pH Electrode, round tip

Instructions

About this document

This instruction describes how to use pH Electrode, round tip and pH Electrode with Cell and Holder, round tip.

The pH Electrode with Cell and Holder, round tip includes a flow cell and a flow cell holder.

This document also contains general descriptions of installation, maintenance, storage and calibration of all pH electrodes supplied by Cytiva. For instructions concerning pH electrodes in specific Cytiva systems, refer to the system user documentation.

Description

The pH Electrode, round tip is optimized for continuous pH measurement in a liquid chromatography system. For best performance, the pH electrode and the flow cell shall be used together with pH monitors from Cytiva or other high input impedance pH monitors.

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WARNING

Hazardous substances. When using hazardous chemicals, take all suitable protective measures, such as wearing protective clothing, glasses and gloves resistant to the substances used.

CAUTION

Handle the pH electrode with care. The glass tip may break and cause injury.

1 Preparing a new pH electrode

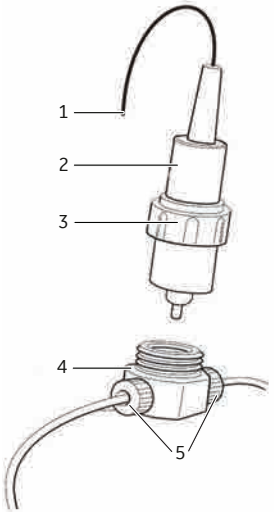
Follow the steps below to prepare your new electrode for use.

Step	Action
1	Unpack the new pH electrode from its box.
2	Check the items against the packing list.
3	Inspect the items for any obvious damage during transport.
4	Remove the plastic end-cover from the electrode tip. ***Note:*** *The plastic end-cover, in which the electrode is supplied, can be used to store the electrode in.*
5	Make sure that the electrode is not broken or has dried out. ***Note:*** *The electrode is delivered in a plastic end-cover containing a 1:1 mixture of pH 4 buffer and 1 M KNO_3 solution. The expiry date of the storage solution can be found on the delivery package.*
6	Rinse the electrode glass bulb with deionized water.
7	Immerse the glass bulb for at least 1 hour in the pH 4 standard buffer.
8	Calibrate the new pH electrode. See instructions in *Chapter 3 Calibration, on page 6*.

2 Installation

Illustration

The illustration below shows the component parts of the pH electrode. The illustration is an example of a pH electrode. The actual product can differ depending on flow cell size and connector type.



Part	Function
1	Connection to the instrument
2	Electrode
3	Locking nut
4	Flow cell[1]

Part	Function
5	Inlet/Outlet tubing[2]

[1] Depending on the product, this part may not be included in the delivery.

[2] This part is not included in the delivery.

The size of the connectors to the flow cell depends on the flow cell size. For smaller flow cells used on systems with pre-flanged tubing with M6 connectors, use a Union M6 female/ 1/16" male connector to connect the flow cell to the system. Larger flow cells are connected with hygienic clamp ferrule connectors.

Note: *The pH electrode must only be used together with the flow cell that it is intended for.*

NOTICE

The tip of the pH electrode has a thin glass membrane. Protect the tip from breakage, contamination or drying out. Always store the electrode in a 1:1 mixture of pH 4 buffer and 1 M KNO_3 solution and do not store in water only.

Installation procedure

Follow the steps below to install the pH electrode.

Step	Action
1	Carefully insert the electrode in the flow cell and tighten the locking nut by hand to secure the electrode in place. ***Note:*** *Make sure that the electrode is fully inserted to avoid leakage and dead volume in the holder.*
2	Connect the inlet tubing to one of the ports of the flow cell (either port can be used).
3	Connect the outlet tubing to the other port on the flow cell. ***Note:*** *The outlet should always be positioned higher than the inlet to reduce the risk of trapped air bubbles in the flow cell.*
4	Connect the pH electrode cable to the pH monitor. Calibrate and adjust the pH monitor before use, see *Chapter 3 Calibration, on page 6*.

