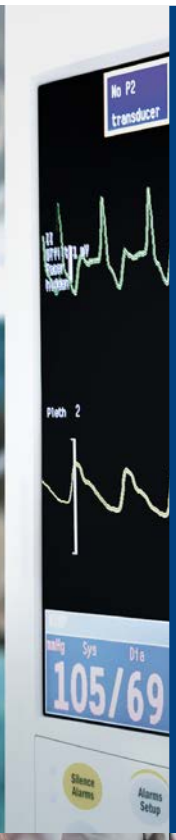
PreSens
PRECISION SENSING

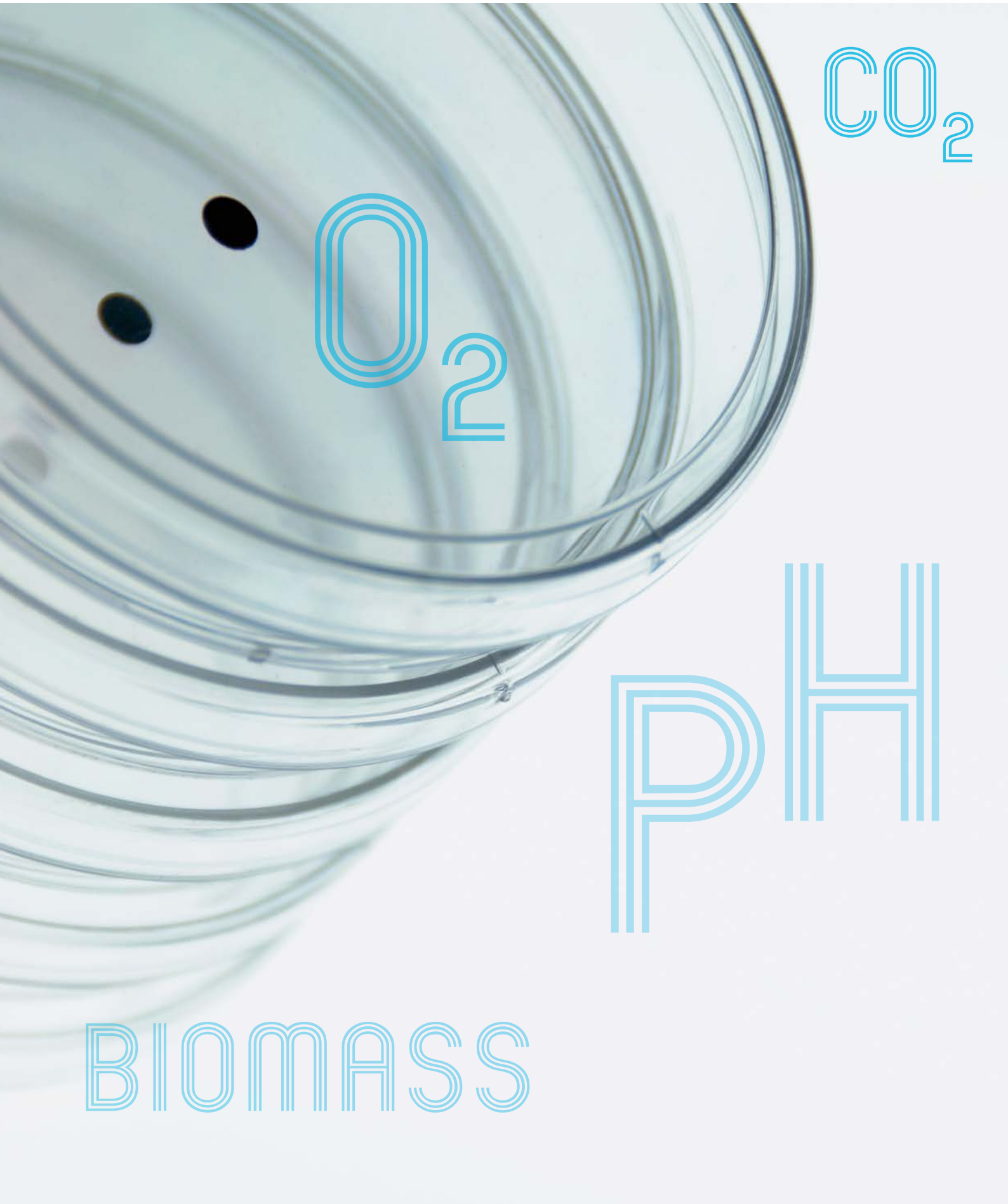
O_2 pH CO_2 BIOMASS



Sensors for Medical Research & Life Sciences

- Minimally invasive or even non-invasive measurements
- Online monitoring of O_2 & pH
- CO_2 monitoring available for selected applications
- Imaging of analyte gradients
- Customized OEM solutions

