



Sensors for Biotech & Pharma Industries



- Micro-invasive or even contactless measurements
- For microbial & cell culture
- From μL to m^3 scale
- Bioprocess development & drug screening
- Quality control



CO₂

O₂

PH

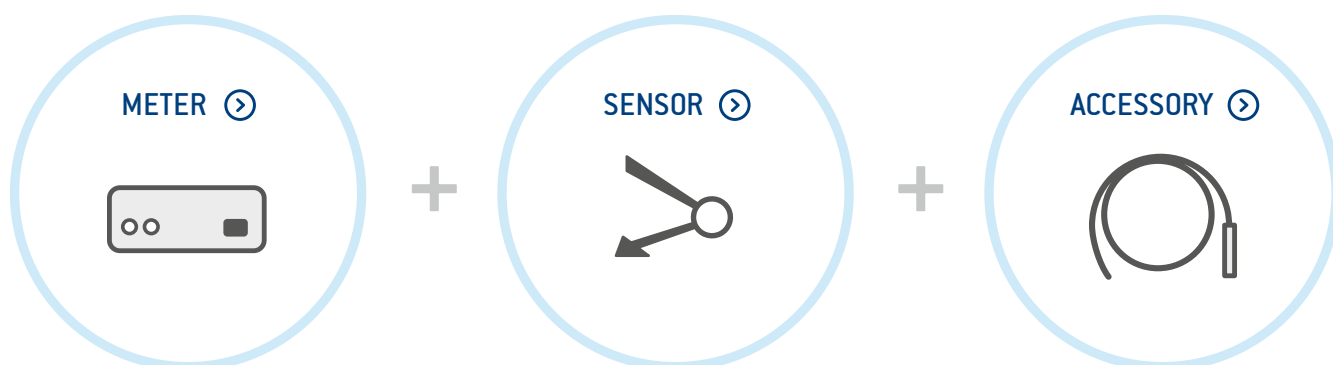
BIOMASS

Contact us and we find your customized solution!

Content

- 04 Company
- 05 Industries
- 06 Sensor Solutions
- 10 Featured Systems
- 12 Featured Applications
- 14 Examples for Meters, Sensors & Accessories

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, CO₂ and oxygen measurement
- Oxygen and pH sensors for single-use bioreactors
- Microsensors pH, oxygen and CO₂
- 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 CO₂-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

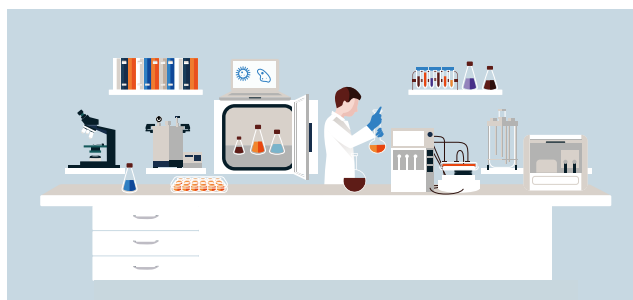
Furthermore, we are developers and manufacturers of optoelectronic OEM sensor components for companies in the field of medical equipment and process control.



Quality Management
ISO 9001
ISO 13485
Voluntary participation in regular monitoring

Contact us and we find your customized solution!

...and work for the following industries.



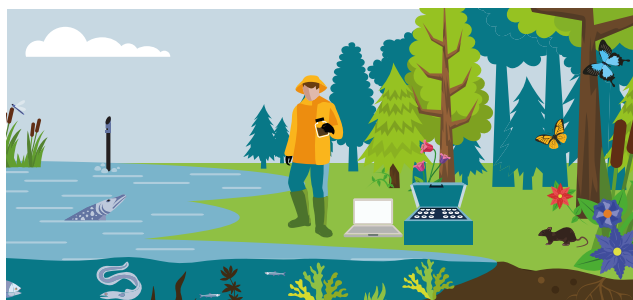
Biotech & Pharma

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.



