Optical pH Sensors & Meters

- Minimally invasive or even contactless measurement
- Pre-calibrated
- μL up to m³ range
- Insertion in plant and animal tissue
- For microbial and cell culture

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

We offer systems for:
- Oxygen measurement in gases and liquids
- Non-invasive online pH, CO₂, and oxygen measurement
- Oxygen and pH sensors for single-use bioreactors
- Microsensors pH, oxygen, and CO₂
- Process control in shake flasks incl. biomass monitoring
- Low-maintenance DO measurement for fermentation and bioreactor systems
- Online oxygen and pH measurement in disposables like multiwell plates and plastic bags
- Imaging solutions for 2D-mapping of oxygen-, pH-, and CO₂-distribution

Our product range is constantly expanding.

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.

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

Quality Management
ISO 9001
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, 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.
The pH-1 SMA & pH-1 micro are precise fiber optic pH meters. They are used with contactless or micro-invasive optical sensors. A PC is connected to run the easy-to-use software. An open communication protocol allows to digitally integrate the pH-micro in control systems.

- Software included
- Simple one-point calibration possible
- One calibration for a multitude of sensor spots
- Ready to use, irradiated and precalibrated probes available
- Software allows to measure with up to 10 single channel instruments simultaneously
- We offer tailored designs so the customer can easily and safely integrate the sensors

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

<table>
<thead>
<tr>
<th>Specifications</th>
<th>pH-1 SMA</th>
<th>pH-1 micro</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH sensors</td>
<td>LG1</td>
<td>HPS</td>
</tr>
<tr>
<td>Temperature sensor</td>
<td>Pt100 temperature connector (sensor not included)</td>
<td>1 x Pt1000 temperature connector (sensor included)</td>
</tr>
<tr>
<td>Temperature performance</td>
<td>From 0 °C to + 50 °C, resolution ± 0.1 °C, accuracy ± 1.0 °C</td>
<td>From 0 °C to + 50 °C / from -10 °C to + 60 °C</td>
</tr>
<tr>
<td>Power supply</td>
<td>5 VDC (USB-2.0 Mini-B, cable included)</td>
<td>18 VDC / 5 W (110 – 240 VAC, 50/60 Hz, adapter included)</td>
</tr>
<tr>
<td>Temperature: operating / storage</td>
<td>From +10 °C to + 50 °C / from -20 °C to +70 °C</td>
<td>From 0 °C to + 50 °C / from -10 °C to + 60 °C</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>Up to 80 % (non condensing)</td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>95 mm x 34 mm x 30 mm (with connectors)</td>
<td>210 mm x 120 mm x 50 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>0.128 kg</td>
<td>0.65 kg</td>
</tr>
<tr>
<td>Digital interface</td>
<td>USB interface (cable included)</td>
<td>RS232 interface (RJ11 4/4 to DSub9, cable included), USB interface (RJ11 4/4 to USB type A, transmitter adapted cable included)</td>
</tr>
<tr>
<td>External trigger</td>
<td>-</td>
<td>TTL-compatible with galvanic isolation (BNC connector)</td>
</tr>
<tr>
<td>Analogue output specifications</td>
<td>-</td>
<td>Dual outputs, 0 – 4095 mV, resolution: 12 bit, accuracy ± 10 mV (BNC connectors)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 mV represent pH: 0.1 pH</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Temperature: 1 °C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Phase: 0.25 °</td>
</tr>
</tbody>
</table>

**pH-1 SMA**

This small pH meter is compatible with non-invasive sensors and flow-through cells of type LG1 (measurement range 4.0 - 8.0 pH). The USB-powered pH-1 SMA is operated with the PreSens Measurement Studio 2 software, which enables simultaneous control of up to 10 devices, so measurement networks can be set up. Combination with oxygen devices like the OXY-1 SMA possible.

**pH-1 micro**

The pH-1 micro is a precise micro fiber optic pH meter. It is temperature compensated and used with pH microsensors based on a 140 µm optical fiber. A PC is connected to run the easy-to-use software. The software supports one point calibration as well as multipoint calibration and can handle up to 10 pH-1 micros. It is also compatible with the PreSens Profiling Studio software and the Automated Micromanipulator AM for profiling applications.
The non-invasive pH sensors are optimized for physiological solutions and cell culture media. These so called sensor spots can be mounted in transparent vessels made of plastic or glass. Plastic vessels with already integrated pH sensors are ready-to-use as they are beta-irradiated and pre-calibrated. The pH is measured contactless through the vessel wall. New self-adhesive sensor spots ease the integration process for the user.

- Online monitoring without sampling
- Optimized for cell culture media and physiological solutions
- Applicable from microliter to production scale
- Contactless & non-destructive measurement
- Pre-calibrated & ready-to-use
- Integrated in beta-irradiated disposables
- Bags & single-use bioreactors

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

Pharma Industry: pH Monitoring in Bags

Bags and single-use bioreactors have revolutionized the way biopharmaceuticals are manufactured. Our non-invasive pH sensors are the tools to turn disposable bags into bioreactors. As non-invasive DO sensors are also available, the two key parameters oxygen and pH can be controlled online.

Bioprocess Development: pH Monitoring in Shake Flasks

Shake flask cultures are widely applied in academic and industrial bioprocess development. Although pH is one of the major issues in the cultivation of cells, yeast or bacteria, adequate methods for real-time monitoring of pH were not available and cumbersome at-line sampling was used. pH Sensor Spots in combination with non-invasive oxygen sensors integrated in shake flasks now provide new insights into metabolic activity and changes in metabolic pathways.

