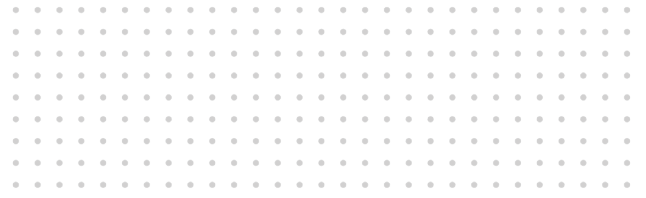




# Optical Sensor Systems



- Parallel online monitoring of oxygen, pH, OUR, & biomass
- Non-invasive & non-destructive measurement
- Microbial & cell cultivation, tissue engineering, hypoxic studies, etc.
- Bioprocess development, respirometry, drug screening, etc.



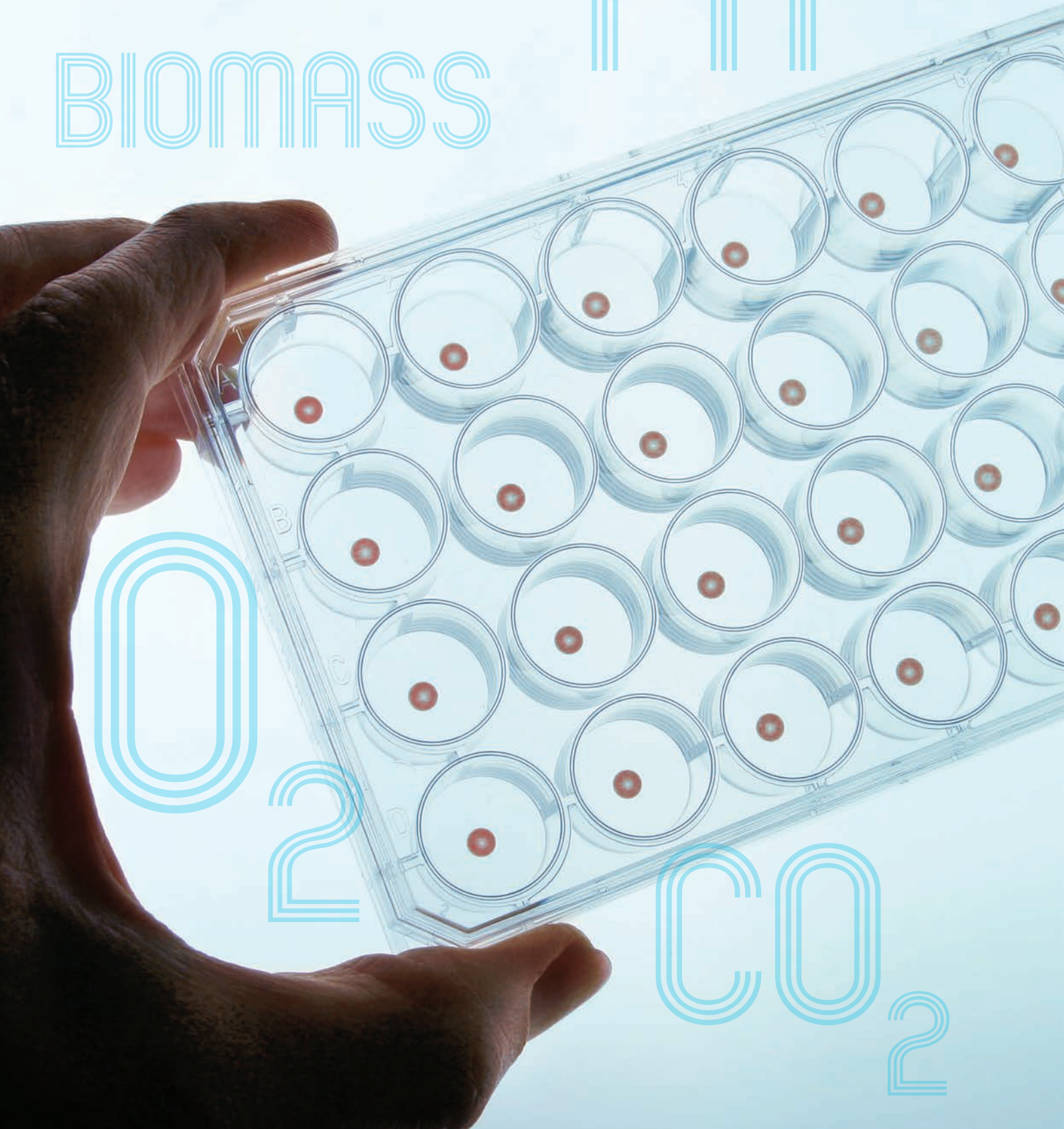
BIOMASS

PH

O

R

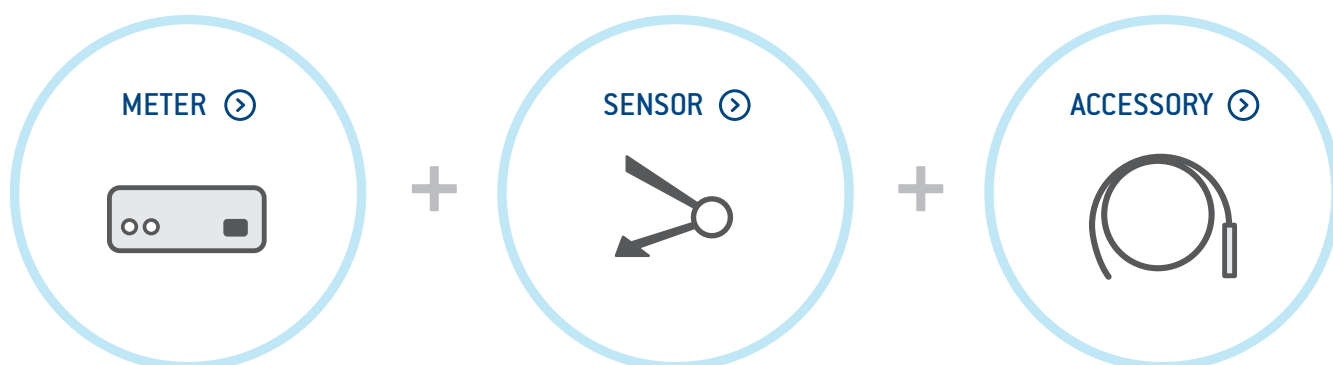
CO<sub>2</sub>



# Content

- 04 - 05 **Company & Industries**
- 06 **Systems**
  - 06 SFR Shake Flask Reader & SFR vario
  - 10 SDR SensorDish® Reader
- 14 **Accessories**
- 16 **Product Range**

## 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 pH, oxygen and CO<sub>2</sub>
- 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 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

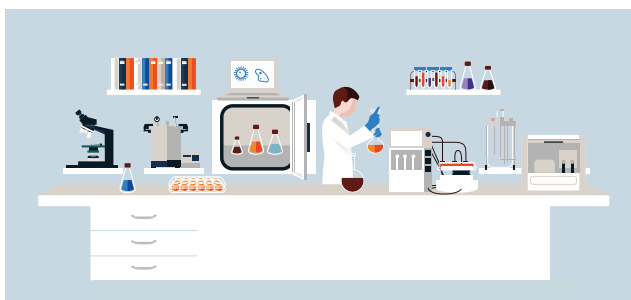
Furthermore, we are developers and manufacturers of optoelectronic OEM sensor components for companies in the field of medical equipment and process control.



Quality Management  
ISO 9001  
ISO 13485  
Voluntary participation in regular monitoring

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

## ...and work for the following industries.



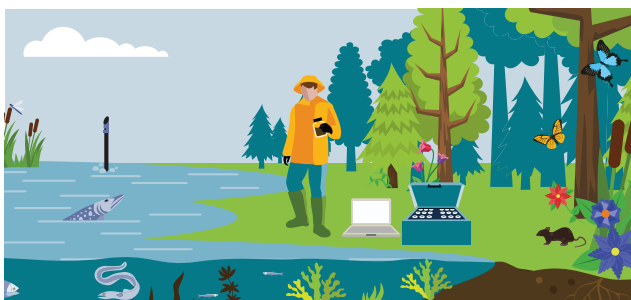