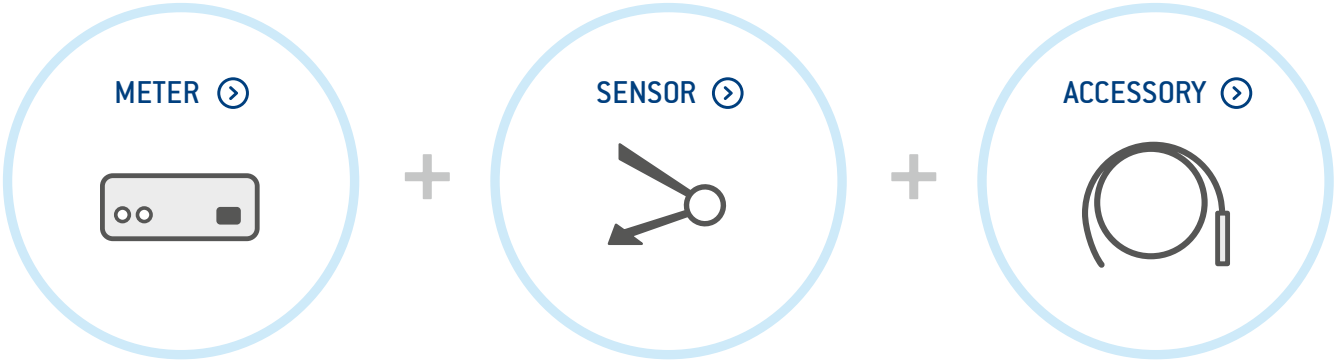
www.PreSens.de/medical-lifescience



Contact us and we find your customized solution!

Content

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_2 and oxygen measurement
- Oxygen and pH sensors for single-use bioreactors
- Microsensors pH, oxygen and CO_2
- 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_2-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.

DEKRA Certification
DEKRA certified

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

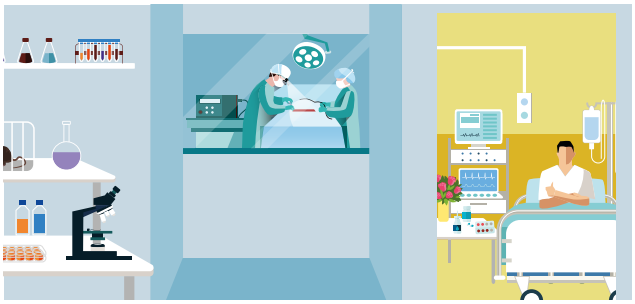
Our Biotech & Pharma business field helps pharmaceutical companies such as Roche and DSM to improve their bioprocess development with PreSens sensors. With two decades of customer feedback our product development provides efficient solutions for your needs.

Food & Beverage

A cooperation with the market leader for beverage filling systems, Krones 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. OEM sensor components can be designed to be integrated in customer systems.

FEATURED SENSORS & METERS

Sensor Technology for O_2, pH & CO_2 Monitoring

Our most recent business field arose from a co-operation with renowned medical technology manufacturers from the Medical Devices sector. PreSens supplies OEM parts, which are integrated into more complex medical systems or multisensory tools for high throughput analyses. Our microsensors, sensor spots, and imaging systems are already applied for high precision measurements in tissue engineering, microfluidics, and many other research fields in medical research and the life sciences.

- Minimally invasive or non-invasive measurements
- Online monitoring of O_2 & pH
- CO_2 monitoring available for selected applications
- OEM components for optical measurements
- Imaging of O_2, pH or CO_2 distributions
- Highly parallelized measurements

Contact us and we find your customized solution!

Microx 4 trace + Needle-type Oxygen Microsensors (NTH-PSt7/8)

The Needle-type Oxygen Microsensor can be inserted in engineered tissue or tissue samples and high resolution trace oxygen measurements can be performed. The sensor is connected to the portable Microx 4 trace oxygen meter for read-out.

Microx 4 + Implantable Oxygen Microsensor (IMP-PSt7)

A bare fiber Implantable Oxygen Microsensor can be connected to the Microx 4 oxygen meter. The bare fiber sensor can be integrated in customized housings, e. g. catheters.

