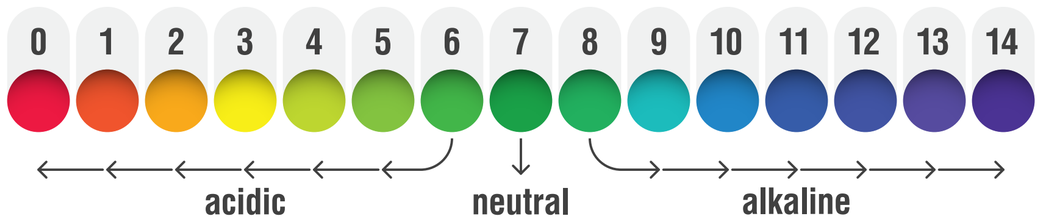
YOKOGAWA
Co-innovating tomorrow™

pH QUICK TIPS

FOR BEST PRACTICE MAINTENANCE AND CALIBRATION

WHAT IS pH?

The pH scale is probably familiar. The pH scale represents the relationship between the level of acidity (H+ ions) or alkalinity (OH- ions) in an aqueous solution being measured. For good practice in order to measure pH there must be at least 5% H_2O present.



WHY MAINTENANCE?

Calibration alone won't extend the lifetime of a pH sensor; however, incorrect calibration can lead to unnecessary replacement due to misinterpreted results. With proper maintenance and following best practice procedures you reclaim the trust in you pH sensor!

Calibration conditions that **improve** sensor lifetime

Use fresh buffers

Buffer precision degrades over time. High alkalinity buffers degrading more quickly when exposed to open air. Follow the manufacturers "use by" dates.

Proper cleaning

Always rinse the sensor with deminer-alised water, when available, or with the next calibration buffer. Wipe the drops off the sensor with a (paper) towel.

Two point calibration

A two point calibration is typically sufficient. We advise a 4 and 7 or 4.01 and 6.87 since the alkaline buffers are less stable.

Take time

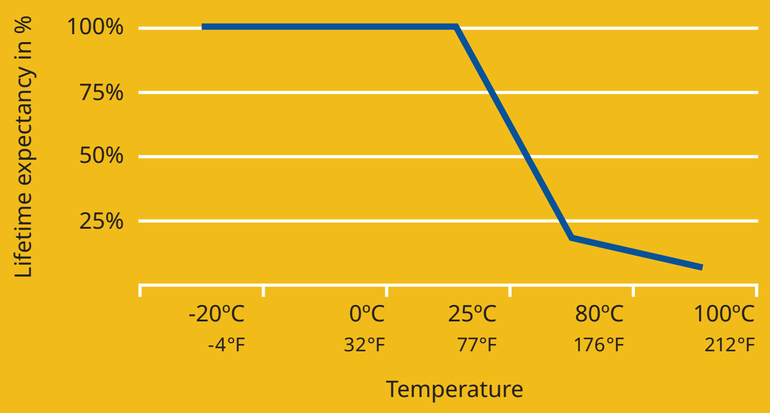
Calibration takes time. Always let the buffer stabilise before starting the calibration.

Use proper buffers

Use NIST traceable, single-use or DIN buffers for superior accuracy and reliability.

HOW DOES TEMPERATURE EFFECT A SENSOR'S LIFETIME:

Every 10°C (50°F) decrease will double the lifetime of a sensor.



A WORD ABOUT BUFFERS

- **pH buffer solutions are an indispensable tool for maintaining an accurate pH measurement.** A pH measurement loop requires regular calibration of the system to compensate for the aging and deterioration of the electrodes it is therefore essential to have a reliable standard with which to do this calibration. This is the task of the pH buffer solution. They are the reference points to which the measurement electrodes are calibrated. Consequently, if these buffers are not accurate themselves, the calibration serves no useful purpose.
- **A good buffer solution is a mixture of a weak acid and its salt mixed in a 1:1 ratio (equilibrium).** NIST buffer solutions are 4.01 pH, 6.86 pH and 9.18 pH respectively at 25°C.
- Figure 1 shows the pH error of NIST buffer 9.18 with varying levels of contaminants present. If contaminants of 0.1 mmol/l are present, an error of 0.09pH will occur.
- If the same level of acid contaminant is present in a technical standard of 10 pH, the error will be at least 0.19pH which is twice as much (see figure 2). If the contaminant is alkaline then the error will be 0.25 pH nearly 3 times that of the NIST buffer.