### Biotech & Pharma

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.



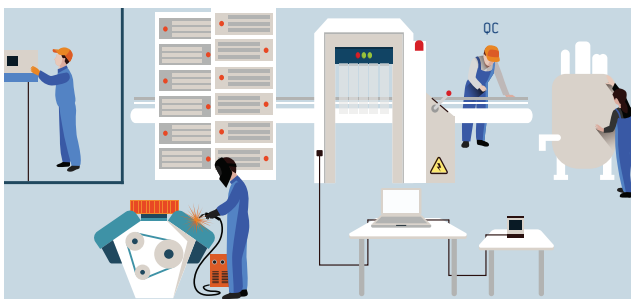
### Biology & Environmental

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. OEM sensor components can be designed to be integrated in customer systems.

# SYSTEMS

## SFR Shake Flask Reader & SFR vario

### Online Monitoring of O<sub>2</sub>, pH, Biomass & OUR – Easy Integration in any Shaking Incubator

The SFR devices enable contactless monitoring in shake flasks. The SFR Shake Flask Reader records O<sub>2</sub>, oxygen uptake rate (OUR) and pH in up to 9 Erlenmeyer flasks. The SFR vario is designed for monitoring one shake flask and additionally gathers biomass development data online. Adapters for e.g. cultivation tubes or T-flasks are available.

The battery-powered readers fit in standard shakers and transfer measurement data wirelessly via Bluetooth.

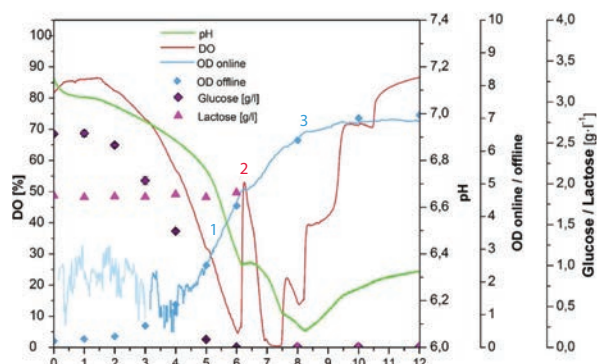
Corresponding vessels contain oxygen and pH sensor spots which are read out non-invasively through the transparent bottom of the vessels. Disposable plastic flasks are pre-calibrated and irradiated. Glass flasks can be equipped with autoclavable oxygen sensors and one-time autoclavable, removable pH or optionally CO<sub>2</sub> sensors.