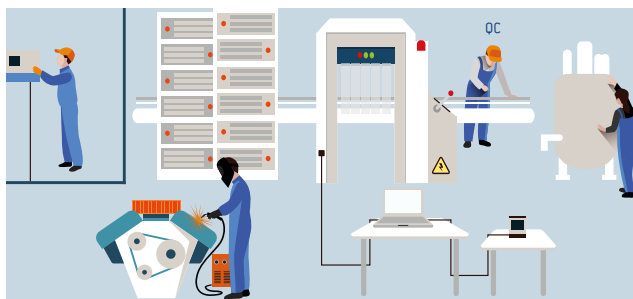
Biology & Environmental

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.



Medical Research & Life Sciences

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 Applications

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. We work together with integrators to design OEM sensor components and with our solution, they can be sure to meet the requirements for their risk assessment as an integrator.



SENSORS

Sensor Solutions

Online Monitoring of O₂, pH, CO₂ and biomass

PreSens sensors for Biotech & Pharma help companies like Roche and DSM to improve their bioprocesses. With our non-invasive measurement systems no more time consuming sampling is necessary and they allow simultaneous monitoring of multiple samples. While our various O₂ sensors suit almost any application, pH sensors are optimized for measurements in cultivations, and our CO₂ sensors work in selected applications depending on the sterilization method and the process conditions. For O₂ and pH even a variety of ready-to-use disposables with integrated sensors is available. We also work together with integrators to assess the suitability of our systems upfront and to design OEM sensor components for specific applications.

Of course, these applications require a detailed risk analysis by the integrator to meet regulatory requirements.

- Micro- or even non-invasive measurement
- Online monitoring of microbial & cell cultures
- From µL to m³ scale
- Bags & single-use bioreactors
- Disposables with pre-integrated sensors
- Autoclavable sensors & dipping probes
- Flow-through cells for perfusion monitoring

Contact us and we find your customized solution!

Applications



Bioprocess Development: Sensors in Small-scale Systems

The online measurement of dissolved oxygen concentration and pH in shaken bioreactors paves the way for proper scale up or scale down activities - from bench-top stirred bioreactors to larger or smaller scales. So far, appropriate measurement methods for culture monitoring in shake flasks were missing. With the application of single-use optical sensors culture conditions can be monitored online without sampling. They enable highly parallelized measurements in multiwell plates and flasks. Limitations can be detected in time while the online readings give new insights into metabolic activities in shaken cultures.



Drug Screening & Strain Development: Monitoring in Multiwell Culture Vessels

Microtiter plates and multidishes with integrated oxygen and pH sensors allow high-throughput assays. By monitoring cellular respiration, the effect of different concentrations of pharmaceutically active substances can be easily determined. In strain development the online dissolved oxygen and pH monitoring gives valuable information about the metabolic status of cultures at all times, while parallel experiments with different strains or different media composition are conducted. These disposables offer new options, e. g. when developing harvesting strategies and optimizing media.