Customized Micro Reactors and Ports

pH and DO sensor spots are mounted in customized micro reactors. They can be delivered beta-irradiated and pre-calibrated and mounting the sensors to a variety of polymeric surfaces is possible. Immobilization by ports, which are integrated into the reactors at the customer’s facilities, is a second application.

Online Measurement in Perfusion Systems

Beta-irradiated and pre-calibrated pH flow-through cells with sensors can be integrated into perfusion systems. This allows easy control of process parameters in perfusion reactors. Typically Luer connectors are used, though different sizes for larger or smaller flow rates are available.
**Optical pH Sensors & Meters**

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

**SPECS**

<table>
<thead>
<tr>
<th>Measurement Range HP5</th>
<th>5.5 - 8.5 pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement Range LG1</td>
<td>4.0 - 8.0 pH</td>
</tr>
<tr>
<td>Response Time (t&lt;sub&gt;90&lt;/sub&gt;)</td>
<td>&lt; 120 sec.*</td>
</tr>
<tr>
<td>Resolution</td>
<td>±0.01 at pH 7</td>
</tr>
</tbody>
</table>

*stored at + 37°C

pH Sensor Spots
The sensor spots are available for normal (5.5 - 8.5 pH, HP5) and a wider pH range (4.0 - 8.0 pH, LG1). The sensors can be attached with silicone glue, and are also available in self-adhesive versions, where no extra glue is needed.

**SET-UP**

1-10 channel
stationary, portable, OEM, etc.

Hard- & Software
measurement control, monitoring, evaluation, export, settings, alerts, etc.

**APPLICATION**

Single-use & Reusable
from µL to production scale

Indoor & Outdoor
Research & Industry

Biology & Environment

**pH Nice Port**
This port with integrated sensor is applied in flexible, bag-type bioreactors or containers like storage and mixing bags. The port is made of polyethylene and allows easy welding with the bags. A polymer optical fiber is attached to the port from the outside to read out the sensor.

**iTube pH**
A pH sensor spot is integrated in these cell culture tubes. They can be read out with the SFR or SFR vario in combination with the specially designed iTube adapter.

**Single-use pH Flow-through Cell FTC-SU**
A pH sensor is attached to a color coded stick, which is delivered in a T-cell made of polycarbonate. A polymer optical fiber connects the sensor to a pH meter. This single-use FTC can be delivered either beta-irradiated or untreated. Irradiated FTC can be delivered with CPC sterile connectors or C-flex tubing for sterile welding.
## Specifications

<table>
<thead>
<tr>
<th></th>
<th>Sensor Spots (SP-HPS)</th>
<th>Sensor Spots (SP-LG1)</th>
<th>pH Nice Port</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Specifications</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement range</td>
<td>5.5 - 8.5 pH</td>
<td>4.0 - 8.0 pH</td>
<td>5.5 - 8.5 pH</td>
</tr>
<tr>
<td>Resolution</td>
<td>at pH = 7: ± 0.01 pH</td>
<td>at pH = 6.5: ± 0.01 pH</td>
<td>at pH = 7: ± 0.02 pH</td>
</tr>
<tr>
<td>Accuracy**</td>
<td>± 0.05</td>
<td>± 0.10</td>
<td>± 0.05</td>
</tr>
<tr>
<td>Drift</td>
<td>at pH = 7: &lt; 0.005 pH per day</td>
<td>From +5 °C to +50 °C</td>
<td></td>
</tr>
<tr>
<td>Response time (t&lt;sub&gt;90&lt;/sub&gt;)***</td>
<td>&lt; 120 sec.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Properties</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compatibility</td>
<td>Aqueous solutions, ethanol [max. 10 % v/v], methanol [max. 10 % v/v], pH 2 - 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross-sensitivity</td>
<td>Reduced to ionic strength [salinity]; a high concentration of small fluorescent molecules in the visible range can interfere</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleaning procedure</td>
<td>pH spots are delivered either beta-irradiated or untreated; a second irradiation or ethylene oxide treatment is not recommended</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calibration</td>
<td>pH spots are pre-calibrated; recalibration is possible</td>
<td>Nice Ports are pre-calibrated; single-point calibration is recommended</td>
<td></td>
</tr>
<tr>
<td>Sterilization procedure****</td>
<td>Irradiation Ethylene oxide (EtO)</td>
<td>Irradiation Ethylene oxide (EtO)</td>
<td></td>
</tr>
</tbody>
</table>

* provided pH sensors are used without further handling and in physiological solutions

**after single-point calibration at pH = 7

***equilibrated sensor kept in well stirred solution at +37 °C

****recalibration may be required

## OEM Solutions for You

PreSens offers customized sensor technology solutions. Our engineers use up-to-date techniques for mechanical design, sensor chemistry, measurement electronics and software development. 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
Miniaturized chemical optical pH sensors integrated in single-use flow-through cells (FTC-SU) allow non-invasive online monitoring in perfusion systems. The sensors are fixed to color coded sticks, which can be attached to flow-through cells of different size and shape, according to your requirements. A polymer optical fiber connects the sensor inside the flow-through cell to the respective measurement device (e.g., pH-1 SMA). The single-use cells are made of polycarbonate and can be delivered beta-irradiated or untreated.

