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TRACE Analytics

# User Manual

# Dialysis probe

**Technical Documentation Dialysis probe**

August 2019 - Version 006 -

**Important Note:**
The data and information in this manual were compiled with the greatest of care. In spite of special care during creation of this document no warranty for an absolute accuracy can be given. If important information in this guidance are missed, if technical errors were found or if you would like to get more information about individual components, please notify us.
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# Content

# Figures

# 1 General Instructions

## 1.1 About this document

These instructions provide all the information necessary for operation of the dialysis probe. The instructions must be read, understood and used by all personnel using the dialysis probe.

- These instructions are part of the dialysis probe.
- Before working with the dialysis probe, read the instructions carefully and completely.
- Keep them in safe and easily accessible place near the dialysis probe site of installation
- If the instructions are lost, request a replacement or download the latest instructions from our website.

Masculine or feminine forms are used to facilitate legibility in these instructions and always simultaneously denote the other gender as well.

## 1.2 Validity

These instructions apply to the dialysis probe out of stainless steel.

## 1.3 Target groups

The instructions are designed for the target group „User“, who is familiar with the operation of the dialysis probe and the associated working processes. The training takes place within the scope of start-up and is performed by TRACE Analytics GmbH or an authorized distributor.

## 1.4 Symbols used

The symbols used in the user manual are specifically intended to draw attention to the safety precautions! The symbol may not replace the text of the respective safety precaution. Therefore, the text must always be read completely!

Warning of potential consequential damage

## 1.5 Intended use

The dialysis probe provide the perfect solution for sterile online sampling in connection with an online analyser e.g. TRACE C2 Control or BioPAT® Trace in bioreactors used in industrial and laboratory facilities.

The user must ensure that

- the dialysis probe is used for its intended purpose only, see chapter 2 – product description.
- the dialysis probe is used only when functional and in proper working order.
- the user manual is always kept legible and complete at the place of use.

## 1.6 Disposal

**Packaging**
The packaging is made of environmentally friendly materials that can be used as secondary raw materials. If the packaging is no longer needed, it can be disposed of by local waste disposal authorities.

**Dialysis probe**
The dialysis probe including accessories does not belong in your regular household waste as this equipment is manufactured from high-grade materials which can be recycled and reused.

## 1.7 Hazardous materials

The dialysis probes and accessories do not contain any hazardous materials that would necessitate special disposal measures.

Dialysis probes contaminated with hazardous materials (NBC-contamination) will not be accepted for repair or disposal.

**Decontamination Declaration**
TRACE Analytics GmbH has a duty to protect its staff from hazardous substances. When returning the dialysis probe, the sender must enclose a decontamination declaration as proof of compliance with the safety regulations governing the area of application for which they were used.

- This declaration must detail the microorganisms, cells and media that the dialysis probe/components have come into contact with and the measures taken to disinfect and decontaminate it.
- The recipient must be able to read this decontamination declaration before opening the packaging.

The form of a decontamination declaration is available on the website of TRACE Analytics at www.trace.de.

# 2 Product description

The **dialysis probe** provides the perfect solution for sterile online sampling in connection with an online analyser (e.g. TRACE C2 Control or BioPAT® Trace) in bioreactors used in industrial and laboratory facilities.

Figure 1: Dialysis probe out of stainless steel

The dialysis probe in its entirety is made of stainless steel and ensures a high level of sterility by the use of an extremely robust membrane.

The dialysis probe is installed in the bioreactor and sterilized in situ.

It is suitable for all types of cultivation and can be installed in the bioreactor as well as in the PG 13.5 and 19 mm top plate and in a 25 mm side port.

Optimal results can only be achieved if the membrane is completely immersed. Therefore, a minimum immersion depth of 5 cm is required.

The application options for the dialysis probe depend on the reactor dimensions and the process conditions. In general, the dialysis probe is recommended for use on smaller bioreactors, where any loss of volume during sampling is unacceptable.

The use of the dialysis probe as a sampling system ensures analysis at constant volumes.

