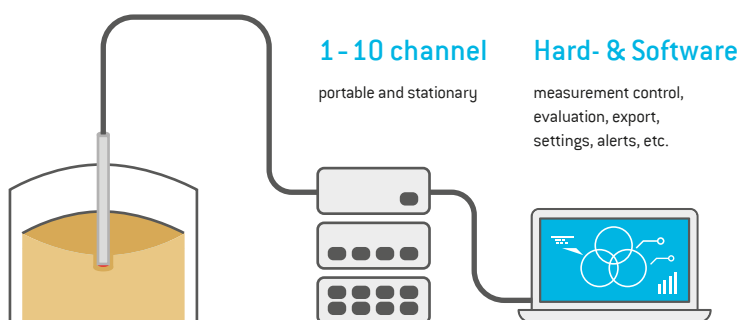
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**Is your application missing? Contact us and we find your customized solution!**

## SPECS

NORMAL RANGE	0-100 % O <sub>2</sub>
TRACE RANGE	0-5 % O <sub>2</sub>

## SET-UP

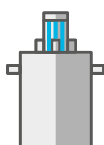


## APPLICATION

### Soil & Environment



### Process Control



### In-line Measurement



### Indoor & Outdoor

Research & Industry



## Oxygen Probe for In-line Measurement OIM

The OIM consists of a fitting made of stainless steel with an optical exchange cap (OEC). The OEC is screwed to the top of the metal fitting and contains the oxygen sensor; it can be replaced. The OIM has a standardized thread and length and is compatible with most bioreactors and port adapters.



## Oxygen Exchange Cap OEC

With the Oxygen Exchange Cap the OIM can be fitted with a new sensor, without having to replace the whole probe.



## Oxygen Dipping Probe DP

The Oxygen Dipping Probe consists of a polymer optical fiber where one end is coated with an oxygen-sensitive foil. The end of the polymer optical fiber is covered with a high-grade steel tube to protect both the sensor material and the optical fiber. The steel tube has an outer diameter of 3 or 4 mm and a length of 10 cm. Other lengths are available on request.



## Examples for Applications



### Process Control in Biotech & Pharma

The oxygen probes for in-line measurement are designed for harsh conditions like high pressure or oil / water mixtures. These systems give high accuracy and are almost maintenance-free as they do not contain membranes and electrolytes. The sensors stand auto-claving, as well as steam sterilization and cleaning in place.



### In-line Oxygen Measurement in the Brewing and Beverage Industries

Even low concentrations of oxygen influence the shelf life and the taste of certain beverages. Due to the extraordinary low detection limit and outstanding accuracy of PreSens trace oxygen sensors the quality of oxygen-sensitive products such as beer, wine and soft drinks is secured. The optical sensors have – compared to standard electrodes – very fast response time and they are very easy to maintain.



### Long-Term Measurements in Soil

PreSens offers dipping probes, which do not consume oxygen in the measurement process. As the probes are long-term stable they can be implanted in soil for many years! Due to their small dimensions they do not disturb the flow and mass-transport and consequently display the in-situ oxygen concentration. With this new method the process of soil aeration, which is very critical for plant productivity, can be investigated.



### Environmental Research – Investigation in Soil Filters

Due to the small outer dimensions and mechanical robustness the oxygen dipping probes offer the possibility to measure the oxygen content in-situ in columns filled with filter sand during the flow of sewage. The results show that a lack of oxygen stops the nitrification process.

## Specifications

### For Fibox & OXY- Series

	Sensor Type PSt3		Sensor Type PSt6		Sensor Type PSt9
Specifications	Gaseous & Dissolved O <sub>2</sub>	Dissolved O <sub>2</sub>	Gaseous & Dissolved O <sub>2</sub>	Dissolved O <sub>2</sub>	Gaseous O <sub>2</sub>
Measurement range	0 – 100 % O <sub>2</sub> 0 – 1000 hPa	0 – 45 mg/L 0 – 1400 µmol/L	0 – 5 % O <sub>2</sub> 0 – 41.4 hPa	0 – 2 mg/L 0 – 56.9 µmol/L	0 - 200 ppmv O <sub>2</sub>
Limit of detection	0.03 % oxygen	15 ppb	0.002 % oxygen	1 ppb	0.5 ppmv O <sub>2</sub>
Resolution	± 0.01 % O <sub>2</sub> at 0.21 % O <sub>2</sub> ± 0.1 % O <sub>2</sub> at 20.9 % O <sub>2</sub> ± 0.1 hPa at 2 hPa ± 1 hPa at 207 hPa	± 0.004 mg/L at 0.091 mg/L ± 0.045 mg/L at 9.1 mg/L ± 0.14 µmol/L at 2.83 µmol/L ± 1.4 µmol/L at 283.1 µmol/L	± 0.0007 % O <sub>2</sub> at 0.002 % O <sub>2</sub> ± 0.0015 % O <sub>2</sub> at 0.2 % O <sub>2</sub> ± 0.007 hPa at 0.023 hPa ± 0.015 hPa at 2.0 hPa	± 0.0003 mg/L at 0.001 mg/L ± 0.0006 mg/L at 0.09 mg/L ± 0.010 µmol/L at 0.03 µmol/L ± 0.020 µmol/L at 2.8 µmol/L	10 ± 0.5 ppmv O <sub>2</sub> 100 ± 0.8 ppmv O <sub>2</sub> 200 ± 1.5 ppmv O <sub>2</sub>
Accuracy	± 0.4 % O <sub>2</sub> at 20.9 % O <sub>2</sub> ± 0.05 % O <sub>2</sub> at 0.2 % O <sub>2</sub>		± 1 ppb or ± 3 % of the respective concentration whichever is higher		± 2 ppmv O <sub>2</sub> or ± 5 % whichever is higher
Drift at 0 % oxygen	< 0.03 % O <sub>2</sub> within 30 days (sampling interval of 1 min.)		< 2 ppb within 30 days (sampling interval of 1 min.)		< 2 ppmv O <sub>2</sub> within 30 days (sampling interval of 1 min.)
Measurement temperature range	From 0 °C to + 50 °C		From 0 °C to + 50 °C		From 0 °C to + 40 °C
Response time (t <sub>90</sub> )	< 6 sec.	< 40 sec.	< 6 sec.	< 40 sec.	< 3 sec.
Properties					
Compatibility	Aqueous solutions, ethanol, methanol				Gas phase only
No cross-sensitivity	pH 1 – 14, CO <sub>2</sub> , H <sub>2</sub> S, SO <sub>2</sub> , Ionic species				CO <sub>2</sub> , SO <sub>2</sub>
Cross-sensitivity	Organic solvents, such as acetone, toluene, chloroform or methylene chloride, chlorine gas				Organic vapor, chlorine gas
Sterilization procedures	Steam sterilization, ethylene oxide (EtO), gamma-irradiation				-
Cleaning procedures	Cleaning in place (CIP, 2 % NaOH, 80 °C, 176 °F), 3 % H <sub>2</sub> O <sub>2</sub> , acidic agents (HCl, H <sub>2</sub> SO <sub>4</sub> ) max. 4 – 5 %				-
Calibration	Two-point calibration in oxygen-free environment (nitrogen, sodium sulfite) and air-saturated environment		Two-point calibration in oxygen-free environment (nitrogen) and a second calibration value optimally between 1 and 2 % oxygen		Two-point calibration in oxygen-free environment (nitrogen 6.0) and a second calibration value optimally between 100 and 200 ppm gaseous oxygen
Storage stability	24 months provided the sensor material is stored in the dark				

### For Microx 4 & Microx 4 trace

Specifications	Sensor Type PSt7		Sensor Type PSt8	
	Gaseous & Dissolved O <sub>2</sub>	Dissolved O <sub>2</sub>	Gaseous & Dissolved O <sub>2</sub>	Dissolved O <sub>2</sub>
Measurement range	0 - 100 % O <sub>2</sub> 0 - 1000 hPa	0 - 45 mg/L 0 - 1400 µmol/L	0 - 10 % O <sub>2</sub> 0 - 100 hPa	0 - 4.5 mg/L 0 - 140 µmol/L
Limit of detection	0.02 % O <sub>2</sub>	10 ppb	0.005 % O <sub>2</sub>	2 ppb
Resolution	± 0.01 % O <sub>2</sub> at 1 % O <sub>2</sub> ± 0.05 % O <sub>2</sub> at 20.9 % O <sub>2</sub>	± 0.005 mg/L at 0.4 mg/L ± 0.025 mg/L at 9.0 mg/L	± 0.002 % O <sub>2</sub> at 0.008 % O <sub>2</sub> ± 0.006 % O <sub>2</sub> at 2.5 % O <sub>2</sub>	± 0.7 ppb at 3 ppb ± 2.5 ppb at 1000 ppb
Accuracy	± 0.05 % O <sub>2</sub> or < 3 % rel.		± 3 ppb or < 3 % rel.	
Measurement temperature range	From 0 °C to + 50 °C		From 0 °C to + 50 °C	
Response time [t <sub>90</sub> ]	< 3 sec.	< 10 sec.	< 3 sec.	< 10 sec.



