PreSens
PRECISION SENSING
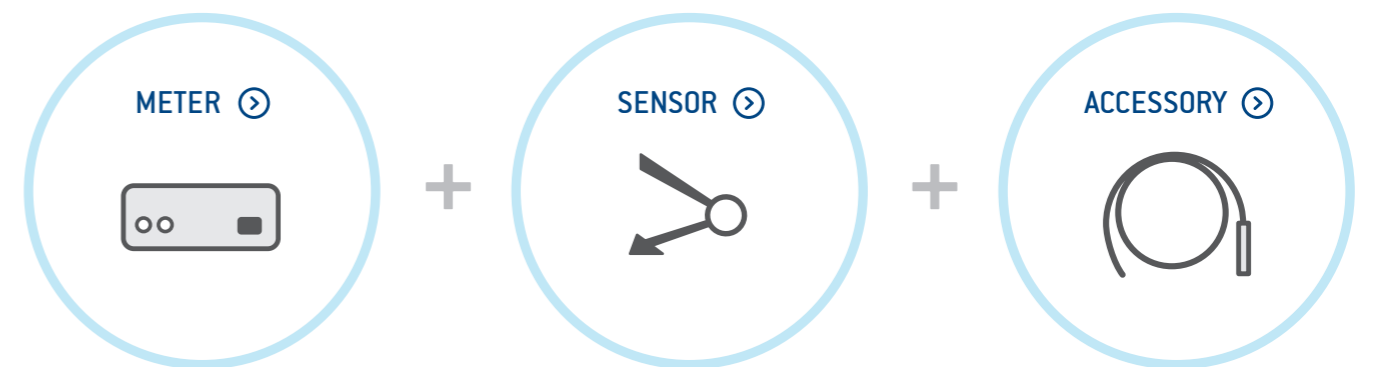
O_2 pH CO_2 BIOMASS

OEM Solutions & Engineering

- Individual optical sensor solutions in various business fields
- Sensors for Oxygen, pH and CO_2 measurements
- OEM solutions since 2004
- Electronics, Chemistry & Software competence
- Certified to EN ISO 13485 and ISO 9001

www.PreSens.de/oc

O₂

CO₂

PH

BIOMASS

Content

CONTENT

Functional Principle

METER ⊙   +   SENSOR ⊙   +   ACCESSORY ⊙

Contact us and we find your customized solution!

⊙ www.PreSens.de/oc

We bring to light what's inside...

...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.
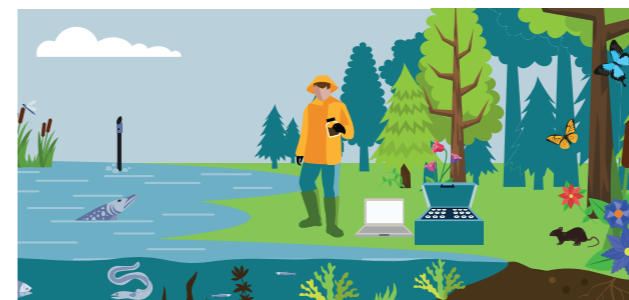
Biology & Environmental

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.

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 in the 1980's at the University of Regensburg, Germany, PreSens Precision Sensing GmbH was founded in 1997.

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.
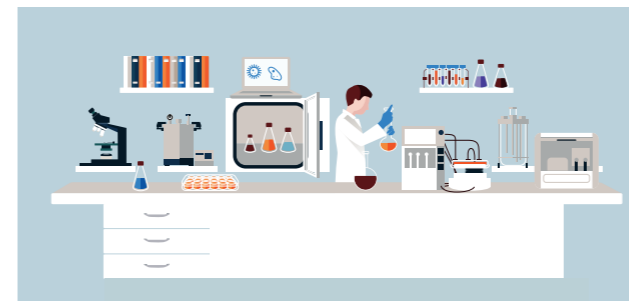
Service

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

DEKRA certified

Quality Management
ISO 9001
ISO 13485
Voluntary participation in regular monitoring

Sensor Engineering Since 2004

We have already developed sensor solutions for:

Deep Sea Research

PreSens sensor spots and read-out units have been integrated in titanium fittings that can stand 600 bar, so oxygen measurements at a depth of 6,000 m can be performed.

