

**D. O. probe  
TriOxmatic<sup>®</sup> 702**

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**Accuracy when  
going to press**

The use of advanced technology and the high quality standard of our instruments are the result of a continuous development.

This may result in differences between this operating manual and your instrument. Also, we cannot guarantee that there are absolutely no errors in this manual. Therefore, we are sure you will understand that we cannot accept any legal claims resulting from the data, figures or descriptions.

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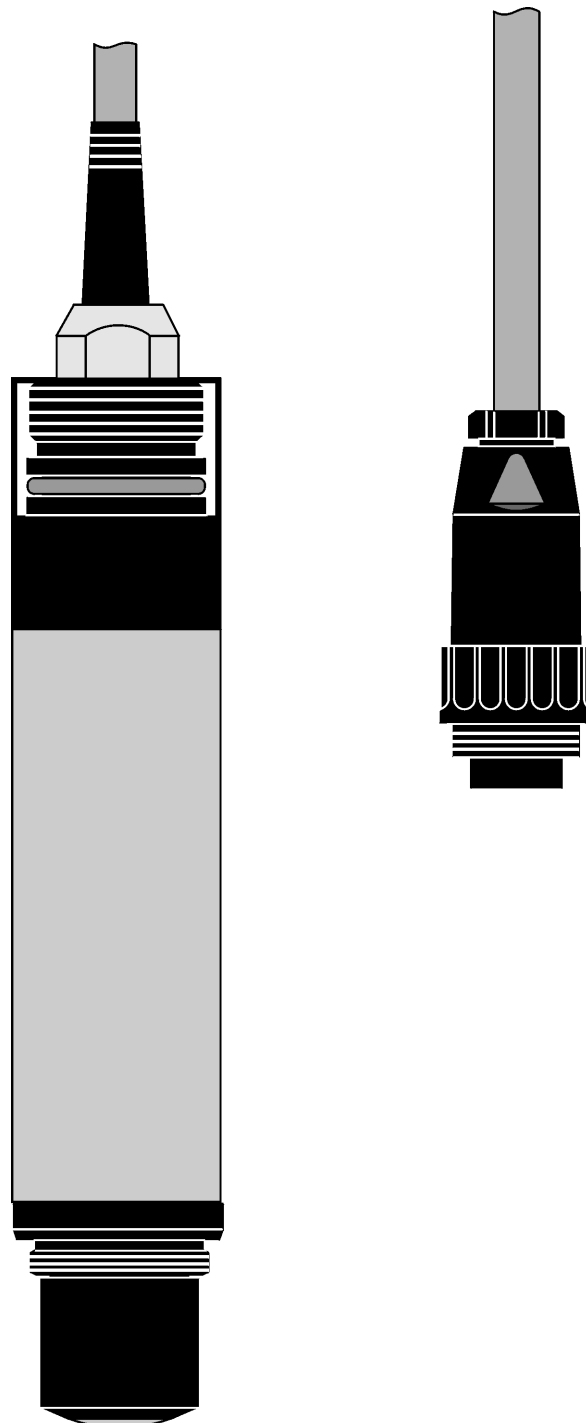
Printed in Germany.

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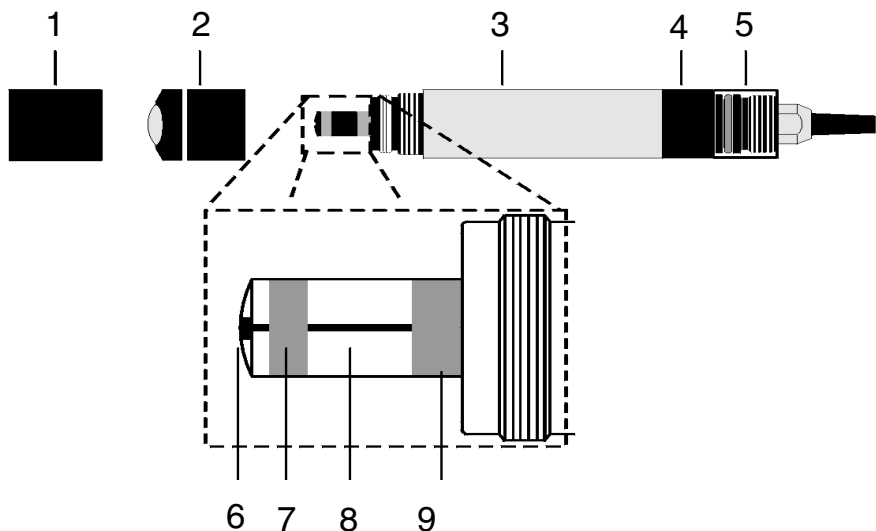
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# 1 Overview

## 1.1 Overall view of the D. O. probe TriOxmatic® 702



## 1.2 Construction of the D. O. probe TriOxmatic® 702



1	Protection cap (for transport and storage)
2	Membrane head, WP 25i
3	Shaft
4	Closing head
5	Protection ring for G1 thread
6	Working electrode (gold cathode)
7	Counter electrode (silver anode)
8	Isolator
9	Reference electrode (silver bromide)

## 2 Safety

This operating manual contains basic instructions that you must follow during the commissioning, operation and maintenance of the probe. Consequently, all responsible personnel must read this operating manual before working with the probe. The operating manual must always be available within the vicinity of the probe.

### Target group

The D. O. probe was designed for use with online instrumentation - mostly in waste water treatment plants. Thus, we assume that, as a result of their professional training and experience, the operators will know the necessary safety precautions to take when handling chemicals.

### Safety instructions

In the various chapters of this operating manual, the following safety instructions point out the different degrees of danger:



#### Warning

indicates safety instructions which must be adhered to precisely to rule out possible serious hazards to persons.



#### Caution

indicates safety instructions which must be adhered to precisely to avoid slight injuries, damage to your equipment or environmental harm.

### Other Notes



#### Note

indicates notes that draw your attention to special features.



#### Note

indicates cross references to other documents, e. g. operating manuals.

### 2.1 Authorized use

The technical specifications as given in chapter 7 TECHNICAL DATA must be observed. Only the operation and running of the probe according to the instructions given in this operating manual is authorized.