Single-use pH Flow-through Cell (FTC-SU-HP5) + EOM-pH-mini or Single-use O_2 Flow-through Cell (FTC-SU-PSt3) + EOM-O_2-mini

Irradiated Single-use Flow-through Cells connected to the Electro-Optical Modules EOM-O_2-mini and EOM-pH-mini can be integrated in customers' systems for online perfusion monitoring.

SDR SensorDish® Reader + OxoDish® / HydroDish®

The SDR is a compact multi-channel reader for online oxygen and pH monitoring in 6- or 24-well multidishes. The dishes have integrated optical sensors at the bottom of each well. This device is ideally suited for screening applications and cell culture monitoring.

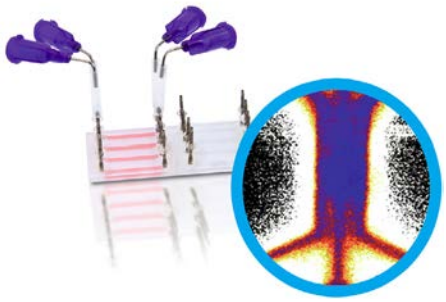
VisiSens™ A1, A2 & A3 Imaging Systems

VisiSens™ sensor foils can be placed directly on a sample surface, a sample cross section or be integrated in transparent experiment vessels. With the respective VisiSens™ System analyte images can be recorded non-invasively as single images or time-series recordings, which allows to follow changes in O_2, pH or CO_2 distribution over time.

Applications

O_2 Monitoring in Tissue Engineering & Regenerative Medicine

One main issue in 3D engineered tissue is the development of oxygen and nutrient gradients towards the middle of an engineered tissue. With PreSens microsensors high resolution measurements inside the tissue can be performed. Our micromanipulator systems ensure exact localization of the measurement tip within a sample. With optical sensor foils integrated at the bottom of the tissue culture vessel 2D analyte maps can be recorded and gradient development can be followed over time.



Gradients and Oxygen Consumption in Microfluidics

Microfluidics are more and more applied to study cell signaling or metabolic processes in microenvironments as they require minimal resources. Optical sensors are an ideal tool to monitor culture conditions even at this small scale. For measurements at the in- and outlet flow-through cells with integrated sensors for very small volumes are available. Moreover, the VisiSens™ imaging system offers complete new opportunities as whole chip areas can be monitored over time.

Monitoring O_2 Supply & pH in Transplantation Research

The time available for transplanting organs or tissue is strongly limited, as the transplants are separated from nutrient and oxygen supply. Researchers investigate new methods for sustaining tissue and organs over longer time spans and reduce the risk of apoptosis or even necrosis. Due to their versatile design PreSens optical sensors are already applied for monitoring oxygen supply and pH of perfusates in different transplantation research projects.

Optical Measurements in High Throughput Analysis

Optical sensors for online oxygen and pH measurements can be integrated in disposable culture vessels. The small sensor size does not disturb media flow or cause shear stress. With multi-channel read-out systems they are ideal tools for conducting highly parallelized measurements and online monitoring in screening applications. There are systems available from mL up to several liters scale.

Tumor Research

Recent research suggests that processes in the tumor microenvironment can influence its growth and development. In vivo experiments on tumor microenvironments are challenging and precise measurement devices are needed. PreSens microsensors with a tip size thinner than a hair combined with our micromanipulators allow to conduct most accurate on-the-spot measurements inside tissue. Even 2-dimensional assessment of analyte distributions over cross-sections of tumor tissue can be realized with the VisiSens™ imaging system.

Quality Control in Pharmaceuticals

PreSens offers several sensor solutions for quality control that contribute to ensure the safety of oxygen sensitive pharmaceuticals. Whether it is monitoring inside liquids after the filling process, experiments to ensure the air tightness of closures, or headspace measurements in blisters and vials, PreSens optical sensors offer the ideal tools for checks and shelf life determination, ensuring the product quality with fast and precise measurements.