- Compatible with standard shakers
- Shake flasks in different sizes available
- Comes with its own control software
- For microbial cultivations & cell cultures
- Used in e. g. seed train & bioprocess development

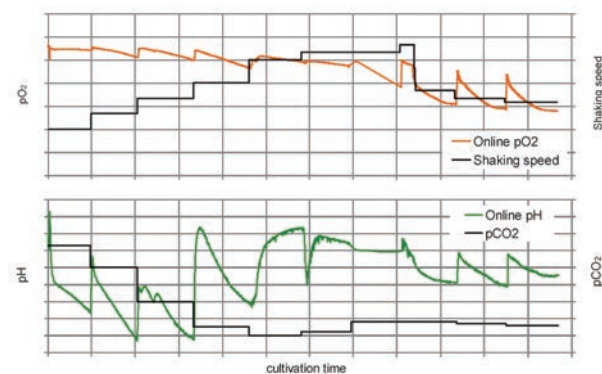
**Is your application missing?** Contact us and we find your customized solution!

## Examples for Applications



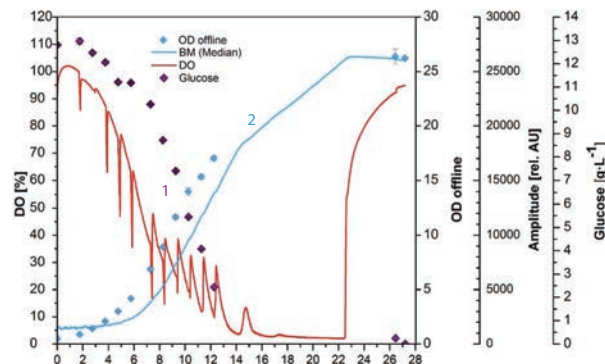
### Biomass, O<sub>2</sub> & pH Monitoring During Diauxic Growth of *E. coli*

*E. coli* K12 shows distinct diauxic growth in medium containing glucose and lactose, here monitored with the SFR vario. In the first growth phase glucose is consumed, which is indicated by a decrease in oxygen concentration [1]. When glucose becomes limiting, growth stops showing in a small plateau in biomass measurements [2]. The bacteria adjust their metabolism to lactose. In the third phase *E. coli* grow on lactose until it is consumed and turns into the stationary phase [3].



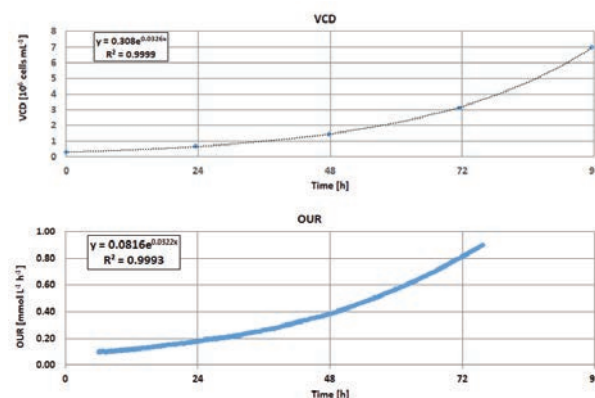
### Process Monitoring in Suspension-Adapted CHO Cell Cultures

The online measurement of dissolved oxygen concentration and pH in shaken bioreactors paves the way for proper scale-down activities from bench-top stirred-tanks to smaller scales. Adjustment of shaking speed as a function of pO<sub>2</sub> is now possible avoiding oxygen limitations at high cell densities. Even a simple pH readjustment by tuning the pCO<sub>2</sub> in the incubator is feasible to optimize the output from simple experiments with shaken bioreactors.



### Yeast Growth Phases in Complex Medium

*K. marxianus* shows two growth phases when cultured with glucose as substrate. In the first phase glucose is metabolized under aerobic conditions [1], and the oxygen content decreases continuously. During the second – oxygen limited – phase *K. marxianus* shows significantly slower growth, which can be clearly observed in the biomass measurements [2], while metabolizing the glucose products generated in the first phase under high oxygen demand [Spikes in oxygen signal due to sampling].



### Growth Rate of Cell Culture calculated from OUR

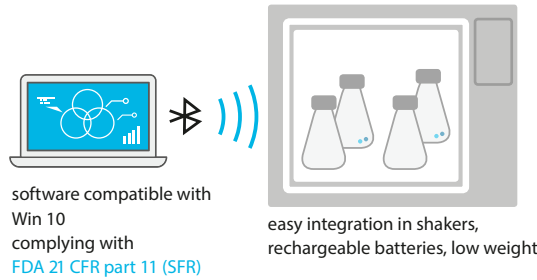
SFR vario determines oxygen uptake rates online. Using an exponential fit  $[c_x(t) = c_{x0} \cdot e^{\mu_{max} \cdot t}]$  the maximum growth rate can be determined. The figures show CHO cultures with offline determined viable cell density (left) and online measured OUR (right). Both graphs yields approximately the same maximum growth rate of 0.03 h<sup>-1</sup>.