- Single-use flow-through cells
- Precise online monitoring of pH
- Different sizes and shapes for various flow rates
- Easy connection to external tubing
- Beta-irradiated or untreated
- CPC connectors available
- Pre-calibrated - ready to use
Examples for Applications

Online Measurement in Perfusion Systems

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

pH Monitoring in Liver Cell Bioreactor

An important aspect of efficient liver cell bioreactors is the automated regulation of physio-chemical culture parameters. A non-invasive pH regulation device for a perfusion bioreactor has been developed. The high performance of the system is based on one of our chemical optical flow-through cells for pH detection and its combination with precision mass-flow controllers for gas. The new controller allows long time stable and contamination-free online pH regulation in complex bioreactor systems – an important technical contribution for future clinical applications.

pH and pO₂ Control in a Bioreactor via FTCs in a Bypass

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

pH Fluxes at Sediment-Water Interface

Eastern boundary upwelling systems are characterized by high concentrations of dissolved inorganic carbon (DIC) and low pH in coastal surface waters. The pH FTCs were applied to study the impact of sedimentary organic carbon content on the pH in pore water and the overlying bottom water on the Namibian shelf. Preliminary results emphasize the role of sedimentary fluxes not only in generating DIC but also total alkalinity which elevated the capacity to mitigate the drop of pH.
**Optical pH Sensors & Meters**

**SPECS**

Different sizes for various flow rates

- **Sensor Stick**
  - Luer
  - 1/4” x 1/4”
  - 3/8” x 3/8”
  - 1/2” x 1/2”

**SET-UP**

1-10 channel

- stationary, OEM, etc.

Hard- & Software

- measurement control and monitoring

**APPLICATION**

Indoor & Outdoor

- Research & Industry

Cell Culture

- Perfusion Bioreactor

Environmental Research

- Animal Physiology

**Sterile Integration**

- For all our flow-through cells we offer quick connect couplings to ensure sterile integration of our sensor products into your system. In case you need another solution, just contact our service team!

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

A pH sensor is attached to a color coded stick, which is delivered in a T-cell made of polycarbonate. A polymer optical fiber connects the sensor to a pH meter. This single-use FTC can be delivered either beta-irradiated or untreated.

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

- 1/4” x 1/4”, 3/8” x 3/8”, 1/2” x 1/2”

The pH sensor stick is incorporated in a flow-through cell of 1/4” x 1/4” size via Luer connector. The cell is integrated in the tubing with hose barb. The FTC-SU can be delivered either beta-irradiated or untreated.

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

<table>
<thead>
<tr>
<th>FTCSU-HP5</th>
<th>FTCSU-LG1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Specifications</strong></td>
<td><strong>Specifications</strong></td>
</tr>
<tr>
<td>Measurement range</td>
<td>pH 5.5 - 8.5</td>
</tr>
<tr>
<td>Resolution at pH = ?</td>
<td>± 0.02 pH</td>
</tr>
<tr>
<td>Accuracy**</td>
<td>± 0.05</td>
</tr>
<tr>
<td>Drift at pH = ?</td>
<td>&lt; 0.005 pH per day (sampling interval of 1 min., may differ depending on system set-up)</td>
</tr>
<tr>
<td>Measurement temperature range</td>
<td>From + 5 °C to + 50 °C</td>
</tr>
<tr>
<td>Response time [t90]***</td>
<td>&lt; 120 sec.</td>
</tr>
<tr>
<td><strong>Properties</strong></td>
<td><strong>Properties</strong></td>
</tr>
<tr>
<td>Compatibility</td>
<td>Aqueous solutions, ethanol (max. 10 % v/v), methanol (max. 10 % v/v), pH 2 -10</td>
</tr>
<tr>
<td>Cross-sensitivity</td>
<td>Reduced to ionic strength (salinity), a high concentration of small fluorescent molecules</td>
</tr>
<tr>
<td>Sterilization procedure****</td>
<td>Irradiation, Ethylene oxide (EtO)</td>
</tr>
<tr>
<td>Calibration</td>
<td>Sensor sticks [SST] are pre-calibrated; single-point calibration is recommended</td>
</tr>
<tr>
<td>Storage stability</td>
<td>18 months provided the sensor is stored in the dark</td>
</tr>
<tr>
<td>T-Cell formats</td>
<td>1/4” x 1/4”, 3/8” x 3/8”, 1/2” x 1/2” (Qosina)</td>
</tr>
</tbody>
</table>

*provided pH sensors are used without further handling and in physiological solution

**after single-point calibration at pH = ?

***equilibrated FTC with physiological solution and sufficient flow rate [min. 15 mL/min] at +37 °C

****recalibration may be required
pH Microsensors are miniaturized pH sensors designed for measuring in small volumes and with high spatial resolution. The sensor tip is in the range of 150 µm. The sensors are based on a 140 µm silica fiber which enables integration into various small scale environments. These sensors do not require reference electrodes and there is no leakage of electrolytes, a clear advantage over common electrodes.

- Integration into plant and animal tissue
- Measuring in smallest volumes
- Profiling of pH gradients
- High spatial resolution
- No need for reference electrodes
- Optimized for cell culture media and physiological solutions
- Independent of electromagnetic fields

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

pH Measurement in Plants and Animals
pH Microsensors can be implanted even in small animals. Due to the small size of the probes only a minimal disturbance will occur and new insights in physiological aspects can be obtained.

pH Measurement in Small Volumes
Due to the small dimension of the probe, pH measurements can be done in very small volumes – even in microtiter plates of a higher format like 384 or 1,536. There is no need for reference electrodes – a real step forward. Of course, the measurement is independent of electromagnetic fields – this even allows measuring in NMR spectrometers.