Any other use is considered **unauthorized**.

### 2.2 General safety instructions

The probe left the factory in a safe and secure technical condition.

#### Function and operating safety

The smooth functioning and operational safety of the probe can only be guaranteed if the generally applicable safety measures and the specific safety instructions in this operating manual are followed during operation.

The smooth functioning and operational safety of the probe can only be guaranteed under the environmental and electrical operating conditions that are specified in chapter 7 TECHNICAL DATA.

The temperature specified for using the probe (chapter 7 TECHNICAL DATA) has to be observed. Protect your probe especially against frost or overheating.



#### Caution

The probe is only allowed to be opened by personnel authorized by WTW.



**Safe operation**

If safe operation is no longer possible, the probe must be taken out of service and secured against inadvertent operation!

Safe operation is no longer possible if the probe

- has been damaged in transport
- has been stored under adverse conditions for a lengthy period of time
- is visibly damaged
- no longer operates as described in this manual.

If you are in any doubt, please contact the supplier of the probe.

**Obligations of the purchaser**

The purchaser of this probe must ensure that the following laws and guidelines are observed when using dangerous substances:

- EEC directives for protective labor legislation
- National protective labor legislation
- Safety regulations
- Safety datasheets of the chemical manufacturers.



## 3 Commissioning

### 3.1 Scope of delivery

- TriOxmatic® 702 with 5 m cable and 7 pin plug, cleaning cap RA 600 and accessory kit ZBK 25i
- The probes are filled with electrolyte and are equipped with a black protection cap.

### 3.2 Commissioning / Readiness for measuring

1	Connect the probe to the measuring instrument.
2	Screw off the protection cap.
3	Let the probe polarize for 60 minutes.
4	Calibrate.



#### Note

#### Recommendation for precision measurements:

Recalibrate the next day or let the probe polarize for the night.

### 3.3 Recommended fields of application

On-line measurements in boiler feed water. The flow-through armature is recommended as an accessory.

### 3.4 Calibration



#### Note

For calibrating, please refer to the operating manual of the measuring instrument.

### 3.5 Measuring

Provide the necessary minimum flow (chapter 7 TECHNICAL DATA), e.g.:

- Ensure the correct flow in the flow-through vessel.

### 3.6 Exterior cleaning and function check

The function check is the simplest way of letting you know whether the probe needs to be cleaned and calibrated.



#### Note

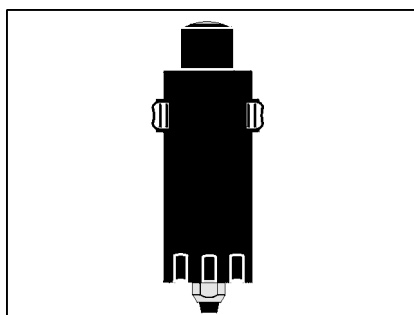
The function check can either be performed in water vapor-saturated air or in air-saturated water.

In the case of air temperatures under 5 °C we recommend to perform the function check not in air but in air-saturated water that has a higher temperature.

#### Function check in water vapor-saturated air

Proceed as follows:

- 1 Take the probe out of the measuring solution and position it approx. 2 cm above a water surface, best in a narrow bucket or similar container with water. When doing so, no liquid should be brought on the membrane.



Wait at least 15 min for adjustment.



- 5 Switch the measuring instrument to the % saturation operating mode. Read the measured value and determine whether it lies within the range of precision required by the user.

% Sat

**Note**

If the measured value is within the accuracy tolerance required by the user it is not necessary to clean or recalibrate the probe.

Example:

Required accuracy: 5 %  
Measured value in air: 97 % saturation  
⇒ no cleaning or recalibrating required  
(the measuring error is within the required accuracy tolerance)

**Note:**

If the temperature difference between the measuring solution and the air is too high, an adjusting time of more than 15 min may be necessary.

### Function check in air-saturated water

In the case of air temperatures under 5 °C do not perform the function check in air but in air-saturated water that has a higher temperature. You obtain air-saturated water by pouring water several times in and out of two vessels so that it sparkles.

Then immerse the probe in a vessel with air-saturated water and perform the function check as described above.

### 3.7 Cleaning with normal operation (e.g. boiler feed water)

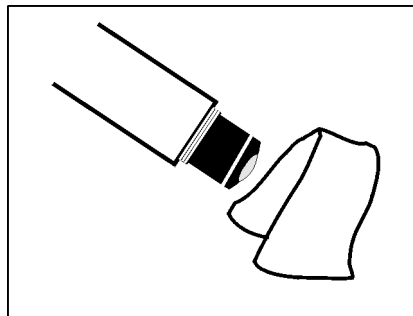
Cleaning and calibrating is required:

- approx. every 3 months
- if the measured values are too low

Thoroughly rinse with deionized water.

#### Exterior cleaning

- 1 **Carefully** clean the probe shaft and the membrane.

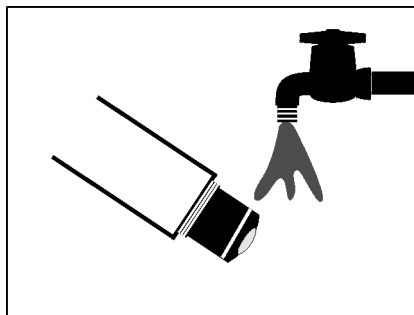


#### Caution

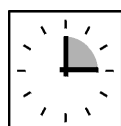
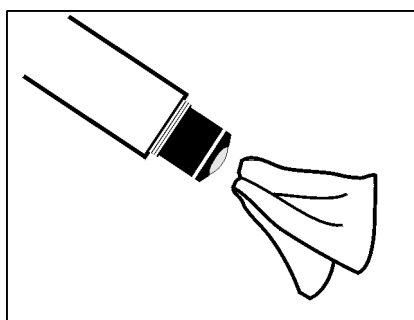
#### Clean the membrane very carefully!

The membrane may be damaged by sharp-edged objects or when lying on stones.

- 2 Rinse the probe with clear tapwater.



