# pH Electrode Guidebook

A guide for choosing an electrode for your application.

HANNA® instruments

hannainst.com

## Contents

# Hello

Thank you for picking up our pH guidebook. We believe that what you have before you will be an invaluable resource towards demystifying pH measurements and helping you achieve the high quality testing results you've been looking for. Our company mission is built upon this very principle of helping our customers, so it is with great pleasure that we present this guidebook to you.

Don't let us keep you; dive on in.

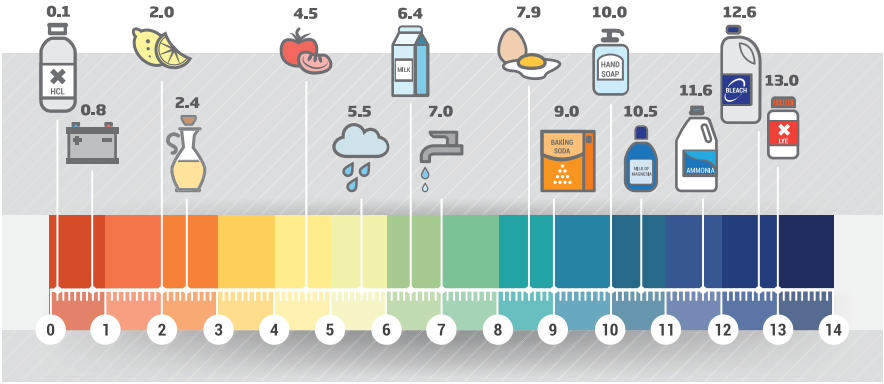
# Theory

## What is pH?

In technical terms, pH, or "potential of hydrogen", is the hydrogen ion activity in a solution. It's measured on a logarithmic scale of 0 to 14, with 7 being neutral because the activity of positively charged hydrogen ions ($H^+$) and negatively charged hydroxide ions ($OH^-$) is equal. At low pH values (from 1 to 6), the hydrogen ion activity is greater so the solution is considered acidic. At high pH values (from 8 to 14), the hydroxide ion activity is greater and the solution is considered basic.

## Temperature and pH

As a solution increases in temperature, ion mobility also increases. Since pH is a measurement of hydrogen ion activity, the temperature-driven increase in ion movement translates to a change in pH. In the same way, a decrease in the temperature of a solution leads to a decrease in ion mobility and a subsequent change in pH. Temperature compensation is required for the most accurate measurements.



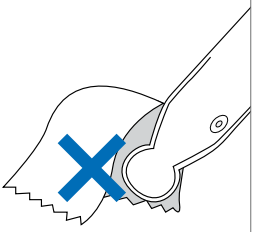
# Best Practices For Great Results



## Keep the electrode hydrated

**Why**–Drying out the electrode leads to drifting pH values, slow response times, and incorrect measurements.

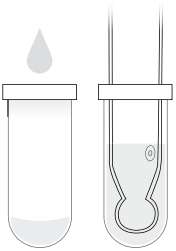
**Fix**–"Revive" a dry electrode by submerging the bulb and junction in pH storage solution for at least one hour.



## Rinse, do not wipe your electrode

**Why**–Wiping the pH glass can produce a static charge which interferes with the pH reading of the electrode.

**Fix**–Simply rinse the electrode with distilled or deionized water (DI). Blot (do not rub) with a lint-free paper towel (e.g. Kimwipes®) to remove excess moisture.



## Store your electrode in storage solution

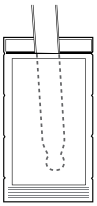
**Why**–Storing in deionized water (DI) causes ions to leach from the glass membrane and reference electrolyte resulting in a slow and sluggish response.

**Fix**–Store your electrode in storage solution.

## Clean your electrode regularly

**Why**–Deposits can form on the electrode during use, coating the sensing glass. This can lead to erroneous calibrations and readings.

**Fix**–Clean the electrode using a specially formulated cleaning solution for pH electrodes- ideally one that's developed for your application.



## Calibrate often

**Why**–All pH electrodes need to be calibrated often for best accuracy.

**Fix**–The frequency of calibration depends on how accurate you want to be - daily calibration is ideal.

## Pick the right electrode for your sample

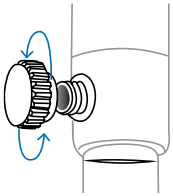
**Why**–General purpose electrodes are functional for a wide variety of applications but not ideal for all samples.

**Fix**–Based on your sample you may require an electrode designed for food, high/low temp, non-aqueous, or other types of samples.

## Open or loosen the fill hole cap

**Why**–A closed electrode fill hole may lead to slower stabilization times.

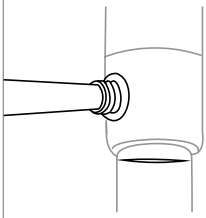
**Fix**–Loosen or remove the fill hole cap. Remember to put it back when storing the electrode. (Not applicable for non-refillable electrodes)



## Keep the electrolyte level full

**Why**–Electrolyte flows out from the reference junction over time. Low electrolyte levels may cause erratic readings. (Not applicable for non-refillable electrodes)

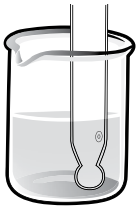
**Fix**–Ensure that your electrode fill solution level is no less than one-half inch from the fill hole cap.



## Properly submerge your electrode

**Why**–Both the pH sensing glass and reference junction need to be completely immersed in order to function properly.

**Fix**–Add enough sample to submerge both the junction and sensing glass.



## Inspect your electrode

**Why**–Over time, the sensing portion of the glass becomes less responsive and will eventually fail. Damage from use is also possible. This will cause erroneous readings.

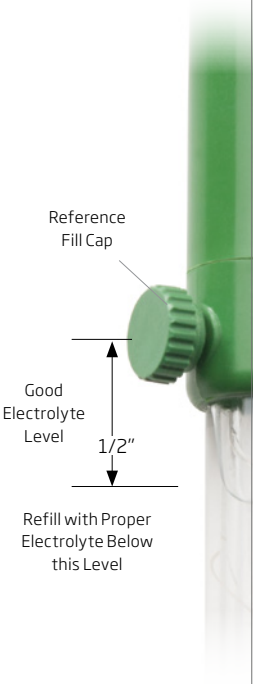
Fix–Check your electrode for damage and perform a slope and offset calculation.

# Calibration

## Five Easy Steps

A clean, calibrated, and conditioned pH electrode will provide lasting value and accurate, repeatable results.

## 1. Inspect




It's important to first check your electrode for any problems such as cracks, bubbles, evaporation, or crystals. If your electrode is damaged, contact our Hanna Technical Service Department.

During transport, air bubbles may form inside of the glass bulb that can affect the measurements. Simply shake down the electrode as you would a liquid thermometer.

If the electrode is dry, you may condition the sensing tip by soaking the bulb and junction in storage solution for at least one hour.

Over time, the electrolyte solution in refillable electrodes may evaporate. Be sure to inspect its level before performing any calibration. If the electrolyte level is more than ½ inch below the filling hole, you will need to replenish it with the proper electrolyte solution.

Sometimes, storage solution evaporates during shipment or storage leaving salt crystals in and around the electrode cap or probe. This is normal and may simply be rinsed away with water.

## 2. Prepare

The calibration of your pH electrode is only as good as the buffers used. Acidic pH buffers at and below 7.01 should be used in 4-8 weeks after opening. Buffers greater than pH 7.01 are best used within 2 weeks.

To prevent cross-contamination, the electrode shouldn't be placed in the bottle of calibration solution and buffer shouldn't be poured back into its bottle.