## Sensor Integration in Customized Fittings

Optical sensors are very versatile and can be integrated in most various fittings according to customer requirements. Contact our service team to get your customized sensor probe!





# SENSORS

## Oxygen Microsensors

Sensor Tip Thinner than a Hair ( $< 50 \mu\text{m}$ ) –  
Measure on-the-spot

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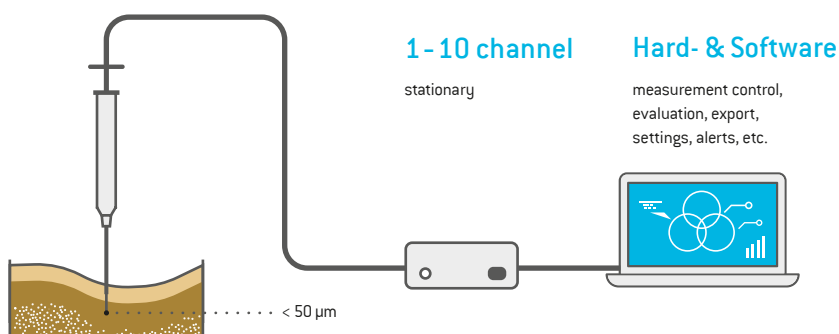
Oxygen microsensors are miniaturized chemical optical oxygen sensors designed for all research and packaging applications where a small tip size ( $< 50 \mu\text{m}$ ) and fast response time ( $t_{90} < 3 \text{ sec.}$ ) are necessary. The optical oxygen microsensors are based on a  $230 \mu\text{m}$  silica fiber and are available with sensor tip diameters from  $< 50 \mu\text{m}$  to  $230 \mu\text{m}$ . The oxygen microsensors are mounted in different housings (needle-type housing, implantable, microprofiling) and offer a unique research tool for investigating systems where micro-invasive and small sensors are needed.

- Insertion in plant and animal tissue
- Measuring in smallest volumes
- Microprofiling of oxygen gradients in biofilms and sediments
- High spatial resolution
- Micro-respiration systems
- Independent of electromagnetic fields

## SPECS

NORMAL RANGE	0-100 % O <sub>2</sub>
TRACE RANGE	0-10 % O <sub>2</sub>
TIP SIZE	< 50 µm

## SET-UP



## APPLICATION

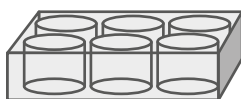
### Profiling



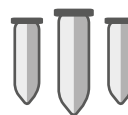
### Plant & Animal Tissue



### Cell & Microbial Culture



### Small Volumes



### Indoor & Outdoor

Research & Industry



## Needle-type Oxygen Microsensors NTH

Needle-type oxygen microsensors measure with high spatial resolution of less than 50 µm. The oxygen-sensitive tip of an optical fiber is protected inside a stainless steel needle. This design is optimally suited for easy penetration of tissue, septum rubber or packaging materials.



## Micro-Profiling Microsensors PM

The PM is specially designed for microprofiling applications with a close-fitting fiber guidance and a mechanical interlock for precise vertical localization of the measurement tip. A PM should be used for all microprofiling applications in semi-solid substrates.



## Implantable Oxygen Microsensors IMP

Implantable oxygen microsensors are designed for various customized applications. The tiny probe has a tip size of < 50 µm to 230 µm. The bare glass fiber tip can be mounted to your own housings, steel tubes and micro-respirometer chambers etc.



## O<sub>2</sub> Microsensor with Fixed Sensor Tip NFSG

This sensor, where the sensor tip is fixed inside the steel needle, is the ideal tool for all packaging applications, e. g. measurements in blisters. The NFSG is specially designed for measurements in the gas phase.

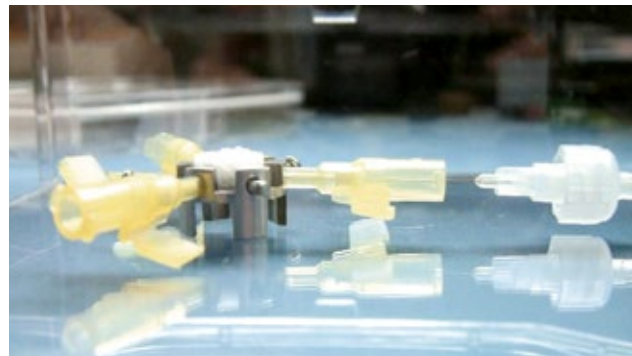


## Examples for Applications



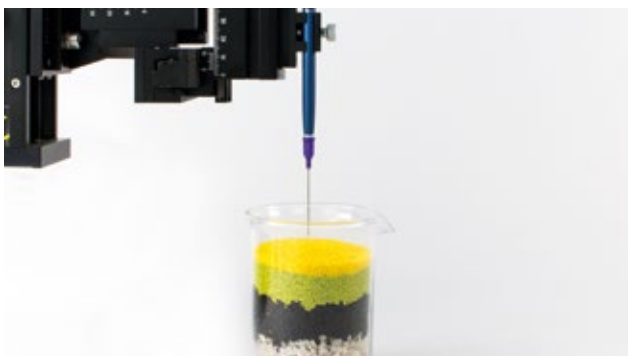
### Packaging & Quality Control

Oxygen inside packaging can lead to oxidative deterioration of certain products. Therefore, determination of the oxygen content within packages or pharmaceutical vials is essential to ensure both the filling quality and the long-term storage stability. With our micro-invasive needle-type oxygen microsensors we offer a simple tool to determine residual oxygen both in the headspace and in liquids.



### Tissue Engineering

Oxygen microsensors measure the oxygen content in various volume compartments of the tissue engineering constructs. To do so, hair-thin sensors are inserted into the constructs and the oxygen content is measured online. In this way, the oxygen partial pressure is measured with a high local resolution and correlated with the constructs tissue quality [composition of the extracellular matrix].



### Microprofiling Measurements in Sediments and Tissue

Due to the extraordinary high local resolution ( $< 50 \mu\text{m}$ ) our oxygen microsensors are ideally suited for recording microprofiles e.g. in sea-floor sediments, biofilms and plant physiology. Combined with our microprofiling equipment – the Manual (MM) or Automated Micromanipulator (AM) – precise localization of the sensor tip inside the sample and vibration-free movement with  $\mu\text{m}$  reading accuracy can be realized.

## Specifications

### For Microx 4 & Microx 4 trace

Specifications	Sensor Type PSt7		Sensor Type PSt8	
	Gaseous & Dissolved O <sub>2</sub>	Dissolved O <sub>2</sub>	Gaseous & Dissolved O <sub>2</sub>	Dissolved O <sub>2</sub>
Measurement range	0 - 100 % O <sub>2</sub> 0 - 1000 hPa	0 - 45 mg/L 0 - 1400 µmol/L	0 - 10 % O <sub>2</sub> , 0 - 100 hPa 0 - 4.5 mg/L, 0 - 140 µmol/L	0 - 4.5 mg/L 0 - 140 µmol/L
Limit of detection	0.03 % O <sub>2</sub>	15 ppb	0.007 % O <sub>2</sub>	3 ppb
Resolution	± 0.01 % O <sub>2</sub> at 1 % O <sub>2</sub> ± 0.05 % O <sub>2</sub> at 20.9 % O <sub>2</sub>	± 0.005 mg/L at 0.4 mg/L ± 0.025 mg/L at 9.0 mg/L	± 0.002 % O <sub>2</sub> at 0.008 % O <sub>2</sub> ± 0.006 % O <sub>2</sub> at 2.5 % O <sub>2</sub>	± 0.7 ppb at 3 ppb ± 2.5 ppb at 1000 ppb
Accuracy	± 0.05 % O <sub>2</sub> or < 3 % rel.		± 3 ppb or < 3 % rel.	
Measurement temperature range	From 0 °C to + 50 °C		From 0 °C to + 50 °C	
Response time (t <sub>90</sub> )	< 3 sec.	< 10 sec.	< 3 sec.	< 10 sec.

