O2k-Manual: SmartPOS service

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SmartPOS: Service

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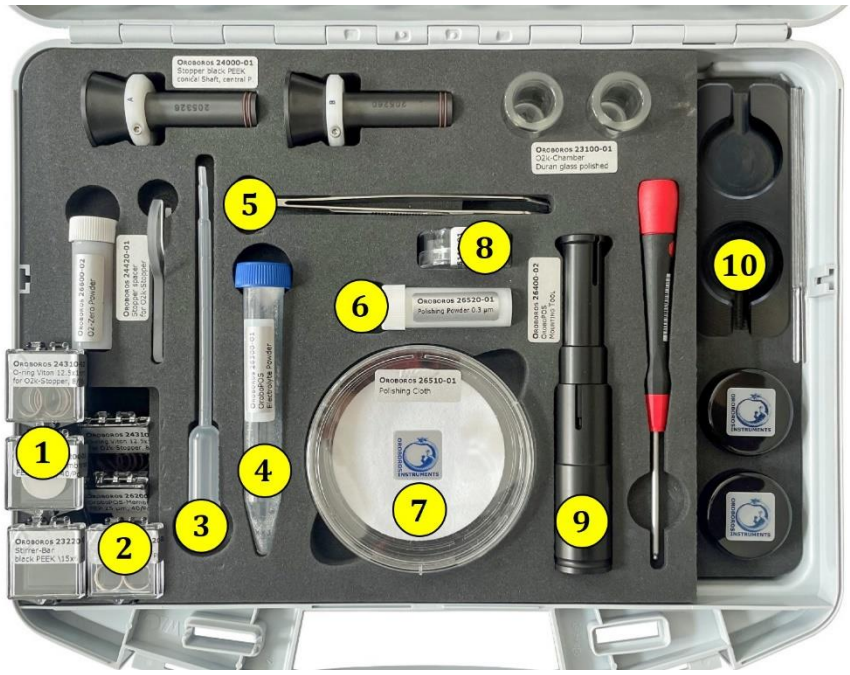
1. Summary

The SmartPOS is the polarographic oxygen sensor (POS) used with the Oroboros O2k-Series J and higher and the NextGen-O2k-Series XB and higher. O2k-Series A-I and NextGen-Ok2-Series XA are provided with the OroboPOS and OroboPOS-Connector. These two components are combined in the SmartPOS, avoiding contamination and moisture in the electrical connections, which can cause a high signal at zero oxygen and high noise in the signal. The serial number of the SmartPOS is automatically recognized by the DatLab 8 software. The SmartPOS and the OroboPOS + OroboPOS-Connector cannot be exchanged due to different ports on the O2k-Main Unit (MiPNet28.07 and MiPNet28.08).

Servicing the POS is fundamental for signal stability, low noise, and high time-resolution. Performance specifications of the Oroboros O2k can be met only with oxygen sensors that are maintained in a well-monitored functional state. POS service may only need to be performed every few months. However, POS service is necessary if (*1*) a new

sensor is installed, (*2*) the signal during air calibration is not stable over time, (*3*) the signal-to-noise ratio is high, (*4*) the time response is prolonged and biphasic (time constant >10 s), (*5*) the oxygen signal at zero calibration does not decline rapidly to 0 % - 5 % of the signal at air saturation. For each sensor, the frequency of POS service is optimized based on long-term calibration records for **quality control** (O2-calibration.xlsx).