If you're using a refillable electrode, the fill cap should be removed prior to calibration and measurement. This allows for a higher flow rate of electrolyte through the junction, resulting in faster and more stable readings.

Prior to placing an electrode in calibration solution, it should be thoroughly rinsed with deionized water (DI) to prevent any contamination of the pH buffer. Be sure to rinse your electrode with DI before and after placing it in any solution.

## 3. Stir

For best results, use a stirrer. This will ensure that the calibration solution or sample is well mixed during measurement. The movement of the solution also speeds up the response time of the electrode.


HI180 and HI181 stirrers p. 68

## 4. Calibrate

Calibration may seem time-consuming, but finding the right meter can make it much easier for you. Meters with automatic calibration will recognize the buffers and prompt you to confirm when the calibration is stable. Most will proceed to the next buffer automatically, repeating the sequence and making calibration as easy as dipping and rinsing. When calibrating, it's recommended to choose calibration points that would bracket your expected measurement range.

## 5. Confirm

Hanna recommends performing a multiple-point calibration. Having at least two calibration points provides calibration slope and offset data that can be used to diagnose problems associated with the electrode or buffers. An offset between ±30 mV and a slope percentage between 85 and 105% is a sign the electrode is working properly.

Many Hanna pH meters feature CAL Check™ technology, a diagnostic system that automatically eliminates questionable readings due to dirty or faulty pH electrodes or contaminated pH buffer solutions by analyzing slope and offset trends during calibrations.

# Care


Specific Use Electrode Cleaning Solutions p. 64

General Use Electrode Cleaning Solutions p. 66

## Clean

The most common cause for inaccurate measurements is a dirty or improperly cleaned electrode. Just because an electrode looks clean doesn't mean that it is. This is important because during calibration, the instrument assumes that the electrode is clean.

Meters on the market will accept calibrations with an offset voltage of 60 mV. A deviation of offset from 0 mV is typical but ideally should be no greater than ±30 mV. Calibration compensates for regular offset changes over time due to regular usage.

A pH electrode offset can be checked by placing the meter in mV mode and reading the mV potential in pH 7.01 buffer. Alternately, a device with electrode diagnostics will provide the offset. If after cleaning, changing electrolyte, and using fresh calibration solution, the offset is still outside of ±30 mV, the electrode may need to be replaced.

Signs of a dirty electrode may include drifting readings, calibration trouble, or slow stabilization times. Your meter can still be calibrated even if the electrode sensor tip is not properly cleaned. If the contamination dissipates, the calibration is no longer valid and must be recalibrated.

By first cleaning the electrode, you are ensuring the surface of the sensor tip is reading correctly resulting in an accurate calibration.


Electrode Storage Solution p. 67

## Condition

After cleaning or while not in use, it's important to keep a pH electrode properly stored and conditioned. Conditioning minimizes junction clogging and hydrates the sensing bulb, ensuring a fast response time.

Storing the sensor in electrolyte storage solution is recommended. Never store an electrode in purified water, such as RO, deionized, or distilled water.

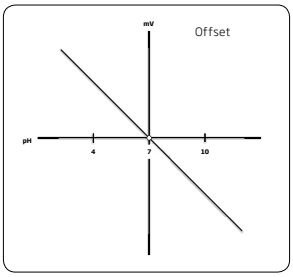
Storing an electrode in deionized water will affect the concentration of the electrolyte fill solution of the sensor leading to a change in sensor reference potential. Storing in deionized water also affects the sensing glass as it results in poor response, premature failure, and ultimately replacement of the electrode.

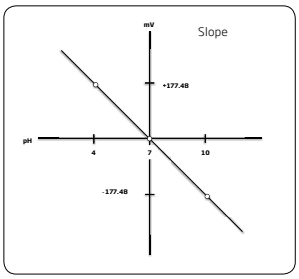
If it's been some time since you've used your electrode, you may want to check to see if it's working properly. Make sure the electrode is clean and conditioned properly before performing an electrode diagnostic.

## Check

Some meters are able to display the probe condition automatically after a calibration, but for those without automatic diagnostics, you can manually check the slope and offset beforehand using mV mode. As stated in the Confirm Section, an offset between ±30 mV and a slope percentage between 85% and 105% is a sign the electrode is working properly.

The average probe will last you 12 to 18 months if used properly and matched to your application. If you find your electrode is outside of these values, give us a call. You may need to replace your electrode.




## How to Calculate the Slope and Offset of a pH Electrode

1. Measure and record the mV value in pH 7.0 buffer; this is the electrode offset.

2. Measure the mV value in a second buffer, such as pH 4.0.

3. To determine the electrode slope, calculate the absolute mV difference in between the two buffers.

4. Divide this by the difference of pH units between buffers. (Example: the difference in pH units between 7.01 buffer and 4.01 buffer is 7.01-4.01=3).

$$\%\ \text{slope} = \left( \frac{\frac{\Delta \text{mV}}{\Delta \text{pH units}}}{\frac{59.16\ \text{mV}}{\text{pH units @ 25°C}}} \right) * 100$$

5. To convert this result to electrode slope percentage, divide the electrode slope by the theoretical maximum slope (59.16 mV/pH unit @ 25°C), and multiply by 100.

# Anatomy of a pH Measuring System

## The Big Picture

A pH measuring system consists of four main parts: a pH sensing half-cell, a reference electrode half-cell, a special meter to display your pH value, and your sample solution. Together, these form an electrochemical circuit that measures and displays the pH of your sample.

### ❶ pH Sensing Cell

The sensor half-cell is composed of an internal electrode in buffered electrolyte and a special glass membrane that responds to the hydrogen ion activity of your sample solution. The pH-sensing chamber is kept separate from the reference electrode chamber.

### ❷ Reference Electrode

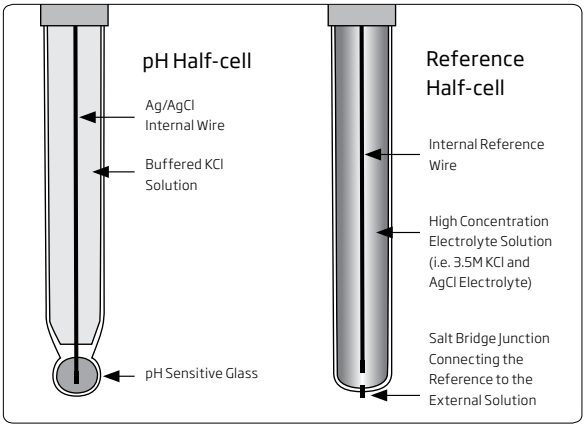
The reference half-cell electrode in electrolyte supplies a known, stable voltage and is insensitive to the sample solution. The pH sensing electrode voltage is measured against the reference.

### ❸ Measurement Device

A high-input impedance meter processes the voltage from the electrochemical cell and converts it to a meaningful measurement unit, pH.

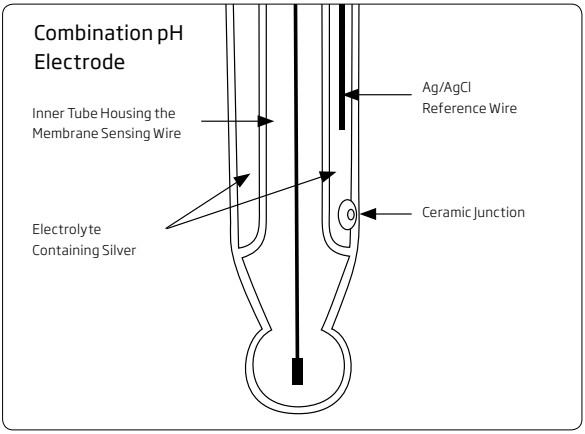
### ❹ Chemical Sample

Your sample is the connection between the sensing electrode and the reference electrode. This connection allows the entire measuring circuit to work.