3 Carefully dry the membrane using a lint-free paper towel.



→ CAL

Wait at least 15 minutes for adjustment, then calibrate the probe.



**Note**

For calibrating the probe refer to the relevant operating manual of the industrial monitor.



**Note**

**Maintenance of the probe is required** (see chapter 4 MAINTENANCE, CLEANING, DISPOSAL, SPARE PARTS) if:

- the membrane is damaged or
- the probe cannot be calibrated anymore (Sens Reg display).

### 3.8 Storing

Store the probe with the black protection cap put on.

Temperature: -5 °C to +50 °C

Position: any



## 4 Maintenance, cleaning, disposal, spare parts

### 4.1 Replacing the electrolyte solution and the membrane head

WTW delivers the probe ready for operation

An exchange is necessary if:

- the membrane is damaged or the Sens Reg message appears-
- the probe cannot be calibrated
- the electrolyte solution is depleted or the counter electrode is poisoned (Sens Reg message).



#### Warning

Contact with the measuring solution can endanger the user! Take protective measures suitable for the kind of measuring solution (protective clothes, eye protectors etc.).



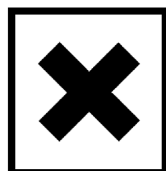
#### Warning

The ELY/A electrolyte solution is strongly alkaline!

- Keep out of the reach of children!
- Wear suitable gloves and eye/face protection!
- After contact with eyes and skin rinse immediately with plenty of water!
- After contact with the eyes seek medical advice!

ELY/A

Xi



Irritating

R: 36/38

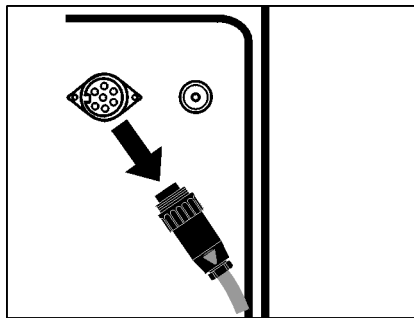
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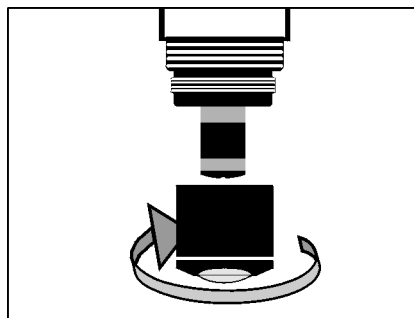
**Caution**

For all maintenance work, disconnect the probe from the instrument!

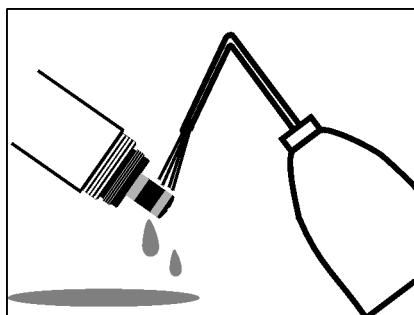
- 1 Disconnect the probe from the instrument.



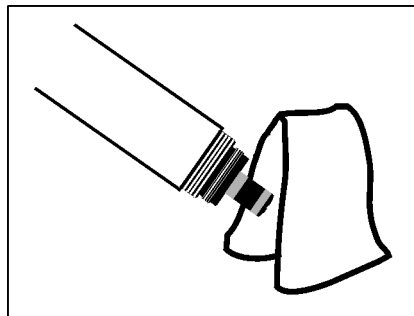
- 2 Screw off the membrane head.



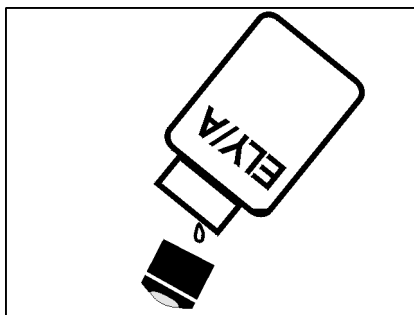
- 3 Thoroughly rinse the probe head with deionized water.



- 4 Carefully wipe and dry the counter electrode using a paper towel.



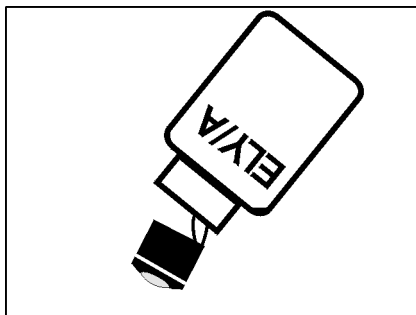
- 5 Moisten the new membrane with some drops of the ELY/A electrolyte solution.



**Warning**

Observe the warning on the ELY/A bottle!

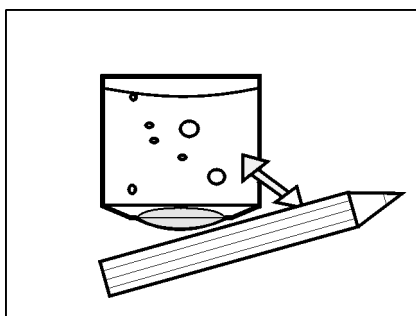
6 Fill the membrane head with electrolyte solution.



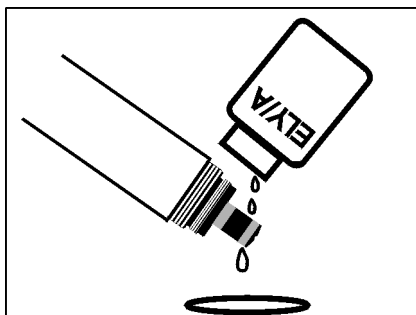
**Caution**

Always use a new membrane head!

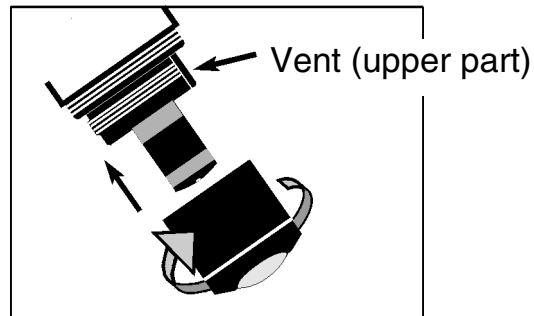
7 Remove air bubbles by careful knocking.