Measurement in Tumor Microenvironments
Medical research on pH levels in tumor microenvironments is technically quite challenging. The Manual Micromanipulator together with a needle-type pH Microsensor offer a simple and effective way to do so. The micromanipulator ensures exact localization of the sensor tip. With its small size the pH Microsensor allows on-the-spot measurements.

pH Microprofiling
For more information on our microprofiling range see page 20
Implantable pH Microsensor IMP-HP5

The IMP-HP5 is not mounted into any additional housing and therefore ideally suited for implementation in customized applications. The tiny probe has a tip size of 150 µm, while the outer diameter ranges from 150 µm to 900 µm. As the IMP-HP5 is free of metal (except for the connector), it can be used in the presence of high electromagnetic fields.

Needle-type pH Microsensor NTH-HP5

The NTH-HP5 is based on a 140 µm silica fiber which enables integration into manifold small scale environments. With its protective syringe needle housing it can easily penetrate tissue, septum rubber or packaging materials. Combined with the Manual Micromanipulator and its safe-insert function it can securely be located inside a semi-solid sample.

Profile Microsensor PM-HP5

Profiling Microsensors (PM) are the most robust microsensor version PreSens offers – with a firmer fiber construction and a splash-proof metal housing. They are specifically designed for profiling applications and should be used whenever minimally invasive measurements need to be performed, e.g. in sediments, microbial mats or biofilms. They are compatible with all PreSens micromanipulators.

Customized Microsensors

pH Microsensors can be implemented in a broad variety of customized housings. "Catheters" as well as special cannulas or needles will turn the pH Microsensor into the ideal tool for your customized application.

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

<table>
<thead>
<tr>
<th>Specifications*</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measurement range</strong></td>
<td>5.5 - 8.5 pH</td>
</tr>
<tr>
<td><strong>Resolution at pH = 7</strong></td>
<td>± 0.01 pH</td>
</tr>
<tr>
<td><strong>Accuracy at pH = 7</strong></td>
<td>± 0.1 pH with sensor calibration</td>
</tr>
<tr>
<td><strong>Drift at pH = 7</strong></td>
<td>&lt; 0.05 pH per day (sampling interval of 1 min., may differ depending on system set-up)</td>
</tr>
<tr>
<td><strong>Measurement temperature range</strong></td>
<td>From +5 °C to +50 °C</td>
</tr>
<tr>
<td><strong>Response time (t₉₀)</strong></td>
<td>30 sec.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Properties*</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compatibility</strong></td>
<td>Aqueous solutions, ethanol (max. 10 % v/v), methanol (max. 10 % v/v), pH 2 - 10</td>
</tr>
<tr>
<td><strong>No cross-sensitivity</strong></td>
<td>Electrical fields, proteins</td>
</tr>
<tr>
<td><strong>Cross-sensitivity</strong></td>
<td>Reduced to ionic strength [salinity]; a high concentration of small fluorescent molecules in the visible range can interfere</td>
</tr>
<tr>
<td><strong>Sterilization procedure</strong></td>
<td>Ethylene oxide (EtO), recalibration is recommended</td>
</tr>
<tr>
<td><strong>Cleaning procedure</strong></td>
<td>Water, Acrylan®, pepsin solution</td>
</tr>
<tr>
<td><strong>Calibration</strong></td>
<td>pH sensors are pre-calibrated; recalibration is possible</td>
</tr>
<tr>
<td><strong>Storage stability</strong></td>
<td>24 months provided the sensor is stored in the dark</td>
</tr>
</tbody>
</table>

*provided pH sensors are used without further handling and in physiological solutions

**stirred solution at +37 °C
The Automated and Manual Micromanipulators are specifically designed for profiling applications with PreSens microsensors. The systems allow moving the microsensor vibration-free in 3 axes with µm reading accuracy and enable exact localization of the sensor in the sample. Automated profiling can be performed along one dimension in µm resolution. Whenever insertion of a microsensor in semi-solid or hard substrates is required, the micromanipulators are the safest way to do it achieving highest accuracy, spatial resolution and stability.

- Vibration-free micromanipulation in 3D
- Fine drive with µm reading accuracy
- Safe-insert function
- Fully automated or manual system
- No electrical interferences due to optical measurement
- Adaptable to any sample
Examples for Applications

Profiling in Biological & Environmental Research

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

Microsensor Measurements in Medical & Life Science Research

PreSens microsensors are ideal tools for medical and life science research, as they allow for precise on the spot measurement and profiling inside tissue constructs. The Manual Micromanipulator is the indispensable equipment in these applications for exact localization of the microsensor inside the sample and profiling in step sizes down to 10 µm. PreSens needle-type microsensors are already used in several tissue engineering applications.

Profiling of Sediments & Biofilms

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

Microprofiling for Field Use

Microprofiling made easy. Use our microprofiling solutions for your next field excursion. With our battery powered transmitters you can work outdoors and indoors according to your needs with just one set-up. Our microprofiling equipment is the ideal tool to confirm your in vitro findings in situ.
### Manual Micromanipulator MM

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

### Automated Micromanipulator AM

The Automated Micromanipulator AM is specifically designed for microprofiling applications with the PreSens Profiling Microsensor (PM), and can also be operated with needle-type housed (NTH) and implantable (IMP) microsensors. The system allows moving the microsensor vibration-free with µm reading accuracy and enables exact localization of the sensor in the sample. Automated microprofiling can be performed along one dimension in µm resolution. The associated database-supported software PreSens Profiling Studio allows complete control of the AM and the respective oxygen, pH or CO₂ meter via USB. Different step zones, variable travel velocities and waiting times can be defined. The AM is compatible with all PreSens oxygen, pH and CO₂ transmitters.
Specifications