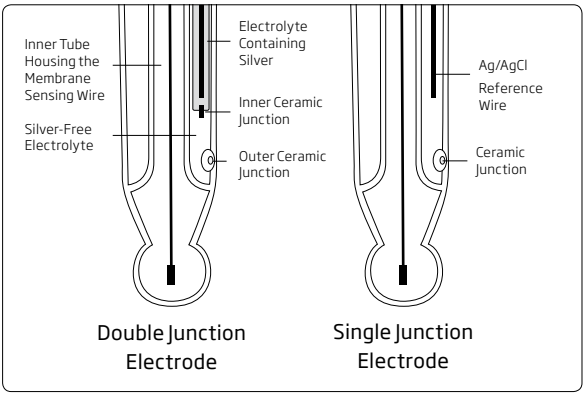

## Half Cell Electrodes

Until the 1970s, it was common practice to offer two half-cells separately, a glass pH sensor and a reference electrode cell.



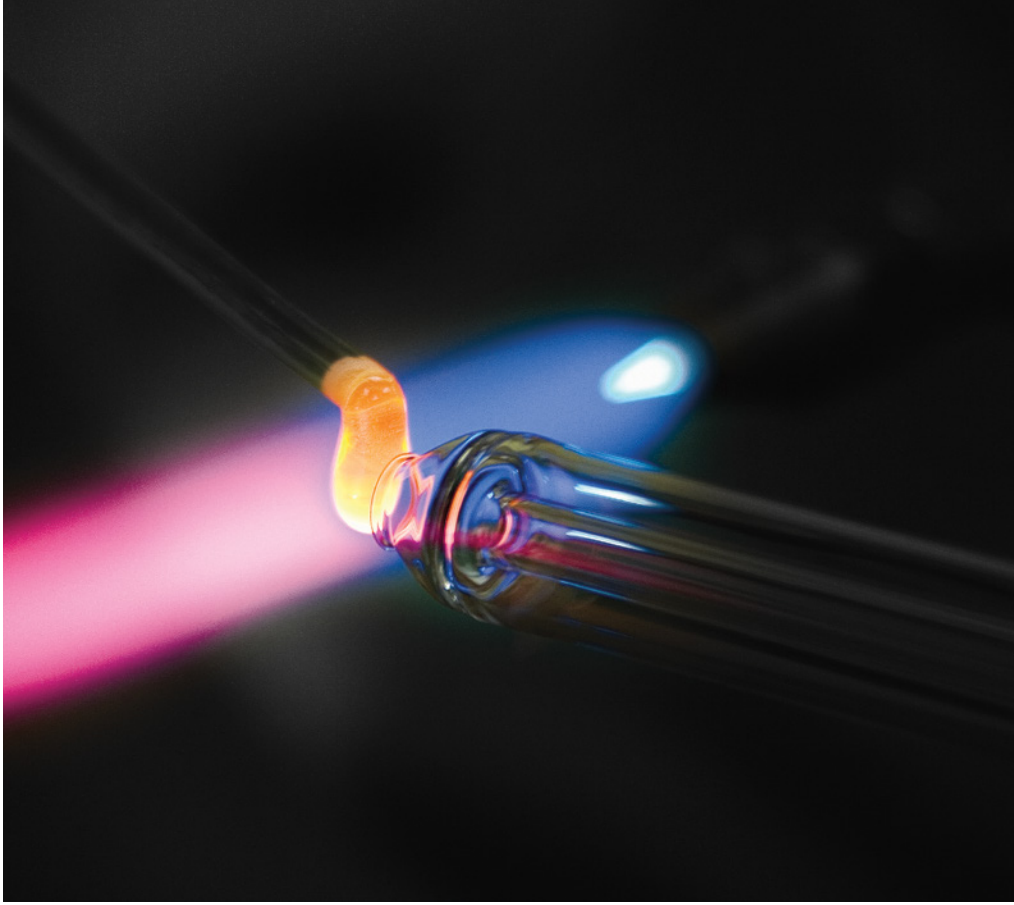

## Combination Probes

Today, it is more common to use a single combined electrode that has both sensing and reference components.




## Single Junction vs. Double Junction

Many of our probes contain a secondary chamber that holds the reference electrode. This "double junction" design is less susceptible to clogging and presents a silver-free electrolyte solution interacting with the sample.



# The Glass Membrane

Hanna's mission of application driven design is what influences our chosen pH glass formulations. We select the highest quality compositions for our glass membrane sensors, ensuring the highest quality measurements with the greatest degree of accuracy. Hanna Instruments produces four different glass types covering the vast number of pH applications.

### General Purpose (GP) Glass

Our general purpose hydrogen sensitive glass provides the greatest response over the entire pH range and can be used for a wide variety of applications. This composition of glass is typically used with a spheric bulb geometry.

### Low Temperature (LT) Glass

Low temperature glass membranes have a lower impedance and are suitable for samples at lower temperatures and lower conductivities. They are often offered in flat or conic geometries.

### High Temperature (HT) Glass

Designed for extended use at elevated temperatures where glass impedance is know to decrease, high-temperature glass offers a higher resistance making it possible to obtain accurate results with excellent response times.

### Hydrofluoric Acid (HF) Glass

Hydrofluoric Acid dissolves glass rapidly. Hanna offers HF resistant glass for aggressive applications containing fluoride ions. Membranes manufactured with this glass composition last ten times longer than sensors made with a standard pH glass formulation.

# Membrane Geometry

Our sensing membranes are fabricated in four different shapes; each serving a unique purpose to maximize sensor accuracy, response, and longevity.

## Spheric Profile

Spheric tips are recommended for general use in aqueous solutions. The round bulb geometry is the most common shape for a glass pH membrane and provides a wide surface area for a variety of liquid samples to contact.

## Conic Profile

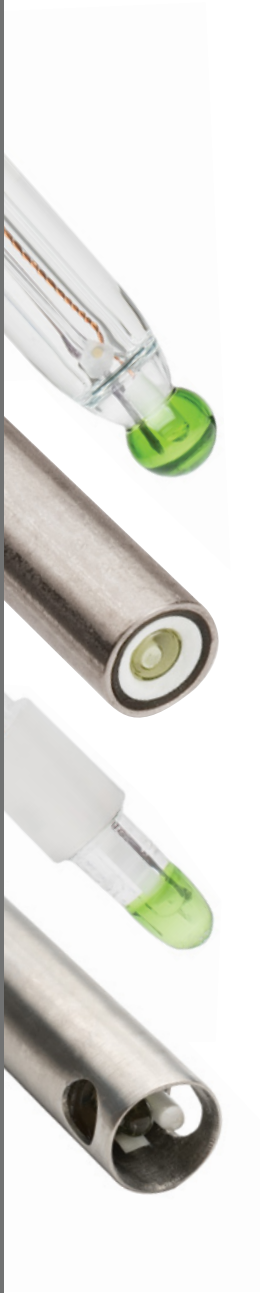
Best used in slurries, emulsions, semi-solids, and solid samples; conic designs are ideal for direct penetration into samples due to their pointed profile and geometric strength. These tips are well suited for samples ranging from soils and gels to sauces, cheeses, and meats.

## Flat Profile

A flat-tip geometry allows for a direct surface measurement of a sample. These designs are ideal for measuring the pH of skin, leather, or paper. When combined with a concentric PTFE junction, these sensors are excellent for measuring the pH of unknown spills in the field or laboratory.