Production-Scale Bioreactor

An autoclavable, robust probe compatible with most ports and port adapters has been developed to monitor oxygen in production-scale bioreactors.

Disposable Bioreactor

PreSens sensors for contact-less measurements were integrated in disposable bioreactors (bags). Factory calibration procedures were established to ease their use.

Blood Gas Analyzer

PreSens developed a solution for oxygen perfusion monitoring in blood-gas analyzers. After EtO-sterilization the oxygen sensors with fast response time are integrated in specially designed flow-through cells.

Transformer Oil

An optical exchange window and reading unit is integrated in transformers to monitor the oxygen content of transformer oils. A system with excellent long-term stability (10 years shelf life), an oil tight fitting and tolerant to temperatures from - 40 °C to + 80 °C had to be built, so it would work in desert as well as in polar climate.

2004 ···· **2005** ···· **2005** ···· **2006** ···· **2007** ·················· **2007** ·· **2008** ···· **2010** ···· **2011** ···· **2011**

Brewing Industry

Oxygen sensor spots and electronics have been integrated in Varivent® fittings to enable oxygen measurements in the process chain.

Brain Catheter

An implantable PreSens microsensor has been integrated in a catheter together with a temperature and pressure sensor. This multisensor device was developed for brain surgery.

Semiconductor Development

An extremely sturdy Teflon® flow-through cell has been developed that could stand oxidation, aggressive chemicals (e. g. TMAH up to 25 %) and abrasion of material while enabling oxygen monitoring in industrial environment.

Natural Gas

Metal flow-through connectors with integrated PreSens oxygen sensors are used for oxygen content monitoring in natural gas pipelines. The challenge was to develop an extremely leak tight measurement solution that detects oxygen concentrations in the range of 0.5 to 200 ppmv.

Zero Gravity Experiments

Due to their small outer dimensions an electro-optical module (EOM) and non-invasive sensor spots were used to monitor oxygen in a closed ecosystem in space. The unit had to be vibration resistant to stand starting and landing procedures of the satellite mission.

20 Years of Experience in OEM Development

For decades PreSens has provided customers from most different industries and research institutions with tailored optical measurement solutions. Whether it is adapting electro-optical modules to fit the measurement set-up and environment, developing customized sensor ports, adapting our systems for single-use applications or create robust measurement solutions for long-term use in harsh environments — our OEM components already have shown their many advantages in most different applications.
Let us help you to bring your ideas to life!

Cellular Assay / Cellular Fitness

Disposables with integrated sensors and the respective read-out electronics have been provided for implementation in a high throughput cell culture analysis system. Multiple culture parameters and cellular fitness can be monitored.

Wastewater Treatment

Oxygen is an important indicator for microbial activity, and with it the degradation of pollutants in wastewater treatment. PreSens robust steel probes for direct connection to control units are used for monitoring processes in treatment plants.

Fuel Cells

PreSens sensor spots and microsensors are applied to conduct battery tests and monitor diffusion processes in fuel cell development.

Orbital Metal Welding

Oxygen integrated during the welding process might cause corrosion. Therefore, the welding joint is flushed with argon and an oxygen measurement unit by PreSens is used to detect even oxygen traces below 200 ppm.

Organ Transport

Continuous perfusion can prolong cell, tissue and organ survival during transport. PreSens miniaturized non-invasive sensors are used in perfusion monitoring units during organ transport.

2012   **2013**   **2014**   **2015**   **2016**   **2018**   **2019**   **2021**   **2022**   **2023**

Fish Farming

An extremely sturdy probe and measurement unit for outdoor use was developed to monitor water quality in fish farms.