### For Microx TX3

Specifications	Sensor Type PSt1	
	Gaseous & Dissolved O <sub>2</sub>	Dissolved O <sub>2</sub>
Measurement range	0 - 50 % O <sub>2</sub> 0 - 500 hPa	0 - 22.5 mg/L 0 - 700 µmol/L
Limit of detection	0.05 % oxygen	20 ppb
Resolution	± 0.01 % O <sub>2</sub> at 0.21 % O <sub>2</sub> ± 0.09 % O <sub>2</sub> at 20.9 % O <sub>2</sub> ± 0.1 hPa at 2 hPa ± 0.087 hPa at 207 hPa	± 0.005 mg/L at 0.09 mg/L ± 0.04 mg/L at 9.06 mg/L ± 0.14 µmol at 2.83 µmol ± 1.3 µmol at 283 µmol
Accuracy	± 0.4 % O <sub>2</sub> at 20.9 % O <sub>2</sub> ; ± 0.05 % O <sub>2</sub> at 0.2 % O <sub>2</sub> ;	
Drift at 0 % oxygen	< 0.1 % O <sub>2</sub> within 30 days (sampling interval of 1 min.)	
Measurement temperature range	From 0 °C to + 50 °C	
Response time TS* (t <sub>90</sub> )	< 1 sec.	< 2 sec.
Response time TF* (t <sub>90</sub> )	< 15 sec.	< 30sec.
<b>Properties</b>		
Compatibility	Aqueous solutions, ethanol, methanol	
No cross-sensitivity	pH 1 - 14 CO <sub>2</sub> , H <sub>2</sub> S, SO <sub>2</sub> Ionic species	
Cross-sensitivity	Organic solvents, such as acetone, toluene, chloroform or methylene chloride Chlorine gas	
Sterilization procedures	Steam sterilization (only implantable & TF** sensor) Ethylene oxide (EtO)	
Cleaning procedures	3 % H <sub>2</sub> O <sub>2</sub> , ethanol, soap solution	
Calibration	Two-point calibration in oxygen-free environment (nitrogen, sodium sulfite) and air-saturated environment	
Storage stability	5 years provided the sensor material is stored in the dark at room temperature	

\*TS: tapered sensor tip with a diameter < 50 µm and no optical isolation

\*\*TF: flat-broken sensor tip with a diameter of 140 µm





# MICROPROFILING

## Microprofiling Solutions

### Vibration-free, High-resolution Control for your Microsensor

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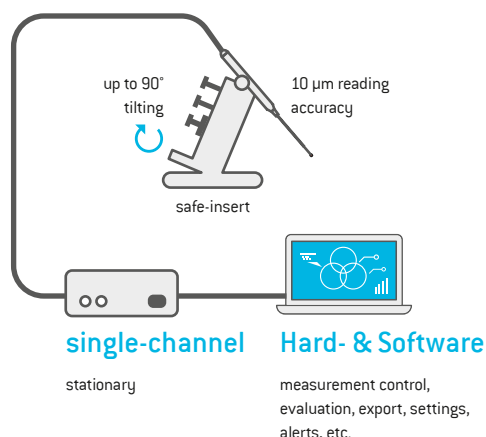
The Automated and Manual Micromanipulator are specifically designed for microprofiling applications with PreSens microsensors. The systems allow moving the microsensor vibration-free in 3 axes with  $\mu\text{m}$  reading accuracy and enable exact localization of the sensor in the sample. Automated microprofiling can be performed along one dimension in  $\mu\text{m}$  resolution. Whenever insertion of a microsensor in semi-solid or hard substrates is required, the micromanipulators are the safest way to do it, achieving highest accuracy, spatial resolution and stability.

- Vibration-free micromanipulation in 3D
- Fine drive with  $\mu\text{m}$  reading accuracy
- Safe-insert function
- Fully automated or manual system
- No electrical interferences due to optical measurement
- Adaptable to any sample

.....

**Is your application missing?** Contact us and we find your customized solution!

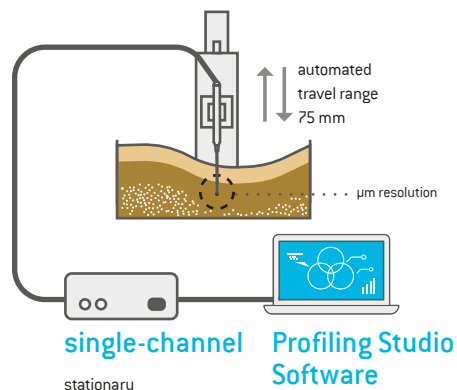
## MICROMANIPULATOR SET-UP



## SPECS

NORMAL RANGE	0-100 % $\text{O}_2$
TRACE RANGE	0-10 % $\text{O}_2$

## AUTOMATED MICROMANIPULATOR SET-UP



## APPLICATION

### Sediments & Biofilms



### Biology & Environment



### Medical Research & Life Science



### Indoor & Outdoor

Research & Industry



## Manual Micromanipulator MM

The Manual Micromanipulator is specifically designed for PreSens needle-type microsensors (NTH). The system allows moving the microsensor vibration-free in 3 axes with  $\mu\text{m}$  reading accuracy. With its solid base plate for a stable set-up the micromanipulator can be tilted safely up to 90°. The safe-insert function enables secure insertion of the NTH retracted in its steel needle into your area of interest. The sensor tip can then be extended safely. Whenever insertion of a microsensor in semi-solid or hard substrates is required this is the safest way to do it, achieving highest accuracy and spatial resolution.



## Micro-Profiling Microsensors PM

The PM is specially designed for microprofiling applications with a close-fitting fiber guidance and a mechanical interlock for precise vertical localization of the measurement tip. A PM should be used for all microprofiling applications in semi-solid substrates.



## Automated Micromanipulator AM

The Automated Micromanipulator AM is specifically designed for microprofiling applications with the PreSens Profiling Microsensor (PM), and can also be operated with needle-type housed (NTH) and implantable (IMP) microsensors. The system allows moving the microsensor vibration-free with  $\mu\text{m}$  reading accuracy and enables exact localization of the sensor in the sample. Automated microprofiling can be performed along one dimension in  $\mu\text{m}$  resolution. The associated database-supported software PreSens Profiling Studio allows complete control with several step zones, variable travel velocity and waiting times of the AM and the respective oxygen or pH meter via USB. The AM is compatible with PreSens oxygen meters Microx 4, Microx 4 trace (Microx TX3 and Microx TX3 trace with PSt1 sensor type only), and the pH meter pH-1 micro.

## Examples for Applications



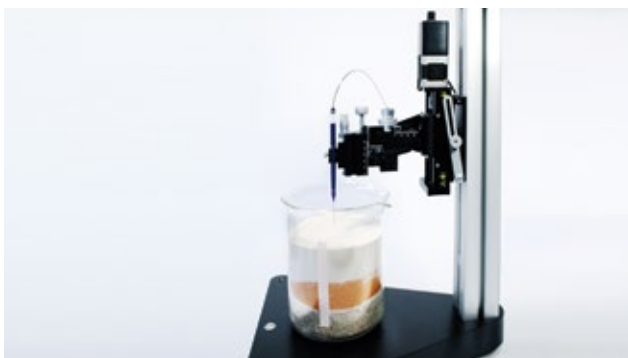
### Microprofiling in Biological & Environmental Research

The different types of oxygen microsensors allow e. g. measurements in smallest sample volumes or inside tissue. The micro-manipulators should be applied whenever it is necessary to insert the microsensor safely into semi-solid samples and when exact localization and stabilization of the microsensor tip within the sample is required. Using the safe-insert function the microsensor tip can be securely inserted and localized at the exact position where you want to conduct your measurements.



### Microsensor Measurements in Medical & Life Science Research

PreSens microsensors are ideal tools for medical and life science research, as they allow for precise on the spot measurement and microprofiling inside tissue constructs. The Manual Micro-manipulator is the indispensable equipment in these applications for exact localization of the microsensor inside the sample and microprofiling in step sizes down to 10  $\mu\text{m}$ . PreSens needle-type microsensors are used in many tissue engineering applications.