## Dome Profile

Similar to a spheric profile, dome profiles are used where a smaller profile would either enhance functionality, such as in electrodes with CPS technology or where space is needed in electrode construction such as in titanium bodied electrodes.



# Junction Design

The type of junction used in a pH electrode is one of the most important design considerations when selecting the right sensor for your application. The junction is the electrical pathway between the sample and the internal reference half-cell. This reference chamber contains an electrolyte solution, which diffuses through the junction into the sample. Any clogging of this junction may result in erratic and unstable readings.

## Porous Ceramic

A porous ceramic frit is one of the most common junctions available for standard laboratory applications. The ceramic material is easily fused with the electrode glass and has a similar coefficient of expansion. A single electrode may contain a single, double, or triple ceramic frit allowing for enhanced electrolyte flow.

## Porous PTFE

Polytetrafluoroethylene (PTFE) contains hydrophobic properties, providing one of the most chemically resistant junctions available. It is commonly used in pH sensors for industrial applications because of its chemical advantages and durability.

## PTFE Sleeve

A PTFE sleeve surrounding an open junction is an excellent choice for applications in samples with high amounts of solids such as slurries, sauces, or wine must. The sleeve design allows for high electrolyte flow and prevents clogging that could otherwise inhibit accurate results.

## Fiber Wick

A fiber wick junction, also known as a cloth junction, is typically used with titanium bodied, gel filled probes or within our tester line. An excellent choice in the field, the junction's renewable surface allows for a quick refresh when readings are erratic or unstable.

### Open Design

Open style junctions are filled with a special gel electrolyte that directly contacts the sample. These designs allow for an extremely high flow rate with low contact resistance and low clogging potential. They are ideal for solid and semi-solid samples and emulsions.

## The Electrode Body

Whether you are using a half-cell pair or combination electrode, the body material is an important consideration. The body of a pH electrode can be made of many different materials that may help to make pH measurements easier. The right body material will vary depending on the testing environment, the sample type, and the frequency of use.

### Glass Body

Glass bodies are a staple of pH electrode design. Glass is resistant to a variety of chemicals, is easy to clean, and transfers heat readily for fast thermal equilibrium between the sample and the sensor. Glass body electrodes are ideal for any type of laboratory application.

### PEI Body

Polyetherimide is a high-performance, durable plastic that offers excellent resistance against aggressive chemicals. Rugged and resilient, PEI electrodes are ideal for environmental or industrial applications in the field or on the factory floor.

### PVDF Body

Polyvinylidene fluoride is food grade plastic that stands up to a variety of cleaning chemicals and solvents. It is durable and has a high resistance to abrasion, mechanical strength, and resistance to fungal growth.

### Stainless Steel Body

Designed and constructed with AISI 316 stainless steel, this extremely robust material can withstand a wide variety of aggressive chemicals in the harshest of applications.

# Sensor Connections

Connection and communication is your final consideration when selecting an electrode. It's important to understand that not all electrodes connect to all meters. Some sensor connections are specific to a meter, brand, or manufacturer. Be sure to take note of your requirements when replacing or purchasing a meter and electrode.

B
BNC

## BNC Connector

A BNC connector is a universal connector for sensors. Any pH meter with a BNC connector is compatible with any pH electrode with a BNC connector, regardless of device manufacturer.

B
BNC+PIN

## BNC+PIN Connector

A BNC + PIN connector are for meters that utilize CAL Check™.

D
DIN

## DIN Connector

This threaded, multi-pin connector is manufacturer-specific and typically matched to a compatible meter. The pin connections allow for additional sensor features such as integrated temperature sensors, amplifiers, and grounding pins.

## Quick Connect DIN

A quick DIN connection allows for a simple, waterproof, and secure connection without having to tighten a threaded connection. These connections are also typically matched to a specific meter.

## 3.5 mm Digital Connector

This digital connector contains a four-pole design used with digital electrodes. This connection allows digital data transfer from the sensor to the meter and is also meter-specific. Within the probe there is an integrated microchip that stores calibration data, electrode type, and serial number, which allows for changing of sensors without having to recalibrate.


## Wireless Connection

Bluetooth wireless connectivity is available with our HALO line of electrodes. These sensors transmit information digitally to our Hanna Lab App available on a variety of smart devices.

# pH and ORP Electrodes

B BNC **HI1043B**

B BNC+PIN **HI1043P**

Designed for hydrocarbons, paints, solvents, high conductivity samples, strong acids and bases, and for measuring samples at elevated temperatures.

## HI1043B, HI1043P

The HI1043B and HI1043P are glass body, refillable, double junction pH electrodes. These electrodes have a single ceramic junction in the outer reference cell and the pH sensing portion is made with high temperature glass.

d DIGITAL **HI10430**

Designed for hydrocarbons, paints, solvents, high conductivity samples, strong acids and bases, and for measuring samples at elevated temperatures.

## HI10430

The HI10430 is a glass body, refillable, double junction pH electrode with a built-in temperature sensor for temperature compensated measurements in a single probe design. The HI10430 has a triple ceramic junction and uses high temperature glass, making it ideal for solutions at temperatures above 30°C.

B BNC **HI1053B**

B BNC+PIN **HI1053P**

Designed for emulsions, fats and creams, soil and semi-solid samples, low conductivity solutions, and for measuring samples at cooler temperatures.

## HI1053B, HI1053P

The HI1053B and HI1053P are glass body, refillable, double junction pH electrodes. These electrodes have three ceramic junctions in the outer reference cell for an increased flow rate of reference electrolyte and a conical pH sensing tip that is made with low temperature glass.

d DIGITAL **HI10530**

Designed for emulsions, fats and creams, soil and semi-solid samples, low conductivity solutions, and for measuring samples at cooler temperatures.

## HI10530

The HI10530 is a digital glass body, refillable, double junction pH electrode that has a built-in temperature sensor. It also features a triple ceramic junction in the outer junction and the conical pH sensing portion is made with low temperature glass.

## HI1083B, HI1083P

The HI1083B and HI1083P are glass body, single reference junction micro pH electrodes. These electrode have a unique open junction design and a bulb tip that is only 3 mm in diameter. Both electrodes can be used to measure pH in samples as little as 100 µL.

**HI1083B** **HI1083P**

Designed for 96 well plates and for expensive samples that offer little volume to work with.

## HI1093

The HI1093B is a glass body, single reference junction pH electrode that is 130mm (5.11") long. The open junction design resists clogging and the probe's 3mm (0.11") diameter spherical micro bulb tip made from general purpose glass.

**HI1093B**

Designed for NMR tubes.

## HI1131B, HI1131P, HI11313

The HI1131B, HI1131P, and HI11313 are glass body, refillable, double junction pH electrodes. These electrodes have a single ceramic junction in the outer reference cell and the spherical pH sensing portion is made with high temperature glass.

**HI1131B** **HI1131P**

**HI11313**

Designed for laboratory samples, beer and other liquid samples, as well as general purpose use.

## HI11310

The HI11310 is a glass body refillable double junction pH electrode with a built-in temperature sensor for temperature compensated measurements in a single probe design. This electrode has a single ceramic junction in the outer reference cell and the spherical pH sensing portion is made with high temperature glass.

**HI11310**

Designed for laboratory samples, beer and other liquid samples, as well as general purpose use.

DIGITAL

**HI11311**

Designed for laboratory samples, beer and other liquid samples, as well as general purpose use.

The matching pin integrated into this sensor is for Sensor Check™ capability of edge® pH meters; Sensor Check™ helps identify pH electrode problems such as sensing glass cracks or poor reference junction condition.

