

Lab Manager

pH METER **RESOURCE** **GUIDE**



INTRODUCTION

by Trevor Henderson, PhD

QUESTIONS TO ASK WHEN BUYING A PH METER

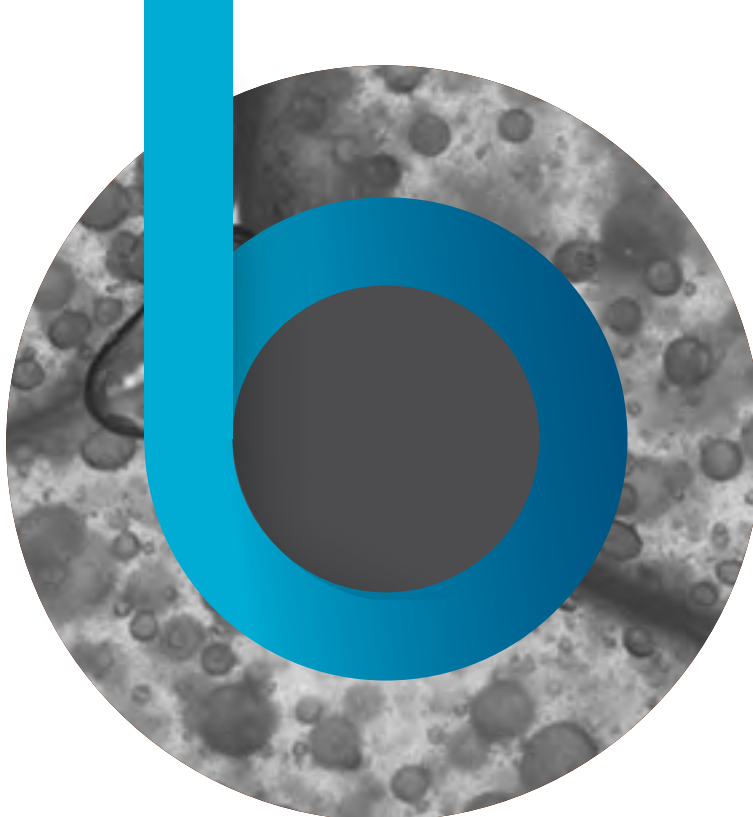
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CHOOSING THE RIGHT PH METER FOR YOUR NEEDS

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FINDING THE RIGHT ELECTRODE

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Introduction

by Trevor Henderson, PhD

The expanded features in today's pH meters reflect the broad use of this technology. Researchers use pH meters in a wide range of research fields—including biological and chemical, agricultural and environmental, and virtually all kinds of manufacturing. Typical pH meters consist of a glass electrode connected to an electronic meter. The electrode produces a small voltage, which is converted to and displayed in pH units by the meter.

Questions to Ask When Buying a pH Meter

by Ryan Ackerman



What if the analysis requires both in-lab work and field work?

Not all research is performed in the laboratory. Many researchers go directly into the field in order to collect samples and perform a variety of tests for applications such as environmental monitoring. As a result, many companies have developed highly advanced portable pH meters, which in some cases can meet the sensitivity and tolerances of their benchtop counterparts. For monitoring purposes inside the laboratory, there are also in-line pH meters, which can be attached directly to a source for real time monitoring of flowing liquids.

What $\pm$ tolerances are required for my processes?

In some cases, even very small fluctuations in pH can have a detrimental effect on the sample or process. Therefore, selecting the proper resolution and range for your pH meter is important. On benchtop models, resolutions as low as 0.001 can be achieved, and for portable models, typically resolutions of 0.01 can be reached. For laboratories dealing with super acids—such as triflic and fluorosulfonic acid—getting a pH meter with an extended range (from -2 to +20 pH) will be ideal.

What if the analysis requires more than just pH (i.e., temperature, conductivity, TDS)?

For researchers who require a more in-depth analysis of their samples, many vendors have begun creating pH meters which cover a wide variety of other tests. Some models are capable of measuring ORP, conductivity, TDS, salinity, temperature, and pH simultaneously. Adding to this convenience is the ability to purchase both benchtop and portable multi test pH meters.

What additional features are offered?

GLP data, PC connectivity (USB vs RS 232), calibration timeout, number of calibration points, ISE concentration readout, incremental methods for ISE, and mv readout of concentration during calibration process are some of the features that may be available for a given pH meter.

5 QUESTIONS TO ASK WHEN BUYING A PH METER

pH measurement systems consist of three main components:

1. What is the replacement cost for a pH electrode?
2. What accessories are included with the meter and what is the complete cost of all the accessories you'll need?
3. What type of connector does the meter use? Is it a BNC or DIN? Is it proprietary or can other manufacturer's probes be used with it?
4. What additional types of features are offered?
5. What type of after sales support is offered? Can repairs be done locally and what is the general turnaround time for a repair?

