SENSOR PROBES

Single-Use Flow-Through Cell O_2 FTC-SU-PSt3

Instruction Manual

PreSens
PRECISION SENSING

Single-Use Flow-Through Cell O_2 FTC-SU-PSt3

Specification:

O_2 sensor stick integrated in a single-use flow-through cell

Document filename: IM_FTC-SU-PSt3_dv2

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Table of Contents

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 Single-Use Flow-Through Cell O_2

The single-use flow-through cell O_2 (FTC-SU-PSt3) comprises a miniaturized chemical optical sensor integrated in a disposable flow-through cell. The sensor is fixed to a color coded stick (sensor stick = SST; blue = oxygen), which can be attached to flow-through cells of different size and shape (via Luer connector), according to requirements. It is delivered with a disposable T-cell made of polycarbonate, which can be easily connected to external tubing via Luer-Lock adapters. A polymer optical fiber connects the sensor inside the flow-through cell to the respective measurement device (e. g. Fibox 4). The single-use flow-through cells can be delivered beta-irradiated (FTC-SU-PSt3-S) or untreated (FTC-SU-PSt3-US).

Fig. 1 Single-use flow-through cell O_2 (FTC-SU-PSt3)

2.1 Scope of Delivery

The FTC-SU-PSt3 is double-packed. It is delivered in a transparent plastic bag (to enable unpacking of irradiated FTCs under sterile conditions) which is again packed in a lightproof packaging (to protect the sensor material).

Fig. 2 Packed single-use flow-through cell O2.

The respective polymer optical fiber has to be ordered separately.

Additionally required equipment (not supplied):

- Polymer optical fiber (POF); with SMA connector on one side, available lengths 1.0, 1.5, and 5.0 m (for lengths of more than 5 m, please contact our service team)
- Fiber optic oxygen transmitter, e. g. Fibox 4 (more oxygen meters can be found on www.presens.de/products/o2/meters.html)
- PC / Notebook
- If your application requires a T-cell with other inner diameter or of other design, you can integrate the sensor stick in another cell as well. The flow-through cell must have a Luer connector, so the sensor stick can be properly attached! Supplier for such cells compatible with the sensor stick is e. g. Qosina (Part Numbers in the 2014 catalogue: 27222 - 27227, 60134 – 60136).

2.2 Measurement Set-up

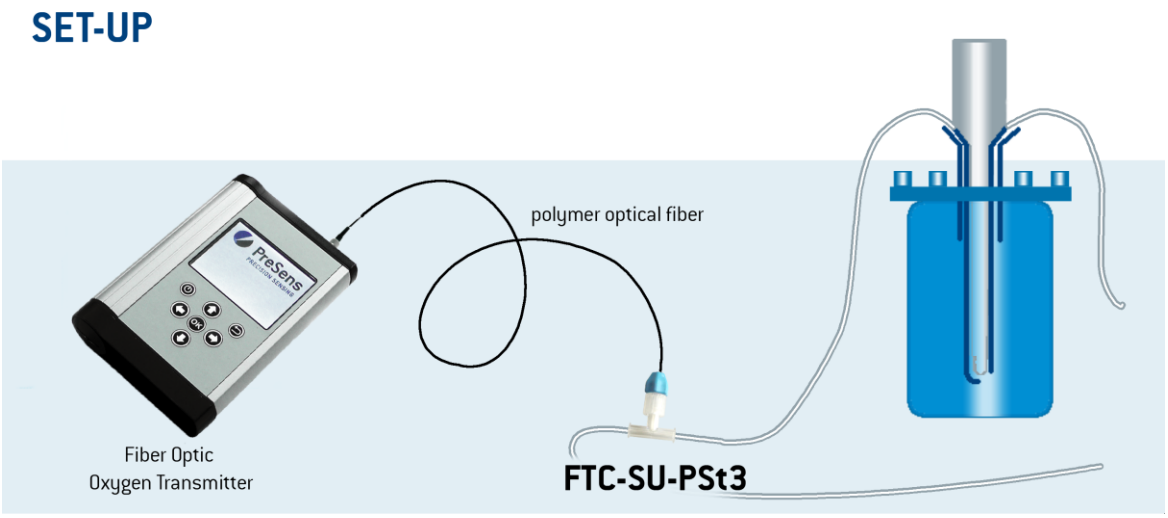

Fig. 3 Set-up for measurement with the FTC -SU-PSt3

A polymer optical fiber, which is connected to an oxygen transmitter, is attached to the FTC-SU-PSt3. The FTC-SU-PSt3 is integrated in the flow path of a perfusion reactor or the bypass of a reactor.