Education

PreSens oxygen dipping probes and compact reading units were integrated in an experimental kit. Students will use it to perform photosynthesis and respiration measurements.

Packaging

Oxygen can affect the quality and shelf life of certain products. An ultra-fast oxygen sensor by PreSens is used to monitor oxygen during automated packaging processes.

COVID-19 Vaccine Development

PreSens single-use oxygen and pH sensor spots were used in disposable bioreactors to monitor culture conditions during vaccine development.

Personalized Medicine

PreSens non-invasive sensors are integrated in specialized, single-use cell culture equipment for the development of personalized medicines.

OUR OFFER

Highest Expertise in Sensor Engineering

Being a step ahead of its competitors is the basis of each successfully working company. For this you will need new or further developed tools. Right from the beginning, PreSens Precision Sensing can be your partner while finding these new approaches: from specifications to implementation and up to production. Your customized solution comes from one single source. PreSens relies on excellent sensor engineering know-how which results in demand-orientated products "Made in Germany".

Let our team be your competent partner!

Reliable Design Transfer to Production

The advantage for our customers by developing sensor engineering together with PreSens – in comparison to research institutes – is the option to enter into the production process right away, even in large quantities. As all stages of the development of the customized solution are from one source our customers can rely on an extensive after sales product support.

Mechanical & Electronic Design

PreSens offers electronics for optical O_2, pH, CO_2 or biomass measurements. Our OEM components are driven by industrial standard communication protocols.

Sensor Design

Sensitive dyes and polymer chemistry are our core competence and the basis of our intelligent measurement system. The measurement electronics and the sensor itself can be physically separated, so you can perform non-invasive measurements through vessel walls.

Software & Digital Design

PreSens offers a variety of custom software solutions based on and supported by Microsoft Windows. In addition, we offer mobile solutions for Android and iOS like the PreSens Wireless Studio.
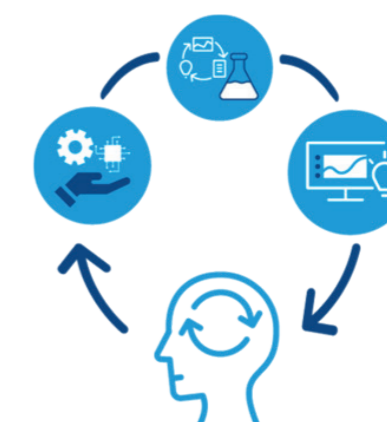
Integration Support

PreSens will support you in all steps of product development and in integrating optical OEM measurement components in your monitoring units. You can count on our experienced customer support.

APPLICATION FIELDS

Single-Use Sensors for Biopharmaceutical Production

Reliable process control is needed in all stages of biomanufacturing processes to ensure consistent scale-up. The integration of single-use sensors in disposable bioreactors can support process analysis and maximize productivity.

Medical Oxygen Sensors

Not only in times of the Corona / COVID-19 crisis it is even more important to have the right equipment for treating patients with acute respiratory problems. PreSens offers development of oxygen measurement solutions according to customers requirements for applications like patient monitoring systems and ventilators.
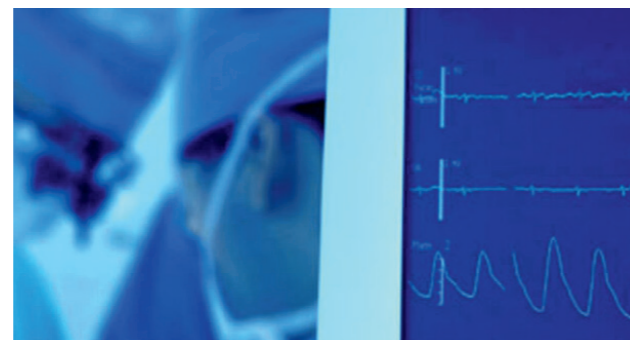
Sensors for Aquaculture & Environmental Research

Dissolved oxygen is an important parameter when assessing water quality. Therefore, measuring dissolved oxygen is essential in aquaculture, wastewater treatment and many other fields.