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatibility</td>
<td>Profiling (PM), needle-type housed (NTH) and implantable (IMP) oxygen, pH &amp; CO₂ microsensors</td>
<td>Profiling (PM), needle-type housed (NTH) and implantable (IMP) oxygen, pH &amp; CO₂ microsensors</td>
<td>Profiling (PM), needle-type housed (NTH) and implantable (IMP) oxygen, pH &amp; CO₂ microsensors</td>
</tr>
<tr>
<td>Dimensions</td>
<td>230 mm x 130 mm x 200 mm</td>
<td>160 mm x 90 mm x 190 mm</td>
<td>275 mm x 95 mm x 220 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>Weight with base plate: 1.1 kg</td>
<td>Weight with base plate: 1.1 kg</td>
<td>Weight of AM: 2.07 kg</td>
</tr>
<tr>
<td></td>
<td>Weight with base plate: 3.03 kg</td>
<td>Weight of AM: 2.07 kg</td>
<td>Weight of Heavy Stand: 14 kg</td>
</tr>
<tr>
<td>Travel range automated</td>
<td>-</td>
<td>-</td>
<td>x-axis: 75 mm</td>
</tr>
<tr>
<td>Travel range manual</td>
<td>x-axis: 37 mm, fine drive 10 mm</td>
<td>x-axis: 37 mm, fine drive 10 mm</td>
<td>x-axis: 37 mm, fine drive 10 mm</td>
</tr>
<tr>
<td></td>
<td>y-axis: 20 mm</td>
<td>y-axis: 20 mm</td>
<td>y-axis: 20 mm</td>
</tr>
<tr>
<td></td>
<td>z-axis: 25 mm</td>
<td>z-axis: 25 mm</td>
<td>z-axis: 25 mm</td>
</tr>
<tr>
<td>Reading accuracy</td>
<td>Coarse adjustment: 0.1 mm, Fine adjustment: 0.01 mm</td>
<td>Coarse adjustment: 0.1 mm, Fine adjustment: 0.01 mm</td>
<td>-</td>
</tr>
<tr>
<td>Coarse positioning</td>
<td>x-axis: 70 mm</td>
<td>x-axis: 70 mm</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>y-axis: -</td>
<td>y-axis: -</td>
<td>y-axis: -</td>
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<tr>
<td></td>
<td>z-axis: -</td>
<td>z-axis: -</td>
<td>z-axis: -</td>
</tr>
<tr>
<td>Rotatability</td>
<td>360°</td>
<td>360°</td>
<td>-</td>
</tr>
<tr>
<td>Resolution</td>
<td>Aluminium &amp; steel</td>
<td>Aluminium &amp; steel</td>
<td>Aluminium &amp; steel</td>
</tr>
<tr>
<td>Repeatability</td>
<td>-</td>
<td>-</td>
<td>&lt; 2.5 μm</td>
</tr>
<tr>
<td>Mounting adapter</td>
<td>M6 screw, 13 mm length</td>
<td>M6 screw, 13 mm length</td>
<td>M6 screw, 13 mm length</td>
</tr>
<tr>
<td>Power supply</td>
<td>-</td>
<td>-</td>
<td>100 - 240 VAC, 50/60 Hz. Use supplied power adapter (15 VDC, 21 mm center positive plug) only</td>
</tr>
<tr>
<td>Digital interface</td>
<td>-</td>
<td>-</td>
<td>USB interface (cable included)</td>
</tr>
<tr>
<td>Control software</td>
<td>-</td>
<td>-</td>
<td>PreSens Profiling Studio (compatible with Windows 7, 8, 10 at 32 or 64 bit)</td>
</tr>
</tbody>
</table>

PreSens Profiling Studio Software

This software enables control of the Automated Micromanipulator and connected oxygen, pH or CO₂ meter. PreSens Profiling Studio allows complete control with several step zones, variable travel velocity and waiting times of the AM. It is database supported and offers multiple features from clear data organization and export, annotations, easy creation of profiling templates, to different analysis functions.
SFR Shake Flask Reader & SFR vario

Online Monitoring of O₂, pH, Biomass & OUR — Easy Integration in any Shaking Incubator

The SFR Shake Flask Reader monitors oxygen, the oxygen uptake rate (OUR) and pH in up to 9 Erlenmeyer flasks, while the SFR vario can measure in one shake flask and additionally monitors biomass development 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 sensors.

- Simultaneous real-time measurement of O₂, OUR, pH, and biomass
- Wireless data transfer enables easy integration
- Compatible with standard shakers
- Pre-calibrated cultivation vessels are ready-to-use
- Glass & plastic flasks in different sizes available
- Contactless measurement through the flask bottom
- 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!
The SFR vario monitors oxygen, OUR, pH, and biomass 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.

Plastic & Glass Flasks with Integrated Sensors SFS

Shake flasks with integrated oxygen and pH 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.
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 is also possible. The SensorDish® Reader can be used in incubators and on shakers and is therefore the ideal tool for cell 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
SDR SensorDish® Reader Basic Set

The SDR Basic Set contains the SDR reader, software and all necessary cables to set up the system. 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.

HydroDish® (low and deep well)

These SensorDishes® are coated with pH sensors type HP8 and can be bought as 6- or 24-well dishes. Deep well dishes in 24-well format are available for shaken cultures as well. HydroDishes® are irradiated and pre-calibrated.
Fluorescent chemical optical sensor foils combined with imaging technology allow for easy 2D visualization of pH distributions in heterogeneous samples. For measurement the sample surface is covered with the sensor film, which translates the analyte content into a light signal. The sensor response is recorded pixel by pixel with a digital camera. With VisiSens™ A2 spatial and temporal changes of pH-values can be monitored.