Production: Single-use and Autoclavable Sensors for Online Culture Monitoring

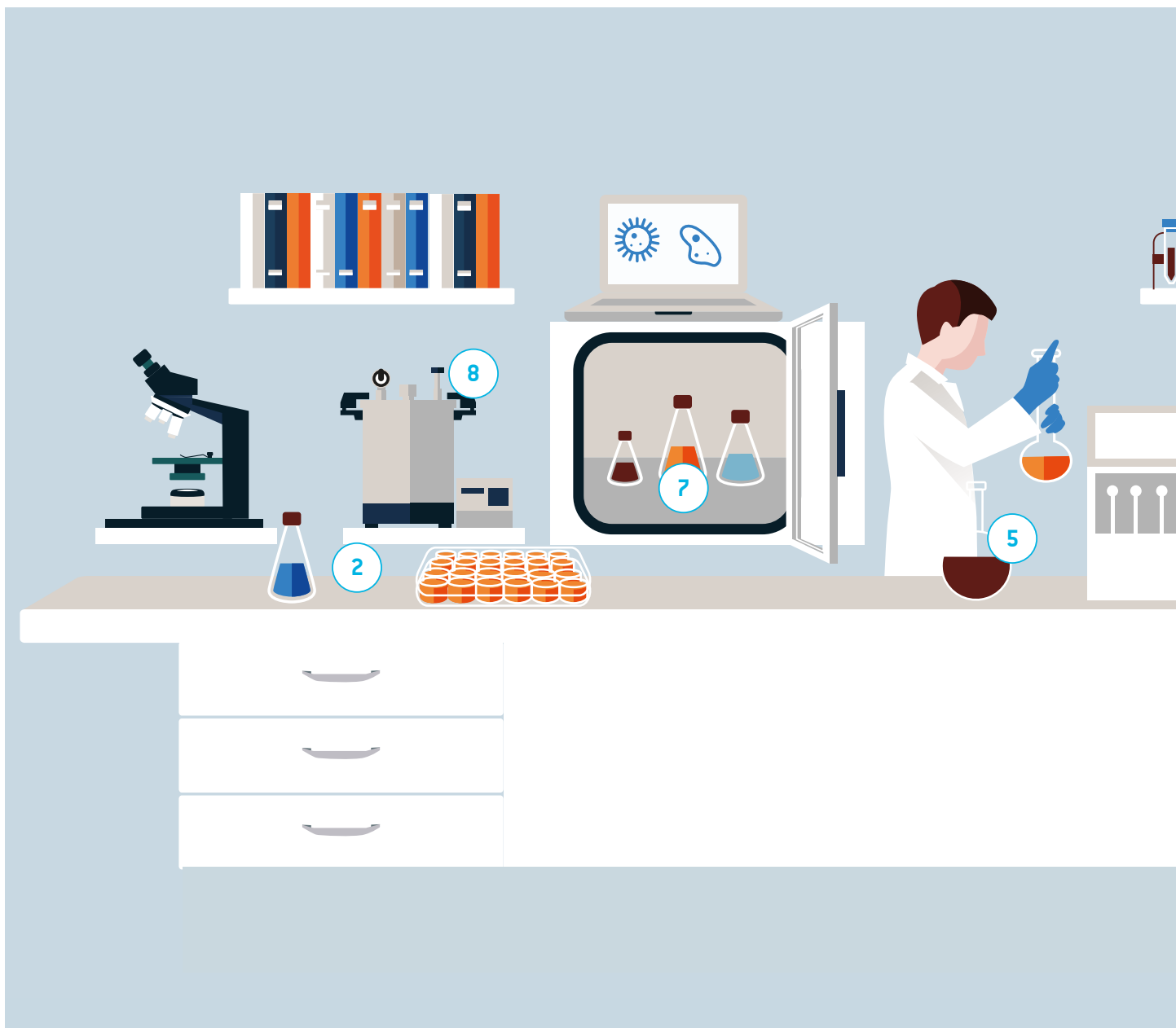
Bags and single-use bioreactors are in the process of revolutionizing the way biopharmaceuticals are manufactured. Our non-invasive oxygen and pH sensors - integrated in the culture vessels - are the tools to turn simple disposables into full bioreactors. For steel fermenters our robust probes are the ideal monitoring device, as they stand autoclaving, SIP, and CIP. The dissolved oxygen probes are equipped with standardized threads that are compatible with most bioreactors and port adapters and can be applied for measurement in large-scale cell or microbial cultures.



Quality Control: Micro-invasive & Fast Oxygen Determination

Oxygen inside packaging can affect the stability of pharmaceuticals. Micro-invasive sensors with steel needles are ideally suited to measure the oxygen content e. g. in blisters or pharmaceutical vials. Pierced through the packaging material, these sensors determine the oxygen content inside the headspace as well as in a liquid within seconds. It is an easy method to check and ensure the quality of pharmaceutical products and packaging.

Sensor Solutions for Biotech & Pharma



Contact us and we find your customized solution!

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



- 1 Sensor Spots**
for contactless measurement in transparent culture vessels
- 2 Disposable Shake Flasks (SFS), Multidishes (Oxo- and HydroDishes), Cell Culture Tubes (iTubes)**
with integrated sensors
- 3 Oxygen Probes OXYPro & OIM**
for bioreactors and steel fermenters
- 4 Flow-through Cells (also disposable versions available)**
with integrated sensors for perfusion monitoring
- 5 Oxygen Microsensors**
for quality control of pharmaceuticals and their packaging
- 6 O₂ & pH Nice Ports**
with single-use sensors for customized integration (welding) into bags
- 7 SFR Shake Flask Reader, SFR vario**
for O₂, pH, biomass and OUR monitoring in shake flasks