In addition to the standard membrane, there are special membranes available:

- Cellulase resistant membrane for media where cellulases are released during the process
- Gas diffusion membrane for samples with volatile components (e.g. methanol and ethanol)
- For small bioreactors (<200 ml) with low immersion depth of the dialysis probe (2.5 cm).

The different membranes are ready-to-use, can easily be installed in the dialysis probe and replaced after every cultivation.

# 3 Function

If the dialysis probe is used to feed the sample from the bioreactor into an online analyser, then the analyte is transferred through a diffusion membrane into an internal pump-driven buffer stream and transported to the measuring cell.

The following figure shows the principle function of the dialysis probe.

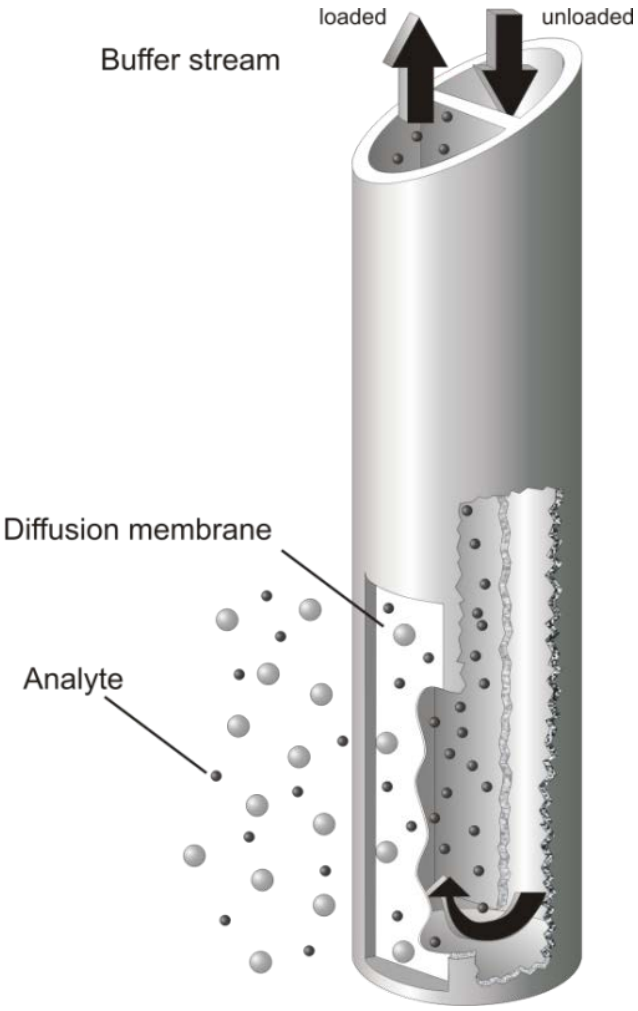


Figure 2: Principal function of the dialysis probe

# 4 Scope of delivery, consumables and spare parts

The dialysis probe including accessories is delivered in protective packaging.

- Please save this packaging; proper (return) shipping is only possible in the original packaging.
- Upon receipt, check the delivery for completeness and any possible damage that may have occurred in transit.
- Any transport damage must be reported within a week of delivery. Complaints made after this date will not be accepted.

## 4.1 Scope of delivery

The dialysis probe (1) for the installation in a PG 13.5 top plate of the bioreactor is delivered with 2 membranes (2), the dialysis probe lunette (3), 2 TORX screws (4), user manual and an installation kit.