Single-Use Technology for Cell & Gene Therapy

Cell and gene therapies offer new opportunities for treating different diseases. A key requirement for the successful production of cell and gene therapeutics are scalable, robust cell culture systems that meet regulatory requirements. Single-use technologies are indispensable for manufacturers as they ensure safe and efficient production and support fast implementation times.

Re-Usable Probes for Production-Scale Bioreactors

Reliable process control for established production processes is essential to guarantee consistent quality and yield. PreSens re-usable oxygen probes give you proven and reliable performance with excellent long-term stability.

Single-Use Systems for Monitoring in Microfluidics

Microfluidics provide efficient tools for various science fields. When microfluidic devices are used e.g. in tumor cell research, the assessment of cell metabolism or cell signaling in organ-on-a-chip applications monitoring the microenvironment is essential. PreSens can provide efficient customized measurement systems for oxygen, pH and CO_2 monitoring directly inside the microchannels or in the media that are pumped through the chip.

Contact us and we find your customized solution!

www.PreSens.de/oc

OEM SOLUTIONS

Ready-to-use Transmitters

Electro-Optical Modules for Optical Sensor Read-out

PreSens offers precise OEM solutions for non-invasive and micro-invasive measurements. The Electro-Optical Modules (EOM) have a small outer diameter, low power consumption, and are ready to be integrated into monitoring & control systems. Our integration guide guarantees a fast implementation. As a standard digital interface they use a RS232 or RS485 communication port. Different communication protocols including Modbus RTU are available. To ensure highest quality standards from development, over serial production, up to application the quality management system is certified to EN ISO 13485 and ISO 9001.

- Thousands of systems in the field
- Experienced customer service
- Variety of sensor integrations available
- Quality management certified to EN ISO 13485 and ISO 9001

Specifications

	EOM-O2-FOM	EOM-tO2-FOM	EOM-O2-micro	EOM-pH-PHB50	EOM-CO2-FOM
Specifications					
Sensors	PSt3 (optical SMA connector)	PSt3 & PSt6 & PSt9 (optical SMA connector)	PSt1 (optical ST connector)	HP5 or LG1 (optical SMA connector)	CD1 (optical SMA connector)
Phase resolution	0.01 °	0.01 °	0.05 °	0.01 °	0.01 °
Sampling rate	0.1[1] sec. - 599.9 sec.	0.1[1] sec. - 599.9 sec.	1 sec. - 120 sec.	0.1[1] sec. - 599.9 sec.	0.1[1] sec. - 599.9 sec.
Temperature sensor	Four-wire Pt100 sensor	Four-wire Pt100 sensor	-	Four-wire Pt100 sensor	Four-wire Pt100 sensor
Temperature performance	0.1 °C + Pt100 accuracy	0.1 °C + Pt100 accuracy	-	0.1 °C + Pt100 accuracy	0.1 °C + Pt100 accuracy
Supply voltage	5 - 28 VDC	5 - 28 VDC	7 - 18 VDC	5 - 28 VDC	5 - 28 VDC
Power consumption in active mode	0.75 W	0.75 W	1.5 W	0.75 W	0.75 W
Power consumption in standby mode	0.25 W	0.25 W	0.6 W	0.25 W	0.25 W
Temperature: operating / storage			0 °C to + 50 °C / - 10 to + 70 °C		
Relative humidity			0 % to 80 % (non condensing)		
Dimensions (L x W x H)	94.2 mm x 25.0 mm x 19.6 mm	94.2 mm x 25.0 mm x 19.6 mm	40 mm x 100 mm x 24 mm (25 mm)	94.2 mm x 25.0 mm x 19.6 mm	94.2 mm x 25.0 mm x 19.6 mm
Weight	39 g	39 g	51.8 g	39 g	39 g
Digital interface	RS232 interface, optionally RS485 (PreSens proprietary or Modbus RTU USB 2.0	RS232 interface, optionally RS485 (PreSens proprietary or Modbus RTU USB 2.0	RS232 interface (RJ 11 4/4 to DSub9, cable included) USB interface (RJ 11 4/4 to USB type A, transmitter adapted cable included)	RS232 interface, optionally RS485 (PreSens proprietary or Modbus RTU USB 2.0	RS232 interface, optionally RS485 (PreSens proprietary or Modbus RTU USB 2.0