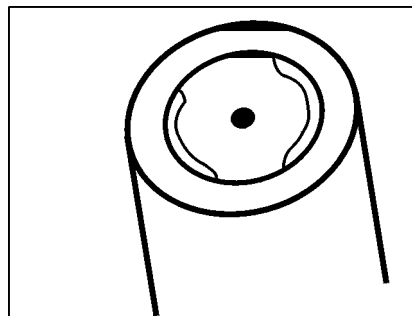
8 Rinse the probe head with electrolyte solution.



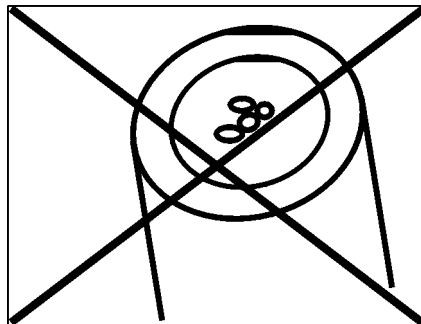
- 9 | Screw the WP 25 membrane head on the shaft. Hold the probe inclined. Excess electrolyte solution is pressed out at the vent.



- 10 | The filling should be free of air bubbles. Small air bubbles do not interfere.



- 11 Refill only in case of:
- Big air bubbles
  - Air bubbles at the gold cathode
  - Measuring with high water pressure
  - Probe cannot be calibrated or is sensitive to knocking.



**Note**

After being connected to the instrument for approx. 60 minutes the probe is ready for operation, then **it is essential to recalibrate the probe.**

Recommendation:

For precision measurements, calibrate the probe the following day once again.

## 4.2 Cleaning the electrodes

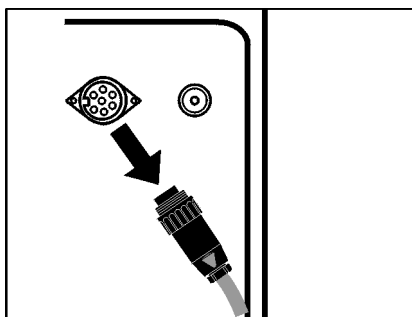


### Note

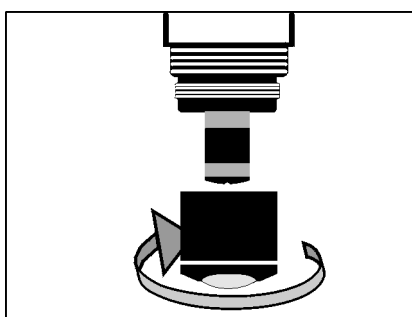
Counter electrode and reference electrodes always show a coloring. This is necessary for the operation of the probe. It is no contamination.

Cleaning is only required if the slope is too high or too low (the probe cannot be calibrated), and if this cannot be remedied by replacing the membrane head and the electrolyte solution.

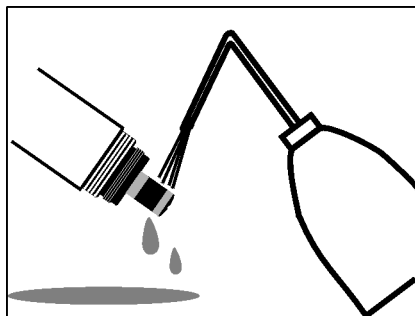
- 1 Disconnect the probe from the instrument.



- 2 Screw off the membrane head.



- 3 Thoroughly rinse the probe head with deionized water.

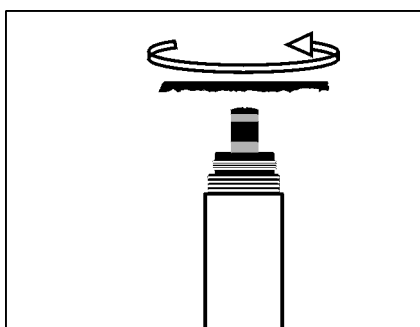




#### 4.2.1 Cleaning the gold working electrode

Moisten the cathode and the SF 300 grinding foil with deionized water.

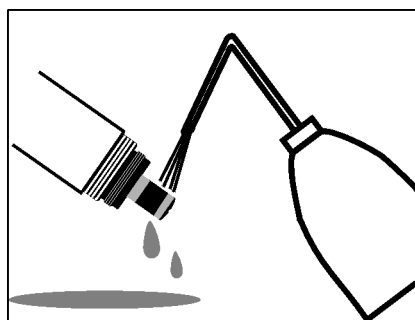
- 1 Using the **wet** SF 300 grinding foil, polish impurities off the cathode under slight pressure.



#### Caution

Do not use normal grinding paper or glass fibre pen!

- 2 Thoroughly rinse the probe head with deionized water.



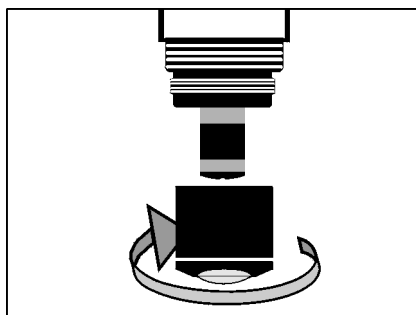
#### 4.2.2 Cleaning the silver counter electrode

The silver counter electrode can either be cleaned:

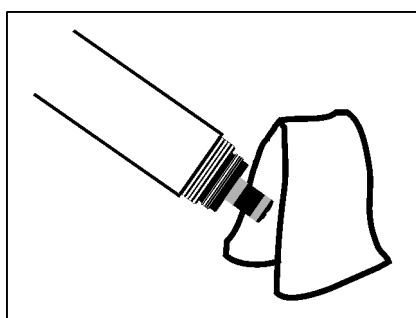
- using the RA 600 cleaning cap or
- in a glass beaker.