## HI11311

The HI11311 is a glass body, refillable, double junction pH electrode with a matching pin and a built-in temperature sensor for temperature compensated measurements. It also features a single ceramic junction and the spherical pH sensing portion is made with high temperature glass.

BNC

**HI1135B**

Designed for applications in which continuous pH monitoring is essential.

## HI1135B

The HI1135B is a glass body, refillable, double junction pH electrode. This electrode has a double ceramic junction in the outer junction and the pH sensing portion is made with high temperature glass. The HI1135B also features a glass side arm construction that allows for a faster flow rate.

BNC

**HI1143B**

Designed for samples with fluoride.

## HI1143B

The HI1143B is a glass body, refillable, double junction pH electrode. This electrode has a single ceramic junction in the outer reference cell and the pH sensing portion is made of glass specially formulated for fluoride applications.

BNC

**HI1331B**

Designed for flasks and smaller vessel applications.

## HI1331B

The HI1331B is a glass body, refillable, single junction pH electrode. This electrode has a single ceramic junction in the outer reference cell and the pH sensing portion is made with general purpose glass.

## HI1230B

The HI1230B is a PEI body, double junction pH electrode. This electrode has a single ceramic junction in the outer reference cell and the spherical pH sensing portion is made with general purpose glass.

B
BNC

**HI1230B**

Designed for field applications as well as general purpose use.

## HI12300, 12303

The HI12300 is a plastic body, double junction, gel filled pH electrode with a built-in temperature sensor for temperature compensated measurements. It also features a single ceramic junction and the spherical pH sensing portion is made with general purpose glass.

d
DIGITAL

Q
QUICK DIN

**HI12300** **HI12303**

Designed for field applications as well as general purpose use.

The matching pin integrated into this sensor is for Sensor Check™ capability of edge® pH meters; Sensor Check™ helps identify pH electrode problems such as sensing glass cracks or poor reference junction condition.

## HI12301

The HI12301 is a plastic body, double junction, gel filled pH electrode with a matching pin and built-in temperature sensor for temperature compensated measurements. It also features a single ceramic junction and the spherical pH sensing portion is made with general purpose glass.

d
DIGITAL

**HI12301**

Designed for field applications as well as general purpose use.

## HI1144B

The HI1144B is a glass body, refillable, single junction pH electrode. This electrode has a single ceramic junction in the outer reference cell and the spherical pH sensing portion is made with high temperature glass. The mercury/mercury (I) chloride ($Hg/Hg_2Cl_2$) reference system of the HI1144B provides a stable reference potential without the presence of silver.

B
BNC

**HI1144B**

Designed for applications involving Tris buffer.

B BNC

**HI1330B**

B BNC+PIN

**HI1330P**

Designed for vials, test tubes, and smaller vessel applications.

## HI1330B, HI1330P

The HI1330B and HI1330P are glass body, refillable, single junction pH electrodes. These electrodes have a single ceramic junction in the outer reference cell and the small, spheric pH sensing portion is made with low temperature glass.

B BNC

**HI1342B**

Designed for applications involving Tris buffer.

## HI1343B

The HI1343B is a PEI body, single junction pH electrode. This electrode has a single ceramic junction in the outer reference cell and the spherical pH sensing portion is made with high temperature glass. The mercury/mercury (I) chloride ($Hg/Hg_2Cl_2$) reference system provides a stable reference potential without the presence of silver.

B BNC

**HI2031B**

Designed for emulsions, dairy products, semi-solid samples, and for measuring samples at cooler temperatures.

## HI2031B

The HI2031B is a glass body, refillable, single junction pH electrode. This electrode has a single ceramic junction in the outer reference cell and the conical pH sensing portion is made with low temperature glass.

B BNC

**HI1332B**

Designed for chemicals, quality control, field applications, and general purpose use.

## HI1332B

The HI1332B is a PEI body, double junction pH electrode. This electrode has a single ceramic junction in the outer reference cell and the pH sensing portion is made with general purpose glass, protected by an extension of the durable PEI body.

## HI3131B

The HI3131B is a glass body, refillable, single junction ORP electrode. This electrode has a single ceramic junction as part of the reference cell and a platinum ORP sensing pin.

B
BNC

**HI3131B**

Designed for laboratories and general purpose ORP measurements, as well as for use as an indicating electrode in ORP titrations.

## HI36183

The HI36183 is a glass body, single junction, refillable ORP electrode with a built-in temperature sensor for temperature compensated measurements. This electrode has a single ceramic junction and the ORP sensing pin is made with platinum.

Q
QUICK DIN

**HI36183**

Designed for laboratories and general purpose ORP measurements.

## HI36180

The HI36180 is a glass body, double junction, refillable ORP electrode with a built-in temperature sensor for temperature compensated measurements. This electrode has a single ceramic junction and the ORP sensing pin is made with platinum.

d
DIGITAL

**HI36180**

Designed for laboratories and general purpose ORP measurements.

## HI36200

The HI36200 is a PEI body, single junction ORP electrode with a built-in temperature sensor. This electrode has a single ceramic junction in the outer reference cell and the ORP sensing pin is made with platinum.

d
DIGITAL

**HI36200**

Designed for ORP measurements in field and industrial applications.

B
BNC

**FC100B**

Designed for sauces, juices, dairy products and other liquid or slurry forms of food.

## FC100B

The FC100B is a PVDF body, refillable, double junction pH electrode. This single ceramic, double junction electrode has a pH indicating probe made of general purpose glass and a food grade plastic body. The recommended operating temperature range is from 0 to 80°C.

B
BNC

**FC200B**

D
DIN

**FC200D**

Designed for dairy, dough, ground meats, and other semi-solid food samples.

## FC200B, FC200D

The FC200B and FC200D are PVDF body, gel filled, single junction pH electrodes. These probes feature an open junction design, a sensing bulb made of low temperature glass, and a food grade plastic body. The recommended operating temperature range is from 0 to 50°C.

B
BNC

**FC210B**

Designed for cream, yogurt, or other semi-solid or emulsified samples.

## FC210B

The FC210B is a glass body, double junction pH electrode. The FC210B electrode features an open junction design with viscolene gel electrolyte, a sensing bulb made of low temperature glass, and a conical tip shape. The recommended operating temperature range is from 0 to 50°C.

d
DIGITAL

**FC2100**

Designed for milk, yogurt, cheese, and other products in the dairy industry.

## FC2100

The FC2100 is a digital glass body, gel filled pH electrode with a built-in temperature sensor for temperature compensated measurements. It also features an open junction design with viscolene gel electrolyte, a sensing bulb made of low temperature glass, and a conical tip shape. The recommended operating temperature range is from 0 to 60°C.

## FC2020

The FC2020 is a digital PVDF body, gel filled pH electrode with a built-in temperature sensor for temperature compensated measurements. It also features an open junction design with viscolene gel electrolyte, a sensing bulb made of low temperature glass, and a conical tip shape. The recommended operating temperature range is from 0 to 60°C.

d
DIGITAL

**FC2020**

Designed for milk, yogurt, cheese, and other products in the dairy industry.

## FC220B

The FC220B is a glass body, single junction pH electrode. The FC220B electrode features a triple ceramic junction with refillable electrolyte, a sensing bulb made of low temperature glass, and a spherical tip shape. The recommended operating temperature range is from -5 to 70°C.

B
BNC

**FC220B**

Designed for creams, sauces, or fruit juice samples.

## FC230B

The FC230B is a PVDF body, single junction pH electrode. The FC230B electrode features an open junction design with viscolene gel electrolyte, a sensing bulb made of low temperature glass, and a conical tip shape. The recommended operating temperature range is from 0 to 50°C.