3 Calibration

Calibration schedule

To adapt a pH monitor to the characteristics of a particular electrode, the pH monitor should be calibrated. A good laboratory routine is to calibrate the monitor:

- Daily
- When the electrode is replaced
- If the ambient temperature changes

Replace the pH electrode when the slope is lower than 80%, and the asymmetry potential is not within ± 60 mV.

Note: *Any specific calibration instructions, referring to a particular Cytiva system, always has the priority.*

General two-point calibration

A pH monitor is calibrated using the standard pH buffer solutions in a two-point procedure. The two buffer solutions can have any pH value as long as the difference between them is at least 1 pH unit.

Follow the steps below to calibrate the monitor.

Step	Action
1	Immerse the electrode in the first standard buffer solution (normally pH 7.0).
2	Allow the pH monitor to stabilize and adjust it to the pH of the buffer. For a Cytiva pH monitor, adjust the potentiometer ***ZERO*** or according to the instructions supplied with the pH monitor.
3	Rinse the electrode tip with distilled water and dab it carefully with a soft tissue to absorb remaining water. ***Note:*** *Do not wipe the electrode as this may produce unstable readings.*

Step	Action
4	Immerse the electrode in the second standard buffer solution (e.g., pH 4.0 or 9.0).
5	Allow the pH monitor to stabilize and then adjust the reading to the pH of the calibration buffer. ***Note:*** *For a Cytiva pH monitor, adjust the potentiometer* ***SLOPE*** *or according to the instructions supplied with the pH monitor.*

The instrument is now calibrated and ready to use.

Calibration of the Cytiva pH monitor

The potentiometer ***ZERO*** on the pH monitor is used to adjust pH for the buffer solution closest to pH 7, and potentiometer ***SLOPE*** is used for the buffer solution that is further from pH 7.

Calibration can be done either with the pH electrode fitted in the flow cell, or with the pH electrode removed from the flow cell.

When calibrating the electrode fitted in the flow cell, follow the instructions described in *General two-point calibration, on page 7* with the following changes. Pump at least 5 mL of the standard buffer solution through the flow cell to reach equilibrium before adjusting the pH monitor.

When calibrating the electrode out of the flow cell, follow the instructions described in *General two-point calibration, on page 7*.

Calibration in chromatography systems

For calibration of pH monitors in your chromatography system from Cytiva, refer to the *Operating Instruction* of the system, or the UNICORN™ *User Manual*.

Monitor pH/C and Monitor UPC-900

For calibration of Monitor pH/C and Monitor UPC-900 when used as a stand-alone, refer to the respective user documentation.

4 Maintenance

Maintenance schedule

Period	Action
Daily or before use	Calibrate the pH electrode.
Weekly	Check if the pH electrode has dried out. If it has dried out, see *Reconditioning, on page 12* for instructions.
Monthly	Replace the storage solution.
Every 6 months	For a pH electrode that is in use, replace the pH electrode.
When required	Clean the pH electrode.

Cleaning the pH electrode

To improve the performance and to prolong the working life of the pH electrode, the electrode needs to be clean from the following deposits:

- Salt
- Oil or grease
- Protein

Note: *Always calibrate the electrode after cleaning.*

Note: *The pH electrode has a limited working life and should be replaced every six months, or when the response time becomes slow.*

Cleaning the electrode

Unplug the electrode from the pH module, then use the appropriate cleaning procedure from the table below according to the nature of the deposits:

Deposits	Cleaning procedure
Salt	Dissolve the deposits by immersing the electrode for a five minute period in each of the following solutions. Rinse the electrode tip in distilled water between each solution. • 0.1 M HCl • 0.1 M NaOH • 0.1 M HCl
Oil or grease	Wash the electrode tip in liquid detergent and water. If the films are known to be soluble in a particular organic solvent, wash with this solvent. After cleaning, rinse the electrode tip in distilled water.
Protein	Dissolve protein deposits by immersing the electrode in a solution of 1% pepsin in 0.1 M HCl for five minutes, followed by thorough rinsing with distilled water.

After cleaning, soak the electrode in pH 4 buffer for at least 30 min before calibration and use.

If these procedures fail to restore the electrode performance, try the following procedure.