Choosing the Right pH Meter for Your Needs

by John Buie



ANATOMY OF PH MEASUREMENT

pH measurement systems consist of three main components:

- The meter measures electrode voltages and displays the results.
- The electrode interacts with the sample.
- The reference electrode delivers a constant output regardless of the activity of the hydrogen ion.

There are many different features of a laboratory pH meter to take into account before making your purchase, including accuracy, calibration type and number of calibration points, intuitive operation, expandability, reliability and value. Here, we examine two main selection criteria: benchtop or portable and pH detection range.

Benchtop or Portable

Benchtop pH meters offer the greatest versatility. Depending on which one you choose, these flexible models can provide the option to add built-in printers, data loggers, many different probe arms and accessories. Traditionally, the most precise, feature-packed meters have been benchtop models.

Portable handheld pH meters in the past have lacked some of the sophisticated features of their benchtop counterparts, but now many of the portable models on the market are nearly as advanced. The new generation of portable meters can be a very attractive, if not required, option for lab or field use. Keep in mind that a portable model may carry a slightly higher price tag.

pH Detection Range

A standard range pH meter measures the standard pH scale of 0 to 14, which will cover most applications involving water-based solutions. Some pH meters read a smaller scale, such as 4 to 10, but they are not suitable for most lab environments.

An extended range pH meter is used in applications requiring a base acid that falls outside the standard pH scale of 0 to 14. It could be either a negative reading such as -2 or as high as +20. Examples of these “super acids” include triflic acid and fluorosulfonic acid, which are commonly used in creating and maintaining organic cations that are useful as intermediate molecules in numerous reactions, such as those involving plastics and high-octane gasoline production and research.

Finding the Right Electrode

by Erica Tennenhouse, PhD



Measuring the acidity or alkalinity of an aqueous solution is a simple task for most labs. But other sample types can pose unique challenges that require special pH measurement considerations.

Soil can be tricky to deal with because there are a number of ways one can prepare their sample, and a high risk of the electrode becoming contaminated. Measuring pH in foods such as meat or cheese can also be challenging because of the fats and oils present.

In general, the most difficult samples for measuring pH are those that are very small, viscous, or acidic, or samples containing Tris buffers—because these buffers are reactive with one of the components of a pH electrode, one must specially design an electrode to ensure that interactions do not take place.

Some electrodes are designed with these tougher sample types in mind. For instance, because oily samples make it hard to get decent electrical contact between the pH electrode and the solution, they require a special kind of junction that lets out a lot of electrolyte solution.

When analyzing soil samples, one might also opt for an open electrode junction system to avoid having the electrode junction clog up. Other solutions for soil analysis include using a pointed electrode tip to allow for direct soil measurements, which cuts down a lot of the sample prep and makes it easier for customers to get the job done.

For food analysis, electrodes that have stainless steel blades at the end are a good option. They allow users to take a direct measurement without having to blend a piece of cheese, for example, and then filter and measure the supernatant. It simplifies the process for those who may not have technical expertise or the equipment to process samples.

Then there are electrodes that are ideally suited to more viscous liquids. These allow more of the internal solution of the pH electrodes to bleed into the sample, giving it the ionic activity it needs for a good measurement of viscous fluid.

ELECTRODES 101

Reference Electrode

- Combination: reference electrode included with measuring electrode
- Electrode pairs: reference and measuring electrode are separate, used for colloidal suspensions

Single versus Double Junction

- Single junction: general-purpose applications
- Double junction: salt bridge prevents reactions between electrode and sample, best for proteins, sulphides, strong reducing ions, Tris

Fill Solution

- Refillable: higher maintenance, higher accuracy, last longer
- Gel-filled: lower maintenance, lower accuracy, shorter lifespan

Electrode Styles

- Shape of the electrode, need to consider the volume of your sample, the size of the sample container, and the state of the sample (solid, gel, aqueous)

Electrode Junctions

- Sure-flow/sleeve: best for dirty samples that may clog standard junctions
- Open pore: provide a larger junction and an increased flow
- Wick and glass fiber: best for aqueous samples
- Ceramic: most standard laboratory applications

Connector

- BNC: universal, can be used with any electrode with a BNC connector
- DIN: proprietary, can only be used with a compatible meter

LINDA Says...

Regularly replacing your pH meter electrode is important in maintaining its accuracy and reproducibility. Depending on how much abuse your unit takes and your specific application, you may need to replace the electrode in three to six months or 12 to 18 months. Some electrodes are not well suited to particular applications and therefore wear out faster in those situations. You'll need to do your research to ensure the right fit.



Meet LINDA

LINDA is a lab manager. Her job is to balance the scientific needs of her staff with the business needs of her lab. LINDA stands for:

Leadership
Informed
Negotiator
Decision-Maker
Accountable