## SPECS

|                                  |                          |
|----------------------------------|--------------------------|
| MEASUREMENT RANGE O <sub>2</sub> | 0 – 100 % O <sub>2</sub> |
| MEASUREMENT RANGE pH HP5         | 5.5 – 8.0 pH             |
| MEASUREMENT RANGE pH LG1         | 4 – 7.5 pH*              |
| MEASUREMENT RANGE BIOMASS        | OD 1 – 80                |

\* only with SFR vario LG1

## SET-UP



**SFR vario for 1 vessel** parallel control of up to 4 readers

configure modules for:

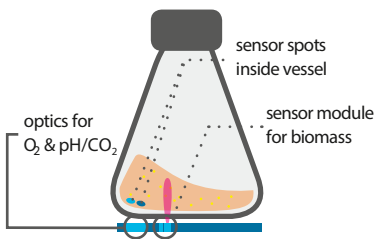
|                |     |     |                    |
|----------------|-----|-----|--------------------|
| O <sub>2</sub> | pH  | T   | CO <sub>2</sub> ** |
| BM             | OUR | OPC | rpm                |

**SFR Shake Flask Reader for 9 vessels** parallel control of up to 7 readers (63 flasks)

measures:

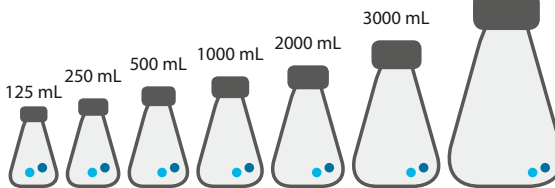
|                |    |         |
|----------------|----|---------|
| O <sub>2</sub> | pH | add-on: |
| OUR            | T  | OPC     |

### Principle

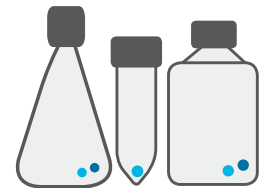


### Sensors

shake flasks in 7 sizes with and without baffles



adaptable for various disposable and reusable flasks

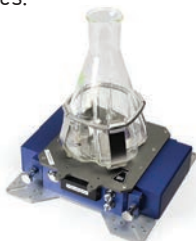


\*\* CO2 sensor integration only onsite by user



## SFR vario

The SFR vario monitors oxygen, OUR, pH, biomass and alternatively CO<sub>2</sub> simultaneously. It also measures temperature and rpm online to have all variables in one data sheet. The device optics can read out pre-calibrated oxygen and pH sensor spots and also comprise a dedicated optical set-up for biomass monitoring. Data transfer is wireless, the reader is powered with rechargeable batteries.



## SFR vario BM

The SFR vario BM offers non-invasive online monitoring of biomass in your shake flask culture, and measures temperature and rpm. Optical biomass measurements are based on scattered light detection, so no integrated sensors are necessary. The biomass data can be correlated with parameters like optical density, cell dry weight or cell concentration. Data transfer is wireless, the reader is powered with rechargeable batteries.



## SFR Shake Flask Reader

The SFR Shake Flask Reader offers oxygen, pH, and OUR monitoring in up to 9 shake flasks, cultivation tubes, or T-flasks simultaneously. In addition, temperature is logged. It is powered with rechargeable batteries and data transfer is hosted by a wireless Bluetooth connection.



## Plastic & Glass Flasks with Integrated Sensors SFS

Shake flasks with integrated oxygen, pH and optionally with CO<sub>2</sub> and LG1 (measuring from pH 4 to pH 7.5) sensors are available from 125 - 5000 mL with and without baffles. The plastic flasks come irradiated. All sensors are pre-calibrated. Special clamps align the sensor flasks in the right orientation on the readers.



## Specifications

|   | Oxygen  | pH*  | Biomass (SFR vario only)                 |
|---|---|--|--|
| <b>Specifications</b>                     |   |  |  |
| Measurement range                         | 0 - 100 % O <sub>2</sub>  | 5.5 - 8.0 pH<br>optionally 4.0 - 7.5 pH***   | Optical density OD <sub>600</sub> 1 - 80 |
| Resolution                                | ± 0.01 % O <sub>2</sub> at 0.21 % O <sub>2</sub><br>± 0.1 % O <sub>2</sub> at 20.9 % O <sub>2</sub> | ± 0.01 pH at pH = 7**  | Depending on culture                     |
| Accuracy                                  | ± 0.4 % O <sub>2</sub> at 20.9 % O <sub>2</sub><br>± 0.05 % O <sub>2</sub> at 0.2 % O <sub>2</sub>  | ± 0.1 pH at pH = 7 with one-point adjustment<br>± 0.2 pH at pH = 7 with pre-calibration                                      | Depending on culture                     |
| Drift                                     | < 0.01 % O <sub>2</sub> per day<br>(sampling interval of 1 min.)                                    | < 0.01 pH per day<br>(sampling interval of 1 min.)   | Depending on culture                     |
| Measurement temperature range             |   | From + 5 °C to + 50 °C   |  |
| Response time (τ <sub>90</sub> ) at 25 °C | < 60 sec.   | < 60 sec.  | -  |
| <b>Properties</b>                         |   |  |  |
| Compatibility                             | Aqueous solutions, ethanol (max. 10 % v/v), methanol (max. 10 % v/v), pH 2 - 10                     |  | -  |
| Cross-sensitivity                         | Typically no cross-sensitivity in culture media   | Reduced to ionic strength (salinity); a high concentration of small fluorescent molecules in the visible range can interfere | -  |

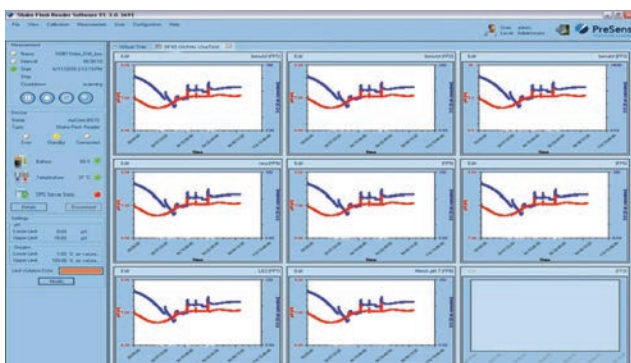
Sensor flasks are delivered irradiated.