Note: *This procedure can be performed only when the pH electrode is not installed in the cell holder.*

Step	Action
1	Heat a 1 M KNO_3 solution to 60°C to 80°C.
2	Place the electrode tip in the heated KNO_3 solution.
3	Allow the electrode to cool while immersed in the KNO_3 solution before re-testing.

If the electrode performance is still unsatisfactory, replace the electrode.

5 Storage and reconditioning

Storage

A new pH electrode has a working life of up to 12 months, from first use.

Note: *The working life is only valid if the pH electrode is maintained according to the instructions described in this document.*

Proper storage maximizes the performance of a pH electrode and extends its working life. The electrode bulb and junction should be kept hydrated. Store the electrode in a 1:1 mixture of pH 4 buffer and 1 M KNO_3 solution.

For a pH electrode that is in use, replace the storage solution every month. For a new pH electrode, replace the storage solution every 6 months. Rinse the plastic end-cover and refill it with the storage solution.

Note: *Do not store the pH electrode in water only.*

Note: *Make sure not to use the storage solution delivered with the pH electrode after its expiry date. The expiry date of the storage solution can be found on the delivery package.*

Reconditioning

If the glass membrane has dried out, it is important to rehydrate the membrane. Follow the steps below to rehydrate a pH electrode.

Step	Action
1	Rinse the electrode carefully with deionized water.
2	Soak the electrode in 0.1 M HCl for 1 hour.
3	Soak the electrode in pH 4 buffer solution overnight.

If the pH electrode continues to be slow or not function properly, replace the electrode.

6 Troubleshooting

Possible problems

The table below describes possible problems that may occur to the pH electrodes and the corrective actions.

Error symptom	Possible cause	Corrective action
No response to pH changes.	Poor cable connection.	Check that the electrode cable is properly connected to the monitor or instrument.
	Damaged glass membrane.	Replace the electrode.

Error symptom	Possible cause	Corrective action
Small response to pH changes.	Dirty electrode.	Clean the pH electrode and recalibrate (see *Chapter 4 Maintenance, on page 9* and *Chapter 3 Calibration, on page 6*). If problem remains, replace the electrode.
Slow pH response or calibration impossible.	pH electrode tip contaminated.	Clean the pH electrode (see *Chapter 4 Maintenance, on page 9*).
	pH electrode has dried out.	Rehydrate the pH electrode by soaking the electrode in buffer, overnight (see *Chapter 5 Storage and reconditioning, on page 11*).
Incorrect or unstable pH reading	Poor cable connection.	Check that the electrode cable is properly connected to the monitor or instrument.
	Damaged pH electrode.	Replace damaged pH electrode.
	Poorly calibrated pH electrode, e.g., due to incorrect temperature.	Calibrate the electrode (see *Chapter 3 Calibration, on page 6*). Check that the calibration is performed at the correct temperature.
	Dirty electrode.	Clean the pH electrode and recalibrate (see *Chapter 4 Maintenance, on page 9* and *Chapter 3 Calibration, on page 6*). If problem remains, replace the electrode.
	Interference from other equipment.	Increase capillary length or shut off the equipment.

Error symptom	Possible cause	Corrective action
	pH electrode used with organic solvents (e.g., ethanol, methanol and acetonitrile).	Do not use the pH electrode in applications involving organic solvents. Dehydration of the electrode makes stable pH measurements impossible.
	Malfunctioning pump or valves, if the electrode used in a Cytiva instrument.	Check that the pump and valves operate correctly.
	Electrode not properly inserted in flow cell, if electrode is connected to a flow cell.	Check that the electrode is correctly inserted in the flow cell and, if necessary, tighten the locking nut.
	Air in the flow cell, if electrode is connected to a flow cell.	Tap or tilt the flow cell carefully to remove the air. Alternatively, flush the flow cell with buffer at 8 mL/min for 30 seconds.
pH values vary with varied back pressure.	Malfunctioning pH electrode.	Replace the pH electrode.

7 Reference information

For technical specifications and spare parts, refer to the *Operating Instruction*, the Accessory List or the Spare Part List of your system.

NOTICE
Use only spare parts approved or supplied by Cytiva for maintenance and service.

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