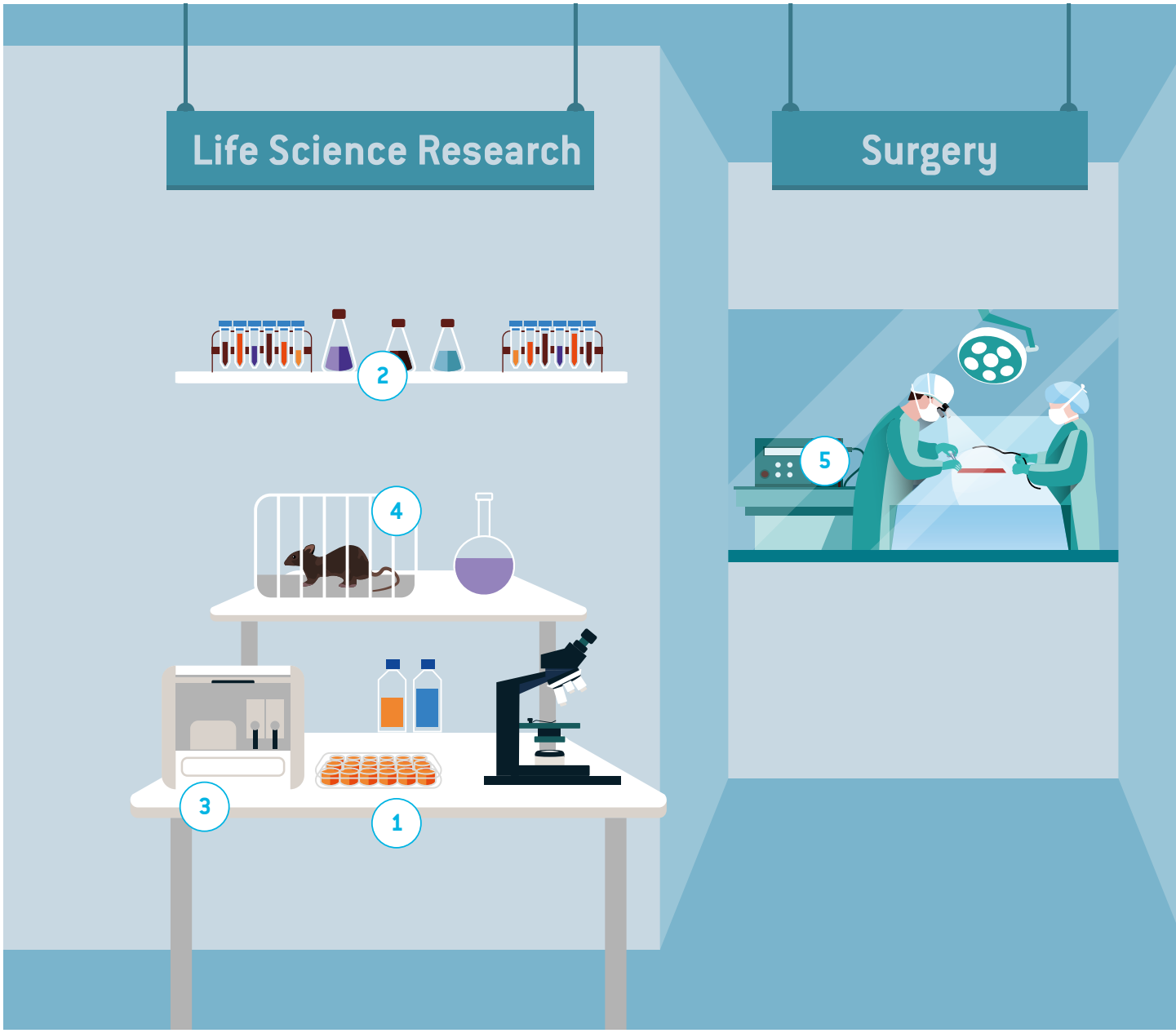
Minimally Invasive Brain Sensor

PreSens supplies sensors and transmitters to medical device manufacturers and supports necessary qualification / certification for medical use. Our microsensors are miniaturized fluorescence sensors. The optical oxygen microsensors are based on a 140 µm silica fiber and are available with two different sensor tip diameters, a < 50 µm tapered tip and a 140 µm flat-broken tip. Other potential applications include tumor oxygen monitoring/ angiogenesis; vital organ and muscle tissue monitoring; flap monitoring as well as ophthalmology.

Blood Perfusion Monitoring

The cardiac surgeon benefits from the extraordinary fast sensor response and the precise pO_2 reading. The flexible nature of the sensor spots supports a free design of the perfusion cell. Sensor spots can be sterilized by autoclavation, irradiation, or ETO. The integrated sensor spots can also be delivered pre-calibrated.