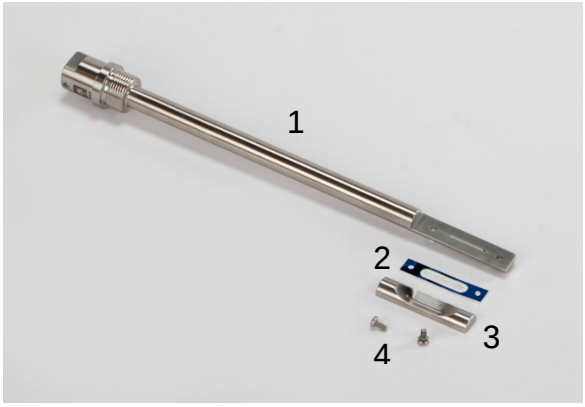

Figure 3: Scope of delivery of the dialysis probe

Figure 4: Content of the installation kit

The installation kit contains the following parts:

- Adapter UNF-LUER male and adapter UNF-LUER female
- Syringe 5 ml
- Autoclave-loop
- O-ring and sliding ring, white
- TORX screw driver

## 4.2 Consumables

Coloured membranes are available for each application (see order information 4.4.2).

| Application: | Colour of the membrane lunette: |
|---|---|
| Glucose/Lactate | green/white |
| Glucose/Lactate/Low | blue/white |
| Glucose/Lactate/cellulase stable | silver/white |
| Ethanol/Methanol | red/white |

## 4.3 Optional spare parts

Two adapter 19/12 mm (M26x1) with fine thread and (RD28x1/8“) with coarse thread are available for the installation of the dialysis probe into the 19 mm top plate.
The dialysis probe with a minimum length of 165 mm can also be installed in a 25 mm side port of the bioreactor using the adapter 25/12 mm.

Figure 5: Dialysis probe with adapter M26x1

Figure 6: Dialysis probe with Adapter RD28x1/8“

Figure 7: Dialysis probe with 25 mm adapter

The dialysis probe (length 300 mm) can also be used in single-use bioreactors via a Kleenpak™ Adapter. The adapter is available from Thermo Scientific™ - Bioreactor Probe Assembly – Order no. SH3B12122.01.

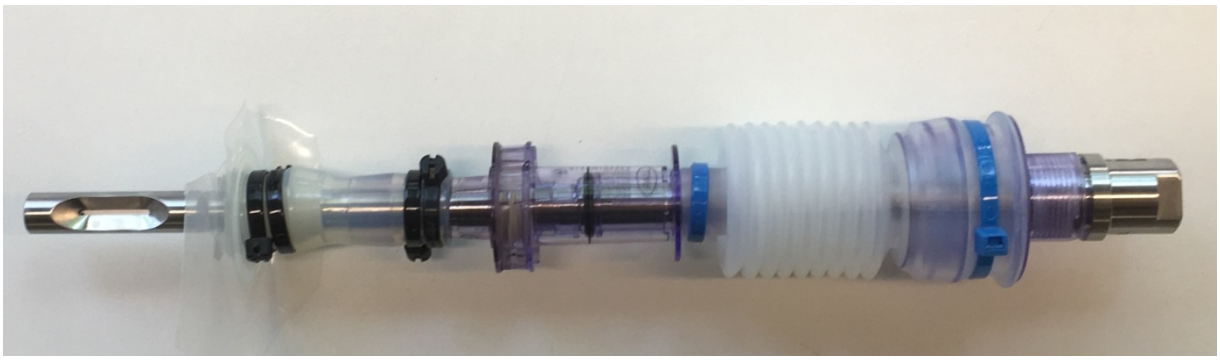

Figure 8: Dialysis probe 300 mm with Kleenpak™ Adapter

## 4.4 Order information

### 4.4.1 Dialysis probe

(Delivery with installation kit, 2 membranes and user manual)

| Description | Order No. |
|---|---|
| Dialysis probe length: 132 mm | 860.202.510 |
| Dialysis probe length: 165 mm | 860.202.520 |
| Dialysis probe length: 212 mm | 860.202.530 |
| Dialysis probe length: 232 mm | 860.202.540 |
| Dialysis probe length: 300 mm | 860.202.545 |
| Dialysis probe length: 332 mm | 860.202.550 |
| Dialysis probe length: 362 mm | 860.202.560 |
| Dialysis probe length: 432 mm | 860.202.570 |