[1]Depends on hardware configuration and parameter settings. < 0.7 s only possible without temperature sensor.

EOM-O2-FOM / EOM-tO2-FOM / EOM-O2-micro

We offer a variety of different versions to be connected to various sensor designs. Our risk management, compliant to the medical device manufacturing standard ISO 13485, ensures high product safety.

EOM-CO2-FOM

The EOM-CO2-FOM are single channel modules for non-invasive measurement. They are compatible with sensors type CD1 (measurement range from 10 - 250 hPa pCO2). A serial communication protocol is offered for data exchange between a PC or another host unit and the EOM. RS232, RS485 or USB 2.0 is used as a digital interface. Additionally, the EOMs have 4 to 20 mA analog output.

EOM-pH-PHB50

The EOM-pH-PHB50 is a precise, single channel module for non-invasive pH measurement. It is compatible with sensor types HP5 & HP8 (pH 5.5 – 8.5). The small outer dimensions and low power consumption make it very easy to integrate this board in custom monitoring and control systems. EOM-pH-PHB50 uses RS232, RS485 or USB 2.0 as digital interface.

Contact us and we find your customized solution!   www.PreSens.de/oc

ACCES-SORIES

Cap Rail Adapter PHB50-CRA

The cap rail adapter is an accessory which allows to easily mount an EOM on a standard TH35 profile. It has a pre-installed terminal adapter to which the EOM is connected. Install your EOM in a control cabinet or create a daisy chain set-up with multiple EOMs, all held in the right place.

Accessories for Electro-Optical Modules

Extensions and Add-ons for PreSens Ready-to-use Transmitters

Specifications

	EVB-EOM	PHB50-PCB-STA	PHB50-CRA	Add-on Temperature Board
Specifications				
Dimensions	150 mm x 67 mm x 24.5 mm	30 mm x 25 mm x 17.4 mm	118 mm x 41 mm x 36.5 mm (wo EOM)	19 mm (± 0.2 mm) x 51 mm (± 0.2 mm)
Connecor type	-	-	-	4-wire Pt100 connection
Compatibility	-	-	-	All EOMs (electro-optical modules)
Supply voltage range for PHB50	USB: 5 VDC ± 0.5 V PWR1: 5 – 28 VDC PWR2: 5 – 28 VDC	-	-	-
Supply voltage range for 4 to 20 mA interface	4 to 20 mA VBUS 5 – 28 VDC	-	-	-
Communication	RS232 Port RS485 Port USB Port	-	-	-

Evaluation Board
EVB-EOM

The Evaluation Board EVB-EOM is an accessory designed for developers to get a fast start with the EOM-FOM / PHB50 boards. Different power and communication options allow an individual set-up and you are able to start with tests in your specific environment immediately.

Terminal Adapter
PHB50-PCB-STA

The terminal adapter PHB50-PCB-STA is an accessory for EOM-FOM / PHB50. The EOM is connected to the terminal adapter via 10-pin FFC cable. All output of the board is transferred to the terminal block. BZ / AY as well as VIN and GND are available twice on the terminal block. This enables a series connection of several devices, i.e. the simple construction of a daisy chain via RS485.

Contact us and we find your customized solution!