SDR SensorDish Reader
for O₂ & pH monitoring in multidishes
- 8 Robust Oxygen Sensors**
that stand autoclaving (+ 121 °C for 30 min)
- 9 Microtiterplates with integrated sensors (O₂ or pH)**
for screening purposes; compatible with most conventional fluorescence readers

FEATURED SYSTEMS



SFR & SFR vario Shake Flask Reader

The SFR Shake Flask Reader and SFR vario offer O_2 , pH, and OUR monitoring in shake flasks, and cultivation tubes. While the SFR can be used for simultaneous monitoring in up to 9 flasks, the SFR vario monitors a single vessel and allows additional biomass measurements.



SDR SensorDish® Reader

The SDR SensorDish® Reader allows non-invasive, parallel monitoring in 6 or 24 wells. PreSens offers multidishes in low- and deep-well format with integrated oxygen (OxoDishes®) as well as pH (HydroDishes®) sensors.

Contact us and we find your customized solution!



OXY-1 SMA-trace-RS485M-A0-BT + Oxygen Probe for In-line Measurement OIM

The OXY-1 SMA-trace-RS485M-A0-BT is an oxygen meter for trace oxygen measurements and can be installed in a control cabinet. Combined with the oxygen probe for in-line measurements it is the ideal tool for oxygen monitoring in steel bioreactors.



Fibox 4 or pH-1 SMA + Single-use O₂ or pH Flow-through Cells + POF

The single-use flow-through cells for oxygen and pH measurements can easily be integrated in bypaths or flow systems and allow continuous monitoring. The FTCs are read out with the Fibox 4 and pH-1 mini meters via polymer optical fiber.



EOM-O₂-FOM or EOM-pH-PHB50 + DO or pH Nice Ports

The DO & pH Nice Ports for oxygen and pH measurement can be welded into cultivation or mixing bags for online culture monitoring. The integrated sensors are read out contactless, via polymer optical fibers. Nice Ports can be connected to PreSens OEM components, for integration in the customer's system.



Microx 4 + Needle-type Oxygen Microsensor NFSG

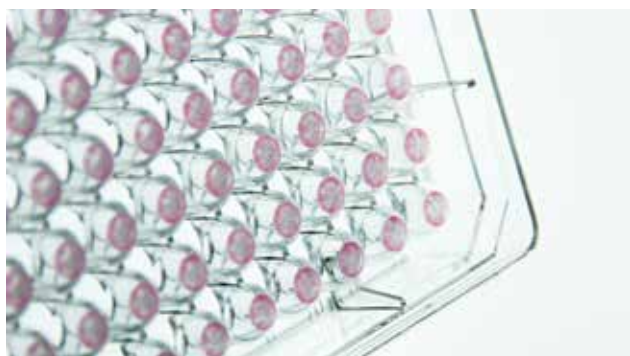
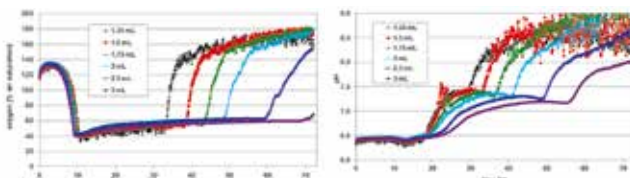
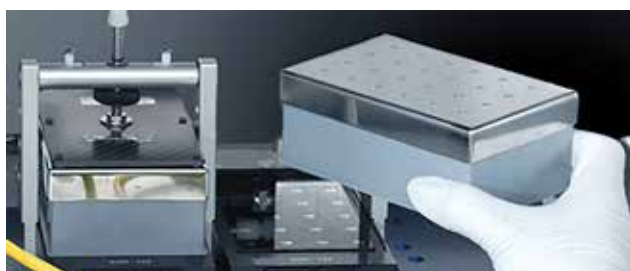
The needle-type oxygen microsensor NFSG can be pierced through packaging material or septum rubber. Oxygen concentrations in headspace can be determined within seconds. It is read out with the Microx 4 oxygen meter.



PhoxyCube & PhoxyPlates

The PhoxyCube is a monitoring platform based on PreSens imaging technology. This system can be used inside an incubator and is ideally suited for high-throughput screenings, cell cultivations or a multitude of parallel respiration measurements. It allows oxygen ([DO]) and pH monitoring in well plates of different formats.