### 4.4.2 Membranes

(Content: 5 pieces)

| Description | Order No. |
|---|---|
| Membranes (Glucose/Lactate) | 860.211.049 |
| Membranes (Glucose/Lactate/cellulase resistant) | 860.211.043 |
| Membranes (Glucose/Lactate/Low) | 860.211.045 |
| Membranes (Glucose/Lactate/low immersion depth) | 860.211.080 |
| Membranes (Ethanol/Methanol) | 860.211.036 |

### 4.4.3 Accessories for the dialysis probe

| Description | Order No. |
|---|---|
| Installation kit dialysis probe (connection to TRACE C2) | 809.100.130 |
| Installation kit dialysis probe (UNF connection to ProcessTRACE) | 809.100.131 |
| Adapter UNF/LUER male/female for the installation kit dialysis probe, content: 5 pieces | 809.100.132 |
| Autoclave loop UNF/UNF for the installation kit dialysis probe, content: 5 pieces | 809.100.133 |
| Adapter 25/12 mm for the installation of the dialysis probe 165 mm in 25 mm side port (Ingold port 52 mm); incl. o-rings | 860.301.001 |
| Retaining nut PG 13.5 with o-ring and sliding ring | 860.300.012 |
| Adapter 19/12 mm for the installation of the dialysis and filtration probe in 12 mm top plate (M26x1); incl. o-rings | 860.301.016 |
| Adapter 19/12 mm for the installation of the dialysis and filtration probe in 12 mm top plate (RD28x1/8") | 860.301.017 |
| Dialysis probe lunette -0.20 mm (Application Ethanol/Methanol) | 860.203.050 |

# 5 Design of the dialysis probe

The dialysis probe is available in the following nominal lengths:

- 132 mm
- 165 mm
- 212 mm
- 232 mm
- 300 mm
- 332 mm
- 362 mm
- 432 mm

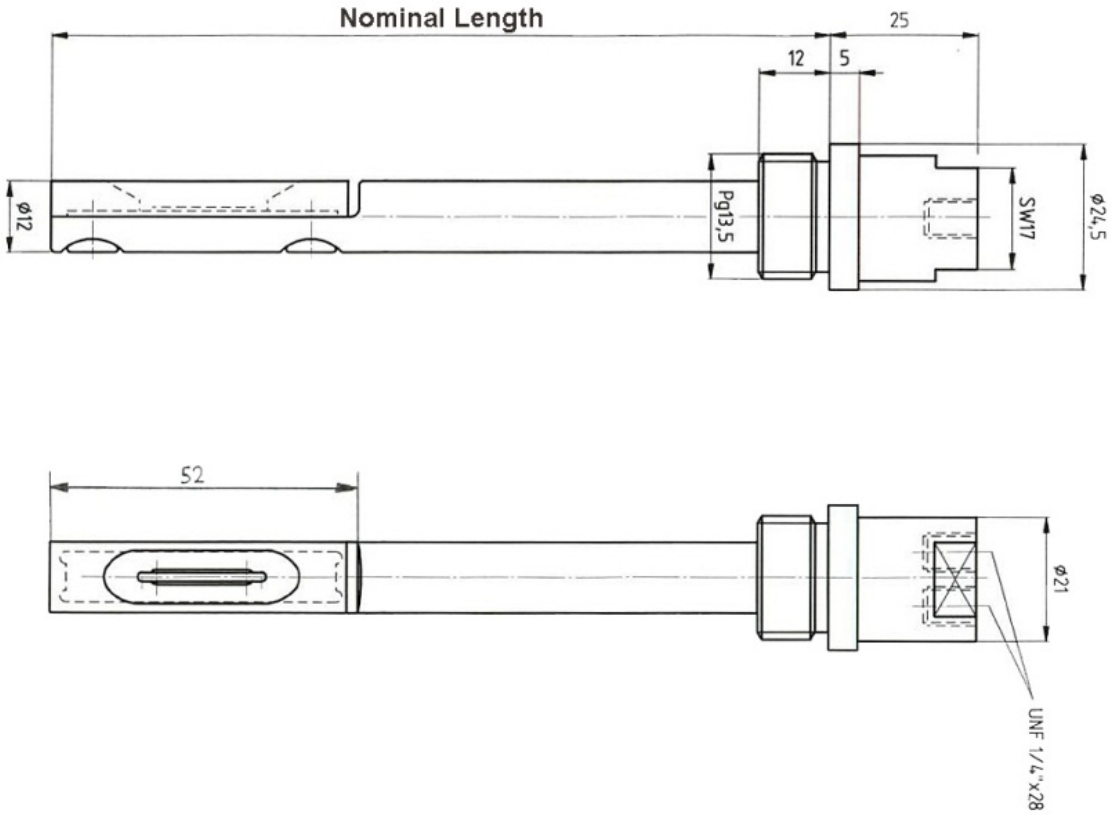


Figure 9: Drawing of the dialysis probe

# 6 Getting started

## 6.1 Connecting the dialysis probe

### 6.1.1 Mounting the membrane in the dialysis probe

Install a new membrane in the dialysis probe before every online measurement involving bioprocesses with sterile feeds, see Figure 10.
If this rule is not observed, a lack of sterility may jeopardize the entire cultivation process.

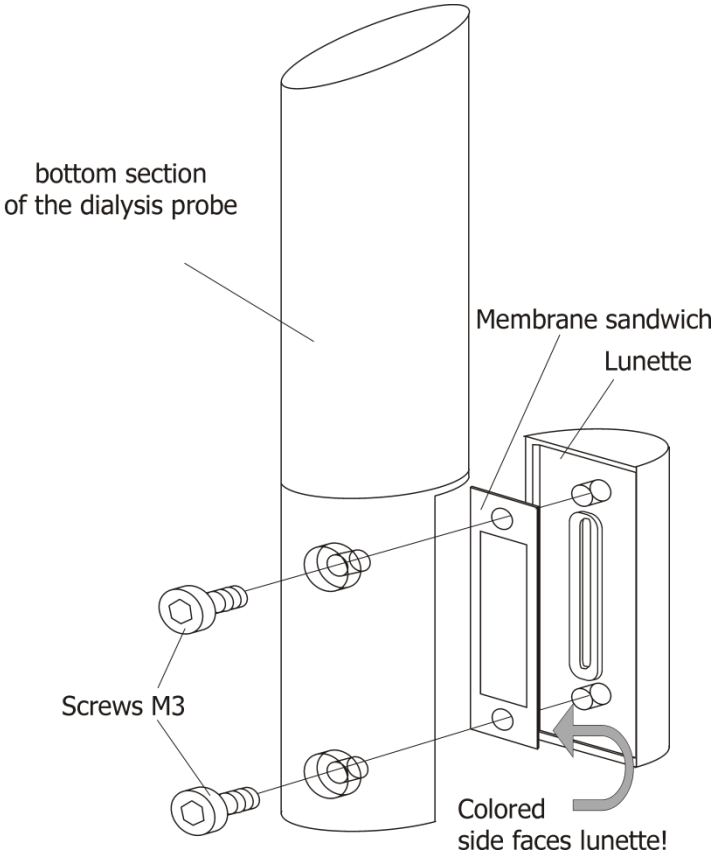


Figure 10: Replacing the membrane in the dialysis probe for the application Glucose/Lactate

The new dialysis membrane must be placed correctly **(colored side faces the lunette!)** and the probe lunette must be tightened firmly with the two screws, see following figures.

Figure 11: Inserting a new membrane

Figure 12: Installation of the lunette

Figure 13: Tightening the 2 screws

| | |
|---|---|
| | **Incorrect insertion of the membrane may result in leaks in the dialysis probe head and jeopardize the sterility of the entire cultivation process.**<br><br>Pay particular attention to ensure that the membrane is seated correctly in the dialysis probe.<br><br>The white side of the membrane must be inserted facing the dialysis probe (buffer-touching).<br><br>The colored side of the membrane faces the probe lunette (media-touching). |
| |  **For the measurement of methanol and ethanol, a special membrane is required.**<br><br>For this purpose a special lunette is to be used with marking "-0.2".<br><br>Obstructions at the membrane lunette can occur if this special lunette is not used resulting in erroneous readings or leakage in the tubeset. |

### 6.1.2 Installing the dialysis probe into the bioreactor

Insert the sliding ring and the o-ring prior to the installation in the fermenter, see Figure 14.