Sensor Solutions for Medical Research & Life Sciences

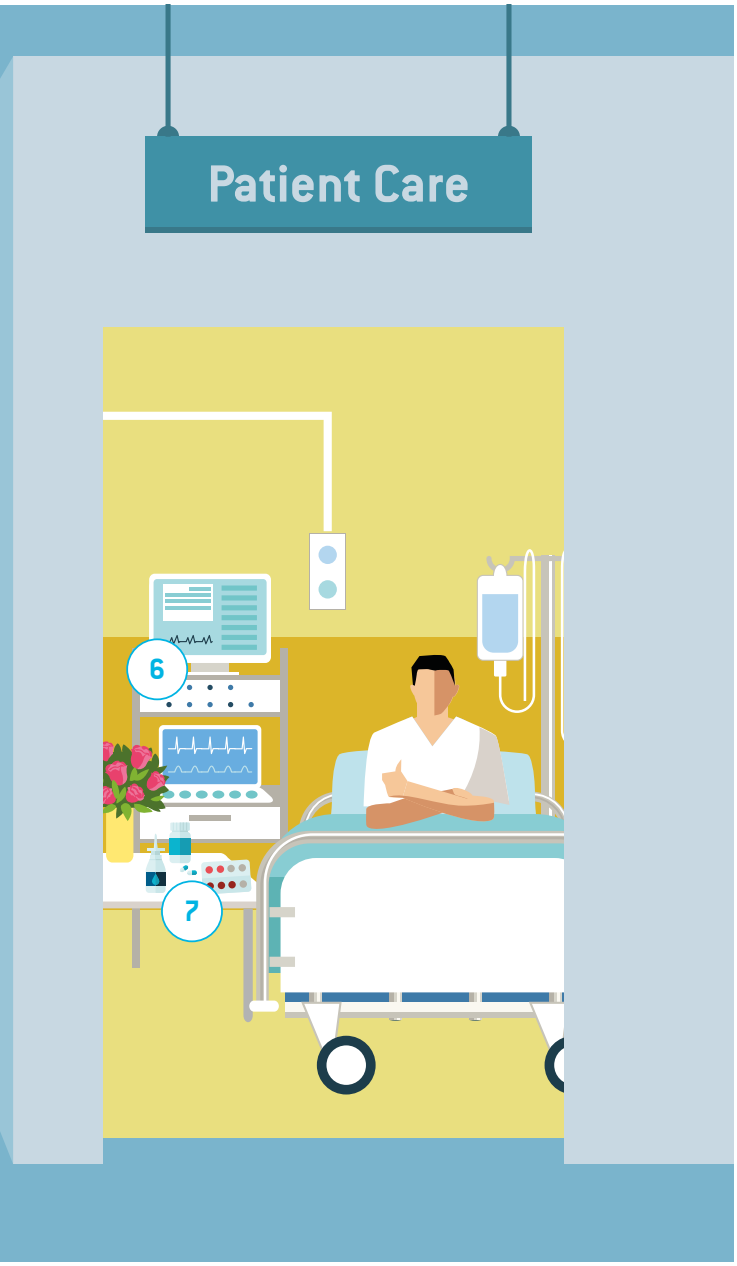


Contact us and we find your customized solution!

OEM Solutions for you

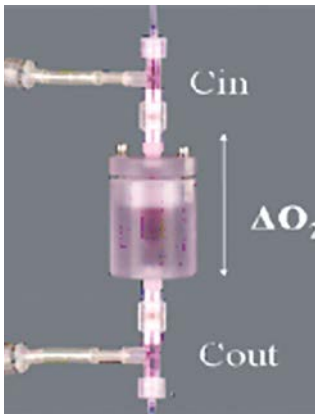
PreSens offers customized sensor technology solutions. Right from the beginning PreSens can be your partner while finding new approaches: from specifications to implementation up to production of your tool.

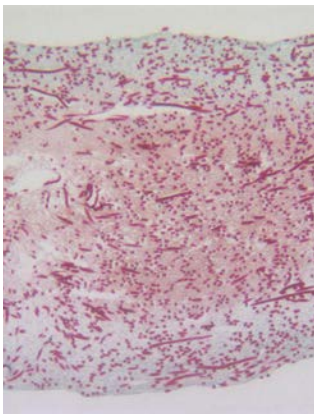
Don't hesitate to ask for your individual solution:
engineering@presens.de



1. **SDR + SensorDishes® / SensorPlates**
   oxygen and pH monitoring in multiwell and microtiter plates for screening and analysis purposes
2. **SFS Shake Flasks with Integrated Sensors + SFR vario**
   online monitoring of shaken cultures
3. **CFS Cell Culture Flasks with Integrated Sensors + SFR**
   monitoring oxygen and pH in cell culture
4. **Microsensors + Automated or Manual Micromanipulator**
   high resolution measurements and exact localization of the measurement tip in tissue or tissue grafts
5. **Flow-through Cells + EOM**
   components for optical oxygen monitoring in perfusion systems integrated in customer devices
6. **OEM Components for Optical Measurement with Medical Devices**
7. **Oxygen Microsensors + portable O_2 Meters**
   oxygen determination in packed pharmaceuticals and headspace measurement in e. g. pharmaceutical vials or blisters