Featured Applications



Yeast Culture Monitoring with the SFR vario

A model process with *S. cerevisiae* was performed in 2 L shake flasks with integrated O_2 and pH sensors. The SFR vario was applied to monitor oxygen, pH, and biomass during cultivation. The online data gathered with the device was then compared to offline pH and OD values gathered with classic sampling and measurement methods. It delivered accurate data consistent with the classic offline measurements. Additionally, it offered a continuous and detailed view of culture performance during different phases. For example even a metabolic shift (55 h) when *S. cerevisiae* switched to consuming another substrate could be detected in the online biomass measurements, showing in a small plateau in the measurement graph.

D. Haskew & D. Ornek, Fujifilm Diosynth Biotechnologies, USA

Assessing Optimal Growth Conditions for Shaken Yeast Culture

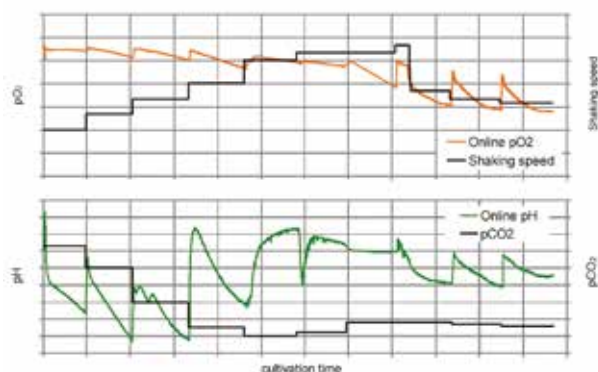
Deep well OxoDishes® and HydroDishes® allow online oxygen and pH monitoring with the SDR SensorDish® Reader. The yeast *P. guillermundii* was cultivated in these 24-well plates in order to examine growth profiles, minimal filling volume of the wells, and different media. It turned out that lower sample volumes lead to higher OD due to the higher oxygen ingress. The optimal working volume for yeast culture in deep well plates is 1.25 – 1.5 mL. Furthermore, valuable data about culture condition and media consumption could be gathered. Online oxygen measurements showed a longer and more stable growth in YE medium with higher glucose concentration (60 mg/L) than in samples with less glucose (20 mg/L).

T. Grimm, Bioworx, DE

Real-time Assessment of Antibacterial Activities in OxoPlates

OxoPlates are 96-well plates with integrated optical oxygen sensors at the bottom of each well. They can be read out with conventional fluorescence readers and were used for a screening experiment on different antibacterial compounds in *Bacillus subtilis* culture. The bacteria were treated with 14 different antibacterials with various mechanisms of action. Reading the oxygen levels inside the differently treated wells, not only the minimum inhibitory concentration values could be determined, but also bactericidal and bacteriostatic compounds could be discriminated. Kinetics, growth inhibition, and killing could easily be detected, and the OxoPlate proved to be highly useful in the initial characterization of antibacterial compounds.

Hutter et. al, Current Microbiology Vol. 48 (2004), 57 - 61



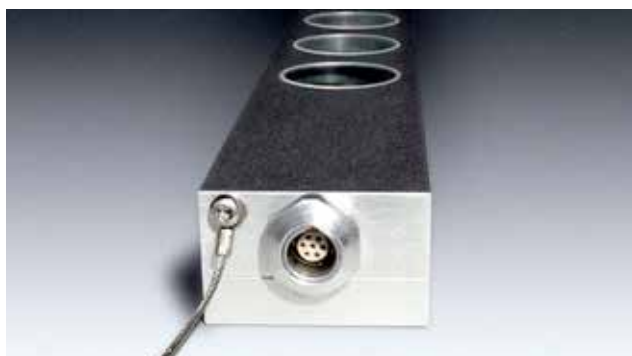
Process Monitoring in Suspension-adapted CHO Cell Cultures

The online measurement of dissolved oxygen concentration and pH in shaken bioreactors enables proper scale down activities from bench-top stirred-tanks to smaller scales. Adjustment of shaking speed as a function of pO₂ is now possible, avoiding oxygen limitations at high cell densities. Furthermore, it is possible to detect necessary pH re-adjustments instantly, in order to optimize experiments with shaken bioreactors.



