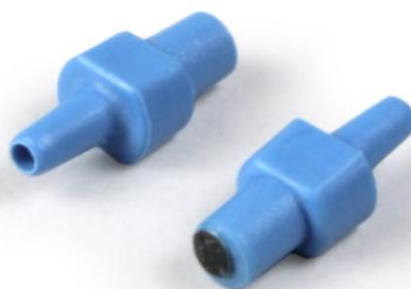


# O<sub>2</sub> SensorPlug SPL-ML-PSt7

SENSOR PROBES

○ Instruction Manual





# O2 SensorPlug

Specification:

## SensorPlug based on Mini Luer for O<sub>2</sub> monitoring in milli- & microfluidics

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# 1 Preface

You have chosen a new, innovative technology for measuring oxygen.

Chemical optical sensors (also called optodes) have several important features:

- They are small.
- Their signal does not depend on the flow rate of the sample.
- They can be physically divided from the measuring system which allows a non-invasive measurement.
- They can be used in disposables.

Therefore, they are ideally suited for the examination of small sample volumes, for highly parallelized measurements in disposables, and for biotechnological applications. A set of different minisensors, flow-through cells and integrated sensor systems is available to make sure you have the sensor which matches your application.

Please feel free to contact our service team to find the best solution for your application.

Your PreSens Team

**PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY BEFORE WORKING WITH THIS ITEM.**

## 2 Description of the O<sub>2</sub> SensorPlug

The SensorPlug for O<sub>2</sub> is based on a color coded Mini Luer (blue = O<sub>2</sub>) which is carrying a sensor spot of about 2 mm on the tip. The SensorPlug is inserted in an appropriate port on your chip so the spot is in contact with your sample inside the channel (please contact our service team for design details). The channel diameter has to be at least 2 mm at this position so the complete spot is in contact with the sample. When inserted, the SensorPlug is sealing the port and the tip carrying the sensor is slightly protruding into the channel. A polymer fiber connects the SensorPlug to the respective measurement device (e.g. Oxy-1ST). SensorPlugs come pre-calibrated and beta irradiated.



**Fig. 1** O<sub>2</sub> SensorPlug SPL-ML-PSt7

### 2.1 Scope of Delivery

The SPL-ML-PSt7 are double-packed. They are delivered in units of 10 plugs in a transparent plastic box (to enable unpacking of irradiated SensorPlugs in cleanroom environment) which is again packed in a lightproof packaging (to protect the sensor material).



**Fig. 2** Packed O<sub>2</sub> SensorPlugs.



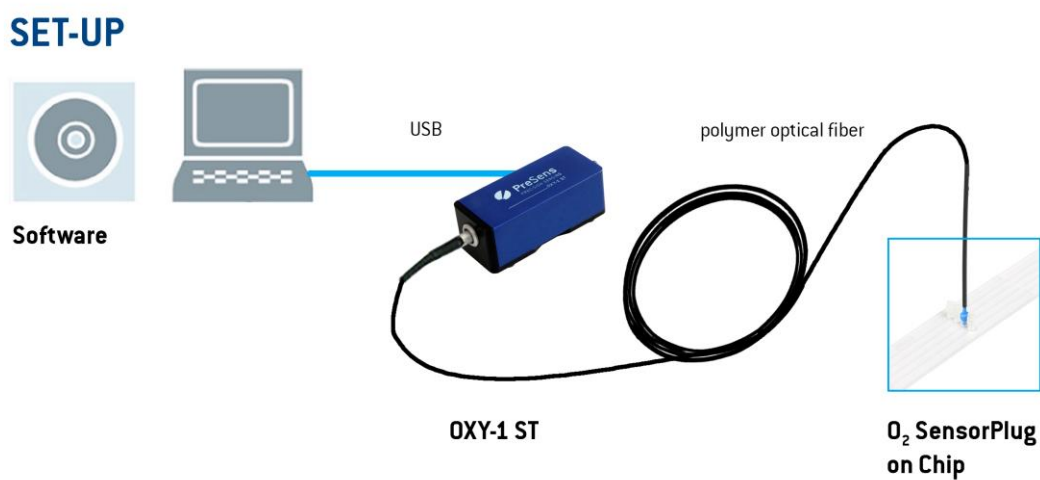
The respective polymer optical fiber has to be ordered separately.