Figure 14: Positioning the sliding ring and o-ring

| | |
|---|---|
| | Attention has to be paid to the minimum immersion depth of the dialysis probe in the bioreactor of 5 cm in order to avoid incorrect measurements.<br><br>A special membrane is available for smaller bioreactors (<200 ml) with low immersion depth of the dialysis probe (2.5 cm), see “4.4.2 Membranes” |

### 6.1.3 Sterilization of the dialysis probe prior connecting to the device

Before connecting the dialysis probe to the analyser (e.g. TRACE C2 Control / BioPAT® Trace) the probe must be sterilized along with the bioreactor.

Connect the dialysis probe to the „UNF to LUER“ adapter, see Figure 15. The inlets and drains on the probe are labeled with arrows on the side. The labels on the tubing set point in the same direction.

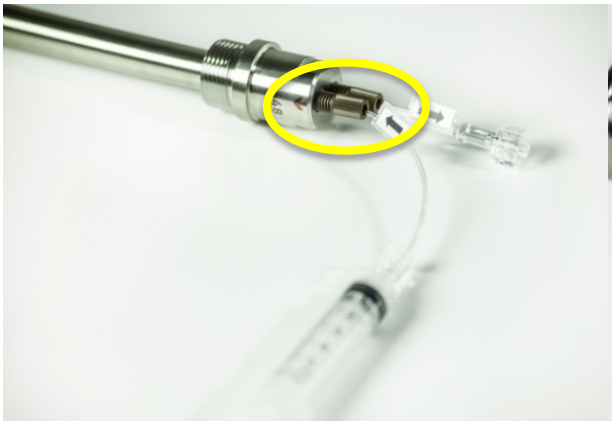

Figure 15: Filling the dialysis probe with buffer solution


Figure 16: Sealing the probe prior to sterilization

a) Prior to sterilization, fill the dialysis probe with buffer solution using the single-use syringe and the „UNF to LUER“-adapter, see Figure 15. At the same time, the probe can be checked for any leaks.
b) For sterilization, seal the probe with the „Autoclave-Loop“, see Figure 16. This will prevent one-sided overpressure from occurring at the membrane in the dialysis probe, which could damage the membrane.
c) Now sterilize the bioreactor.
d) After sterilization: Reconnect the UNF to LUER adapter after cooling.
e) As before, fill the dialysis probe with buffer solution by using the single-use syringe and carefully check if it flows freely, see Figure 15.
f) Now, the dialysis probe can be connected to the corresponding tubing set of the online analyser.

| | |
|---|---|
|  | Dry sterilization is not suitable because the membrane may be damaged. |
|  | Steam sterilization at 1 bar and 121°C.<br>The condition is that the membrane was installed correctly.<br><br>During sterilization, the probe must be filled with buffer solution and closed with the "Autoclave-Loop" otherwise the membrane may be damaged. |

### 6.1.4 Connecting the dialysis probe to the tubing set

The dialysis probe is connected to the online analyser through the dialysis tubing set. The inlets and drains on the probe are labeled with arrows on the side. The labels on the tubing set face the same direction, see the following figures.

