

pH Electrode Care

Electrode Calibration

Since glass pH electrodes measure H^+ concentration relative to their reference half-cells, they must be calibrated periodically to ensure accurate, repeatable measurements.

Although calibration against one pH reference buffer (one-point calibration) typically ensures accurate pH measurement, frequent two-point or even three-point calibrations ensure the most reliable results. Make sure your pH system includes calibration buffers for a range of pH values.

Conditioning

Prior to using your electrode for the first time, follow these three steps to condition your electrode:

1. Remove the protective cap from the bottom of the sensor and rinse the electrode with distilled or deionized water. Do not be alarmed if salt deposits are present. This is a normal condition. Simply rinse with water to remove these deposits.
2. During transport, tiny air bubbles may form inside the glass bulb affecting proper functioning of the electrode. These bubbles can be removed by “shaking down” the electrode as you would do with a glass thermometer.
3. Place the electrode in a beaker containing one of the liquids listed below (in order of ionic ability to condition the electrode). Soak for 20 minutes.
 - 3.0 M or 4.0 M KCL (Storage Solution)
 - 4.0 pH buffer
 - 7.0 pH buffer

Note: Never condition a pH electrode in distilled or deionized water. Long term exposure to water will damage the special glass membrane.

4. After conditioning the sensor for 20 minutes, rinse the electrode with distilled or deionized water. The electrode is now ready for calibration and to measure pH.

Handling

Electrodes should be rinsed between samples with distilled or deionized water. Never wipe an electrode—wiping can cause erroneous readings due to static charges. Blot the end of the electrode with lint-free paper to remove excess water. Never directly touch the glass membrane of the electrode with your fingers as oils from your hands will damage the electrode.

Refillable Electrodes

The filling solution in refillable electrodes should be filled up to, but not past, the refill hole. Make sure the refill hole is left open when measuring to ensure that the fill solution flows properly through the reference junction.

Storage

Always keep your pH electrode moist. We recommend that you store your electrode in storage solution. If storage solution is not available, use either a pH 4 or 7 buffer solution. DO NOT store electrode in distilled or deionized water—this will cause ions to leach out of the glass bulb and render your electrode useless.

After storage, you may notice white KCl crystals forming outside your electrode. This will not interfere with measurements. Simply rinse the electrode and blot dry before use.

Protective Cover

Most electrodes are shipped with a protective plastic cover over the glass bulb to help prevent cracking or scratching. Remove the cover before using your electrode. Keep your electrode in long-term storage with the cover on—just fill the cover with enough storage solution to cover the glass bulb and replenish as needed to keep the bulb moist.

Troubleshooting

The purpose of this test is to determine if a pH electrode is functioning within acceptable limits. The asymmetry potential (AP) and slope (efficiency) can be used as guidelines to judge an electrodes performance. Typically an electrode is replaced when the AP is greater than +/- 40mV and/or the slope drops below 85%.

Please follow this step by step procedure to determine the performance of an electrode. Required test equipment includes a pH meter with a mV readout and buffer solutions of 7.0 and 4.0 pH.

1. Connect the pH electrode to the BNC connector.
2. Rinse the electrode thoroughly with DI water to remove all traces of storage solution, process medium, or previous test solution. Thoroughly rinse the electrode after each buffer test to prevent carry over contamination of the pH buffer solutions. Gently shake or blot the electrode with a soft tissue to remove the excess rinse water. Do not rub the bulb since it can cause a static charge and damage your probe.
3. Place the clean electrode into a pH 7 buffer solution. Allow 30 seconds for the electrode to stabilize. Adjust the meter to read 7.0 ph and place the meter in mV mode and record the mV reading.

The mV reading of your electrode in pH buffer of 7.0 is your AP reading. This number should be between -40mV and $+40\text{mV}$. Outside of this range indicates a problem.

4. Repeat step 4 above. Rinse and place the clean electrode in a pH 4 buffer. Allow 30 seconds to stabilize, adjust the meter to read 4.0 and record the mV reading.

The 4.0 pH mV reading should be 159 mV higher than value in pH 7 mV reading.

ex. Example: pH 7 buffer is 10 mV; pH 4 buffer should read 169 mV or more. Outside of this range indicates a problem.

5. To Determine the slope:
 - a. Calculate the mathematical difference between the two mV readings. This is the electrodes span.
 - b. Divide the electrode's span by the theoretical span of 176.9mV and multiply by 100. This determines the slope of the electrode.

Example:

Reading in a 7.01 pH buffer solution: -7.4 mV

Reading in a 4.01 pH buffer solution: +164.6 mV

Span = +164.6 - (-7.4) = 172.0 mV

Slope Calculation example:

$$\frac{\text{Span}}{\text{Theoretical Span}} \text{ or } \frac{172.0\text{mV}}{176.9\text{mV}} \times 100 = \underline{\underline{97\%}}$$

*** Ensure that buffers are fresh and not contaminated. If readings are still outside of this range, clean the electrode and repeat test.**

Cleaning Procedures

If the electrode becomes sluggish or non responsive clean the electrode by:

General

Soak in 0.1M HCl or 0.1M HNO₃ for half an hour.

For refillable electrodes. Drain and refill the Electrode Filling Solution.

Soak the electrode in Filling or Storage Solution for 1 hour.

Inorganic

Soak in 0.1M tetrasodium EDTA solution 15 minutes.

Drain and refill the Electrode Filling Solution.

Soak the electrode in Filling or Storage Solution for 1 hour.

Protein

Soak in 1% pepsin in 0.1M HCl for 15 minutes.

Drain and refill the Electrode Filling Solution.

Soak the electrode in Filling or Storage Solution for 1 hour.

Grease and Oil

Rinse with mild detergent or methanol solution.

Drain and refill the Electrode Filling Solution.

Soak the electrode in Filling or Storage Solution for 1 hour.