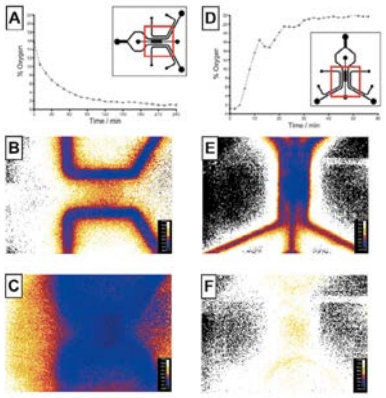
Featured Applications





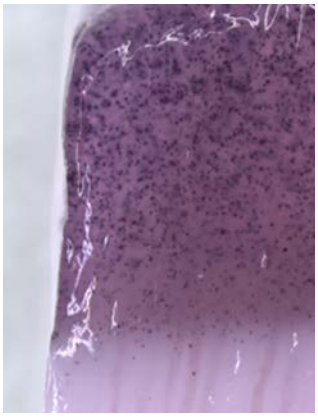
Perfusion Culture of Cell-seeded 3D Scaffolds for Tissue Engineering

Since oxygen has a low solubility in culture medium it must be supplied to cells within 3D scaffolds via constant perfusion of the medium. The oxygen content before and after having passed by the cells can help to determine whether the flow rate applied is sufficient. PreSens flow-through cells with integrated optical sensors were incorporated in the construct at the inlet and outlet and allowed in-line measurement of oxygen tension. This way it was possible to culture HAC in a long term experiment and generate a homogeneous tissue with a uniform distribution of viable cells and cartilaginous extracellular matrix.



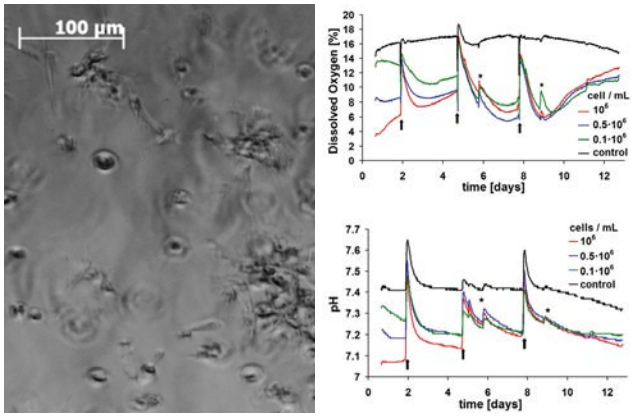
2D Visualization of Cellular Oxygen Consumption in Microfluidic Chips

By integrating an optical oxygen sensor foil in a microfluidic chip and recording analyte maps with the VisiSens™ system whole chip areas can be investigated and gradient formation monitored over time. The imaging system controlled the oxygen tension inside microfluidic devices fabricated from materials with different oxygen permeability. Cellular oxygen consumption and oxygen replenishment from the environment in chips cultured with different rat cell lines could be observed. VisiSens™ helped to characterize the chips and to suggest suitable culture device materials depending on the application and cell line of interest.



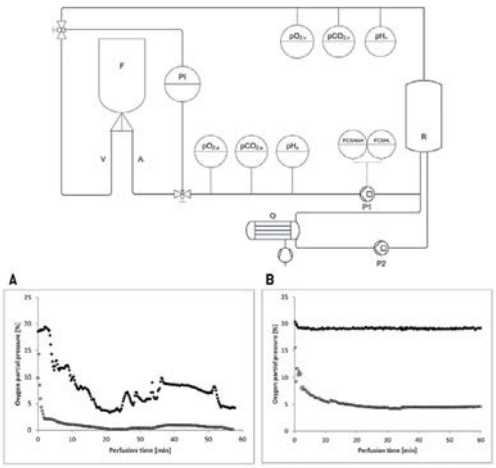
Oxygen Monitoring in Hydrogels with Embedded Cells for Regenerative Therapy

Controlling oxygen levels of cell-matrix-constructs plays a major role in regenerative therapy and tissue engineering. Cartilage is a hypoxic tissue with low regenerative capacity. Chondrocytes can be embedded in alginate hydrogel containing cartilage matrix components and with oxygen controlling functionalization. The aim of this study was to detect and quantify the reduction of oxygen saturation inside the chondral layer of the scaffold caused by living cells and chemical modification under sterile conditions. Needle-type oxygen microsensors enabled the characterization of the local environment and showed that living chondrocytes reduced the O_2 level compared to cell free samples.