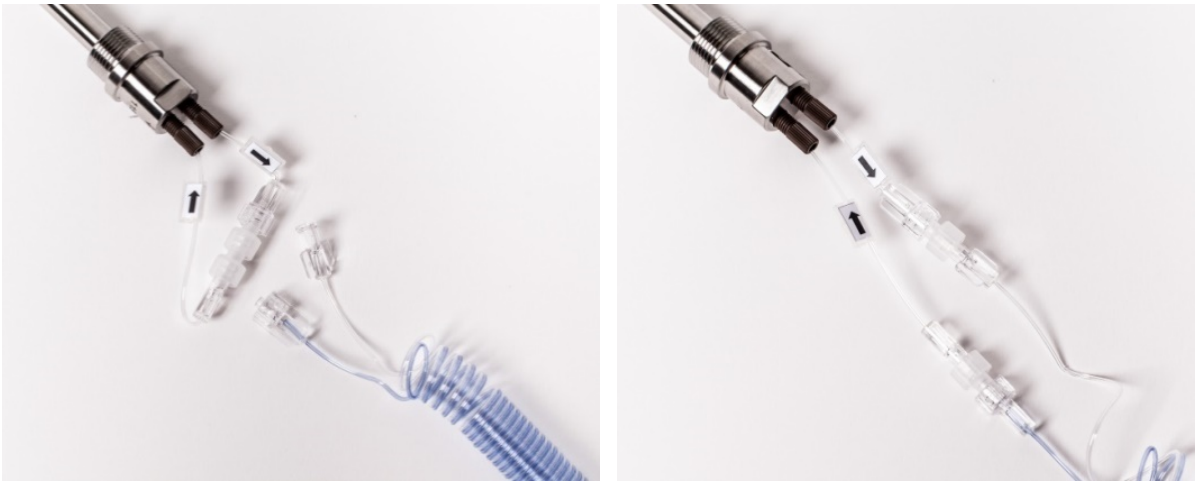

Figure 17: Connecting the dialysis probe to the dialysis tubing set

When connecting the probe to the tubing set, care must be taken to ensure that as little air as possible is introduced into the tubing set in the form of small air bubbles, since these could be trapped in the measuring cell which could lead to fluctuating measurements.

Procedure:

- First, rinse the probe with buffer or distilled water.
- Then connect only the inlet line (arrow towards the probe) and leave the outlet line (arrow away from the probe) open.
- Then start the measurement. This triggers the probe purge and liquid and any remains of air escape from the output line of the probe.
- The second line of the tubing set is then connected and rinsed for a few minutes.

Basically, air bubbles in the tubing set are rinsed out over time. However, this process takes some time (e.g., during the priming process). If air bubbles are present in the measuring cell after the connection of the dialysis probe, it would be advantageous to operate the system with a maximum measuring frequency for a duration of approx. 30 minutes.

| | |
|---|---|
|  | If air bubbles are present in the measuring cell, under no circumstances should calibrations or referencing be carried out, as they may be faulty and consequently lead to incorrect results. |

## 6.2 Cleaning the dialysis probe and replacing the membrane

a) Before removing the dialysis probe from the bioreactor, the tubing set is removed from the probe by removing the tube ends.
b) After harvesting the bioreactor or any dead autoclaving phase, remove the dialysis probe from the bioreactor.
c) The cleaning of the outer surface of the dialysis probe is carried out with a soft brush and water.
d) Check to make sure that the gaskets on the dialysis probe adapter are clean and seated properly
e) Remove the two TORX screws on the end of the dialysis probe using the TORX wrench supplied; this allows the dialysis probe lunette to be removed from the lunette holder along with the dialysis membrane.
f) Afterwards, clean the probe lunette and the lunette holder with a soft brush and water.
g) Unscrew the UNF Adapter, flush with cleaning solution and distilled water to remove any residual salt.

| | |
|---|---|
|  | **Removal of deposits inside the dialysis probe:**<br><br>In order to avoid blocking in the dialysis probe which may result in leakages at the tubing set it is necessary to remove deposits inside the dialysis probe.<br><br>Rinse the dialysis probe with deionized water using the single-use syringe. Drying afterwards by pressing air through the dialysis probe using the single-use syringe. |

# 7 Data sheet dialysis probe

| | |
|---|---|
| Available length in mm: | 132, 165, 212, 232, 300, 332, 362, 432 |
| Material: | Austenitic stainless steel |
| Quality of the material: | 1.4404/AISI 316L |
| Sterilization: | Steam sterilization at 1 bar / 121°C |
| Pressure range: | Resistant up to 6 bar |
| Probe diameter: | 12 mm with PG 13.5 thread |