| Device                             | SFR Shake Flask Reader                        | SFR vario  |
|------------------------------------|---|--|
| Cleaning                           | Ethanol (moist cloth)                         | Ethanol (moist cloth)  |
| Input                              | 2 x Li-Ion battery 14.4 V / 4000 mAh          | Battery: 2 x Nickel-metal hydride battery 7.2 V / 2500 mAh<br>Permanent: 100 - 240 VAC power adapter with 18 VDC / 830 mA output |
| Dimensions [L x W x H, w/o clamps] | 380 mm x 380 mm x 30 mm                       | 190 mm x 190 mm x 47 mm  |
| Weight                             | w/o base tray: 5.4 kg<br>w/ base tray: 6.7 kg | w/o batteries: 1.1 kg<br>w/ batteries: 1.66 kg   |

\*provided Sensor Flasks are used without further handling in physiological solutions

\*\*at 100 rpm & cell culture media

\*\*\*SFR vario only

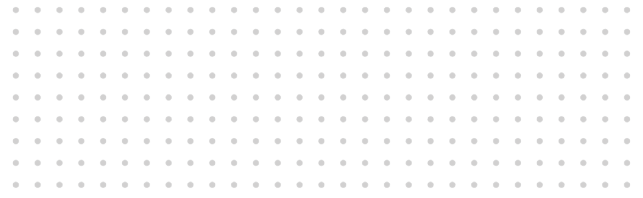


## SFRS Software

The SFR Software SFRS controls up to 7 SFR Shake Flask Reader devices in parallel (i.e. up to 63 flasks). In addition, it offers an integrated database to show and evaluate measurements. Oxygen and pH are visualized in real-time during the entire cultivation. Results are displayed in a variety of graphical representations. The advanced graphic data handling supports Design of Experiment. All measured data can be exported to Microsoft Excel® or as .csv for further evaluation. In addition, the current measurement can be compared to stored cultivation data online.

## PreSens Flask Studio (PFS) Software

PreSens Flask Studio connects to up to 4 SFR vario simultaneously. It compares measured data of all connected devices. In addition, historical data can be uploaded to see differences. All measured variables can be exported using different formats. Oxygen, OUR, pH and biomass are visualized in real-time during the entire cultivation and former measurements can be compared with running ones. The measurement data can be exported in different file formats (e.g. Microsoft Excel®) for further analysis. Real-time access is possible by OPC functionality.

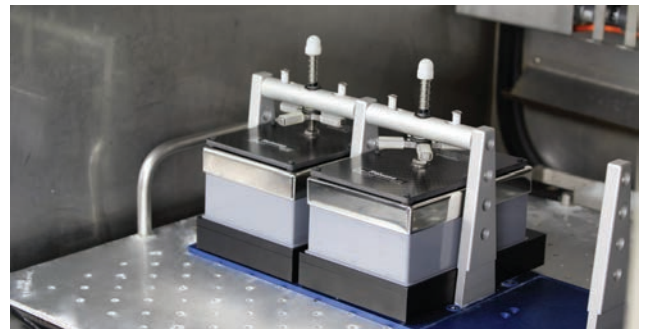


# SYSTEMS

## SDR SensorDish® Reader

### Online Monitoring of O<sub>2</sub> & pH in Multiwell Plates and glass vials

The SDR SensorDish® Reader is a small 24-channel reader for non-invasive detection of oxygen and pH in multidishes (SensorDishes®). These multidishes contain a sensor spot at the bottom of each well and are read out non-invasively through the transparent bottom. SensorDishes® for oxygen (OxoDish®) and pH (HydroDish®) are available in 24- and 6-well format. Deep well plates with integrated oxygen (OxoDish®-DW) or pH sensors (HydroDish®-DW) allow measurements in shaken cultures. Read-out of oxygen sensors integrated in glass vessels for respiration monitoring and photosynthesis is also possible. The SensorDish® Reader can be used in incubators and on shakers and is therefore the ideal tool for cell, bacterial and yeast cultivation.



- Measurement under real conditions in incubator atmosphere
- Parallel online monitoring in disposable 24- or 6-well plates
- Deep well plates (for monitoring in shaken cultures) & low well plates available
- Pre-calibrated & ready-to-use
- For microbial & cell culture
- Non-invasive & non-destructive measurement
- Monitoring of respiration and photosynthesis in small glass vials

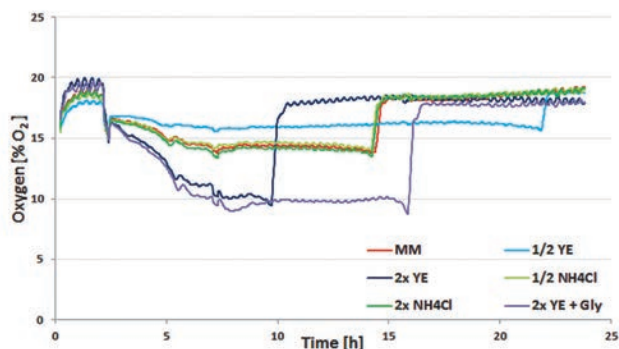
**Is your application missing?** Contact us and we find your customized solution!