B
BNC

**FC230B**

Designed for meats and semi-frozen food products.

FC098 and FC099 stainless steel blades for meat penetration (optional).

See page 33 for more information.


B
BNC

**FC240B**

Designed for cheese, dairy products, and quality control processes.

## FC240B

The FC240B is a stainless steel body, single junction pH electrode. The FC240B also features an open junction design with viscolene gel electrolyte, a sensing bulb made of general purpose glass, and a conical tip shape. The very small 5 mm (0.2") diameter of the FC240B is protected by an AISI 316 stainless steel body that is 150 mm (5.9") long. The recommended operating temperature range is from 0 to 50°C.


B
BNC

**FC400B**

Designed for meats and semi-frozen food products.

## FC400B

The FC400B is a PVDF body, double junction pH electrode. The FC400B electrode features an open junction design with viscolene gel electrolyte, a sensing bulb made of low temperature glass, and a conical tip shape. The recommended operating temperature range is from 0 to 50°C.


B
BNC

**FC911B**

Designed for creams, fruit juices, and sauces.

## FC911B

The FC911B is a PVDF body, double junction pH electrode. This electrode features a single ceramic junction with refillable electrolyte, a sensing bulb made of general purpose glass, and a spherical tip shape. The recommended operating temperature range is from -5 to 80°C.


# edge® Tablet Meters

### Plug and play.

Your edge meter will automatically recognize each digital electrode, providing sensor calibration data, and serial number.

### Trust your results.

On-screen indicators track the condition of your electrode between calibrations so you can always be sure you are getting accurate results.

### Test anywhere, anytime.

Use your edge meter as a portable or benchtop meter. If you need to save benchtop space, just mount it on the wall.

DIGITAL


# 5000 Series Benchtop Meters

### Get more out of one device.

With intelligent programming, your benchtop meter is designed to help you get the high-quality results you need every time.

### Higher quality measurements.

Your benchtop meter has electrode diagnostics to tell you when your electrode needs cleaning or calibration.

### Helpful.

Let your meter guide you through setup and calibration with on-screen tutorials so you always know the next step.

BNC BNC+PIN


# 98 Series Meters

### Durable by design.

Built to withstand dust and debris, our rugged meters are field tested and approved.

### Never miss a measurement.

Do not waste time writing down details with the ability to log data at the push of a button.

### Reduce downtime.

Spend more time testing with dedicated keys for a wide variety of functions such as measurement mode, calibration, help, setup, backlight and GLP.

Q
QUICK DIN


# 99 Series Meters

### Confidence when you test.

Designed to meet the standards of your industry, these handy meters ensure reliability and safety of your products.

### No hassle measurements.

A simple, two-button design gives accurate results quickly with our waterproof pH meters.

### Bring clarity to your data.

A large, informative screen clearly shows readings along with tutorial messages for help.

D
DIN

An essential parameter.

pH is an essential parameter that requires close observation throughout food production to provide the best possible product.

# Food Applications

One of the most common measurements of food products is pH because of how it affects food characteristics such as shelf stability, texture, and flavor.

In food processing, some products require the measurement of pH to meet industry regulations to ensure the quality and safety of goods. A lower pH will help in preventing unwanted bacteria from growing thus extending the shelf life of a product.


## FC2023, FC202D

FC2023 and FC202D are amplified single junction pH electrodes with a built-in temperature sensor. These electrodes feature a food grade plastic PVDF body, an open junction design with viscolene gel electrolyte, a sensing bulb made of low temperature glass, and a conical tip shape. The recommended operating temperature range is from 0 to 50°C.

FC2023 works with HI98161 portable pH meter for food care applications.

FC202D works with HI99161 portable pH meter for food care applications.

QUICK DIN **FC2023**

DIN **FC202D**

Designed for dairy products, emulsions, cream, or other semi-solid samples.

# Milk Applications

The measurement of pH in milk is important in testing for impurities, spoilage, and signs of mastitis infection. While there are a number of factors that affect the composition of milk, pH measurements can help producers understand what might be causing certain compositional changes. pH measurements are commonly performed at various points in a milk processing plant.

Fresh milk has a pH value of 6.7. When the pH value of the milk falls below pH 6.7, it typically indicates spoilage by bacterial degradation. Bacteria from the family of Lactobacillaceae are lactic acid bacteria (LAB) responsible for the breakdown of the lactose in milk to form lactic acid. Eventually when the milk reaches an acidic enough pH, coagulation or curdling will occur along with the characteristic smell and taste of "sour" milk.

Milk with pH values higher than pH 6.7 potentially indicate that the milk may have come from cows infected with mastitis. Mastitis is an ever-present challenge with dairy milking cows. When infected, the cow's immune system releases histamine and other compounds in response to the infection. There is a resulting increase in permeability of endothelial and epithelial cell layers, allowing blood components to pass through a paracellular pathway. Since blood plasma is slightly alkaline, the resulting pH of milk will be higher than normal. Typically milk producers can perform a somatic cell count to detect a mastitis infection, but a pH measurement offers a quick way to screen for infection.

Understanding the pH of raw milk can also help producers optimize their processing techniques. For example, in operations that use Ultra High Temperature (UHT) processing, even small variations from pH 6.7 can affect the time required for pasteurization and the stability of the milk after treatment.

## FC1013, FC101D

FC1013 and FC101D are amplified pH electrodes with a PVDF body. These specialized electrodes offer numerous features that improve pH testing for milk producers. An integrated temperature sensor allows for temperature compensated pH measurements without the need for a separate temperature probe. The contact between the bulb's large surface area and the milk sample ensures a stable calibration and measurement.

The durable PVDF body of the FC1013 and FC101D ensures pH measurements can be safely taken on the dairy farm or production floor. The components of the electrode are also able to withstand a wider range of temperatures to allow for accuracy during stages such as pasteurization, which requires heating to temperatures near 72°C (161°F).

FC1013 works with HI98162 portable pH meter for milk.

FC101D works with HI99162 portable pH meter for milk.

Q QUICK DIN **FC1013**

D DIN **FC101D**

Designed specifically for milk analysis.

# Meat Applications

In the meat production industry, the monitoring of pH is considered to be of the utmost importance due to its effect on the meat's quality factors including water binding capacity and shelf life. Upon slaughter, biochemical processes begin to break down the meat. Glycolysis begins post-mortem, converting glycogen to lactic acid, reducing the pH of the carcass. Depending on a number of factors such as type of animal and even breed, this decrease in pH can take anywhere from a single hour to many. It is vital to monitor pH during this phase as once the lowest pH value is reached, the pH will begin to slowly rise, indicating that decomposition has begun.

The pH value of meat influences its' water binding capacity which directly impacts consumer qualities such as tenderness and color. Lower pH values result in a lower water-binding capacity and lighter colors. Factors such as these can be important when considering how to efficiently produce meat products. For example, when producing dry sausages the meat must have a low water binding capacity so that it can dry evenly.

Depending on the type of the final product and the steps required to get there, pH values will vary throughout the meat processing industry. It is imperative, regardless of the final product, that pH be maintained at a low value to prevent bacterial spoilage and comply with food safety regulations. By monitoring pH values throughout the meat production process, you can ensure the creation of consistent and safe meat products.

## FC2323, FC232D

FC2323 and FC232D is an amplified single junction pH electrode that has a built-in temperature sensor. These electrodes feature a food grade plastic PVDF body, an open junction design with viscolene gel electrolyte, a sensing bulb made of low temperature glass, and a conical tip shape. The recommended operating temperature range is from 0 to 50°C.