3 Operation

3.1 Unpacking the FTC-SU-PSt3

The FTC-SU-PSt3 is delivered in lightproof packaging to ensure a long shelf-life, so do not open this packaging immediately at delivery. It is recommended to unpack the FTC just before using it.

! Take care when opening the lightproof packaging with scissors, especially when handling irradiated FTCs. Cut close to the welding seam of the packaging, not to cut into the inner plastic bag.

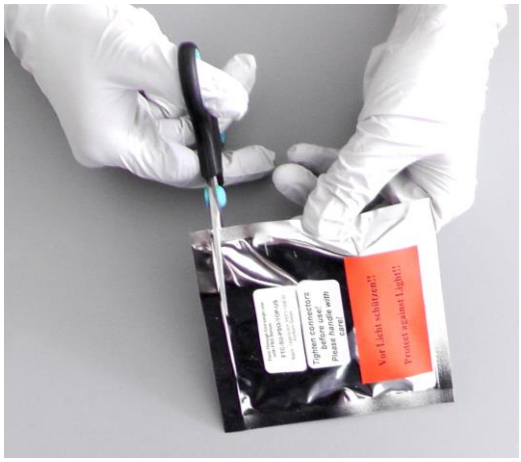

Fig. 4 Opening the lightproof outer packaging.

Inner packaging: FTC in transparent plastic bag.

! If your FTC-SU-PSt3 is delivered irradiated open the inner plastic bag with the FTC components in a laminar flow box, or in a similar controlled environment, and wear gloves!

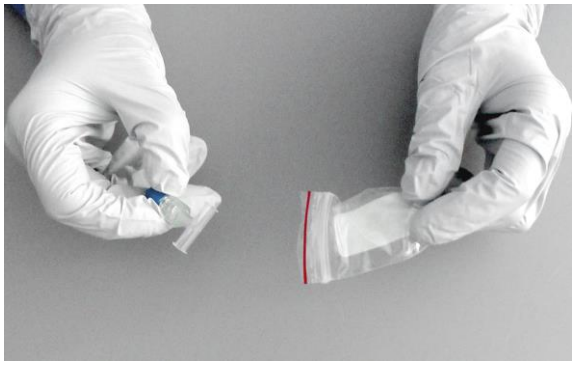

Fig. 5 FTC-SU-PSt3: the sensor stick is attached to a disposable T-cell.

3.2 Assembling and Connecting the FTC-SU-PSt3

If you want to use the sensor stick (SST) with another flow-through cell than the T-cell it is delivered with, you can simply remove it from the T-cell by turning it counter-clockwise at the Luer connector. Now you can attach the sensor stick to a flow-through cell of your choice. Make sure it is attached firmly, but do not use force when connecting the parts.