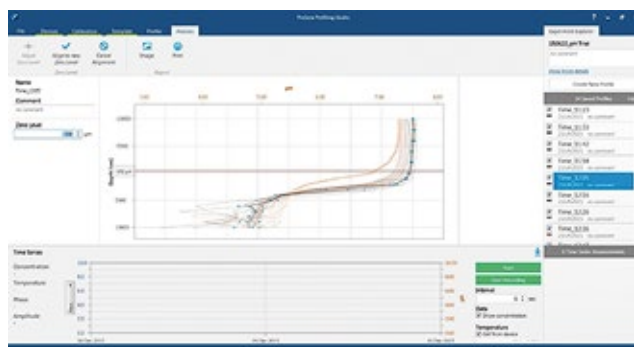
### Microprofiling of Sediments & Biofilms

Together with the specially designed PreSens Profiling Microsensors (PM) the Automated Micromanipulator is the ideal tool for oxygen measurements in sediment and biofilm applications. With a free choice of step zones, travel velocities and wait times different layers inside the sample can be monitored and assessed in step sizes down to 10  $\mu\text{m}$ . The software visualizes the online measurements, so you can follow gradients and identify boundaries immediately while the sensor is automatically moved inside the sample.

## Specifications

Specifications	Manual Micromanipulator (MM)	Automated Micromanipulator (AM)
Compatibility	Profiling (PM), needle-type housed (NTH) and implantable (IMP) pH microensors	Profiling (PM), needle-type housed (NTH) and implantable (IMP) pH microensors
Dimensions	230 mm x 130 mm x 200 mm	275 mm x 95 mm x 220 mm
Weight	Weight w/o base plate: 1.1 kg Weight with base plate: 3.03 kg	Weight of AM: 2.07 kg Weight of Heavy Stand: 14 kg
Travel range automated	-	x-axis: 75 mm
Travel range manual	x-axis: 37 mm, fine drive 10 mm y-axis: 20 mm z-axis: 25 mm	x-axis: 37 mm, fine drive 10 mm y-axis: 20 mm z-axis: 25 mm
Reading accuracy	Coarse adjustment: 0.1 mm Fine adjustment: 0.01 mm	-
Coarse positioning	x-axis: 70 mm	-
Rotatability	360°	-
Material	Aluminium & steel	Aluminium & steel
Resolution	-	1 µm
Repeatability	-	< 2.5 µm
Mounting adapter	M6 screw, 13 mm length	M6 screw, 13 mm length
Power supply	-	100 - 240 VAC, 50/60 Hz. Use supplied power adapter (15 VDC, 2.1 mm center positive plug) only.
Digital interface	-	USB interface (cable included)
Control software	-	PreSens Profiling Studio (compatible with Windows 7, 8, 10 at 32 or 64 bit)

## PreSens Profiling Studio Software



This software enables control of the Automated Micro-manipulator and connected oxygen or pH meter. PreSens Profiling Studio allows complete control with several step zones, variable travel velocity and waiting times of the AM. It is database supported and offers multiple features from clear data organization and export, annotations, easy creation of profiling templates, to analysis functions.





# SENSOR SOLUTIONS

## Oxygen Ingress Measurement

**Non-invasive, Non-destructive & Under Real Conditions:  
Determine the Shelf Life of your Product**

---

Fiber optic oxygen meters determine oxygen permeability of plastic bottles and containers most precisely. Ideal for assurance, production and quality control, this sensor solution incorporates state-of-the-art optical sensor technology. Permeation rates can be confirmed without piercing the package or bottle. PreSens sensor spots enable contactless and non-destructive measurements. A trace oxygen sensor spot is attached to the inner surface of the transparent bottle or package and an optical fiber is positioned outside. The sensor response changes with oxygen concentration on the inside and oxygen ingress can be easily determined.

- Determination of oxygen ingress in PET bottles
- Determination of scavenger capacity
- Determination of oxygen permeation through closures
- Determination of product shelf life
- Contactless & non-destructive online measurements
- Measurements under real conditions
- Sensitive down to 1 ppb dissolved oxygen
- Easy & precise measurements

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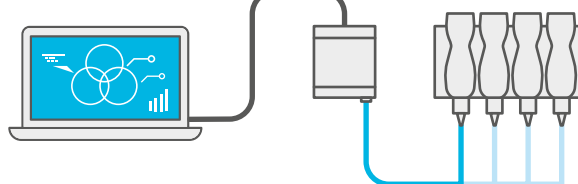
**Is your application missing? Contact us and we find your customized solution!**

## SPECS

NORMAL RANGE	0-100 % O <sub>2</sub>
TRACE RANGE	0-5 % O <sub>2</sub>
ULTRA TRACE RANGE	0-200 ppm

## SET-UP

### Subsequent measurement

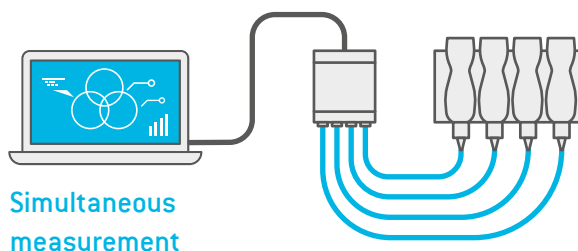


### Hard- & Software

measurement control,  
evaluation, export,  
settings, alerts, etc.

### 1 - 10 channel

stationary, portable,  
OEM, etc.



### Simultaneous measurement



## Fibox 4 trace

The compact Fibox 4 trace is designed for easy handheld use. The robust housing is splash-proof and the controls – color display and buttons – can be operated even while wearing heavy gloves. The integrated long-lasting battery and immense storage capacity allow for prolonged computer-independent work.



## OXY-4 trace & OXY-10 trace

These multi-channel oxygen meters can read out up to 4 or 10 sensors in parallel. Oxygen traces in multiple containers can be investigated simultaneously.



## O<sub>2</sub> Sensor Spots SP-PSt6/PSt9

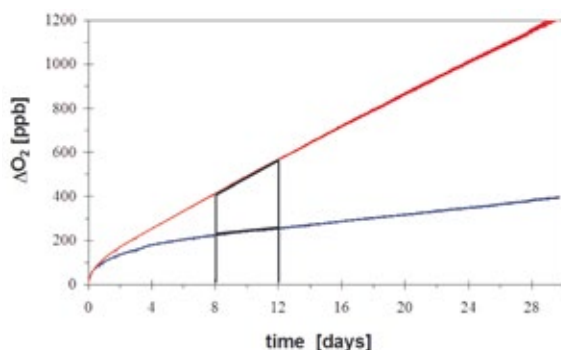
The trace oxygen sensor spots can easily be integrated in transparent containers or PET bottles. The PSt6 type sensor has a measurement range of 0 – 5 % O<sub>2</sub> [gaseous & dissolved], while the PSt9 type sensor measures ultra-low oxygen traces in a range of 0 – 200 ppmv O<sub>2</sub> in gas.



## Oxygen-Sensitive Cap OSC-PSt6

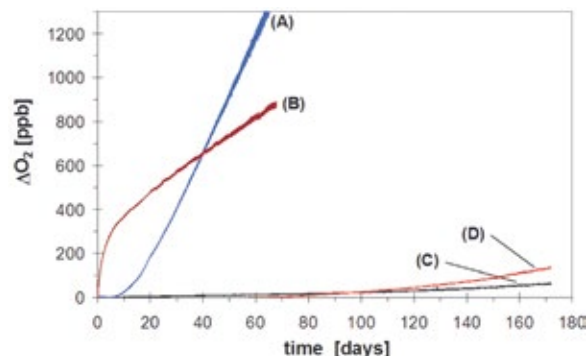
To determine the oxygen ingress in dark brown or non-transparent PET bottles, directly attaching an oxygen sensor spot to the bottle wall is not possible as the colored material interferes with sensor read-out. To enable non-invasive oxygen ingress measurement also for deeply colored and non-transparent containers PreSens has developed an oxygen-sensitive cap which can be used as closure.

## Examples for Oxygen Ingress Measurement in PET Bottles



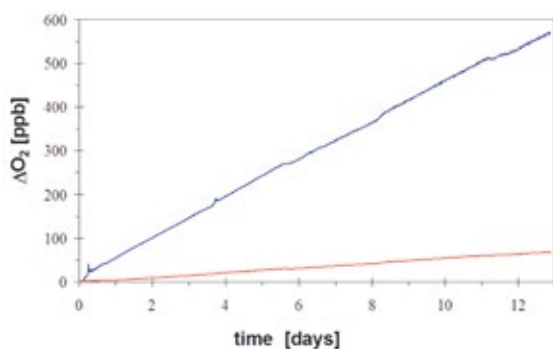
### Bottle Type 1: External Coated PET Bottles

The oxygen ingress into an externally coated PET bottle (blue line) and the respective reference bottle without coating (red line) are shown over a period of more than 25 days. In the first 48 hours the increase of the oxygen concentration in non-coated bottles and bottles with external coating is non-linear due to the migration of oxygen out of the PET bottle wall. The external barrier coating reduces the rate of permeation.