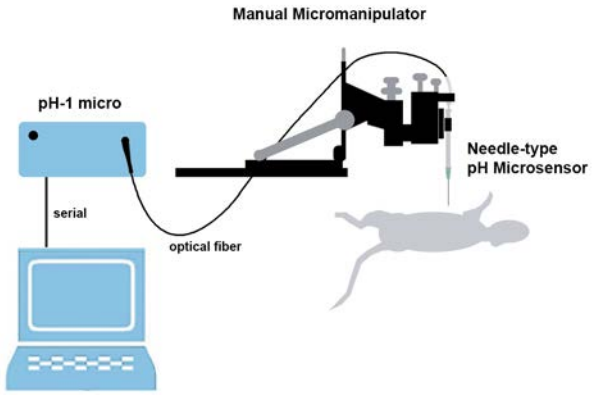
Monitoring O_2 & pH Kinetics in 3D Culture of Disc-chondrocytes with the SDR SensorDish® Reader

Hydrogel-based 3D culture systems offer particular advantages in regenerative medicine. The availability of oxygen within the culture medium and pH kinetics were analyzed with the SDR SensorDish® Reader. The measurement system enabled non-invasive detection of both culture parameters close to the cells inside 24-well dishes. The DO kinetics showed in detail how media changed and complex factors like cell proliferation influenced the O_2 level inside the culture. pH kinetics also displayed characteristic dynamics. Non-invasive DO and pH monitoring with the SDR is well suited for in-process assessments of culture quality and determination of optimum medium change times in 3D cell cultures.



O_2, pH, and CO_2 Monitoring in Extracorporeal Preserved Tissue

Tissue undergoing free transfer in transplant or reconstructive surgery always is at high risk of ischemia-related cell damage. Ongoing research projects are assessing different procedures using an extracorporeal perfusion and oxygenation system. Flow-through cells with integrated optical O_2, pH and CO_2 sensors were implemented in this system for online monitoring before and after the perfusate passed through a free muscle flap. The non-invasive measurements show oxygen demand and CO_2 excretion of the investigated muscle, and perfusate pH. Investigation of hypoxia markers displayed that air saturated solution supplies sufficient oxygen to the free flap.



pH Monitoring in Tumor Research

Past research revealed that pH in malignant solid tumors is acidic compared to that of normal tissues. This study now tested, if tumor formation in rats could also influence urine pH through the production of certain ions and organic acids. For in vivo measurements in the tumor tissue and in very small urine volumes a pH microsensor combined with a Manual Micromanipulator was used. pH in the tumor microenvironment seemed only slightly increased, compared to the tissue of healthy individuals. However, further tests are necessary. Urine measurements showed that the pH is decreased in tumor bearing animals compared to healthy ones.

Examples for Meters, Sensors & Accessories

Meters

Fibox 4 & Fibox 4 trace

Portable oxygen meters; the Fibox 4 trace can measure in a range from 1 ppb to 100 % oxygen.

Microx 4 & Micox 4 trace

Portable oxygen meters for use with micro-sensors, sensor spots, flow-through cells, and dipping probes

Fibox 3 LCD trace

Oxygen meter with LCD display for use with sensor spots, flow-through cells, and dipping probes

OXY-1 SMA/ST/trace

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

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

pH-1 micro

Micro fiber optic pH meter for use with pH Microsensors

SDR SensorDish® Reader

Non-invasive online culture monitoring of oxygen & pH in multiwell plates

Contact us and we find your customized solution!