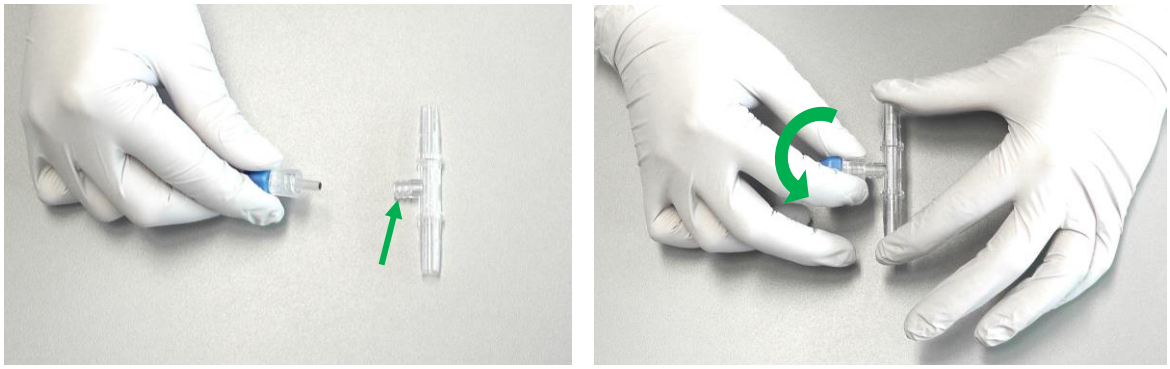

Fig. 6 Connecting the sensor stick (SST) to a flow-through cell.

The FTC-SU-PSt3 can be integrated in the flow path of your perfusion system. According to your tube size you can use end caps (Luer-Lock adapter). Attach the tubes at the inlet and outlet of the FTC.

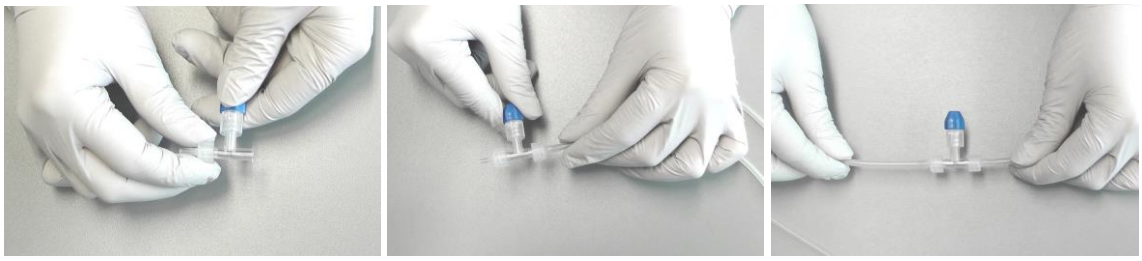

Fig. 7 Connecting the FTC with the tubes of the perfusion system (using Luer-Lock adapter).

When the FTC is connected and the flow path is closed, 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.) Loosen the blue cap on the sensor stick. Then insert the polymer optical fiber in the sensor stick until stop, and fasten it with the blue cap by turning the cap clockwise.

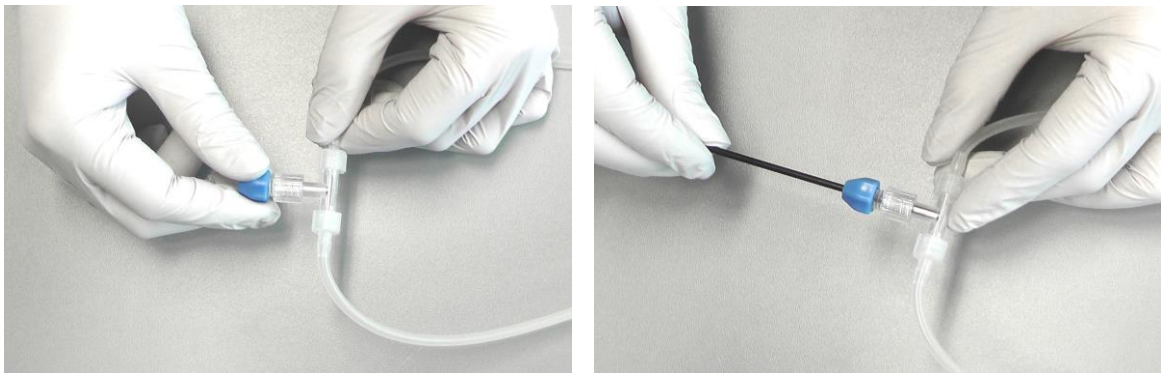

Fig. 8 Loosen the blue cap and insert the polymer optical fiber until stop; then fasten the blue cap again.

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

! Please check the connection before using the FTC and tighten it again if necessary, but without using force!

Fig. 9 Tighten the connections before use!

Medium can be pumped through the FTC-SU-PSt3 now.