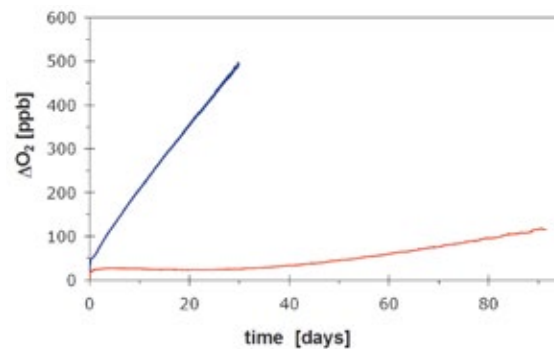
### Bottle Type 2: External Coating & Different Oxygen Scavenger Content

Oxygen ingress into differently treated PET bottles of the same type: (A) non-coated PET bottle with 2 % scavenger, (B) externally coated PET bottle with no scavenger, (C) externally coated PET bottle with 1 % scavenger, (D) externally coated PET bottle with 0.5 % scavenger. The combination systems (C) and (D) hold oxygen ingress to less than 1 ppm over six months, which could not be accomplished with the active [scavenger A] or passive barrier [external coating B] alone.



### Bottle Type 3: Internally Coated PET Bottles

The inner coating provides an efficient barrier to oxygen (red line), and prevents oxygen desorption from the PET bottle wall into the product during the first few days of storage contrary to bottles coated externally. In this case a thin layer of amorphous carbon, typically 100 to 200 nm thick, is applied to the inner surface of the bottle. This is deposited from high-energy plasma of acetylene gas within a high vacuum environment.



### Bottle Type 4: Multilayer Bottles Containing Oxygen Scavenger

Common multilayer structures combine two layers of PET and a middle layer of Nylon MXD6 in three layer structures. The high barrier material is present in separate layers which are made by simultaneous or sequential co-injection (blue line). The combination of a multilayer structure adding an active barrier within the middle layer decreases oxygen ingress significantly, which could not be accomplished with a multilayer structure without an active barrier (red line).

## Specifications

	Sensor Type PSt3		Sensor Type PSt6	
Specifications	Gaseous & Dissolved O <sub>2</sub>	Dissolved O <sub>2</sub>	Gaseous & Dissolved O <sub>2</sub>	Dissolved O <sub>2</sub>
Measurement range	0 – 100 % O <sub>2</sub> 0 – 1000 hPa	0 – 45 mg/L 0 – 1400 µmol/L	0 – 5 % O <sub>2</sub> 0 – 41.4 hPa	0 – 2 mg/L 0 – 56.9 µmol/L
Limit of detection	0.03 % oxygen	15 ppb	0.002 % oxygen	1 ppb
Resolution	± 0.01 % O <sub>2</sub> at 0.21 % O <sub>2</sub>	± 0.004 mg/L at 0.091 mg/L	± 0.0007 % O <sub>2</sub> at 0.002 % O <sub>2</sub>	± 0.0003 mg/L at 0.0001 mg/L
	± 0.1 % O <sub>2</sub> at 20.9 % O <sub>2</sub>	± 0.045 mg/L at 9.1 mg/L	± 0.0015 % O <sub>2</sub> at 0.2 % O <sub>2</sub>	± 0.0006 mg/L at 0.09 mg/L
	± 0.1 hPa at 2 hPa	± 0.14 µmol/L at 2.83 µmol/L	± 0.007 hPa at 0.023 hPa	± 0.010 µmol/L at 0.03 µmol/L
	± 1 hPa at 207 hPa	± 1.4 µmol/L at 283.1 µmol/L	± 0.015 hPa at 2.0 hPa	± 0.020 µmol/L at 2.8 µmol/L
Accuracy		± 0.4 % O <sub>2</sub> at 20.9 % O <sub>2</sub> ± 0.05 % O <sub>2</sub> at 0.2 % O <sub>2</sub>	± 1 ppb or ± 3 % of the respective concentration whichever is higher	
Drift at 0 % oxygen	< 0.03 % O <sub>2</sub> within 30 days (sampling interval of 1 min.)		< 2 ppb within 30 days (sampling interval of 1 min.)	
Measurement temperature range	From 0 °C to + 50 °C		From 0 °C to + 50 °C	
Response time (t <sub>90</sub> )	< 6 sec.	< 40 sec.	< 6 sec.	< 40 sec.
<b>Properties</b>				
Compatibility	Aqueous solutions, ethanol, methanol			
No cross-sensitivity	pH 1 – 14, CO <sub>2</sub> , H <sub>2</sub> S, SO <sub>2</sub> , Ionic species			
Cross-sensitivity	Organic solvents, such as acetone, toluene, chloroform or methylene chloride, chlorine gas			
Sterilization procedures	Steam sterilization, ethylene oxide [EtO], gamma-irradiation			
Cleaning procedures	Cleaning in place [CIP, 2 % NaOH, 80 °C, 176 °F], 3 % H <sub>2</sub> O <sub>2</sub> , acidic agents [HCl, H <sub>2</sub> SO <sub>4</sub> ] max. 4 – 5 %			
Calibration	Two-point calibration in oxygen-free environment (nitrogen, sodium sulfite) and air-saturated environment		Two-point calibration in oxygen-free environment (nitrogen) and a second calibration value optimally between 1 and 2 % oxygen	
Storage stability	24 months provided the sensor material is stored in the dark			





# IMAGING

## VisiSens™ O<sub>2</sub> Imaging System

### Record Spatial and Temporal O<sub>2</sub> Distributions

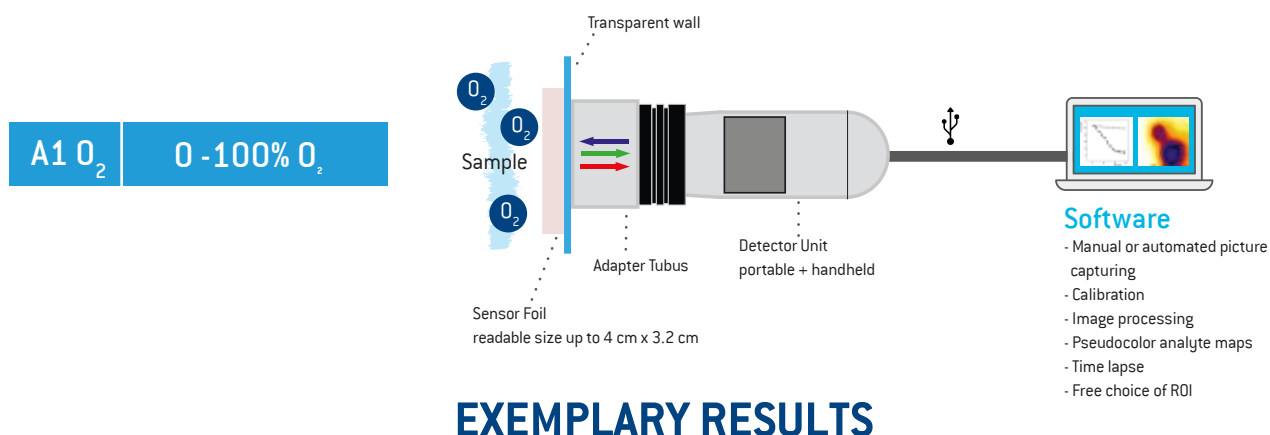
---

Fluorescent chemical optical sensor foils combined with VisiSens™ imaging technology allow for non-invasive mapping O<sub>2</sub> distributions in heterogeneous samples. The fluorescent sensor foil is attached directly on the sample surface or in a transparent vessel made of glass or plastic. The sensor foil is available in different sizes and can easily be cut in any desired shape. It translates the O<sub>2</sub> content into a light signal. The 2D sensor response is recorded contactless with the VisiSens™ imaging device in spatial and temporal manner.