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

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

Spatial and Temporal pH Dynamics in Plants and Soil

pH plays a crucial role in plant and soil processes. Determining the best cultivation conditions for optimal growth is of major importance for sustainable agriculture, as e. g. water supply and fertilizing could be adjusted for the respective crop plant. This planar optical sensor technique allows non-invasive readout of pH through glass walls of rhizotrons and visualizes pH dynamics in complex root systems and the surrounding soil. The acquired pH maps for distinct root regions are quantitative and have a resolution in sub-millimeter range.

Visualizing pH in Sediments

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

pH Gradients in Microfluidics

pH surveillance within microfluidics is a challenging issue. Liquid quantities available are limited and mostly inaccessible for measuring. Absence of turbulent mixing can quickly build up pH gradients and makes single-point measurements rather unreliable for describing the state in the whole system. Via VisiSens™ sensor foils mounted within microfluidics, pH can be monitored spatially and temporally, gradients can be detected and pH can be quantitatively determined.
Optical pH Sensors & Meters

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

VisiSens™ Detector Unit DU02
The detector unit DU02 is a spectral 2D detection device for pH imaging. It is designed for read-out of fluorescent optical sensor foils. The device is portable and connected via USB2.0 to a PC / notebook for measurement. For fields of view from microscopic to 3.6 x 3.0 cm².

VisiSens™ TD
The VisiSens TD Basic System is a modular 2D read-out unit for O₂, pH and CO₂ sensor foils, even simultaneously in one experiment. The field of view ranges from 4 x 3 cm² to 8 x 6 cm² or up to 20 x 30 cm² with the Big Area Kit.

pH Sensor Foils SF-HP5R & SF-LV1R
The pH sensor foils can be attached to any sample surface or the inner surface of any transparent glass or plastic vessel. pH is measured contactless. The sensor foil measures in liquids. SF-HP5R sensor foils have a measuring range of pH 5.5 – 7.5, SF-LV1R from pH 2.5 - 4.5

VisiSens™ AnalytiCal 2
Software for recording and evaluation of data obtained by the VisiSens™ pH imaging set-up.

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

### VisiSens® Detector Unit DU02

<table>
<thead>
<tr>
<th></th>
<th>SF-LV1R</th>
<th>SF-HPSR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Specifications</strong>&lt;sup&gt;*&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement range</td>
<td>pH 2.5 - 4.5</td>
<td>pH 5.5 - 7.5</td>
</tr>
<tr>
<td>Response time (&lt;t&lt;sub&gt;90&lt;/sub&gt;)&lt;sup&gt;**&lt;/sup&gt;</td>
<td>&lt; 30 sec.</td>
<td>&lt; 30 sec.</td>
</tr>
<tr>
<td>Size of sensor foil&lt;sup&gt;**&lt;/sup&gt;</td>
<td>40 x 40 mm&lt;sup&gt;2&lt;/sup&gt; to 100 x 150 mm&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Number of sensing points within one image&lt;sup&gt;**&lt;/sup&gt;</td>
<td>300,000</td>
<td></td>
</tr>
<tr>
<td>Measurement temperature range</td>
<td>From + 5 °C to + 45 °C</td>
<td></td>
</tr>
<tr>
<td><strong>Properties</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compatibility</td>
<td>Aqueous solutions, pH 2 - 9, ethanol [max. 10 % v/v]</td>
<td></td>
</tr>
</tbody>
</table>

**Camera chip**
- Enhanced Color CMOS

**Image resolution**
- 1.3 megapixel (1280 x 1024 pixels)

**Magnification**
- 10-fold up to 220-fold, depending on adapter tubus used

**Field of view**
- ~2.3 x 2.0 mm<sup>2</sup> to ~4.1 x 3.3 cm<sup>2</sup>; typically ~1.5 x 1.2 cm<sup>2</sup>

**Output**
- 15 fps live video preview [no storage] and 0.5 fps full-resolution picture storage [png]

**Number of LEDs**
- 8

**Dimensions**
- Length 10 cm, diameter 3.8 cm

**Weight**
- 0.17 kg [without adapter tubus]

**Material**
- All-aluminum housing

**Digital interface**
- USB 2.0, high speed USB transmission

<sup>*VisiSens™ is no approved medical device</sup>

<sup>**Typical data which may strongly differ with adapting the imaging set-up to specific needs</sup>

### VisiSens® TD

<table>
<thead>
<tr>
<th></th>
<th>SF-LV1R</th>
<th>SF-HPSR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Specifications</strong>&lt;sup&gt;*&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement range</td>
<td>pH 2.5 - 4.5</td>
<td>pH 5.5 - 7.5</td>
</tr>
<tr>
<td>Response time (&lt;t&lt;sub&gt;90&lt;/sub&gt;)&lt;sup&gt;**&lt;/sup&gt;</td>
<td>&lt; 30 sec.</td>
<td>&lt; 30 sec.</td>
</tr>
<tr>
<td>Size of sensor foil&lt;sup&gt;**&lt;/sup&gt;</td>
<td>40 x 40 mm&lt;sup&gt;2&lt;/sup&gt; to 150 x 100 mm&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Precision [temporal]&lt;sup&gt;***&lt;/sup&gt;</td>
<td>± 0.01 pH at pH 4</td>
<td>± 0.01 pH at pH 7</td>
</tr>
<tr>
<td>Precision [spatial]&lt;sup&gt;****&lt;/sup&gt;</td>
<td>± 0.1 pH at pH 4</td>
<td>± 0.1 pH at pH 7</td>
</tr>
<tr>
<td>General sensor temperature working range</td>
<td>from + 5 °C to + 45 °C</td>
<td></td>
</tr>
<tr>
<td><strong>Properties</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compatibility</td>
<td>Aqueous solutions, pH 2 - 9, 10 % ethanol</td>
<td></td>
</tr>
</tbody>
</table>