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Featured Examples

SENSORS

15 Years of OEM Engineering

Some Examples for our Developments & Innovations

Right from the start in 1997 PreSens worked together with its international customers to create new optical sensor technology made to measure. The following pages show just some examples for products that resulted from engineering projects for most different application fields. Whether it is the integration of optical sensor technology in an existing unit or the development of a complete stand-alone measurement solution, see for yourself what's possible!

- ○ Thousands of systems in the field
- ○ Experienced customer service
- ○ Variety of sensor integrations available
- ○ Quality management certified to EN ISO 13485 and ISO 9001

Dual Electrode Simulator

The Optrode Dual™ is an electrode simulator. This small device converts the reading of chemical optical sensors to electro-chemical nA and mV signals (ECS). Connected to the electrode input of conventional controllers it expands their functionality to work with chemical optical sensors.

MCR Multi-channel Reader

This tool for bioprocess development uses disposable culture vessels with integrated sensors. 48 DO and pH sensors can be read out and culture conditions continuously monitored. The MCR housing is designed according to IP 64.

10 mL Bioreactor

PreSens cooperated with the company 2mag to enable non-invasive oxygen and pH measurements in their single-use bioREACTOR reaction vessels for high-throughput bioprocess development.
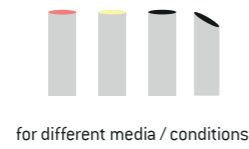
Nice Ports

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.
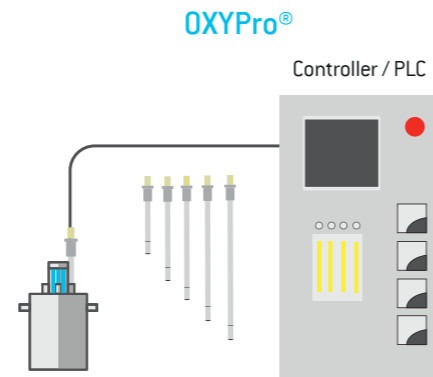
SPECS

WIDE RANGE	0-100 % O_2
MID RANGE	0-20.9 % O_2
TRACE RANGE	0-10 % O_2
ULTRA TRACE RANGE	0-200 ppm

SET-UP

Various Caps

for different media / conditions

OXYPro®

Controller / PLC

APPLICATION

Research & Chemical Industry   **Food & Beverage**   **Biotechnology**

Specifications

OXYPro® Series

Specifications	OXYPro® WR (OEC Type PSt7)	OXYPro® MR (OEC Type PSt8)	OXYPro® TR (OEC Type PSt6)	OXYPro® UT (OEC Type PSt9)
Measurement range*	Optimal: 0 - 50 % O_2, 0 - 22.5 mg/L Max.**: 0 - 100 % O_2, 0 - 45 mg/L	Optimal: 0 - 10 % O_2, 0 - 4.5 mg/L Max.**: 0 - 20.9 % O_2, 0 - 9 mg/L	Optimal: 0 - 5 % O_2, 0 - 2 mg/L Max.**: 0 - 10 % O_2, 0 - 4.5 mg/L	0 - 200 ppmv O_2
Properties				
Compatibility	Aqueous solutions			Gas phase only
Cross-sensitivity	Organic solvents such as acetone, toluene, chloroform or methylene chloride Chlorine gas			
Sterilization procedure***	Steam sterilization (max. 140 °C, 1.5 atm)			-
Cleaning procedure***	Cleaning in place (CIP, 2 % NaOH, + 80 °C, + 176 °F) 3 % H_2O_2, acidic agents (HCl, H_2SO_4) max. 4 - 5 % Ethanol, methanol, cleaning agents at room temperature			-
Temperature sensor	NTC (for temperature compensation of oxygen values only, not suitable for process monitoring)			
Temperature performance	± 1 °C in operation temperature range (0 °C to + 50 °C)			
Power supply	7 - 24 V			
Power consumption in active mode / stand-by mode	Max. 1 W / 0.15 W			
Temperature range operation	Optimal: 0 °C to + 50 °C Max.: - 10 °C to + 90 °C			Optimal: 0 °C to + 40 °C Max: -10 °C to + 60 °C
Temperature range storage	Optimal: room temperature (+20 °C ± 5 °C) Max.: 0 °C to + 70 °C			
Dimensions	Max. immersion depth: 120 mm / 225 mm / 325 mm / 425 mm (+ 7 mm with OEC30) PG13.5 thread and VP8 connector: 55 mm Diameter: 12 mm			
Weight	100 g			
Digital interface	RS485, half duplex (variable Baud rate, default: 19200, data bits: 8, parity: none, stop bits: 1, handshake: none) or RS485 Modbus RTU			
Analog output	4 - 20 mA			