- 2D read-out
- Contactless, direct sensing or through transparent walls
- Visualize spatial and temporal gradients
- Numerous measurement points in one image

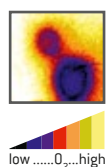
## SPECS

## SET-UP

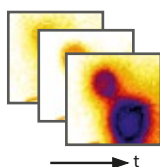


## EXEMPLARY RESULTS

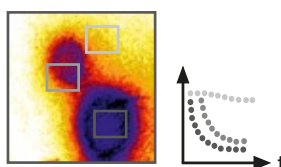
### 2D Read-out



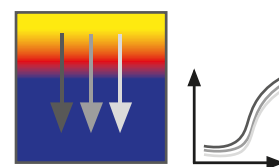
### Time Series



### Multiple ROI



### Gradients



## VisiSens™ Detector Unit DU01

The detector unit DU01 is a spectral 2D detection device for O<sub>2</sub> imaging. It is designed for read-out of fluorescent optical sensor foils. The device is portable and connected via USB2.0 to a PC / notebook for measurement.



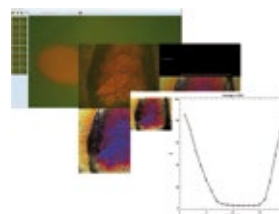
## pH Sensor Foil SF-RPSu4

The O<sub>2</sub> sensor foil can be attached to any sample surface or the inner surface of any transparent vessel. O<sub>2</sub> is measured contactless in gaseous and liquid phase. SF-RPSu4 sensor foils have a measuring range of 0 – 100 % air saturation [0 – 20.9 % O<sub>2</sub>].



## Adapter Tubes

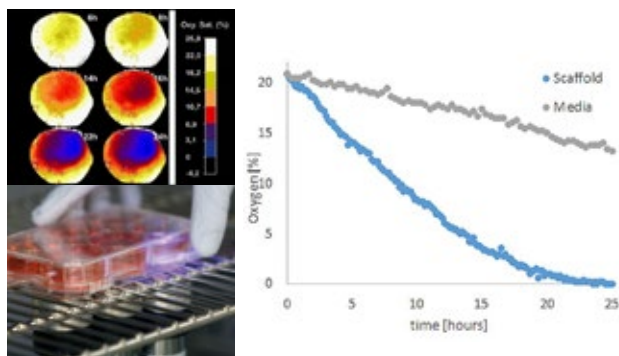
Tubes in different sizes can be attached to the VisiSens™ detector unit to adjust the field of view under standardized conditions.



## VisiSens™ AnalytiCal 1

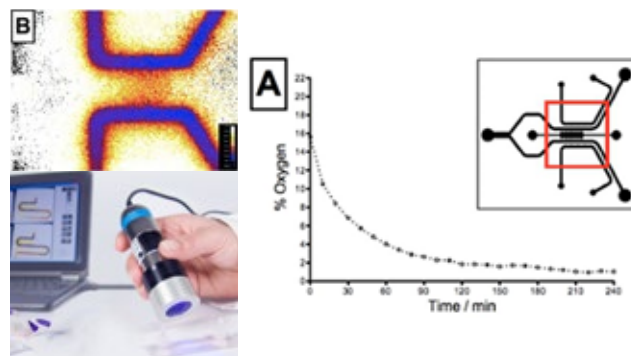
Software for recording and evaluation of data obtained by the VisiSens™ O<sub>2</sub> imaging set-up.

## Examples for Applications



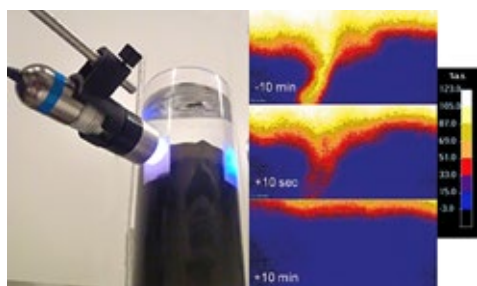
### O<sub>2</sub> in Cell Culture and Engineered Tissue

Cellular metabolism critically depends on local O<sub>2</sub> supply. Especially in 2D and 3D cell culture or engineered tissue, cells located in diffusion limited regions [e.g. in scaffolds or spheroids] can be subject to low oxygen levels and pH changes. Non-invasive, continuous 2D-mapping can be performed directly in the incubator under growth conditions. Furthermore, 2D analyte distributions in living samples can be visualized.



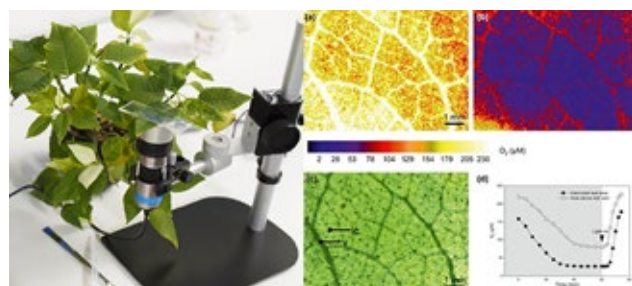
### Non-invasive 2D O<sub>2</sub> Mapping in Microfluidics

VisiSens™ enables 2D visualization of important culture parameters inside microfluidic chips. You can continuously monitor in 2D, with high resolution at specific positions or over the whole chip surface in a non-contact readout mode. Detect metabolic hotspots, record time-series, and monitor hypoxia, cellular growth, or O<sub>2</sub> supply inside the chip. You can gain new insights on metabolic activity and natural or artificially produced gradients.



### O<sub>2</sub> Mapping in Sediments

O<sub>2</sub> is a key factor for microbial activity, various geochemical and living processes in sediments. Its supply highly varies locally, e.g. at interfaces, different depths or benthic disturbances. Spatial and temporal O<sub>2</sub> dynamics over long time periods can be visualized. Various regions can be compared within one measurement. VisiSens™ enables non-invasive 2D-mapping over cross-sections or on sample surfaces. The portable device can be used in lab and field.



### Visualized O<sub>2</sub> Respiration in Leaves

Plants are both producers and consumers of oxygen. Visualizing O<sub>2</sub> levels on the surface of plant leaves can give information about oxygen changes during light/dark conditions. The sensor foils attached to the leaf surface seal it against oxygen from ambient air and translate the respective analyte level with high spatial resolution. With VisiSens™ it is even possible to investigate different petal or vascular structures and compare them in terms of oxygen consumption.

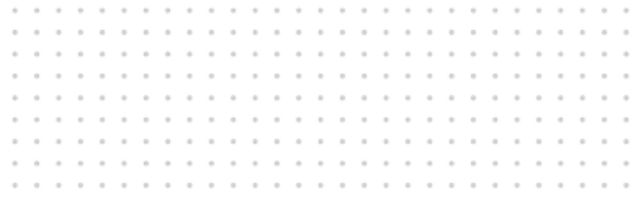
## Specifications

Oxygen (blue) SF-RPSu4	
<b>Specifications*</b>	
Measurement range	0 - 100 % air saturation (0 - 20.9 % O <sub>2</sub> )
Response time (t <sub>90</sub> )**	30 sec.
Size of sensor foil**	5 x 5 mm <sup>2</sup> to 40 x 40 mm <sup>2</sup>
Number of sensing points within one image**	300,000
Measurement temperature range	From + 5 °C to + 45 °C
<b>Properties</b>	
Compatibility	Aqueous solutions, ethanol (max. 10 % V/V), methanol (max. 10 % V/V), pH 2 - 10
<b>Device</b>	
Camera chip	Enhanced Color CMOS
Image resolution	1.3 megapixel (1280 x 1024 pixels)
Magnification	10-fold up to 220-fold, depending on adapter tubus used
Field of view	~ 2.3 x 2.0 mm <sup>2</sup> to ~ 4.1 x 3.3 cm <sup>2</sup> ; typically ~ 1.5 x 1.2 cm <sup>2</sup>
Output	15 fps live video preview (no storage) and 0.5 fps full-resolution picture storage (.png)
Number of LEDs	8
Dimensions	Length 10 cm, diameter 3.8 cm
Weight	0.17 kg (without adapter tubus)
Material	All-aluminum housing
Digital interface	USB 2.0, high speed USB transmission

\*VisiSens™ is no approved medical device

\*\*typical data which may strongly differ with adapting the imaging set-up to specific needs





# ACCESSORIES

## Accessories for Optical O<sub>2</sub> Sensors & Meters

### Extensions and Add-ons for Oxygen Measurements

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We offer numerous accessories for our measurement devices. They extend the application possibilities of PreSens measurement systems. Optical sensor adapters allow our sensors to be used in a wide variety of containers.