#### 4.2.3 Cleaning the counter electrode using the RA 600 cleaning cap

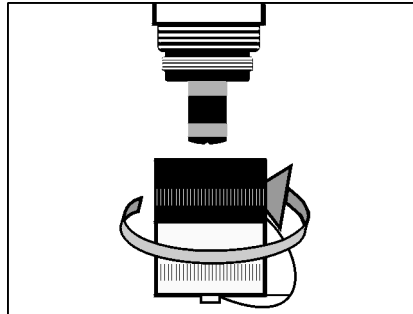
- 1 | Screw off the membrane head.



- 2 | Using a lint-free paper towel, wipe the counter electrode and carefully remove any loose coating.



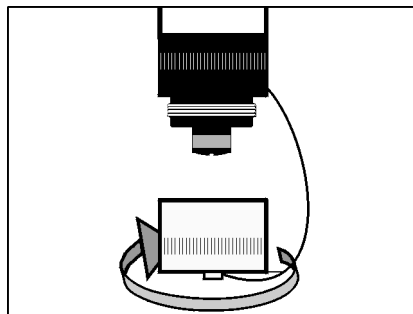
- 3 | Screw the cleaning cap on the probe instead of the membrane head.



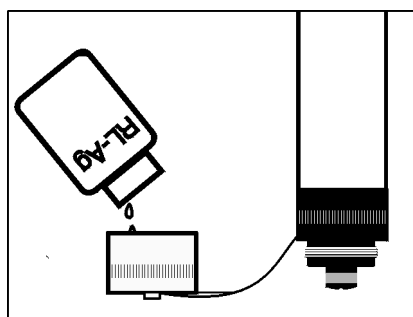
**Caution**

Never grease or oil the inner O ring!

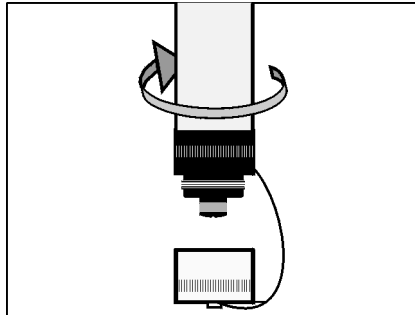
- 4 | Remove the screw cap from the safety cap.



- 5 | Fill the screw cap with RL-Ag/Oxi cleaning solution.



- 6 | Screw the safety cap with the probe on the screw cap.



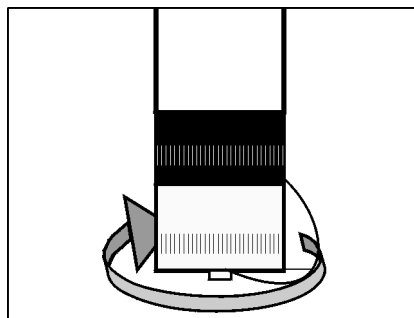
**Caution**

Never immerse the reference electrode into the cleaning solution! The reference electrode might be destroyed and the probe defective. If the RA 600 is used correctly, however, there is no danger for the probe.

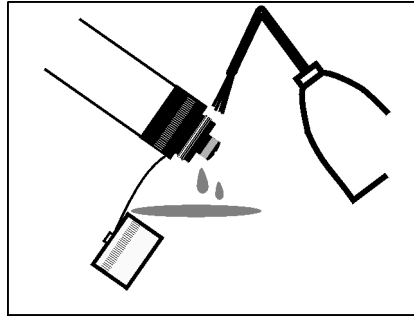


Allow the cleaning solution to react for max. 1 hour.

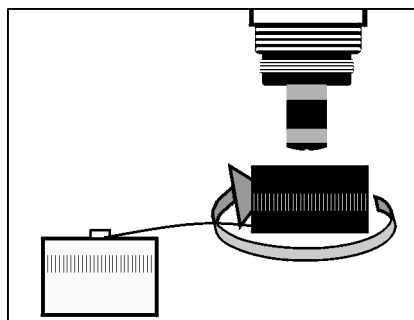
- 7 | Screw off the protection cap.



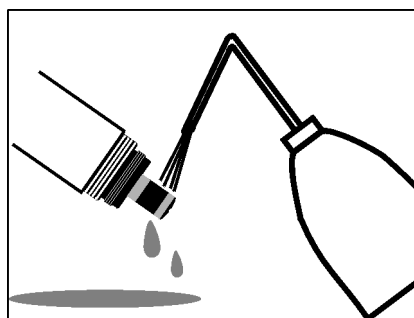
- 8 Thoroughly rinse the electrode - with the safety cap put on - with deionized water.-



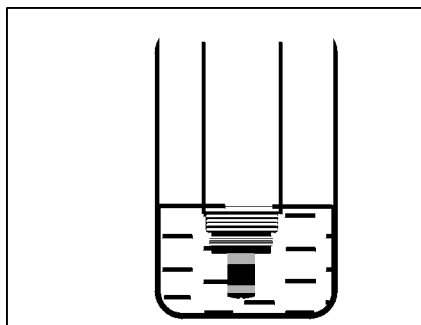
- 9 Screw off the safety cap.



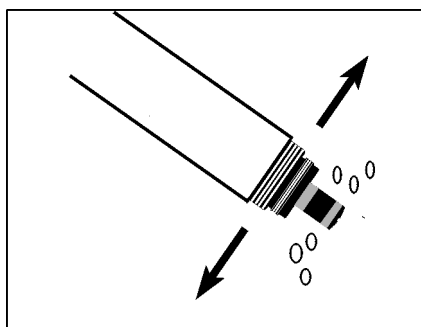
- 10 Thoroughly rinse the probe head and the electrode unit with deionized water several times.



- 11 Soak the probe head and the electrode unit in deionized water for at least one hour.



- 12 Carefully shake off water drops.