**Camera chip**
- CCD Progressive with 12 bit ADC

**Image resolution**
- 1.3 megapixel (1292 x 964 pixels)

**Field of view**
- ~4 x 3 cm<sup>2</sup> to ~8 x 6 cm<sup>2</sup>; up to 30 x 20 cm<sup>2</sup> with Big Area Imaging

**Output**
- up to 15 fps live video preview [no storage] and 0.5 fps full-resolution picture storage [png]

**Digital interface**
- Ethernet with power injection (via AC adapter)

<sup>*Prototype component. Please contact our service team!</sup>

<sup>**Typical data which may strongly differ with adapting the imaging set-up to specific needs</sup>

<sup>***Typical data of accuracy in a defined ROI (~6,000 pixels) over time in dark lab conditions at + 20 °C, FoV 8 cm x 6 cm; strongly depends on used sensor foil batch</sup>

<sup>****Typical data of spatial standard deviation in defined ROI (~6,000 pixels) in dark lab conditions at + 20 °C, FoV 8 cm x 6 cm</sup>
Accessories for Optical pH Sensors & Meters

Extensions and Add-ons for pH Measurement

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

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

Is your application missing? Contact us and we find your customized solution!
<table>
<thead>
<tr>
<th>Specifications</th>
<th>POF</th>
<th>Coaster for Shake Flasks (CFG)</th>
<th>Centrifuge Tube Adapter (CTA)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compatibility</strong></td>
<td>All devices with SMA connectors</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>Optical diameter is 2 mm; outer diameter including the black cladding is approx. 2.8 mm</td>
<td>Approx. 93 mm x 41 mm x 16 mm</td>
<td>Approx. 65 mm x 40 mm x 65 mm</td>
</tr>
<tr>
<td><strong>Length of fiber</strong></td>
<td>Available lengths for the POF are 1.0, 2.5 and 5.0 m (for lengths of more than 5 m, please contact our service team)</td>
<td>2.5 m</td>
<td>2.5 m</td>
</tr>
<tr>
<td><strong>Connector type</strong></td>
<td>SMA connectors on one or both sides available for use with SOA and ARC</td>
<td>SMA socket</td>
<td>SMA socket</td>
</tr>
<tr>
<td><strong>Details</strong></td>
<td>Temperature stability: The POF is resistant to temperatures up to + 70 °C</td>
<td>Compatible with shake / culture flasks up to 1 L</td>
<td>Compatible with culture tubes of 50 mL volume</td>
</tr>
</tbody>
</table>

**Adapter for Round Containers (ARC)**

<table>
<thead>
<tr>
<th>Specifications</th>
<th>All devices with SMA connectors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dimensions (D x W x H)</strong></td>
<td>Velcro© strip 1000 mm x 22 mm x 4 mm</td>
</tr>
<tr>
<td><strong>Connector type</strong></td>
<td>SMA socket</td>
</tr>
</tbody>
</table>

**FTC-SU-Pt100 Temperature Sensor**

<table>
<thead>
<tr>
<th>Specifications</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outer diameter</strong></td>
<td>Luer T-cell (delivered); inner diameter 5 mm, cell volume 0.3 mL</td>
</tr>
<tr>
<td><strong>Integration length</strong></td>
<td>15 mm</td>
</tr>
<tr>
<td><strong>Cable length</strong></td>
<td>2 m</td>
</tr>
<tr>
<td><strong>Cable coating</strong></td>
<td>Silicone</td>
</tr>
</tbody>
</table>

**Polymer Optical Fiber POF**

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

**FTC-SU-Pt100**

Enables continuous measurement of temperature in perfusion systems. Irradiated, ready to use versions available. Ideal in combination with FTC-SU for DO, pH and CO2.

**Centrifuge Tube Adapter CTA**

For centrifuge tubes of 50 mL volume with integrated, pre-calibrated O₂ & pH sensors.

**Adapters ARC & SOA**

The adapter for round containers ARC and stick-on adapter SOA are used to attach the polymer optical fiber (POF) to a container opposite the sensor spot. The ARC is suitable for round containers, the SOA for planar transparent surfaces.

**Coaster CFG**

Allows convenient read-out of sensor spots integrated at the container bottom.

**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.
# Product Matrix

<table>
<thead>
<tr>
<th>Sensors</th>
<th>Meters</th>
<th>Multi-Parameter Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pH-1 SMA</td>
<td>EDM-pH-mini</td>
</tr>
</tbody>
</table>

## Non-invasive pH Sensors
- pH Nice Port
- SP-LG1-SA

## pH Flow-through Cells
- FTC-SU-HP5 [standard, 1/4” x 1/4”, 3/8” x 3/8”, 1/2” x 1/2”]
- FTC-SU-LG1 [standard, 1/4” x 1/4”, 3/8” x 3/8”, 1/2” x 1/2”]

## pH Microsensors
- PM-HP5
- NTH-HP5
- IMP-HP5

## Disposables with integrated pH Sensors
- SFS-HP5-PSt3 [Shake Flask]
- SPS-HP5-PSt3 [Spinner Flask]
- iTube pH

## Sensor Foils for Imaging
- SF-HP5R
- SF-LV1R

Is your application missing? Contact us and we find your customized solution!
<table>
<thead>
<tr>
<th>Imaging</th>
<th>Accessories</th>
<th>Profiling</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VisiSens™ A2</strong></td>
<td>Detector Unit DU02</td>
<td></td>
</tr>
<tr>
<td></td>
<td>POF</td>
<td>ARC</td>
</tr>
<tr>
<td></td>
<td>x</td>
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<td></td>
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</table>
Product Range