- Optical adapters for connecting sensors to the meters
- Polymer optical fibers in different variations and lengths

## Specifications

POF			
<b>Specifications</b>			
Dimensions	Optical diameter is 2 mm; outer diameter including the black cladding is approx. 2.8 mm		
Connector type	SMA connectors on one or both sides available for use with stick-on adapter and adapter for round containers		
Length of fiber	Available lengths for the POF are 1.0 m, 2.5 m and 5.0 m (for lengths of more than 5 m, please contact our service team)		
Compatibility	All devices with SMA connectors: Oxy-4 mini, Oxy-4 trace, Oxy-10 mini, Oxy-10 trace, Fibox 3, Fibox 3 trace, Fibox 3 LCD trace, Fibox 4, Fibox 4 trace, EOM-02-mini and EOM-t02-mini		
Details	Temperature stability: The POF is resistant to temperatures up to 70 °C		

	Adapter for Round Containers (ARC)	Stick-On Adapter (SOA)	Vial Adapter for 20 mL Sensor Vials (VA)
<b>Specifications</b>			
Dimensions (D x W x H)	Velcro® strip 1000.0 mm x 22.0 mm x 4.0 mm	20.0 mm x 20.0 mm x 7.0 mm 12.0 mm total height w/ SMA socket	Ø 41.0 mm x 11.0 mm, inner Ø 28.5 mm
Connector type	SMA socket	SMA socket	slotted-head plastic screw
Compatibility	All devices with SMA connectors, e. g. Fibox 4, OXY-10 mini, and others		20 mL SensorVial-PSt3 together with all oxygen meters with SMA connectors, e. g. Fibox 4, OXY-10 mini, and others



### Polymer Optical Fiber POF

For all our meters with SMA sockets, a polymer optical fiber is needed as a light guide between the device and the sensor. We offer different standard lengths, e.g. 2.5 m, and fibers with SMA connectors on one or both sides.



### Adapter for Round Containers ARC

The adapter for round containers ARC is an adjustable Velcro®-type adapter. It can be used for round containers with diameters of 2.5 to 20 cm (1 to 8 inches). The SMA socket on this adapter must be connected to the polymer optical fiber (POF).



### Stick-on Adapter SOA

The stick-on adapter SOA is used to attach the polymer optical fiber (POF) to a planar transparent glass or plastic container. It is equipped with an SMA socket, which must be connected to the POF.



### Vial Adapter for 20 mL SensorVials VA

Adapter for attaching a polymer optical fiber to a 20 mL SensorVial

# Product Matrix

		Meters										
		Microx 4 & Microx 4 trace		Fibox 4 & Fibox 4 trace		Fibox 3 LCD trace	OXY-4/-10 mini & OXY-4/-10 trace				EOM-02-mini	EOM-t02-mini
		Microx 4	Microx 4 trace	Fibox 4	Fibox 4 trace	Fibox 3 LCD trace	OXY-4 mini	OXY-10 mini	OXY-4 trace	OXY-10 trace	EOM-02-mini	EOM-t02-mini
Sensors	Non-Invasive Oxygen Sensors											
	SP-PSt3			x	x	x	x	x	x	x	x	x
	SP-PSt3-SA			x	x	x	x	x	x	x	x	x
	SP-PSt6				x	x			x	x		x
	SP-PSt9				x	x						
	SP-PSt7	x	x									
	SP-PSt8		x									
	Nice Port D0			x	x	x	x	x	x	x	x	x
	SV-PSt3-20mL			x	x	x	x	x	x	x	x	x
	Oxygen Flow-Through Cells											
	FTC-PSt3			x	x	x	x	x	x	x	x	x
	FTC-PSt7	x	x									
	FTC-SU-PSt3			x	x	x	x	x	x	x	x	x
	FTC-SU-PSt6				x	x			x	x		x
	FTC-PSt3-YAU			x	x	x	x	x	x	x	x	x
	FTC-PSt6-YAU				x	x			x	x		x
	FTCH-PSt1											
	FTCM-PSt1											
	FTCM-PSt7	x	x									
	FTCM-PSt8		x									
	FTM-PSt3			x	x	x	x	x	x	x	x	x
	FTM-PSt6				x	x			x	x		x
	FTM-PSt9				x	x						
	Oxygen Microsensors											
	NTH-PSt1											
	NTH-PSt7	x	x									
	NTH-PSt8		x									
	NFSG-PSt1											
	NFSG-PSt7	x	x									
	NFSG-PSt8		x									
	IMP-PSt1											
	IMP-PSt7	x	x									
	IMP-PSt8		x									
	PM-PSt1											
	PM-PSt7	x	x									
	PM-PSt8		x									
	Oxygen Probes											
	OP for In-Line Measurement OIM-PSt3			x	x	x	x	x	x	x	x	x
	OP for In-Line Measurement OIM-PSt6				x	x			x	x		x
	Oxygen Dipping Probe DP-PSt3			x	x	x	x	x	x	x	x	x
	Oxygen Dipping Probe DP-PSt6				x	x			x	x		x
	Oxygen Dipping Probe DP-PSt9				x	x						
	Oxygen Dipping Probe DP-PSt7	x	x									
	Oxygen Dipping Probe DP-PSt8		x									
	Oxygen Exchange Cap OEC-PSt3			x	x	x	x	x	x	x	x	x
	Oxygen Exchange Cap OEC-PSt6				x	x			x	x		x
	Oxygen Probe integrated in Varivent valve OIM-PSt3-Var			x	x	x	x	x	x	x	x	x
	Oxygen Probe integrated in Varivent valve OIM-PSt6-Var				x	x			x	x		x
	Sensor Foil for Imaging											
	SF-RPSu4											

Is your application missing? Contact us and we find your customized solution!



# Product Range

## Meters

O<sub>2</sub>

### Microx 4

Portable fiber optic oxygen meter for measurement in normal oxygen range with sensor spots, dipping probes or microsensors



### Microx 4 trace

Oxygen meter for measurement with sensor spots, dipping probes or microsensors in normal and trace oxygen ranges



### Fibox 4

Portable fiber optic oxygen meter for measurement in normal oxygen range



### Fibox 4 trace

Fiber optic oxygen meter for measurement in normal, trace, and ultra-low oxygen ranges



### Fibox 3 LCD trace

Fiber optic oxygen meter with LCD display for measurement in normal, trace, and ultra-low oxygen ranges



### OXY-4 mini

4-channel fiber optic oxygen meter for measurement with sensor spots and probes



### OXY-4 trace

4-channel fiber optic oxygen meter for measurement in normal and trace oxygen ranges



### OXY-10 mini

Oxygen meter for parallel read-out of up to 10 sensor spots or probes

**Is your application missing?** Contact us and we find your customized solution!



### OXY-10 trace

Oxygen meter for measuring oxygen traces with up to 10 sensors in parallel



### OXY-4 micro

Oxygen meter for parallel read-out of up to 4 microsensors



### OXY-10 micro

Oxygen meter for measurements with up to 10 microsensors



### EOM-O<sub>2</sub>-mini

Precise OEM solution for oxygen measurements with sensor spots, FTCs and probes



### EOM-tO<sub>2</sub>-mini

OEM solution for measurement in normal and trace oxygen ranges



### EOM-O<sub>2</sub>-micro

OEM solution for high resolution oxygen measurements with microsensors



## Sensors

O<sub>2</sub>

### O<sub>2</sub> Sensor Spots SP-PSt3/PSt6/PSt9

Versatile, small oxygen sensors for measurements in normal, trace, and ultra-low oxygen ranges (0 – 100 % O<sub>2</sub> / 0 – 45 mg/L, or 0 – 5 % O<sub>2</sub> / 0 – 2 mg/L, or 0 – 200 ppm); compatible with Fibox and OXY-mini/trace series



### Self-adhesive O<sub>2</sub> Sensors SP-PSt3-SA

Easily to integrate into transparent vessels; for contactless measurement in normal oxygen range (0 – 100 % O<sub>2</sub> / 0 – 45 mg/L); compatible with Fibox and OXY-mini/trace series



### O<sub>2</sub> Sensor Spots SP-PSt7/PSt8

Small, versatile oxygen sensors for measurements in normal and trace oxygen ranges (0 – 100 % O<sub>2</sub> / 0 – 45 mg/L or 0 – 10 % O<sub>2</sub> / 0 – 4.5 mg/L); compatible with Microx 4 & Microx 4 trace



### 20 mL SensorVial SV-PSt3-20mL

Vial with sensor stripe for measurements in headspace and liquid or different depths (0 – 100 % O<sub>2</sub> / 0 – 45 mg/L); also autoclavable version available