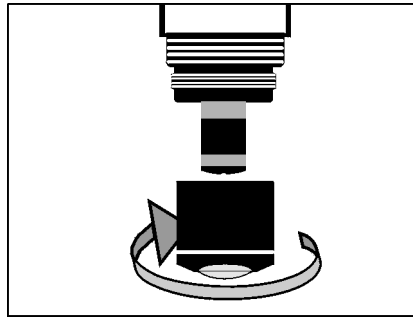


**Note**

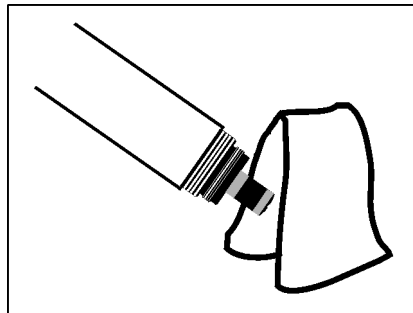
See section 4.3 REFILLING THE MEMBRANE HEAD

#### 4.2.4 Cleaning the counter electrode in the glass beaker

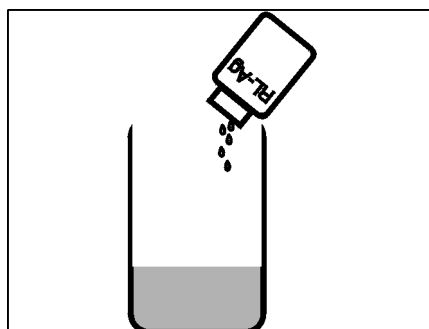
- 1 | Screw off the membrane head.



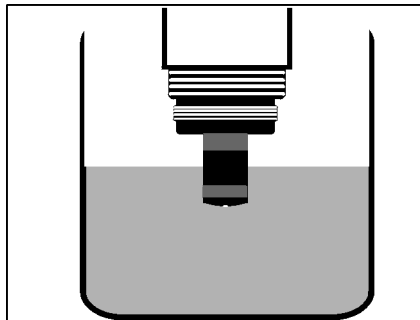
- 2 | Using a lint-free paper towel, wipe the counter electrode and carefully remove any loose coating.



- 3 | Fill the glass beaker (150 mL, high shape) with approx. 25 mL RL-AG/Oxi cleaning solution.



- 4 Put the probe in the stand.  
Immerse the electrode unit into the RL-AG/Oxi cleaning solution up to a little bit above the counter electrode.



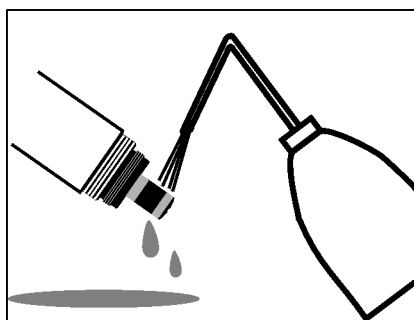
### Caution

Never immerse the reference electrode into the cleaning solution! The reference electrode might be destroyed and the probe defective-



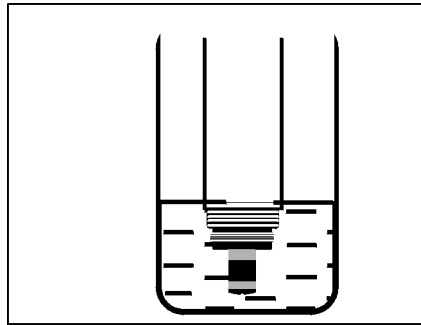
Allow the cleaning solution to react for 1 hour.

- 5 Thoroughly rinse the probe head and the electrode unit with deionized water several times.



- 6 Immerse the probe head and the electrode unit into deionized water.

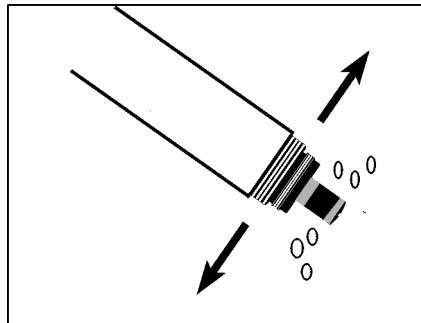




Soak in deionized water for at least one hour.

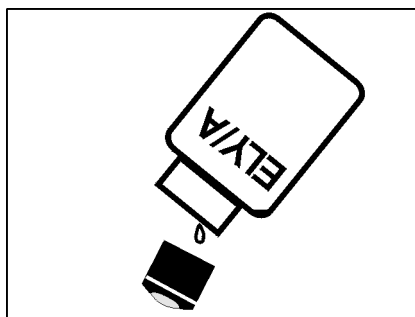


7 | Carefully shake off water drops.



### 4.3 Refilling the membrane head

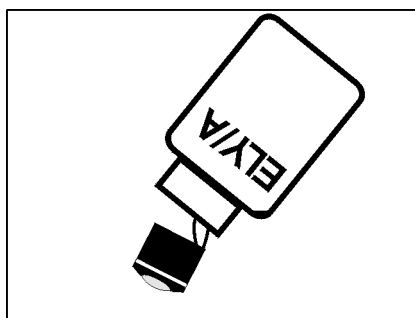
- 1 Moisten the new membrane with some drops of the ELY/A electrolyte solution.



#### Warning

Observe the warning on the ELY/A bottle!

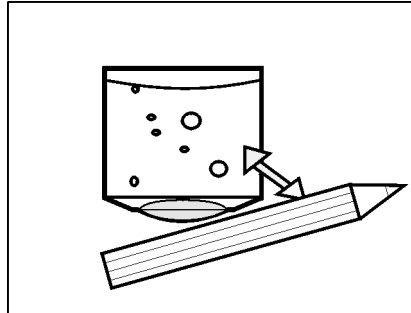
- 2 Fill the membrane head with electrolyte solution.



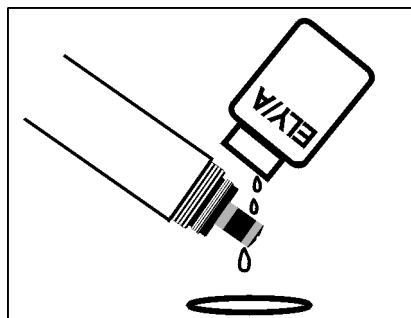
#### Note

Always use a new membrane head!