**Additionally required equipment (not supplied):**

- Polymer optical fiber (POF) with ST connector on one side, and an uncovered ending with polymer sleeve, length 2.5 m (for other lengths, please contact our service team)
- Fiber optic oxygen transmitter, OXY-1 ST
- PC / Notebook
- Microfluidic chip with an appropriate port

## 2.2 Measurement Set-up



**Fig. 3** Set-up for measurement with the SPL-ML-PSt7

A polymer optical fiber, which is connected to an oxygen transmitter, is attached to the SPL-ML-PSt7. The SensorPlug is inserted in the port on your microfluidic chip.

## 3 Operation

### 3.1 Unpacking the O<sub>2</sub> SensorPlugs

The SPL-ML-PSt7 is delivered in a lightproof packaging to ensure a long shelf-life, so do not open this packaging immediately at delivery. It is recommended to unpack the SensorPlugs just before using it.

- ! Take care when opening the lightproof packaging with scissors. Cut close to the welding seam of the packaging, not to damage the plastic box inside.



Fig. 4 Opening the lightproof outer packaging.



Inner packaging: 10 O<sub>2</sub> SensorPlugs in a plastic box

- ! If you want to use the irradiated SensorPlug in cleanroom environments, open the plastic box with the plugs in a laminar flow box, or in a similar controlled environment, and wear gloves!

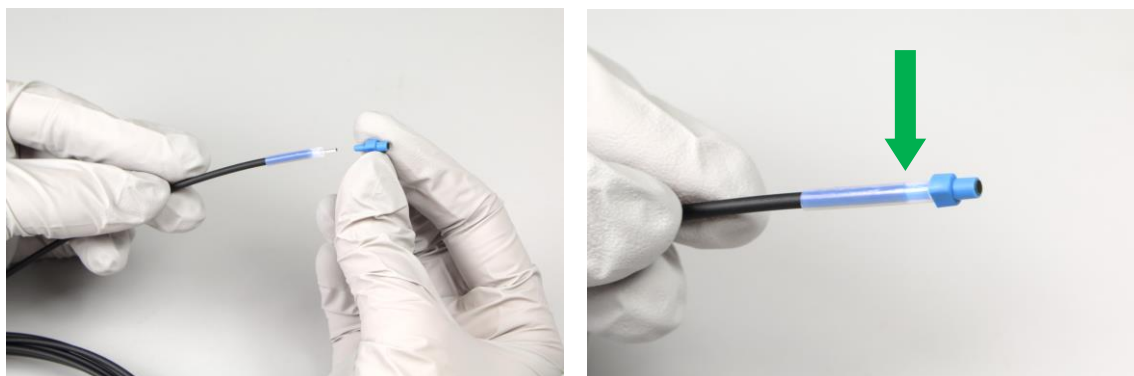
### 3.2 Connecting the SPL-ML-PSt7

The SPL-ML-PSt7 can be integrated in a port on your chip.

When the SPL is integrated, the chip is closed and the polymer optical fiber can be attached.

- ! Do not attach the polymer optical fiber before closing the flow path, if you want to avoid contamination; the fiber is not irradiated.

Insert the uncoated end of the fiber into the socket of the SensorPlug until the SPL touches the edge of the black fiber coating.



**Fig. 5** Insert the uncoated end of the fiber in the SPL until the plug touches the black fiber coating.

- ! Do not remove the polymer sleeve but place it over the junction to avoid breaking the fiber by leverage effects.

Connect the polymer optical fiber to the ST connector on the front panel of your oxygen transmitter.

Medium can be pumped through the chip now.

## 3.3 Calibration

The SPL-ML-PSt7 is delivered pre-calibrated. The enclosed Final Inspection Protocol contains the calibration values, which have to be entered in the respective oxygen meter software. (Please see the respective O<sub>2</sub> meter or software instruction manual for more detailed information on calibration.)

The oxygen sensor on the SPL requires no re-calibration up to 100,000 measurement points. In case a recalibration of the SPL is required, a conventional two-point calibration in oxygen-free environment (nitrogen or sodium sulfite), and air saturated environment has to be performed.

### 3.3.1 Preparation of Calibration Standards

1st Calibration Point:

- Oxygen-free water

To prepare oxygen-free water dissolve 1 g of sodium sulfite (Na<sub>2</sub>SO<sub>3</sub>) and 50 µL cobalt nitrate (Co(NO<sub>3</sub>)<sub>2</sub>) standard solution (ρ(Co) = 1000 mg/L; in nitric acid 0.5 mol/L) in 100 mL water. Use a suitable vessel with a tightly fitting screw top and label it **cal 0**. Make sure there is only little headspace in your vessel. Due to a chemical reaction of oxygen with the Na<sub>2</sub>SO<sub>3</sub> the water becomes oxygen-free. Additional oxygen, diffusing from air into the water, is removed by surplus Na<sub>2</sub>SO<sub>3</sub>. Close the vessel with the screw top and shake it for approximately one minute to dissolve Na<sub>2</sub>SO<sub>3</sub> and to ensure that the water is oxygen-free. To prepare oxygen-free water you also can use sodium dithionite (Na<sub>2</sub>S<sub>2</sub>O<sub>4</sub>).