FC2323 works with HI98163 portable pH meter for meat.

FC232D works with HI99163 portable pH meter for meat.

QUICK DIN

**FC2323**

DIN

**FC232D**

Designed specifically for meat products.

## FC2320

The FC2320 is a digital PVDF body, gel filled pH electrode with a built-in temperature sensor for temperature compensated measurements in a single probe design. It also features an open junction design with viscolene gel electrolyte, a sensing bulb made of low temperature glass, and a conical tip shape. The recommended operating temperature range is from 0 to 60°C.

DIGITAL

**FC2320**

Designed specifically for meat products.

## Stainless Steel Blade for Meat pH Electrodes

- Made of high grade stainless steel for long life
- Razor sharp for easy piercing into meat and other semi-solids
- Protects glass pH electrode from breakage

FC098 and FC099 stainless steel blades for meat penetration (optional).

**FC098**
20 mm
(0.8")

**FC099**
35 mm
(1.4") long

# Yogurt Applications

Monitoring pH is crucial in producing consistent, quality yogurt. Yogurt is made by the fermentation of milk with live bacterial cultures. Following pasteurization and compositional adjustment, milk is homogenized for a consistent texture, heated to the desired thickness, and cooled before inoculation. Most yogurt is inoculated with a starter culture consisting of *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. Once the live culture is added, the mixture of milk and bacteria is incubated, allowing for fermentation of lactose to lactic acid. As lactic acid is produced, there is a correlating drop in pH. Due to the more acidic mixture, the casein protein in milk coagulates and precipitates out, thickening the milk into a yogurt-like texture.

Yogurt producers cease incubation once a specific pH level is reached. Most producers have a set point between pH 4.0 and 4.6 in which fermentation is stopped by rapid cooling. The amount of lactic acid present at this pH level is ideal for yogurt, giving it the characteristic tartness, aiding in thickening, and acting as a preservative against undesirable strains of bacteria.

By verifying that fermentation continues to a predetermined pH endpoint, yogurt producers can ensure their products remain consistent in terms of flavor, aroma, and texture. A deviation from the predetermined pH can lead to a reduced shelf life of yogurt or create a product that is too bitter or tart. Syneresis is the separation of liquid, in this case whey, from the milk solids; this can occur if fermentation is stopped too early or too late, resulting in yogurt that is respectively too alkaline or too acidic. Consumers expect yogurt to remain texturally consistent, so ensuring fermentation is stopped at the appropriate pH is vital to consumer perception.


## FC2133, FC213D

The FC2133 and FC213D amplified pH electrodes are specialized probes that offer numerous features that improve pH testing for yogurt producers. An integrated temperature sensor allows for temperature compensated pH measurements without the need for a separate temperature probe. The probe's conical sensing bulb ensures stable calibration and measurement in semi-solids and emulsions like yogurt.

Clogging of the reference junction is a common challenge faced by yogurt producers as the milk solids and proteins can easily build up on the electrode. The open junction design of the FC2133 and FC213D utilize a viscolene reference electrolyte that comes into direct contact with the yogurt sample. Without a physical junction, the electrode resists clogging and continues to provide accurate, stable readings.

FC2133 works with HI98164 portable pH meter for yogurt.

FC213D works with HI99164 portable pH meter for yogurt.

Q
QUICK DIN
**FC2133**

D
DIN
**FC213D**

Designed specifically for yogurt.

# Cheese Applications

pH is an essential measurement throughout the entire cheesemaking process. From the initial measurements of incoming milk to the final measurements of ripened cheese, pH is the most important parameter for cheese quality and safety control.

Acidification of milk begins with the addition of bacterial culture and rennet. The bacteria consume lactose and create lactic acid as a byproduct of fermentation, lowering the pH of the milk. Once the milk reaches a particular pH, the rennet is added. The enzymes in rennet help to speed up curdling and create a firmer substance. For cheesemakers that dilute their rennet, the pH of the dilution water is also critical; water that is near pH 7 or higher can deactivate the rennet, causing problems with coagulation.

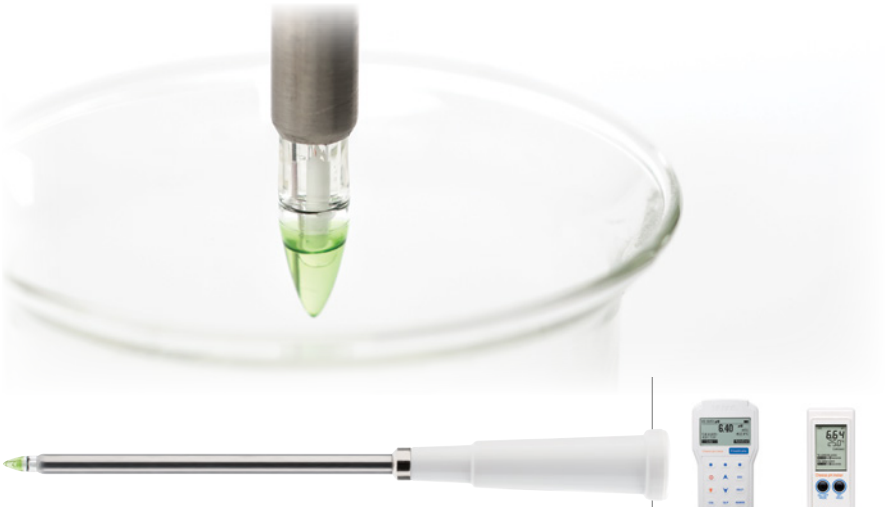
Once the curds are cut, stirred, and cooked, the liquid whey must be drained. The pH of whey at draining directly affects the composition and texture of the final cheese product. Whey that has a relatively high pH contributes to higher levels of calcium and phosphate and results in a stronger curd. Typical pH levels at draining can vary depending on the type of cheese; for example, Swiss cheese is drained between pH 6.3 and 6.5 while Cheddar cheese is drained between pH 6.0 and 6.2.

The next stages of milling and salting are affected by pH as well. During milling, curds are cut into smaller pieces to prepare the cheese for salting. Curds with a lower pH at milling result in a harder cheese. A low pH will also result in higher salt absorption during the salting stage.

When curds are pressed into a final, solid form, the pH directly affects how well the curds fuse together. If the pH is too high during pressing, the curds will not bind together as well and the final cheese will have a more open texture.

During brining, the cheese soaks up salt from the brine solution and loses excess moisture. The pH of the brine solution should be close to the pH of the cheese, ensuring equilibrium of ions like calcium and hydrogen. If there is an imbalance during brining, the final product can have rind defects, discoloration, a weakened texture, and a shorter shelf life.

Cheeses must fall within a narrow pH range to provide an optimal environment for microbial and enzymatic processes that occur during ripening. Bacterial cultures used in ripening are responsible for characteristics like the holes in Swiss cheese, the white mold on Brie rinds, and the aroma of Limburger cheese. A deviation from the ideal pH is not only detrimental to the ecology of the bacteria, but also to the cheese structure. Higher pH levels can result in cheeses that are more elastic while lower pH levels can cause brittleness.





FC2423 works with HI98165 portable pH meter for cheese.



FC242D works with HI99165 portable pH meter for cheese.

## FC2423, FC242D

The FC2423 and FC242D are stainless steel, amplified pH electrodes. These specialized electrodes offer numerous features that improve pH testing for cheese producers. The robust stainless steel sheath paired with the conical sensing tip allows for penetration in cheese at various points throughout the production process. An integrated temperature sensor also ensures that all pH measurements are compensated for temperature without the need for a separate temperature probe.