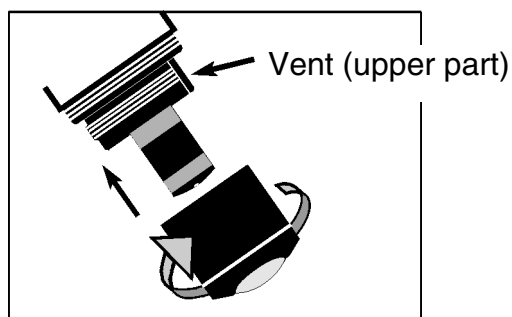
- 3 Remove air bubbles by careful knocking.



- 4 Rinse the probe head with electrolyte solution.



- 5 Screw the WP 25 membrane head on the shaft.  
Hold the probe inclined. Excess electrolyte solution is pressed out at the vent.



- 6 Connect the probe to the measuring instrument again. The probe is ready to operate after being connected to the instrument for approx. 60 minutes.



### Note

After each refilling, **it is essential to recalibrate the probe.**

Recommendation:

For precision measurements, calibrate the probe the following day once again.

#### 4.4 Checking whether the probe is zero current free

The probe is zero current free. Therefore, it is not possible to calibrate the probe in air free of oxygen.

It is possible, however, to check whether the probe is zero current free

according to DIN EN 25814/ISO 5814. This is required in case of a suspected malfunction.

##### Test solution

1 g/L aqueous sodium sulfite solution,  $\text{Na}_2\text{SO}_3$  (adding 1 mg/L of a cobaltous salt accelerates the removal of oxygen from the solution.)

The probe should have been in operation for at least one hour before the check.

##### Course of the check

- Perform an exterior cleaning of the probe.
- Switch the measuring instrument to the % saturation operating mode.
- Immerse the probe into the test solution.
- Wait for one hour.



##### Note

Leave the probe in the test solution for one hour.

##### Test criterion

The probe is OK when the measuring instrument displays < 1 % oxygen saturation.

If the measured value is > 1 %:

- Clean the gold working electrode and replace the electrolyte and membrane head.
- If necessary, also clean the counter electrode (see chapter 4.2.1 CLEANING THE GOLD WORKING ELECTRODE to chapter 4.3 REFILLING THE MEMBRANE HEAD).

### 4.5 Disposal

We recommend to dispose of the probe as electronic waste.

### 4.6 Maintenance and spare parts

	<b>Model</b>	<b>Order no.</b>
Exchange membrane heads (2 pieces)	WP 25i/2	202 852
Electrolyte solution (1 bottle with 50 mL)	ELY/A	205 212
Cleaning solution for the silver counter electrode (1 bottle with 50 mL)	RL-Ag/Oxi	205 200
Grinding foil	SF 300	203 680
Accessory kit	ZBK 25i	202 621

## 5 What to do if ...

**The measuring instrument displays 0.0 mg/L or 0 % Sat O<sub>2</sub> (the probe is in air)**

<b>Cause</b>	<b>Remedy</b>
– Measuring instrument and probe are not connected to each other	– Check the connection between measuring instrument and probe
– No electrolyte in the membrane head	– Replace the WP 25 membrane head
– Cable defective	– Send probe to WTW
– Electronics defective	– Send probe to WTW

**Probe cannot be calibrated**

<b>Cause</b>	<b>Remedy</b>
– Membrane head contaminated	– Perform an exterior cleaning of the probe according to the operating manual. Then wait for at least 15 minutes and recalibrate. If there is contamination that cannot be removed: Replace the electrolyte solution and the membrane head

**Probe still cannot be calibrated after the electrolyte and the membrane head have been replaced**

<b>Cause</b>	<b>Remedy</b>
– The electrodes are contaminated or the probe is poisoned	– Clean the electrodes according to the operating manual

## What to do if ...

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**The probe has been mechanically damaged**

**Cause**

---

**Remedy**

---

- Send probe to WTW

**Measured values too low**

**Cause**

---

**Remedy**

---

- Membrane contaminated
  - Probe has not been calibrated for a lengthy period of time
- 

- Perform an exterior cleaning and calibration according to the operating manual
- 

- Membrane does not contact gold- working electrode
- 

- Replace the membrane head and calibrate according to the operating manual
- 

- Shunt resistance caused by moisture in the probe, plug or cable
- 

- To check, disconnect the probe, screw off the membrane head, thoroughly rinse the electrode unit with distilled water and completely dry it. - Connect the probe to the instrument and switch to the highest measuring range (0 - 100 %): If the display is > 1 digit: There is a shunt. Send the probe to WTW for repair.



<b>The measured value strongly fluctuates</b>	<b>Cause</b>	<b>Remedy</b>
	<ul style="list-style-type: none"> <li>– Membrane does not contact gold working electrode</li> </ul>	<ul style="list-style-type: none"> <li>– Replace the membrane head and calibrate according to the operating manual</li> </ul>
	<ul style="list-style-type: none"> <li>– There is a tiny hole in the membrane, directly in front of the working electrode</li> </ul>	<ul style="list-style-type: none"> <li>– Replace the membrane head and recalibrate according to the operating manual, if necessary clean the electrodes</li> </ul>
<b>Measured values are too high</b>	<b>Cause</b>	<b>Remedy</b>
	<ul style="list-style-type: none"> <li>– The has not yet completely polarized</li> </ul>	<ul style="list-style-type: none"> <li>– Wait for the polarization to be completed (2 h)</li> </ul>
	<ul style="list-style-type: none"> <li>– Probe has not been calibrated for a lengthy period of time</li> </ul>	<ul style="list-style-type: none"> <li>– Perform an exterior cleaning and calibration according to the operating manual</li> </ul>
	<ul style="list-style-type: none"> <li>– Shunt resistance caused by moisture in the probe, plug or cable</li> </ul>	<ul style="list-style-type: none"> <li>– To check, disconnect the probe, screw off the membrane head, thoroughly rinse the electrode unit with distilled water and completely dry it. Connect the probe to the instrument and switch to the highest measuring range (0 - 100 %): If the display is &gt; 1 digit: There is a shunt. Send the probe to WTW for repair.</li> </ul>

## What to do if ...

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<b>The Sens Reg message appears</b>	<b>Cause</b>	<b>Remedy</b>
	<ul style="list-style-type: none"><li>– Electrolyte depleted</li></ul>	<ul style="list-style-type: none"><li>– Replace the membrane head and calibrate according to the operating manual</li></ul>
	<ul style="list-style-type: none"><li>– Counter electrode contaminated</li></ul>	<ul style="list-style-type: none"><li>– Clean the electrodes</li></ul>
<b>Wrong temperature display</b>	<b>Cause</b>	<b>Remedy</b>
	<ul style="list-style-type: none"><li>– Defective temperature sensor</li></ul>	<ul style="list-style-type: none"><li>– Send probe to WTW</li></ul>

## 6 Recommended accessories

	Model	Order no.
Mounting set	EBST 700-DU	203 716
Mounting set	EBS 700-DU	203 715
Flow-through armature	D 702	203 738



### Note

For further holders and simulators refer to the WTW catalog.