2. Accessories for POS service

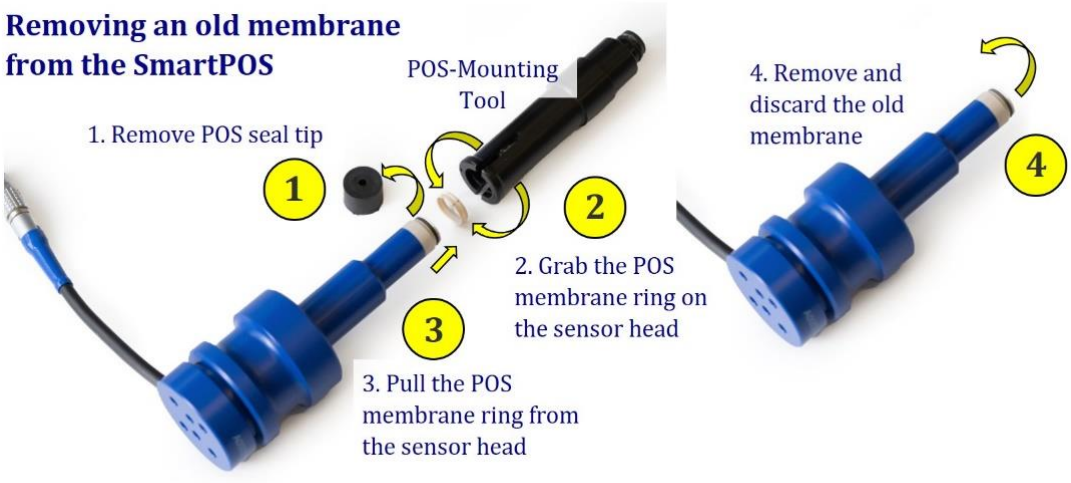


Oroboros-O2k Accessory Box with components for POS service:
(1) POS-Membranes, FEP 25 µm, 40/Pck.
(2) POS-Membrane Ring, PEEK
(3) Pipette\Plastic\1 mL ungraded for electrolyte
(4) POS-Electrolyte Powder, KCl
(5) Forceps for membrane application
(6) POS-Polishing Powder for cathode cleaning (0.3 µm)
(7) POS-Polishing Cloth for cathode cleaning
(8) POS-Seal TIP
(9) POS-Mounting Tool for membrane application
(10) SmartPOS rack

Accessories for the POS service are provided in the Oroboros-O2k Accessory box. In addition, deionized or double distilled water and 25 % ammonia solution are required. To ensure premium quality of the content, the components for POS service should be stored in the dark.

3. Cleaning

⚠ Prevent damage by electrostatic discharge (ESD) when handling the SmartPOS or cable connections to the O2k (MiPNet14.01).



For sensor service, remove the black POS-Seal TIP (1). It is normal to observe many small bubbles in the electrolyte reservoir. This does not indicate that the bubbles caused a problem while the sensor was in use. Remove the POS-membrane ring (2), (3) and membrane (4). Wash off electrolyte with deionized or double distilled water.

The cathode needs to be cleaned if its gold surface appears to be coated by a colored layer or whenever the anode is cleaned. The silver/silver chloride anode darkens after long-term operation, inadequate storage of the sensor, or contact with hydrogen sulfide. This may cause high signal-to-noise ratio or reduce the signal output by >30 %, reflected by the necessity to increase the gain. Such sensor problems can be improved by cleaning the cathode and anode.

3.1. Cathode cleaning

⚠ **The cathode must be treated with extreme care**. Do not touch with fingers, nor expose to detergents or greasy liquids.
The SmartPOS must not be disassembled!

Place the Petri dish with the Polishing Cloth (Oroboros-O2k Accessory box) on a flat surface. Add a few drops of distilled water and a spatula tip of Polishing Powder (aluminum oxide, 0.3 µm) and mix to create a thin paste. Hold the sensor in a vertical position and polish the cathode in the paste for one minute moving it in a figure-eight motion. Hold the SmartPOS by its thin part when cleaning the cathode. Wash the polishing powder carefully off the sensor with deionized or double distilled water. After you have finished cleaning the cathode, wash the polishing cloth with deionized or double distilled water and make sure that it is completely dry before storage. The anode is also always cleaned subsequently (Section

3.2). If the noise remains high or the response time of the sensor signal is biphasic (exponential phase followed by a slow drift) after polishing the cathode and cleaning the anode with ammonia, repeat the cathode/anode cleaning cycle several times.

In extreme cases, the cathode may be cleaned by adding a drop of 50-75 % nitric acid with extreme care onto the surface of the cathode and leaving it for no longer than 15 seconds. Carefully remove any traces of nitric acid by washing with distilled water and proceed as described above.