Quality Check in Blister Packaging

The oxygen microsensor can be used for oxygen measurements in blisters. Septa are attached to the blister to avoid oxygen from the air entering the packaging. The needle of the microsensor housing is pierced through this septum into the blister. The tip of the needle is placed in the space between the packaging and the tablet or capsule. Then the sensor tip is extended and the oxygen content inside the blister can be determined. This is an easy method to ensure the shelf life of pharmaceuticals and other products packed in blisters.



Sensor Block for Biochemical Engineering

An example of our OEM devices is the sensor block for parallel measurement of pH and oxygen in multiple cultivation tubes. These transmitters were engineered to read out 48 DO and pH sensors. To be more flexible for different formats, the whole monitoring setup consists of 6 small units with 8 x 2 optical modules, interfaced by robust RS485 standard. They are currently used in the bioREACTOR 8 and 48 sold by 2mag AG, Germany (www.2mag.de/en/products/bioreactor-e).

Examples for Meters, Sensors & Accessories

Meters



SFR Shake Flask Reader

Online oxygen and pH monitoring in shake flasks, T-flasks, and culture tubes



SFR vario

Online oxygen, pH, biomass, OUR and optional CO₂ monitoring in shake flasks, T-flasks, and culture tubes



SDR SensorDish® Reader

Basic Set for non-invasive online culture monitoring of oxygen & pH in multiwell plates



SDR SensorDish® Reader Extension Set

Up to 9 SDR Extension Sets can be combined with one Basic Set.



PhoxyCube Reader

Monitoring platform for non-invasive oxygen and/or pH measurements in different multiwell plate formats



Microx 4 / Microx 4 trace

Stand-alone fiber optic oxygen meters for use with sensor spots, dipping probes and microsensors



OXY-1 SMA/ST/trace

Small, PC-controlled and USB-powered oxygen meter for measurements in normal and trace oxygen range



OXY-1 SMA-trace-RS485M-A0-BT

Fiber optic oxygen meter with 4 – 20 mA analogue ports for use with sensor spots, dipping probes and flow-through cells



OXY-4 SMA/ST/trace

Small, 4-channel oxygen meter with temperature compensation for each individual channel



pH-1 SMA

Fiber optic pH meter for use with sensor spots and flow-through cells



CO₂-1 SMA

Fiber optic carbon dioxide meter for use with sensor spots, dipping probes and flow-through cells

Disposables & Glass Vessels with Integrated Sensors



Sensor Flasks SFS

Glass or plastic flasks with integrated O₂ & pH sensors, available from 125 mL to 5000 mL volume, with or without baffles



iTubes

Plastic cell culture tubes with integrated, pre-calibrated sensors; read out with SFR or SFR vario in combination with the iTube Adapter



OxoDishes® (low-well)

Multidishes with integrated oxygen sensors, available in 24-well format, irradiated and pre-calibrated



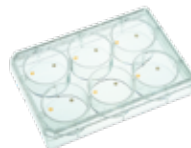
HydroDishes® (low-well)

Multidishes with integrated pH sensors, available in 24-well format, irradiated and pre-calibrated



Deep Well Oxo- and HydroDishes®

Deep well dishes for applications on shakers, available with oxygen (Deep Well OxoDish) or pH sensors (Deep Well HydroDish) in 24-well format, irradiated and pre-calibrated



OxoHydroDishes

Multidishes with integrated O₂ & pH sensors, available in 6-well format, irradiated and pre-calibrated



OxoPlates & HydroPlates

96-well plates with integrated oxygen or pH sensors; compatible with conventional fluorescence readers