## 7 Technical data

### 7.1 General data

<b>Probe types</b>	TriOxmatic® 702-5	Cable length 5 m Customized lengths up to 100 m
<b>Measuring principle</b>	Membrane covered amperometric probe with a 3 electrodes system potentiostatically operated; electrode with integrated preamplifier	
<b>Electrolyte</b>	ELY/A	
<b>Output signal</b>	Voltage signal, proportional to the O <sub>2</sub> partial pressure (corrected by temperature and water vapor partial pressure)	
<b>Temperature measurement</b>	via integrated NTC	
<b>Temperature compensation</b>	IMT	

## Technical data

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<b>Material</b>	Protection cap:	PVC
	Membrane head:	POM
	Membrane:	Fluoroplastics
	Probe head:	POM
	Isolator:	Epoxy, PEEK
	Closing head:	POM
	Shaft:	VA steel 1.4571
	Protection ring:	POM
	Cable screw joint:	VA steel 1.4571
	Cable coating:	PU (Polyurethane)
<b>Dimensions</b>	Shaft length	193 mm
	Shaft diameter	40 mm
	Membrane thickness	50 µm
	Cable length	5 m customized lengths up to 100 m
<b>Weight (5 m cable included)</b>	1010 g	

## 7.2 Measuring conditions

<b>Measuring range</b>	0 - 9 mg/l O <sub>2</sub> at 20 °C 0 - 100 % saturation (≈ 0 - 220 mbar pO <sub>2</sub> )		
<b>Polarization time</b>	for initial commissioning or after replacing the electrolyte: at least 60 min; for precision measurements at least 120 min, recalibrate on the following day; after short polarization breaks: 30 to 120 min depending on the duration of the break		
<b>Temperature range</b>	Operation:	0 °C ... + 50 °C	
	Storage:	- 5 °C ... + 50 °C	
<b>Max. admissible overpressure</b>	10 bar		
<b>Connection</b>	7-pin plug		
	Connection	Probe - cable:	IP 68 (100 m)
		Cable - plug:	IP 65
		Plug - instrument:	IP 65
<b>Operating position</b>	especially to mount into the D 702 flow through vessel		
<b>Flow to the probe</b>	≥ 0.5 cm/s for 10 % measuring accuracy ≥ 30 cm/s for < 1 % measuring accuracy		

**Flow-through in the  
D 702**  $\geq 100$  ml/min

**Fields of application** as oxygen trace sensor (ppb range)  
e. g. to control boiler feed water

### 7.3 Characteristics when delivered

**Slope** - 22.5 mV/mbar O<sub>2</sub>; mean value at 20 °C

**Signal resolution** < 1 ppb (0.001 mg/l)

**Response time at  
20 °C**  
t<sub>90</sub> (90 % of the final displayed value after) < 30 s  
t<sub>95</sub> (95 % of the final displayed value after) < 50 s  
t<sub>99</sub> (99 % of the final displayed value after) < 110 s

if the measurement was made with a low oxygen  
concentration:

10 ppb            10 min

5 ppb             15 min

< 2 ppb          45 min

after changing the membrane head or electrolyte:

10 ppb            40 min

5 ppb             70 min

< 2 ppb          180 min



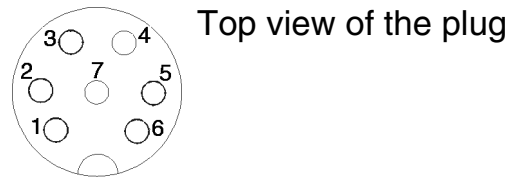
**Own consumption at  
20 °C**      0.34  $\mu\text{g h}^{-1} (\text{mg/L})^{-1}$  at 20 °C

**Drift**      < 0,5 % per month with permanent polarization in air  
< 1 % per month with low O<sub>2</sub> concentration

**Operational lifetime**      45 days in air;  
12 years in samples with 100 ppb oxygen

## 7.4 Electrical data

### Pin assignment



Pin	Assignment	Voltage	Maximum current
1	Ub+	+ 6.5 V ... + 8.5 V	< 1mA
2	0V	---	---
3	NTC (30kOhm)	< 3.5 V	< 0.15mA
4	NTC (30kOhm)	< 3.5 V	< 0.15mA
5	Ub-	- 6.5 V ... - 8.5 V	< 1 mA
6	Reg/Leak (output signal)	- 8.5 V ... + 8.5 V	---
7	pO <sub>2</sub> (output signal)	0 V ... + 8.5 V	---



### Warning

- All voltages must be protective low voltages or safety extra low voltages without shock-hazard according to IEC 1010 or UL3101.
- All currents to the probe must not exceed 8 A even in case of a short-circuit.



# What can Xylem do for you?

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**Service address:**

Xylem Analytics Germany  
Sales GmbH & Co. KG  
WTW  
Dr.-Karl-Slevogt-Str. 1  
82362 Weilheim  
Germany

Tel.: +49 881 183-325  
Fax: +49 881 183-414  
E-Mail [wtw.rma@xyleminc.com](mailto:wtw.rma@xyleminc.com)  
Internet: [www.WTW.com](http://www.WTW.com)



Xylem Analytics Germany GmbH  
Dr.-Karl-Slevogt-Str. 1  
82362 Weilheim  
Germany