## Examples for Applications



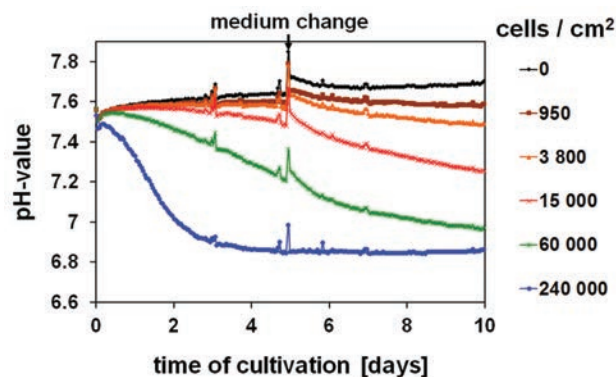
### More Security for Hypoxic Stem Cell Cultivation

The influence of medium change on dissolved oxygen (DO) during cultivation of human embryonic stem cells (hESC) was investigated at different oxygen tensions in the incubator atmosphere. Samples with full medium change using not pre-calibrated medium showed a DO increase of 20 – 60 % air saturation. Other than expected, even half medium change with pre-incubated medium resulted in a notable DO increase of 10 – 30 % air saturation.



### Evaluating the SDR SensorDish® Reader for Strain Development

Oxygen kinetics during a shaken cultivation were monitored using a Deep Well OxoDish®. Different media compositions were tested and compared to a minimal medium (MM). A higher concentration of yeast extract (YE) led to faster growth. Adding glycerine as a second substrate prolonged the stationary phase. Ammonium chloride had no influence on the metabolism. After the substrate was consumed, oxygen increased due to oxygen ingress.



### Oxygen & pH Monitoring in Tissue Engineering

Human chondrocytes with different start cell concentrations were cultivated in OxoDishes® and HydroDishes®. pH deviations from the control wells (medium only) could be detected even for the lowest start concentration. The acidification rates were in accordance with the different start concentrations. Medium change after 5 days led to a temporal pH increase until the samples were in equilibrium with the incubator atmosphere (5 % CO<sub>2</sub>) again. Oxygen kinetics show the respective oxygen decrease.



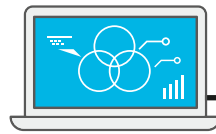
### Real-time Monitoring of Marine Zooplankton Respiration

Oxygen consumption of 3 – 4 copepod nauplii per sample was monitored in SensorVials for 6 hrs. The nauplii were offered phytoplankton. Feeding and faecal pellet production rates were estimated simultaneously. Respiration rates were linear: The nauplii were neither influenced by the vessel walls nor by diminishing food. The higher nauplii respiration rate, compared to literature values of other species, was presumably due to constant feeding.

## SPECS

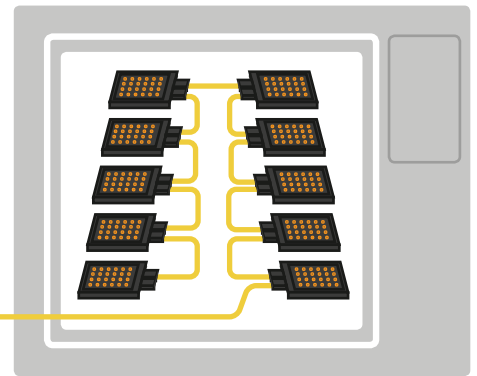
|                             |                        |
|-----------------------------|------------------------|
| NORMAL RANGE O <sub>2</sub> | 0 - 50% O <sub>2</sub> |
| RESOLUTION O <sub>2</sub>   | ±0.4% O <sub>2</sub>   |
| NORMAL RANGE pH             | 6.0 - 8.5              |
| RESOLUTION pH               | ± 0.05 pH at pH = 7    |

## SET-UP Multi-channel set-up (240 samples)

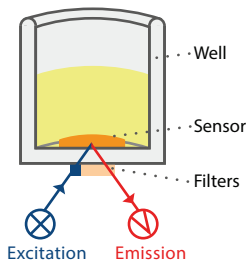


### SensorDish® Reader Software Features:

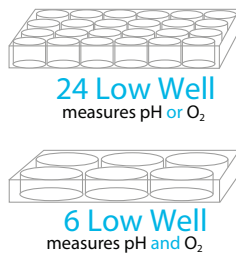
- Control of up to 10 SDR - 240 samples
- Visualization of kinetics in real-time
- Graphical representations from each well or for all wells in one graph
- Export to Microsoft Excel



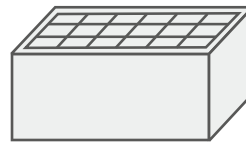
### SDR Principle



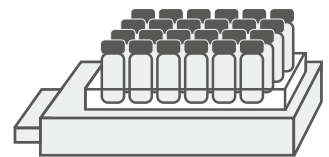
### Low Well



### Deep Well measures pH or O<sub>2</sub>



### Respirometry measures O<sub>2</sub>



## SDR SensorDish® Reader Basic Set

The SDR Basic Set contains the SDR reader and all necessary accessories. It can be combined with OxoDishes® as well as HydroDishes® in low and deep well format. The SDR is compatible with 6- and 24-well plates. Furthermore, it can be used with glass vials with integrated oxygen sensors (SensorVials) of different sizes.



## SDR SensorDish® Reader Extension Set

Up to 9 SDR Extension Sets can be combined with one Basic Set. The Extension Set is a reader and a connection cable to install up to 10 devices in a row and thus monitor up to 240 samples in parallel.



## OxoDish® (low well) OD24

OxoDishes® are directly coated with oxygen sensors type PSt5 and read out non-invasively. OxoDishes® come irradiated and pre-calibrated.