3.2. Anode cleaning

Place the SmartPOS in the SmartPOS rack to keep it in a stable position. Fill the electrolyte reservoir of the POS with fresh 25 % ammonia solution. Within 10 min the silver/silver chloride should appear bright gray. Wash the sensor with distilled water and if the anode is still dark gray, repeat the anode cleaning. For older sensors it becomes necessary to prolong the exposure to ammonia up to several hours or even overnight, under the cap of the Perspex housing. Protect the POS from light, since the silver/silver chloride anode is light sensitive.

3.3. Cleaning the electrical connection

The electrical connections of the SmartPOS are protected thus there is no need to clean them. For cleaning of the cable plug that connects to the O2k-Main Unit, remove any contamination such as salt crystals, grease, and moisture with a fine lint-free paper cloth. If necessary, moisten a lint-free paper cloth with 100 % ethanol and gently clean the pins. If the O2k is used in a humid environment, the SmartPOS, can be dried in an oven at up to 60 °C for 1-2 h.

4. Membrane mounting

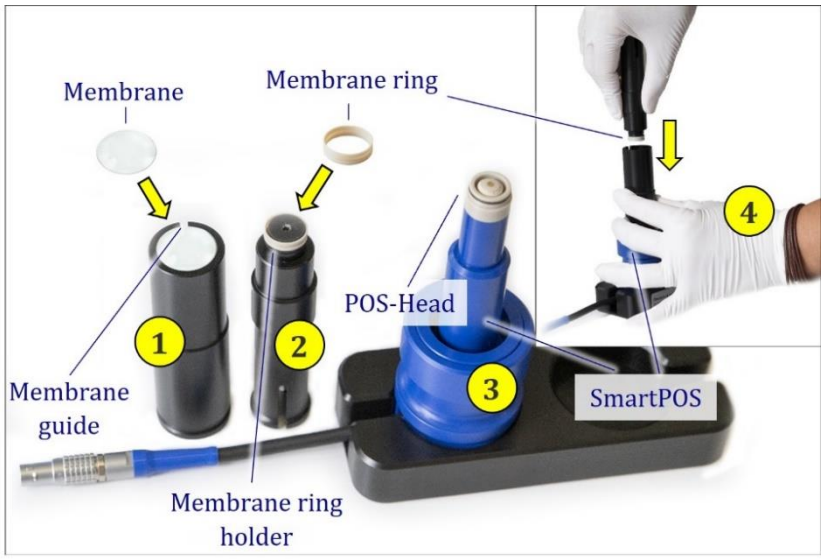
For membrane mounting, the SmartPOS is placed in the SmartPOS rack. Check the O-ring on the POS head to ensure that its surface is smooth and intact. In exceptional cases, apply a tiny amount of grease to the O-ring of the sensor head.

Use KCl solution as electrolyte (1 mol·dm^{-3}; 74.56 g potassium chloride per liter, in deionized or double distilled water). Add deionized or double distilled water to the electrolyte powder provided in the Oroboros-O2k Accessory box up to the 10 mL mark. Alternatively, dissolve 1.49 g KCl in deionized or double distilled water with a total volume of 20 mL. Store at 4-8 °C in a closed vial. To prevent the formation of gas bubbles in the electrolyte solution, heat the solution by gently agitating the electrolyte vial in hot water (40-70 °C) before membrane mounting.

The transparent POS membranes are kept in small boxes in the Oroboros-O2k Accessory box. Each membrane is separated by a non-transparent white paper sheet. Do **not** add the paper to the oxygen sensor. Carefully separate a membrane from the stack of paper sheets and membranes, avoiding any mechanical damage of the membrane. Do not touch the central area of the membrane.

The black POS-Mounting Tool consists of two parts, (*1*) the membrane guide (larger diameter) and (*2*) the membrane ring holder with O-ring. Wash off any electrolyte and salt crystals with deionized or double distilled water.

(1) Position a new membrane into the **membrane guide** using the forceps. (2) Fix the POS-Membrane Ring (which seals the membrane against the sensor body) to the **membrane ring holder**. Fill the POS head with electrolyte. (3) Slide the membrane guide downwards across the POS head while pushing the lower ring (arrow) of the SmartPOS firmly downwards. By releasing this ring, the membrane guide is fixed to the SmartPOS. (4) To fix the POS-Membrane Ring over the POS head, slide the membrane ring holder into the membrane guide, and press firmly down in a single movement to the final position.