Meters

**pH-1 SMA**
Fiber optic pH meter for use with pH sensor spots and FTCs

**EOM-pH-mini**
The EOM-pH-mini is a precise OEM solution for pH sensor spots and FTCs.

**pH-1 micro**
Micro fiber optic pH meter for use with pH Microsensors

Systems

**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 CO₂ monitoring in shake flasks, T-flasks, and culture tubes

**SDR SensorDish® Reader Basic Set**
Non-invasive online culture monitoring of oxygen & pH in multiwell plates

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

**pH Sensor Spots SP-HP5**
The most versatile version of non-invasive pH sensors

**pH Nice Port**
Port with pH sensor for customized application in cultivation bags

**Single-use pH Flow-through Cells for Different Flow Rates**
T-Cells of 1/4" x 1/4", 3/8" x 3/8", 1/2" x 1/2" size with integrated pH Sensor Stick

**Implantable pH Microsensor IMP-HP5**
Bare fiber microsensor without additional housing

**Spinne r Flask with Integrated Sensor SPS-HP5-PSt3**
Spinner flask with integrated pH & O₂ sensors for contactless culture monitoring

**HydroDish® (low well) HD6 / HD24**
Multidish with integrated pH sensors available in 6- or 24-well format, irradiated and pre-calibrated

**Deep Well HydroDishes® HD24-DW**
For shaken applications, available with pH sensors in 24-well format

**Self-adhesive pH Sensors SP-HP5-SA & SP-LG1-SA**
Easy sensor integration for contactless pH monitoring

**Single-use pH Flow-through Cells FTC-SU-HP8**
Online monitoring in perfusion systems; single-use FTCs for various flow rates

**Needle-type pH Microsensor NTH-HP5**
This pH Microsensor is protected by its robust housing.

**Profiling pH Microsensor PM-HP5**
Metal housed microsensor with extendable fiber & mechanical interlock for profiling applications

**Sensor Flasks SFS-HP5-PSt3**
Plastic or glass flasks with integrated pH and O₂ sensors, available with or without baffles in sizes from 125 mL up to 5 L

**OxoHydroDish OHD6**
Multidish with integrated oxygen and pH sensors available in 6-well format

**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.
Optical pH Sensors & Meters

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

Profiling Solutions

**Manual Micromanipulator MM**
Vibration-free, high-resolution control for pH microsensors and dipping probes

**Manual Micromanipulator MM33**
Vibration-free, high resolution control for oxygen microsensors

**Automated Micromanipulator AM**
Fully automated, high-resolution control for pH microsensors and dipping probes

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

**Heavy Stand**
The Heavy Stand ensures safe vertical mounting and operation of the Micromanipulators.

**Transport Case**
High-quality travel case for one AM and one Heavy Stand

Imaging Solutions

**Detector Unit DU02**
Detection device for pH imaging

**VisiSens™ TD**
Modular imaging detector unit that can be equipped with various imaging modalities for read-out of O₂, pH or CO₂ sensor foils

**pH Sensor Foils SF-HP5R & SF-LV1R**
Sensor for pH imaging in a range of pH 5.5 – 7.5 (SF-HP5R) and pH 2.5 - 4.5 (SF-LV1R)

**Adapter Tubes**
Tubes in different sizes to adjust the field of view

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

**Polymer Optical Fiber POF**
They serve as a versatile connection from meter to sensor.

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

**Adapter for Round Containers ARC**
The ARC is used for round containers with a diameter of 2.5 to 20 cm (1 – 8 inches).

**Integration Set for Sensor Spots IS-SP**
Vacuum tweezers for easy integration of self-adhesive sensor spots

**Coaster CFG**
Allows convenient read-out of sensor spots integrated at the container bottom

**FTC-SU-Pt100**
For continuous measurement of temperature in perfusion systems

**Centrifuge Tube Adapter CTA**
For centrifuge tubes of 50 mL volume with integrated, pre-calibrated O₂ & pH sensors

**Sterile Integration**
Quick connect couplings to ensure sterile integration of our sensor products into your system

**iTube Adapter**
Can be mounted on SFR or SFR vario for online culture monitoring inside cell culture tubes with integrated sensors (iTubes)
Discover the complete PreSens portfolio

Products
- Optical Oxygen Sensors & Meters
- Optical pH Sensors & Meters
- Optical CO₂ Sensors & Meters
- Optical Sensor Systems
- VisiSens™ Imaging Systems
- OEM Solutions & Engineering

Industries
- Biology & Environmental
- Industry & Technical
- Biotech & Pharma
- Medical & Life Sciences
- Food & Beverage

Bring to light what’s inside.

PreSens comes from PRECISION SENSING and offers:
- precise and simple measurement of O₂, pH, CO₂ and biomass
- systems for Pharma, Biotech, Food & Beverage, Biological & Environmental Research, Technical or Industrial Applications and Medical Devices
- sensors thinner than a hair, non-invasive and online
- optimum advice and support
- more than 1,000 items in stock
- prompt delivery worldwide

Ask our experts:
PreSens Precision Sensing GmbH
Am BioPark 11
93053 Regensburg, Germany
Phone +49 941 942 72 100
Fax +49 941 942 72 111
info@PreSens.de

www.PreSens.de