*at 20 °C, 960 - 980 hPa; humidified gas mixture
**after customized calibration
***not for OEC-PStx-NAU-OIW

OXYBase® Series

Specifications	OXYBase® WR (OEC Type PSt3)
Measurement range*	Optimal: 0 - 50 % O_2, 0 - 22.5 mg/L Max.**: 0 - 100 % O_2, 0 - 45 mg/L
Properties	
Compatibility	Aqueous solutions, ethanol, methanol, cleaning agents containing ClO_2 at room temperature
Cross-sensitivity	Organic solvents such as acetone, toluene, chloroform or methylene chloride Chlorine gas
Storage stability of sensor cap	5 years provided the sensor material is stored at room temperature in dry conditions and in the dark
Temperature sensor	NTC (for temperature compensation of oxygen values only, not suitable for monitoring purposes)
Temperature performance	Accuracy below ± 1 °C
Power supply	OXYBase® WR-RS232: 5 VDC ± 5 % OXYBase® WR-RS485/WR-RS485M: 5 - 30 VDC OXYBase® WR-RS485-AO: 7 - 30 VDC
Power consumption in active mode / stand-by mode	Max. 1 W / < 0.15 W
Temperature range operation	Optimal: 0 °C to + 40 °C Max.: - 10 °C to + 70 °C
Temperature range storage	Optimal: room temperature (+20 °C ± 5 °C) Max.: 0 °C to + 70 °C
Dimensions	OXYBase® WR-RS232: 12 mm x 81.4 mm OXYBase® WR-RS485/WR-RS485M: 12 mm x 106 mm OXYBase® WR-RS485-AO: 12 mm x 135 mm
Weight	OXYBase® WR-RS232: 12 mm x 81.4 mm OXYBase® WR-RS485/WR-RS485M: 100 g OXYBase® WR-RS485-AO: 12 mm x 135 mm
Digital Interface	RS232 (PreSens proprietary) RS485 (PreSens proprietary or Modbus RTU) RS485 4 - 20 mA output

*at 20 °C, 960 - 980 hPa; humidified gas mixture
**after customized calibration

SENSORS

OXYPro® Series

The OXYPro® combines an optical sensor and electro-optical module in one probe. The sensor is integrated in a stainless steel cap that is screwed to the probe housing, so a used sensor coating can easily be exchanges. The OXYPro® is connected directly to a control unit. They are available for wide, mid-, trace and ultra trace range oxygen measurements. As a digital interface they use RS485 (PreSens proprietary or Modbus RTU). These probes stand steam sterilization and cleaning in place.

OXYBase® Series

These compact probes combine an electro-optical module and sensor in a stainless steel housing. The sensor is integrated in a removable cap and can easily be replaced if necessary. These probes are extremely robust and ideally suited for e. g. O_2 monitoring in fish farms.

Oxygen Exchange Caps OECs

These sensor caps are available for different measurement ranges and in different designs, e. g. with optical isolation, USP class VI compatible and a special version safe for food applications. The caps can be used to replace a used sensor coating on OIMs, OXYBase® or OXYPro® probes.

Oxygen Exchange Cap OEC30

These sensor caps have a tapered tip to reduce air bubble formation when measuring dissolved oxygen. The caps can replace a used sensor coating on OIMs or OXYPro® probes.

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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