Mounting a membrane onto the SmartPOS. The POS-Mounting Tool consists of two parts, the membrane guide, and the membrane ring holder.

No bubbles should be trapped in the electrolyte reservoir after membrane application. Nor should folds be visible in the membrane in the central area. Inspect the electrolyte reservoir under a magnifying glass. Small folds in the membrane near the outer circumference have no negative effects, but large folds should be avoided. Wash excess electrolyte off the SmartPOS. Apply a wet POS-Seal Tip and attach the SmartPOS to the POS-Holder

After POS service, the POS needs some time in operation to stabilize in pure water or MiR05, which may be a few or several hours (overnight). During this stabilization time the O2k must be running (25 °C; illumination off). After a POS has been used and the seal tip has been removed from the POS it is normal to see many small bubbles. This does not indicate that there was a problem while the sensor was in use.

5. Cable connection

For connection of the SmartPOS to the O2k-Main Unit, refer to the following manuals:

» MiPNet28.08 Oroboros O2k Series J manual
» MiPNet28.07 NextGen-O2k Series XB manual

6. Storage of the SmartPOS

6.1. Short-term storage

For short periods of time, *i.e.* days to several weeks, the SmartPOS is maintained in the O2k-chamber. The chamber is prewashed with deionized or double distilled water and filled with 70 % ethanol for chemical sterilization. The stopper is inserted loosely without pushing it down beyond the point where the sealing ring is inserted into the glass chamber. This ensures a longer lifetime of the sealing rings. The receptacle of the stopper is completely filled with 70 % ethanol and sealed with a black cover slip to avoid evaporation of ethanol. Before an experiment, the ethanol is siphoned off and the chamber is washed with distilled water (MiPNet06.03).

For short-term shelf storage (2-3 days), unplug the SmartPOS from the main unit and detach it from the POS holder, Clean the seal tip and membrane with distilled water. Seal the SmartPOS with the Perspex cap to **prevent the electrolyte from drying out**. Place the SmartPOS in the SmartPOS rack and store it in the dark. The SmartPOS must not be disassembled!

6.2. Long-term storage

For storage of the POS for several months, the seal tip is removed and the membrane is freed by gripping the membrane ring with the groove in the lower end of the membrane ring holder of the POS-Mounting Tool (see above) and peeled off with forceps. Wash the electrolyte off the POS with distilled water. Check the plug for any moisture and salt contamination and clean with a soft tissue if needed. The SmartPOS is **sealed in the Perspex housing and stored dry in the SmartPOS box**.

7. High signal at zero oxygen

A 'high signal at zero oxygen' may be observed during zero calibration and can be a sign of (*1*) a damaged SmartPOS or O2k-Main Unit or (*2*) a dirty SmartPOS, or (*3*) contamination of the electrical connections. It is therefore recommended to perform cathode cleaning and several rounds of anode cleaning. After cleaning, the SmartPOS can be dried at 50-60 °C for at least 1-2 h. Additionally, the zero current of the O2k-Main Unit and the SmartPOS (without membrane) should be tested for any leak current (Leak current test). If repeated rounds of cleaning do not solve the issue, contact our technical support.

8. References

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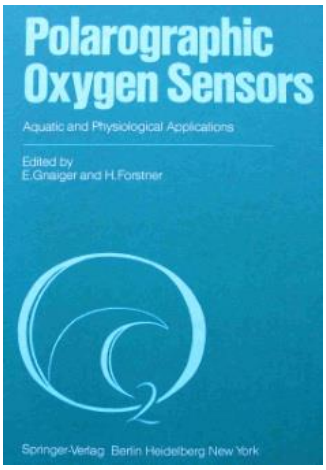

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Related MiPNets

» MiPNet28.08 Oroboros O2k Series J manual
» MiPNet28.07 NextGen-O2k Series XB manual

9. Acknowledgements

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