PhoxyPlate 24 OP

Multidish with integrated oxygen and pH sensors in 24-well format for PhoxyCube



PhoxyPlate 96 P

Multidish with integrated pH sensors in 96-well format for PhoxyCube



PhoxyPlate 96 O

Multidish with integrated O₂ sensors in 96-well format for PhoxyCube



Sensors



O₂ Sensor Spots

Versatile, small oxygen sensors for measurement in different oxygen ranges



Self-adhesive O₂ Sensors

Easy integration into transparent vessels, for contactless measurement in normal oxygen range (0 – 100 % O₂, 0 – 45 mg/L)



pH Sensor Spots

Versatile, small pH sensors for integration into transparent vessels



Self-adhesive pH Sensors

Easy integration into transparent vessels, for contactless pH monitoring



CO₂ Sensor Spots

Versatile, small carbon dioxide sensors for integration into transparent vessels



DO Nice Port

Port with O₂ sensor for customized application in flexible, bag-type bioreactors



pH Nice Port

Port with pH sensor for customized application in flexible, bag-type bioreactors



O₂ Flow-through Cells

T-cells with integrated oxygen sensor; different sizes for various flow rates available



Single-use O₂ Flow-through Cells

Single-use flow-through cell for oxygen monitoring in normal oxygen range (0 – 45 mg/L, 0 – 1400 µmol/L); can be delivered beta-irradiated or untreated



Autoclavable O₂ Flow-through Cell

Flow-through cell for monitoring in normal or trace oxygen range (0 – 45 mg/L, 0 – 1400 µmol/L or 0 – 5 % O₂, 0 – 2 mg/L)



Single-use pH Flow-through Cells FTC-SU-HP8

Polycarbonate T-cell with integrated pH sensor for online monitoring in perfusion systems



Single-use pH Flow-through Cells for Different Flow Rates

T-Cells with integrated pH sensor; different sizes for various flow rates available



Single-Use CO₂ Flow-through Cells FTC-SU-CD1

T-cell with integrated CO₂ sensor for on-line monitoring in perfusion systems



O₂ Probe for In-line Measure- ments OIM

Robust probe for production processes with excellent long-term stability (0 – 100 % O₂ / 0 – 45 mg/L or 0 – 5 % O₂ / 0 – 2 mg/L)



Needle-type oxygen microsensor with fixed sensor tip NFSG

For measurement inside packaging (0 – 100 % O₂ / 0 – 45 mg/L or 0 – 10 % O₂ / 0 – 4.5 mg/L); compatible with Microx 4 or Microx 4 trace oxygen meters



Accessories



Shake Flask Clamp

Available in sizes for 125 to 5000 mL flasks with a special base plate and holder to align the sensor flasks (glass or plastic) with the reader optics



iTube Adapter

Mounted on SFR or SFR vario for online culture monitoring inside cell culture tubes with integrated sensors (iTubes)



Coaster for Shake Flasks CFG

Read-out of sensors integrated at the flask bottom



Power Supply SFR vario

Allows to connect the SFR vario to permanent power supply, whenever it is used outside the shaking incubator (stationary application only!)



Optical Shielding Mask SDR-OSM24

Designed for use with the SDR and Deep Well SensorDishes® in case fluorescent media or products interfere with the optical sensor readings



Polymer Optical Fiber POF

Serves as a versatile connection from meter to sensor, available in different lengths



Adapter for Round Containers ARC

Used for round containers with a diameter of 2.5 to 20 cm (1 – 8 inches) to connect the POF



Stick-on Adapter SOA

Glued onto planar containers to connect the POF



Adapter for 25 mm Ports OAD-25

The OAD-25 is used with the 12 mm OIM-PSt3 / OIM-PSt6. It adapts to 25 mm ports.



Integration Set Sensor Spots IS-SP

Vacuum tweezers for easy integration of self-adhesive sensor spots

Notes



Discover the complete PreSens portfolio



Products

Optical Oxygen
Sensors & Meters

Optical pH
Sensors & Meters

Optical CO₂
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 O₂, pH, CO₂ and biomass
- systems for Pharma, Biotech, Food & Beverage, Biological & Environmental Research, Technical or Industrial Applications and Medical Research
- sensors thinner than a hair, non-invasive and online
- optimum advice and support
- more than 1,000 items in stock
- prompt delivery worldwide

PreSens Precision Sensing GmbH reserves the right to make changes in specifications and features shown herein, or discontinue the products described at any time without notice or obligation. Contact info@presens.de for the most current information.

Ask our experts: PreSens Precision Sensing GmbH
Am BioPark 11
93053 Regensburg, Germany

Phone +49 941 942 72 100
Fax +49 941 942 72 111
info@PreSens.de