SFR Shake Flask Reader

Oxygen and pH monitoring in shake flasks, T-flasks, and culture tubes

SFR vario

Online oxygen, pH, biomass, OUR and optional CO_2 monitoring in shake flasks, T-flasks, and culture tubes

VisiSens™ Detector Units DU01 / DU02 / DU03

USB powered and portable 2D detection devices for oxygen, pH or CO_2 imaging

Sensors

O_2 Sensor Spots SP-PSt3/PSt6/PSt7/PSt8/PSt9

Versatile, small oxygen sensors for measurement in different oxygen ranges

Self-adhesive O_2 Sensors SP-PSt3-SA

Easy integration into transparent vessels; for contactless measurement in normal oxygen range (0 – 100 % O_2, 0 – 45 mg/L)

pH Sensor Spots SP-HP5

Versatile, small pH sensors for integration into transparent vessels

Self-adhesive pH Sensors SP-HP5-SA

Easy integration into transparent vessels, for contactless pH monitoring

Profiling Oxygen Microsensors PM-PSt7/PSt8

Microsensor for oxygen profiling (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

Profiling pH Microsensor PM-HP5

Metal-housed microsensor with extendable fiber & mechanical interlock for profiling applications

DO Nice Port

Port with O_2 sensor for customized application in flexible bags

pH Nice Port

Port with pH sensor for customized application in flexible bags

Sensors

O_2 Flow-through Cells

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

Single-use O_2 Flow-through Cell

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

Autoclavable O_2 Flow-through Cell

FTC for monitoring in normal or trace oxygen range (0 – 45 mg/L, 0 – 1400 µmol/L or 0 – 5 % O_2, 0 – 1.8 mg/L)

Single-use pH Flow-through Cell FTC-SU-HP5

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

Needle-type Oxygen Microsensors NTH-PSt7/PSt8

On-the-spot measurement of oxygen (0 – 100 % O_2 / 0 – 45 mg/L, or 0 – 10 % O_2 / 0 – 4.5 mg/L); compatible with Microx 4 or Microx 4 trace

Implantable Oxygen Microsensors 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)

Needle-type pH Microsensor NTH-HP5

This pH Microsensor offers safe insert function in combination with our Manual Micromanipulator.

Implantable pH Microsensor IMP-HP5

Bare fiber microsensor without additional housing

VisiSens™ Sensor Foils

Fluorescent sensor foils for oxygen imaging from 0 – 100 % air saturation, pH imaging in a range of 2.5 – 4.5 or 5.5 – 7.5 pH, and CO_2 imaging from 0 – 1 % or 1 – 25 % CO_2

Contact us and we find your customized solution!

Disposables & Glass Vessels with Integrated Sensors

Sensor Flasks SFS-PSt3 / SFS-HP5-PSt3

Available with and without baffles from 125 to 5000 mL volume with integrated oxygen (glass) or oxygen & pH sensor (plastic)

T-Flasks with Integrated Sensors CFS-HP5-PSt3

Cell culture flasks with integrated pH and oxygen sensors are available for different growth areas and read out with the SFR or SFR vario in combination with the T-flask adapter.

HydroDish® (low well) HD6 / HD24

Multidishes with integrated pH sensors are available in 6- or 24-well format, irradiated and pre-calibrated.

OxoHydroDish OHD6

Multidish with integrated oxygen and pH sensors available in 6-well format

iTubes

Plastic cell culture tubes with integrated sensors are pre-calibrated and read out either with the SFR or SFR vario in combination with the specially designed iTube adapter.

OxoDish® (low well) OD6 / OD24

Multidishes with integrated oxygen sensors are available in 6- and 24-well format, irradiated and pre-calibrated.

Deep Well Oxo- and HydroDishes® OD24-DW / HD24-DW

For shaken applications and available with oxygen (Deep Well OxoDish®) or pH sensors (Deep Well HydroDish®) in 24-well format

Accessories

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.

Manual Micromanipulator MM

Vibration-free, high-resolution control for oxygen and pH microsensors

Automated Micromanipulator AM

Fully automated, high-resolution control for oxygen and pH microsensors

Integration Set Sensor Spots IS-SP

Vacuum tweezers for easy integration of self-adhesive sensor spots

Clamp (Universal)

Clamps are available in sizes for 125 to 5000 mL flasks with a special base plate to align the sensor flasks (glass or plastic).

iTube Adapter

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

T-Flask Adapter

Can be mounted on SFR or SFR vario for oxygen and pH monitoring in cell culture flasks with integrated sensors (CFS)

Optical Shielding Mask SDR-OSM24

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

Contact us and we find your customized solution!

Notes

Discover the complete PreSens portfolio

Products

Optical Oxygen Sensors & Meters

Optical pH Sensors & Meters

Optical CO_2 Sensors & Meters

Optical Sensor Systems

VisiSens™ Imaging Systems

OEM Solutions & Engineering

Industries

Biology & Environmental

Industry & Technical

Biotech & Pharma

Medical & Life Sciences

Food & Beverage

Bring to light what's inside.

PreSens comes from PRECISION SENSING

and offers:

- precise and simple measurement of O_2, pH, CO_2 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

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