FAQ pH MEASUREMENT

What is the Accuracy of pH electrodes?

The McGraw-Hill Dictionary of Scientific and Technical Terms defines “accuracy” as:

> “The extent to which the results of the readings of an instrument approach the true values for the measured quantities, and are free from error.”
> This is not possible to do with pH or Redox (ORP) electrodes, because they are not instruments, but sensors that only provide a value when combined together with an instrument. Then, it is the accuracy of the instrument and the solutions used to calibrate the instrument (buffers) that determines the accuracy of the system.

Unlike many sensors today, such as temperature, pressure, flow, etc., it is not possible to pre-calibrate pH sensors, so it is not possible to have an accuracy value. Each sensor needs to be matched to a specific instrument with buffer solutions. In laboratory tests the electrodes have always been able to attain the maximum accuracy possible with a particular system. That is to say they are the “strongest link” in the measurement chain. If the instrument has an accuracy statement of ±0.01 pH units, and the buffers are specified as ±0.01pH units, and the procedures are followed properly, then the system and therefore the electrode, has an accuracy of ±0.01 pH units.

BJC electrodes are tested in NIST traceable buffer solutions, and their output is measured to see if it falls within an acceptable range. If so, the electrode receives a Quality Assurance Certificate that specifies the performance criteria. However, the electrode is not checked for “accuracy”. Rather, it is proven to be “calibratable” when used together with a quality instrument and precise buffer solutions.

So, any pH electrode by itself is not accurate. To establish accuracy requires the simultaneous use of the electrode, pH meter and buffer solutions. Only when used concurrently with all of these components can accuracy be determined.

Is it possible to receive a “calibration certificate” for an instrument, if purchased with an electrode as a complete “system”?

Here the answer still turns out to be “no”. Due to the variable nature of the system; it may or may not hold its calibration during shipment. It is always necessary to re-calibrate a system once it is installed where it will be used for actual measurements. So, “pre-calibration” is not possible.

The conventional approach is to verify the functionality of the instrument using electronic simulation. The electrode is compared to known standards, as described above. Given the acceptable performance of both instrument and electrode, the two can be calibrated using NIST buffer solutions.

TMP-BF-102101

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