3.3 Calibration

The FTC-SU-PSt3 is delivered pre-calibrated. The enclosed Final Inspection Protocol contains the calibration values, which have to be entered in the respective oxygen meter menu or the respective transmitter software. (Please see the respective transmitter instruction manual for more detailed information on calibration.)

The oxygen sensor inside the FTC requires no re-calibration up to 100,000 measurement points.
In case a recalibration of the FTC-SU-PSt3 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_2SO_3) and 50 µL cobalt nitrate ($Co(NO_3)_2$) 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_2SO_3 the water becomes oxygen-free. Additional oxygen, diffusing from air into the water, is removed by surplus Na_2SO_3. Close the vessel with the screw top and shake it for approximately one minute to dissolve Na_2SO_3 and to ensure that the water is oxygen-free. To prepare oxygen-free water you also can use sodium dithionite ($Na_2S_2O_4$).

  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 transmitter manual!

Fig. 10 Calibration set-up: The FTC-SU-PSt3 is connected with tubing to a container with calibration solution and to a syringe.

Connect one side of the FTC with a plastic tube. The tube is dipped into the vessel containing the calibration solution **cal 100** (air saturated water). Then connect a syringe – using a small piece of tube – to the opposite side (see Fig. 10). Fill the flow-through cell with **cal 100** by slowly pulling the syringe plunger (see Fig. 11). Make sure there are no air bubbles inside the T-cell. (If you want to use automatic temperature compensation, connect the temperature sensor to the respective connector on the oxygen meter, put it into the calibration vessel and ensure that there is no difference in temperature between the calibration vessel and the flow-through cell.)

Fig. 11 Filling the FTC with calibration solution

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 ± 0.2 ° and ± 0.2°C, respectively). When the first calibration value **cal 100** is recorded press the syringe plunger and empty the calibration solution form the flow-through cell into a waste container.

To record the second calibration value, oxygen-free water, dip the plastic tube into the vessel containing the calibration solution **cal 0**. Again pull the syringe plunger and slowly fill the flow-through cell with **cal 0**. Make sure that there are no air bubbles inside the T-connector. (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 ± 0.2 ° and ± 0.2°C, respectively). When the second calibration value **cal 0** is recorded press the syringe plunger and empty the calibration solution form the flow-through cell into a waste container.

After calibration the flow-through cell has to be cleaned from sodium sulfite. Dip the plastic tube in a vessel containing distilled water and fill the flow-through cell using the syringe. Then press the syringe plunger and empty the washing solution into a waste vessel. Repeat this cleaning procedure 3 times. (Also clean the temperature sensor with distilled water, if it has been dipped into **cal 0**).

3.4 Equilibration

! The sensor needs to be equilibrated before use. In order to do so you have to fill the FTC with your medium and wait for at least 15 minutes so that the sensor can equilibrate.

4 Technical Data

Specifications	
Measuring range	0 – 45 mg/L 0 – 1400 µmol
Response time (t_{90}) at 37 °C**	< 30 sec.
Resolution	± 0.14 µmol at 2.83 µmol ± 1.4 µmol at 283.1 µmol
Accuracy	± 0.4 % O_2 at 20.9 % O_2 ± 0.05 % O_2 at 0.2 % O_2
Drift	at 0 % O_2: < 0.03 % O_2 within 30 days (sampling interval of 1 min.)
Measurement Temperature	From 0 °C to + 50 °C
Properties	
Compatibility	Aqueous solutions, ethanol, methanol
Cross Sensitivity	Organic solvents, such as acetone, toluene, chloroform or methylene chloride; chlorine gas
Sterilization procedure*	Irradiation, Ethylene oxide (EtO)
Calibration	SST are pre-calibrated; Two-point calibration in oxygen-free environment (nitrogen, sodium sulfite) and air-saturated environment
Storage Stability	2 years provided the sensor is stored in the dark

*recalibration may be required
** at a flow rate of min. 15 mL/min

5 Concluding Remarks

Dear Customer,

With this manual, we hope to provide you with an introduction to work with the single-use flow-through cell O_2 (FTC-SU-PSt3).

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.

With best regards,

Your PreSens Team

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