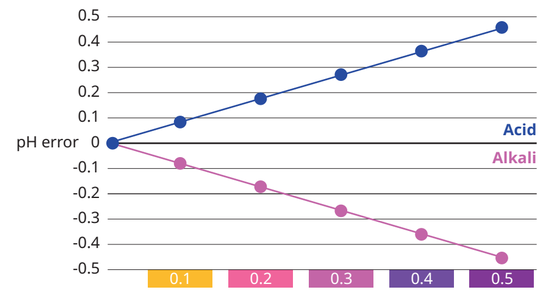


Figure 1. Buffer capacity NIST standard 9.18 pH

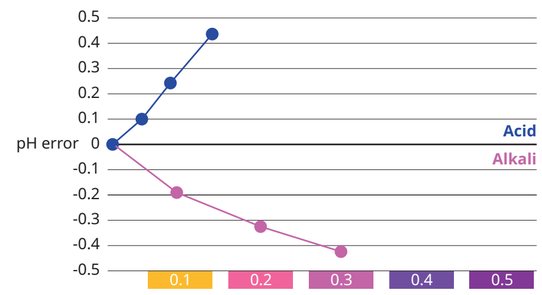


Figure 2. Buffer capacity Technical standard pH 10

Q. **Why then do most pH users use technical or traceable buffers with adjusted pH values of 4.00, 7.00 and 10.00 pH?**

A. **Old habits are hard to break. For decades traceable buffers have been used, because when we have an analog meter it was easier to read and calibrate to a round number.**

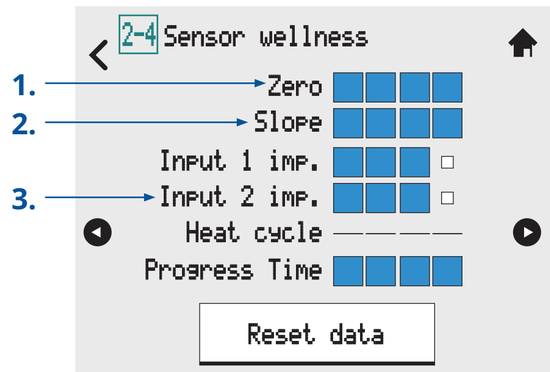
THE BASICS: WHAT DOES YOUR CALIBRATION TELL YOU?

There are four Main Parameters for pH Troubleshooting:

- Asymmetry / Zero
- Slope
- Impedance 1 (Measuring electrode impedance)
- Impedance 2 (Reference electrode impedance)

1. When the millivolt offset is +/- 30 mV, it is advisable to replace the reference electrode.
   Solution: **Clean and recalibrate.**
2. Depending on the application and response time required, it is advisable to replace the pH electrode when the slope value is in the mid to low 80% range.
   Solution: **Clean and recalibrate.**

REMINDER: NERNST Equation determined that every pH change is equal to 59.16 mV at 25°C. If your pH system has zero of 30 mV then you are adjusting an offset equal to 0.5 pH.



3. When the Impedance 2 value starts to approach 30-35 KOhms, the electrode will start to have a slow upward drift.
   Solution: **Clean and recalibrate.**

5 STORAGE RULES:

01

Electrodes can be stored in a pH 4 buffer, storage solution or water.

02

Never store in deionized water. This will decrease the life time and accuracy of your combination pH electrode.

03

Close refilling port & store upright in a cool, dry place.

04

Never allow the sensor to dry out. Rehydrating in the appropriate storage solution for 24hrs may reconstitute the pH glass measuring sensor, but most likely the reference junction will be blocked permanently.

05

Always store your combination pH electrode in the same solution that is used inside your reference electrode, usually a 3mol/l KCl solution. Use an airtight storage vessel.