## HydroDish® (low well) HD24

These SensorDishes® are coated with pH sensors type HP8. HydroDishes® are irradiated and pre-calibrated.

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



## Specifications

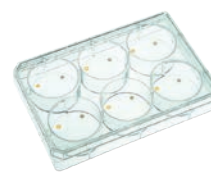
|   | pH   | Dissolved Oxygen   |                                   |
|---|--|--|-----------------------------------|
| <b>Specifications</b>                     |  |  |                                   |
| Measurement range                         | 6.0 – 8.5  | 0 – 50 % O <sub>2</sub>  |                                   |
| Resolution*                               | ± 0.05 pH at pH = 7  | ± 0.4 % O <sub>2</sub> at 20.9 % O <sub>2</sub>                    |                                   |
| Precision*                                | ± 0.2 pH at pH = 7 (Sensor batch calibration)<br>± 0.1 pH at pH = 7 (Sensor spot calibration)                              | ± 1 % O <sub>2</sub> at 20.9 % O <sub>2</sub>                      |                                   |
| Drift*                                    | < 0.1 pH within one week (sampling interval 10 min.)   | < 0.2 % O <sub>2</sub> within one week (sampling interval 10 min.) |                                   |
| Measurement temperature range             | From + 15 °C to + 45 °C  | From + 15 °C to + 45 °C  |                                   |
| Response time (t <sub>90</sub> ) at 25 °C | < 120 sec.   | < 30 sec.  |                                   |
| <b>Properties</b>                         |  |  |                                   |
| Compatibility                             | Aqueous solutions, ethanol (max. 10 % v/v), methanol (max. 10 % v/v), pH 2 – 10  |  |                                   |
| Cross-sensitivity                         | Reduced to ionic strength (salinity); high concentration of small fluorescent molecules in the visible range can interfere |  |                                   |
| Calibration                               | HydroDishes® and OxoDishes® are pre-calibrated<br>Beta-irradiated  |  |                                   |
| <b>Device</b>                             | <b>SensorDish® Reader</b>  | <b>Splitter</b>  | <b>Power adapter</b>              |
| Type                                      | SDR v3 or higher   | SP1.1 or higher  | Mascot 9920                       |
| Cleaning                                  | Ethanol (moist cloth)  |  |                                   |
| Input                                     | 18 – 24 V DC 150 mA  | 18 – 24 V DC 1.5 A   | 100 – 240 V AC 50/60Hz max. 0.9 A |
| Weight                                    | 0.38 kg  | 0.24 kg  |                                   |
| Dimensions                                | 16.3 cm x 8.9 cm x 2.2 cm  | 12.4 cm x 8.0 cm x 4.5 cm  |                                   |

\* in physiological solutions at 37 °C



### Deep Well Oxo- and HydroDishes®

Deep well multidishes are ideally suited for shaken applications and are available with oxygen (Deep Well OxoDish®) or pH sensors (Deep Well HydroDish®) in 24-well format. We recommend the combination with a Clamp System to fix the SDR inside your shaker.



### OxoHydroDish

OxoHydroDishes in 6-well format contain an oxygen and pH sensor in the same well, which are read out simultaneously. The SDR software will show one parameter in live view, the second parameter can be exported and shown in MS Excel by copy / paste into a provided template.



### SensorVials SV-PSt5 2 mL & 4 mL

2 mL and 4 mL glass vials are equipped with oxygen sensors PSt5 and fit into a 24 well plate. They are used for respirometry studies as they allow to minimize oxygen ingress. The re-usable SensorVials can be cleaned with ethanol or mild detergents. Together with the SDR-MSV24 they can also be used during in photosynthesis experiments. Customized formats (1mL/20mL) are also possible.



### Sensor Spots SP-PSt5

Optically isolated oxygen sensor spots type PSt5 for read-out with the SDR are available with 3 and 5 mm diameter and can be integrated into glass or plastic vials of your choice. They can be cleaned with ethanol or mild detergents and be re-used.

# ACCESSORIES

## Accessories for Optical Sensor Systems

### Extensions and Add-ons for PreSens Sensors & Readers

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

- Add-ons for optical measurement
- Adapters for different disposables with integrated sensors
- Power adapter for permanent power supply

#### For SFR Shake Flask Reader & SFR vario



#### Shake Flask Clamp

For sensor flasks special clamps are needed to use with the SFR Shake Flask Reader or the SFR vario. The clamps align the sensors inside the flasks in the right position for read-out. They are available in sizes of 125 to 5000 mL glass or plastic flasks.



#### iTube Adapter

The iTube Adapter can be mounted on an SFR Shake Flask Reader or the SFR vario to use these devices for online culture monitoring inside iTubes – cell culture tubes with integrated sensors. Either oxygen or pH can be recorded with the readers.

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



## T-Flask Holder

The T-Flask Holder can be mounted on an SFR Shake Flask Reader or the SFR vario. Oxygen and pH can be monitored simultaneously and online in your cell culture flasks with integrated sensors (CFS).

For SDR SensorDish® Reader



## Integration Set Sensor Spots IS-SP

The integration set is a suction pump that comes with fitting tips for easy handling and integration of PreSens self-adhesive sensor spots, but can also be applied to integrate our other sensor spots using liquid glue.



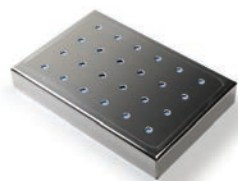
## Mask for SensorVials SDR-MSV24

This mask shields the SDR optics from artificial light, so optical oxygen measurements are not disturbed. This allows the use of SensorVials during light exposure in photosynthesis experiments. The 2 mL and 4 mL SensorVials fit into the wells of the mask, which assures correct positioning of the vials above the reader optics.



