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pH Measurement tips

FAQ

How often do I need to calibrate my pH meter?
This depends on the type of products being measured, the maintenance and the required accuracy. It may be weekly, daily or before each use or set of uses.

If measuring the entire range of pH what buffers should be used?
At least 3 buffers, e.g. pH 4, 7 and 10.

What pH electrode do I use for a specific application?
Follow the general rules below for selecting the right pH electrode:

- Glass bodied pH electrodes may be used in most sample types.
- Epoxy bodied pH electrodes are designed for rugged environments, multiple-user situations, and field or plant applications. Epoxy bodied pH electrodes should not be used in organic solvents.
- For situations containing proteins, sulphide, and TRIS, use double junction electrodes.
- For viscous or dirty samples, use sleeve junction electrodes for best results and easy cleaning.
- Check the Selection Guide.

What filling solution do I use?
The recommended filling solution depends on the type of electrode. Some electrodes have sealed references and do not require filling solution. For refillable pH electrodes, use a 3…4 M KCl solution.

How far can my pH electrode be from my meter? What if it is too far?
The maximum distance an electrode can be from a pH meter is about 15 m, sometimes more and depends on the environment where it is placed. If the distance is greater, you will need a transmitter. Use either a transmitter or purchase an industrial electrode with a built-in transmitter. A transmitter will allow you to use your electrode up to 300 m from your meter provided you are not in a noisy environment.

Do pH buffers and filling solutions have a shelf-life?
The typical shelf-life for pH buffers and filling solutions is 2 years unopened and 6 months open. For best results, the pH buffer bottles should be sealed promptly to avoid carbon dioxide absorption.

What is a good pH electrode slope range?
The acceptable slope range is 92% to 102%. Slopes below 92% indicate that the electrode may require cleaning or if cleaning does not help, the electrode should be replaced. Slopes above 102% indicate that the pH buffers are contaminated.

What is a good pH electrode ISO-pH range?
The acceptable slope range is 6.5 to 7.5 pH. Values outside this range indicate that the electrode may require cleaning or if cleaning does not help, the electrode should be replaced.

Do I need an Automatic Temperature Compensation (ATC) probe?

The most common cause of error in pH measurements is temperature. The slope of a pH electrode is highly dependent of temperature, and pH buffer values and sample values change with temperature. For the most accurate results an ATC probe is always recommended. There are three advantages for using an ATC probe. The meter recognises a particular pH buffer and autocalibrates with the correct pH value at the current temperature. The meter calculates and stores the correct slope value. The meter automatically adjusts the stored slope in memory to display the temperature adjusted pH value of the sample.

Why is a double junction electrode better than a single junction electrode?

A double junction electrode is less likely to become clogged because the second junction is located higher up in the probe out of contact with the sample. It is also less sensitive to pollution as the first reference solution chamber is isolated from the measurement solution by means of a second chamber that acts as a salt bridge.

What is the best absolute accuracy I can achieve?

Measuring errors depend on the electronic accuracy of the meter (generally 0.01 pH), the accuracy of the two buffers (generally 0.02 pH) and the chemical behaviour of the electrode. This results in an error of minimum 0.05 pH provided the sulutions are stirred. It is better to consider 0.1 pH as the best possible absolute accuracy. In extreme situations like measuring very low or high pH measurements, difficult solutions, or temperatures far from room temperature will increase the errors.

Why will my pH system no longer autocalibrate?

When the pH system will not autocalibrate, the meter, pH electrode and pH buffers should be checked systematically. If your meter has a mV mode, measure the electrode mV in pH buffers:

- The electrode mV in a pH 7 buffer should be 0 ± 30 mV.
- The electrode mV in a pH 4 buffer (at 25°C) should be 160 to 180 mV more than the value in pH 7.
- The electrode mV in a pH 10 buffer (at 25°C) should be 160 to 180 mV less than the value in pH 7.
- If the mV values are outside of the above ranges, clean the pH electrode. If cleaning does not return the mV to an acceptable range, replace the electrode. Note: as long as the pH electrode has a slope between 92% and 102%, the electrode should be working properly. The pH buffers should be replaced if the measured mV values are outside of the acceptable ranges. Contaminated buffers may slightly contribute to shifted mV values.

My pH electrode is drifting. What should I do?

There are three possible causes for electrode drift:

- If the electrode is new (or has been dry) and drifting, the electrode may not be properly conditioned. Refer to the appropriate electrode instruction manual for details.
- If the electrode is stable in buffers but not in the sample, the electrode may be incompatible with the sample or application.
- If the electrode is drifting in buffers and samples, the electrode may require cleaning, see Maintenance pH.
- Electrode that have been stored for longer periods may have an air bubble in the pH sensitive glass bulb. To remove it, take the electrode in the hand with the glass buble pointed downwards and shake it like a clinical mercury thermometer until the bubble has vanished.

Good Measurement Practices

- While calibrating or measuring all solutions should be stirred gently (e.g. with a magnetic stirrer) to ensure the electrode gives a true representation of the beaker contents.
- Calibration solutions should be chosen which have values near the expected sample value.
- Only fresh calibration solutions should be used! Changing all solutions daily is a good practice.
- All solutions should be maintained at equal temperature.
- Rinse the electrode twice between measurements: first thoroughly in distilled water and then with a small amount of the next sample to be measured.
- Allow the electrodes sufficient time to stabilise while calibrating or measuring. A stability indicator on most of our meters prompts the user when readings should be taken.

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pH measurement in different substances

gas

The only way to measure the pH of a gas is to dissolve it into distilled water and measure the mixture. Technically, the pH of the distilled water/gas mixture will be that of the gas.

Soil

Prepare the sample by combining a 10 g soil sample with distilled water (total volume should be 50 ml), mixing thoroughly, and allowing the mixture to settle for 10 minutes. Carefully insert the pH electrode and allow readings the stabilise.

Ethanol

You need a pH electrode with a low resistance pH bulb, and the reference portion of the electrode should have a double junction design with an outer chamber that is refillable.

Take a 10 ml aliquot of the regular 4 M KCl fill solution and dilute it to volume with the ethanol in a 100 ml volumetric flask. Use this solution to fill the reference chamber of the electrode.

Ethanol solutions require the correct type of liquid junction, that is, one that is easily renewed and cleaned. An open liquid junction or sleeve junction electrode is recommended. The proper functioning of the glass electrode depends on the hydration of the glass layer which takes place on the surface of the pH sensitive glass membrane during soaking and measurement in aqueous solutions.

As long as the electrode is frequently rehydrated, accurate measurements in non-aqueous or partly aqueous solutions such as ethanol are also possible. You are going to have dehydration of the pH bulb and reference junctions with the ethanol. You will have to switch out the electrodes for rehydration every few days. This can be accomplished by soaking in a slightly acidic buffer such as pH 4 buffer.