### Oxygen-sensitive Cap OSC-PSt3/PSt6

Transparent closure with oxygen sensor for oxygen ingress monitoring in PET bottles (0 – 100 % O<sub>2</sub> / 0 – 45 mg/L, or 0 – 5 % O<sub>2</sub> / 0 – 2 mg/L)



### OxoPlate OP96C/OP96U

96-well microtiter plate (flat bottom or round bottom) with integrated oxygen sensor in each well; compatible with conventional fluorescence readers



### Spinner Flask with Integrated O<sub>2</sub> & pH Sensors SPS-HP5-PSt3

Spinner flask with integrated sensors for contactless culture monitoring



### O<sub>2</sub> Flow-Through Cell FTC-PSt3

Oxygen monitoring in perfusion systems (0 – 45 mg/L, / 0 – 1400 µmol/L); different sizes for various flow rates available



### O<sub>2</sub> Flow-Through Cell FTC-SU-PSt3

Plastic FTC for oxygen monitoring (0 – 45 mg/L / 0 – 1400 µmol/L); can be delivered beta-irradiated or untreated



### O<sub>2</sub> Flow-Through Cell FTC-PSt7

Oxygen monitoring in perfusion systems (0 – 45 mg/L, / 0 – 1400 µmol/L) with Microx 4 or Microx 4 trace; different sizes for various flow rates available



### O<sub>2</sub> Flow-Through Cell FTC-SU-PSt7

Plastic FTC for oxygen monitoring with Microx 4 or Microx 4 trace (0 – 45 mg/L / 0 – 1400 µmol/L); can be delivered beta-irradiated or untreated



### Autoclavable O<sub>2</sub> Flow-Through Cell FTC-PSt3/PSt6-YAU

Monitoring in normal or trace oxygen range (0 – 45 mg/L / 0 – 1400 µmol/L, or 0 – 5 % O<sub>2</sub> / 0 – 2 mg/L) inside perfusion systems or bypasses



### Oxygen Probe Integrated in Metal Flow-Through Connector FTM-PSt3/PSt6/PSt9

Robust probe for oxygen monitoring in the process chain (0 – 100 % O<sub>2</sub> / 0 – 45 mg/L, or 0 – 5 % O<sub>2</sub> / 0 – 2 mg/L, or 0 – 200 ppm). Stands CIP & pressure up to 15 bar



### Oxygen Exchange Window OEW-PSt3/PSt6/PSt9

Easy replacement of a used normal range, trace or ultra-low oxygen sensor (0 – 100 % O<sub>2</sub> / 0 – 45 mg/L, or 0 – 5 % O<sub>2</sub> / 0 – 2 mg/L, or 0 – 200 ppm) by just exchanging the OEW



## Sensors

O<sub>2</sub>



### O<sub>2</sub> Dipping Probe DP-PSt3/PSt6/PSt9

Oxygen probe with steel fitting for normal range, trace, or ultra-low oxygen measurements (0 – 100 % O<sub>2</sub> / 0 – 45 mg/L, or 0 – 5 % O<sub>2</sub> / 0 – 2 mg/L, or 0 – 200 ppm)



### O<sub>2</sub> Dipping Probe DP-PSt7/PSt8

Robust oxygen probe for measurements with the all-round devices Microx 4 & Microx 4 trace (0 – 100 % O<sub>2</sub> / 0 – 45 mg/L, or 0 – 10 % O<sub>2</sub> / 0 – 4.5 mg/L)



### O<sub>2</sub> Probe for In-line Measurements OIM-PSt3/PSt6

Robust probe for production processes with excellent long-term stability (0 – 100 % O<sub>2</sub> / 0 – 45 mg/L, or 0 – 5 % O<sub>2</sub> / 0 – 2 mg/L)



### Oxygen Exchange Cap OEC-PSt3/PSt6

Easy replacement of a used sensor by just exchanging the OEC (0 – 100 % O<sub>2</sub> / 0 – 45 mg/L, or 0 – 5 % O<sub>2</sub> / 0 – 2 mg/L)



### Needle-type Oxygen Microsensor NTH-PSt1

High resolution measurement in normal oxygen range with Microx TX3 (0 – 100 % O<sub>2</sub> / 0 – 45 mg/L)



### Needle-type Oxygen Microsensor NTH-PSt7/PSt8

On-the-spot measurement of oxygen (0 – 100 % O<sub>2</sub> / 0 – 45 mg/L, or 0 – 10 % O<sub>2</sub> / 0 – 4.5 mg/L); compatible with Microx 4 or Microx 4 trace



### Needle-type Oxygen Microsensor with Fixed Sensor Tip NFSG-PSt1

Ideal sensor for measuring oxygen inside packaging with Microx TX3 (0 – 100 %  $O_2$  / 0 – 45 mg/L)



### Needle-type Oxygen Microsensor with Fixed Sensor Tip NFSG-PSt7/PSt8

Measures inside packaging (0 – 100 %  $O_2$  / 0 – 45 mg/L, or 0 – 10 %  $O_2$  / 0 – 4.5 mg/L) with Microx 4 or Microx 4 trace oxygen meters



### Implantable Oxygen Microsensor IMP-PSt1

Bare fiber microsensor for oxygen measurements in normal range (0 – 100 %  $O_2$  / 0 – 45 mg/L); compatible with Microx TX3



### Implantable Oxygen Microsensor IMP-PSt7/PSt8

Bare fiber microsensor for use with Microx 4 & Microx 4 trace (0 – 100 %  $O_2$  / 0 – 45 mg/L, or 0 – 10 %  $O_2$  / 0 – 4.5 mg/L)



### Profiling Oxygen Microsensor PM-PSt1

Microsensor for microprofiling applications; compatible with Microx TX3 (0 – 100 %  $O_2$  / 0 – 45 mg/L)



### Profiling Oxygen Microsensor PM-PSt7/PSt8

Microsensor for oxygen microprofiling (0 – 100 %  $O_2$  / 0 – 45 mg/L, or 0 – 10 %  $O_2$  / 0 – 4.5 mg/L); compatible with Microx 4 & Microx 4 trace





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## Microprofiling Solutions

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**O<sub>2</sub>**

### Manual Micromanipulator MM

Vibration-free, high resolution control for oxygen microsensors



### Automated Micromanipulator AM

Fully automated, high resolution control for oxygen microsensors



### Heavy Stand

Ensures safe mounting and operation of the Automated Micromanipulator.



### Safe-Insert

This accessory can be attached to the Automated Micromanipulator for safe insertion of NTHs in semi-solid and hard substrates.



### Transport Case

High-quality travel case for one AM and one Heavy Stand

## Accessories

O<sub>2</sub>



### Polymer Optical Fiber POF

They serve as a versatile connection from meter to sensor.



### Adapter for Round Containers ARC

The ARC is used for round containers with a diameter of 2.5 to 20 cm [1 – 8 inches].



### Stick-On Adapter SOA

The Stick-On Adapter (SOA) is used for planar containers.



### Vial Adapter for 20 mL SensorVials VA

Adapter for attaching a polymer optical fiber to a 20 mL SensorVial



### Permeation Cell

Leak tight measurement cell to test the oxygen transmission rate of material films



### Adapter for 25 mm Ports OAD-25

The OAD-25 is used to connect all OIMs to 25 mm ports.



### Integration Set Sensor Spots IS-SP

Vacuum tweezers for easy integration of self-adhesive sensor spots



### Coaster for Shake Flasks CFG

Read-out of sensors integrated at the flask bottom



### Dipping Probe Weights DW

Stabilize the probe in underwater applications



# Discover the complete PreSens portfolio



## Products

Optical Oxygen  
Sensors & Meters

Optical pH  
Sensors & Meters

Optical CO<sub>2</sub>  
Sensors & Meters

Optical Sensor  
Systems

VisiSens™  
Imaging Systems

OEM Solutions &  
Engineering



## Industries

Biology &  
Environmental

Industry &  
Technical

Biotech &  
Pharma

Medical &  
Life Science

Food &  
Beverage

Bring to light  
what's inside.

PreSens comes from  
**PRECISION SENSING**  
and offers:

- precise and simple measurement of O<sub>2</sub>, pH, CO<sub>2</sub> and biomass
- systems for Pharma, Biotech, Food & Beverage, Biological & Environmental Research, Technical or Industrial Applications and Medical Devices
- sensors thinner than a hair, non-invasive and online
- optimum advice and support
- more than 1,000 items in stock
- prompt delivery worldwide