## Optical Shielding Mask SDR-OSM24

This black mask is made of aluminum specifically designed for use with the SDR and Deep Well SensorDishes®. In case fluorescent media are used or if fluorescent products are developed, this can interfere with the optical sensor readings. This mask shields the SDR optics from the fluorescence and ensures precise measurements.



## Sandwich Cover for 24-Well Deep Well Plates

This metal cover by EnzyScreen has 24 holes and contains 3 different layers made from different materials to ensure homogeneous oxygen ingress and evaporation in all 24 wells during shaken cultivations. This enables comparing measurements from all wells. At the same time the covers avoid contamination.



## Clamp System for 2 or 4 SDRs

These Clamp Systems fasten up to 2 or 4 SensorDish® Readers, Deep Well Sensor-Dishes® and Sandwich covers on a shaker. The system is compatible with most standard shakers and is attached to the shaker tray with screws. The SDRs slide into the system and are held down from above by clamps.

## Specifications

|                        | Shake Flask Clamps  | iTube Adapter                          |
|------------------------|---|--|
| <b>Specifications</b>  |   |  |
| Compatibility          | for plastic & glass shake flasks on SFR vario / SFR   | SFR vario / SFR / ITR                  |
| Dimensions / Weight    | 125 mL flasks: ø 70 mm / 45 g<br>250 mL flasks: ø 85 mm / 80 g<br>500 mL flasks: ø 100 mm / 125 g<br>1,000 mL flasks: ø 130 mm / 225 g<br>2,000 mL flasks: ø 165 mm / 335 g<br>3,000 mL & 5,000 mL flasks: ø 230 mm / 700 g | 65 mm x 40 mm x 65 mm / 130 g          |
| Connector type         | 4 socket screws   | 2 socket screws                        |
| Details                | Material: stainless steel   | Material: stainless steel and aluminum |
|                        | T-Flask Holder  | Optical Shielding Mask SDR-OSM24       |
| <b>Specifications</b>  |   |  |
| Compatibility          | for plastic T-flasks on SFR vario / SFR   | for Deep Well SensorDishes® on SDR     |
| Dimensions [D x W x H] | 102 mm x 80 mm x 4.5 mm   | 125 mm x 80 mm x 3 mm                  |
| Weight                 | 80 g  | 30 g                                   |
| Connector type         | 4 socket screws   |  |
| Details                | Material: aluminum  | Material: black anodized aluminum      |

# Product Range

## Meters



### SFR Shake Flask Reader

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



### SFR vario / BM

Online oxygen, pH, biomass, OUR and optional CO<sub>2</sub> monitoring (SFRvario) or Biomass only (SFR vario BM) in shake flasks, T-flasks, and culture tubes



### SDR SensorDish® Reader Basic Set

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



### SDR SensorDish® Reader Extension Set

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

## Disposables & Glass Vessels with Integrated Sensors

### For SFR Shake Flask Reader & SFR vario



### Sensor Flask SFS-PSt3 / SFS-HP5-PSt3

Available with and without baffles from 125 to 5000 mL volume with integrated oxygen & pH sensors



### Glass Shake Flask with Integrated Sensor SFS-PSt3 / SFS-HP5-PSt3

Available with and without baffles from 125 to 5000 mL volume with integrated oxygen & pH sensors



### T-Flasks with Integrated Sensors CFS-HP5-PSt3

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



### iTubes pH

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 adapters



### CO<sub>2</sub> Sensor

The CO<sub>2</sub> CD1 sensor is only offered for self-integration into glass flasks. They can be autoclaved once and need to be replaced after every cultivation



### Integration Set Sensor Spots IS-SP

Vacuum tweezers for easy integration of self-adhesive sensor spots

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



## Accessories

### For SFR Shake Flask Reader & SFR vario



#### 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)



#### Power Adapter

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

### For SDR SensorDish® Reader



#### OxoDish® (low well) OD24

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



#### HydroDish® (low well) HD24

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



#### OxoHydroDish OHD6

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



#### Deep Well Oxo- and Hydro-Dishes® OD24-DW / HD24-DW

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



#### SensorVials SV-PSt5

2 mL and 4 mL glass vials with integrated oxygen sensors PSt5 for read-out with the SDR, can be cleaned with ethanol and are re-usable



#### Oxygen Sensor Spots SP-PSt5

Oxygen sensor spots type PSt5 for read-out with the SDR are available with 3 and 5 mm diameter and can be integrated into glass or plastic vials; they can be cleaned with ethanol and mild detergents and be re-used



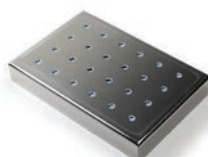
#### Optical Shielding Mask SDR-OSM24

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



#### Mask for SensorVials SDR-MSV24

Designed for use with the SDR and SensorVials (2 mL and 4 mL format) to shield the reader optics from light exposure during photosynthesis experiments



#### Sandwich Cover for 24-Well Deep Well Plates

Metal cover by EnzyScreen with 24 holes and 3 layers made from different materials to ensure homogeneous oxygen ingress and evaporation



#### Clamp System for 2/4 SDRs

Clamp Systems which fasten up to 2 or 4 SensorDish® Readers, Deep Well SensorDishes® and Sandwich covers on a shaker

# 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 Sciences

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

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