For storing the calibration solution **cal 0** keep the vessel closed after calibration with a screw top to minimize oxygen contamination. The shelf life of **cal 0** is about 24 hours provided that the vessel has been closed with the screw top.

2nd Calibration Point:

- Air-saturated water

Add 100 mL water to a suitable vessel and label it **cal 100**. To obtain air-saturated water, blow air into the water using an air-pump with a glass-frit (air stone), creating a multitude of small air bubbles, while stirring the solution. After 20 minutes, switch of the air-pump and stir the solution for another 10 minutes to ensure that the water is not supersaturated.

### 3.3.2 Calibration Procedure

For instructions and further information on software settings and handling see the respective O<sub>2</sub> meter or software manual!



**Fig. 6** Calibration set-up: The SPL is connected to the oxygen meter and held into a vessel with calibration solution.

Connect the SPL with the polymer optical fiber to your oxygen meter. Dip the plug into the vessel containing the calibration solution **cal 100** (air saturated water). Make sure there are no air bubbles on the sensor. (If you want to use automatic temperature compensation, connect the temperature sensor to the respective connector on the oxygen meter and put it into the calibration vessel, see Fig. 6.)

Wait for about 3 minutes until the phase angle and temperature value displayed in the software are constant (the variation of the phase angle and temperature should be smaller than  $\pm 0.2^\circ$  and  $\pm 0.2^\circ\text{C}$ , respectively).

To record the second calibration value, oxygen-free water, dip the SPL into the vessel containing the calibration solution **cal 0**. Again make sure that there are no air bubbles on the sensor tip. (If you want to use automatic temperature compensations, transfer the temperature sensor to the calibration vessel with **cal 0**).

Wait for about 3 minutes until the phase angle and temperature value displayed in the software or on your oxygen meter are constant (the variation of the phase angle and temperature should be smaller than  $\pm 0.2^\circ$  and  $\pm 0.2^\circ\text{C}$ , respectively).

After calibration the SensorPlug has to be cleaned from sodium sulfite by rinsing it with water (or ethanol 70 % (v/v)).

## 4 Technical Data

Specifications	Gaseous & Dissolved O <sub>2</sub>	Dissolved O <sub>2</sub>
Measurement range	0 – 100 % O <sub>2</sub> 0 – 1000 hPa	0 – 45 g/mL 0 – 1400 µmol/L
Limit of detection	0.03 % oxygen	15 ppb
Resolution	± 0.01 % O <sub>2</sub> at 1 % O <sub>2</sub> ± 0.05 % O <sub>2</sub> at 20.9 % O <sub>2</sub>	± 0.005 mg/L at 0.4 mg/L ± 0.025 mg/L at 9.06 mg/L
Accuracy at + 20 °C*	± 0.05 % O <sub>2</sub> or ± 3 % rel.	
Response time (t90)	< 6 sec.	< 40 sec.
Compatible O <sub>2</sub> meters	OXY-1 ST (trace), OXY-4 ST (trace), Microx 4 (trace)	
<b>Properties</b>		
Compatibility	Aqueous solutions, ethanol, methanol	
No cross-sensitivity	pH 1 – 14, CO <sub>2</sub> , H <sub>2</sub> S, SO <sub>2</sub> , ionic species	
Cross Sensitivity	Organic solvents, such as acetone, toluene, chloroform or methylene chloride; chlorine gas	
Cleaning procedure	Ethylene oxide (EtO), beta irradiation  Water, ethanol 70 % (v/v)	
Calibration	SPL are pre-calibrated Two-point calibration in oxygen-free environment (nitrogen, sodium sulfite) and air-saturated environment	
Storage Stability	60 months provided the sensor material is stored in the dark at room temperature	
Plug type	Male Mini Luer fluid connector	

\*after two-point calibration

## 5 Concluding Remarks

Dear Customer,

With this manual, we hope to provide you with an introduction to work with the O<sub>2</sub> SensorPlug (SPL-ML-PSt7).

This manual does not claim to be complete. We are endeavored to improve and supplement this version.

We are looking forward to your critical review and to any suggestions you may have.

You can find the latest version at [www.PreSens.de](http://www.PreSens.de).

With best regards,

Your PreSens Team



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