**FC2423**


**FC242D**

Designed specifically for cheese.

# Wine Applications

The pH of wine is important to determine because it will affect the quality of the final product in terms of taste, color, oxidation, chemical stability and other factors. Generally in winemaking, the higher the pH reading, the lower amount of acidity in the wine. Three important factors in determining the pH of wine include the ratio of malic acid to tartaric acid, the amount of potassium, and the total amount of acid present.

Most wines optimally have a pH between 2.9 and 4.0, with values differing based on the type of wine. Values above pH 4.0 indicate that the wine may spoil quickly and be chemically unstable. Lower pH values allow the wine to stay fresher for a longer period and retain its original color and flavor. High pH wine is more likely to breed bacteria and become unsuitable to drink.

For finished white wines, the ideal pH is between pH 3.00 and pH 3.30, while the final pH for red wine is ideally between pH 3.40 and pH 3.50. The optimal pH before the fermentation process is between pH 2.9 and pH 4.0. The pH of wine therefore not only affects the color of wine, but also the oxidation, yeast fermentation, protein stability, and bacterial growth and fermentation.

# CPS™ Technology

An integral part of any pH electrode is the reference junction. The reference junction is a part of the electrode that allows for the flow of ions located in the reference cell into the sample being measured. The ions provide for an electrical connection between the reference electrode and the indicating electrode.

Clogging Prevention System (CPS) technology is an innovation for the improvement of pH measurements in wine juice and must samples that have high solids content. Conventional pH electrodes use ceramic junctions that can clog quickly from solids found in juice and must. When the junction is clogged, the electrode does not function properly and erratic readings can result. CPS technology utilizes a ground glass junction coupled with a movable PTFE sleeve to prevent clogging. The ground glass allows proper flow of the liquid, while the PTFE sleeve repels solids. As a result, pH electrodes with CPS technology take up to 20 times longer to be fouled as compared to conventional electrodes. When the electrode becomes fouled the PTFE sleeve can be moved to clean the ground glass surface rejuvenating the junction and extending probe life.


## HI1048B, HI1048P, HI1048D, HI10480

These models are glass body, refillable, sleeve junction pH electrodes. These electrodes feature a double junction reference, Hanna's Clogging Prevention System (CPS) technology, and spherical glass sensing bulb made with general purpose glass.


## HI3148B

HI3148B is a glass body, refillable, open junction ORP electrode. This electrode features a double junction reference, Hanna's Clogging Prevention System (CPS) technology, and platinum sensing ring.

CPS technology

Anti-clogging PTFE sleeve that maintains stability and fast response.

HI1048D works with HI99111 portable pH meter for wine.

B BNC **HI1048B**

B BNC+PIN **HI1048P**

D DIN **HI1048D**

d DIGITAL **HI10480**

Designed specifically for wine must and juice.

B BNC **HI3148B**

Designed specifically for wine must and juice.

# Beer Applications: The Effects of pH in Brewing

In the brewing process, the enzymes required to convert starch into sugar are pH-sensitive, with an optimal pH of 5.2 to 5.6. Different compounds are used to adjust the pH including phosphoric acid, lactic acid, and gypsum.

Wort clarity and break formation are also affected by pH. Protein coagulation occurs during wort boiling, where the optimum pH is around pH 4.9, though a common boil pH is 5.2. A pH that is too high will not only inhibit coagulation, but also promote browning due to the interaction of amino acids and reducing sugars.

Hop utilization during the wort boil is also affected by pH; as pH increases, the solubility of hop resins increase. A high pH also increases the release of tannins, resulting in a harsher taste, and a tendency to favor elevated microbial activity.

## FC214D

The FC214D is a titanium body, gel filled, single reference junction pH electrode. This electrode features high temperature glass and an extendable cloth type junction, along with a built-in temperature sensor and amplifier in a single probe design.

The FC214D is the replacement pH/temperature probe supplied with the HI99151 portable meter for beer.

An integral part of any pH electrode is the reference junction. The reference junction is the part of the electrode that allows for the flow of ions located in the reference cell into the sample being measured. It is vital that this flow occurs in order to complete an electrical circuit. Any clogging of the reference junction will prevent the circuit from being completed and will result in readings that are erratic and/or constantly drifting. A typical pH electrode has a junction made of ceramic material. This ceramic material can be easily clogged by samples, such as mash with a high solids content or wort that is viscous. With the cloth junction it is possible to clear the junction by simply extracting 1/8" of the junction from the electrode. This exposes a new portion, resulting in a renewed junction.

FC214D works with HI99151 portable pH meter for beer.

D
DIN

**FC214D**
Designed specifically for mash or wort in the beer making process.

# Drinking Water Applications

The pH of drinking water is a vital measurement. If the pH is too low, or acidic, the water will be corrosive to the distribution system and water pipes in homes. The pH of water also influences other properties including taste, odor, clarity, and disinfection efficiency. In the United States, the pH of water is determined by a pH meter according to EPA method 150.1 and Standard Methods 4500-H.

Most drinking water plants use surface water (lakes, rivers, and streams) or groundwater as their point source. Surface water is typically lower in mineral content, which results in lower EC/TDS readings. Groundwater that has percolated through limestone, dolomite or gypsum will have a relatively higher mineral content. Depending on location, there are sources of groundwater that can be very low in mineral content.

Measuring the pH of water that is low in minerals can be difficult. The lower the mineral content the less conductive the water will be. Low conductivity water presents a challenge since the pH meter is an electrochemical system that relies on the solution being measured to be conductive. The HI99192 uses the FC215D amplified pH electrode. The FC215D has three ceramic junctions in the outer reference cell that allows for pH measurement in low conductivity solutions.


FC215D works with HI99192 portable pH meter for drinking water.

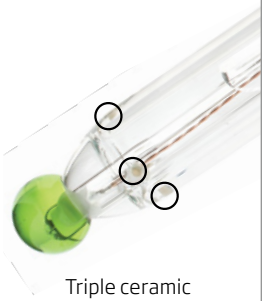
## FC215D

The FC215D is a glass body, refillable, single junction pH electrode. This electrode has a triple ceramic junction in the outer reference cell and the pH sensing bulb is made with low temperature glass.

**D**
DIN
**FC215D**

Designed specifically for drinking water.

An integral part of any pH electrode is the reference junction. The reference junction is a part of the electrode that allows for the flow of ions located in the reference cell into the sample being measured. The ions provide for an electrical connection between the reference electrode and the indicating electrode. A standard pH electrode will use a single ceramic junction that allows for 15 to 20 µL/hour of electrolyte to flow. The FC215D has three ceramic junctions providing for 40 to 50 µL/hour of electrolyte to flow. This increased flow provides a greater continuity between the reference electrode and the indicating electrode, making it suitable for water of low ionic strength. To optimize the flow from the electrode, the refill cap should be unscrewed; this allows for positive head pressure to be created, allowing for the electrolyte to flow more easily into the sample.



Triple ceramic junction

# Soil and Soilless Media

Correct soil pH is essential to ensure optimal plant growth and crop yield, because it allows nutrients to be freely available for plants to take in. Testing the pH of your soil helps to determine what plants are best suited for that area.

Sometimes soil needs supplements, like fertilizers and soil pH adjusters, for plants to be able to thrive. Measuring the pH can help you figure out what and how much you need.

Plants that thrive in more acidic soil include apple trees (pH 5 – pH 6.5), potatoes (pH 4.5 – pH 6), and orchids (pH 4.5 – pH 5.5). Alkaline loving plants include acacia and walnut trees (they both like soil between pH 6 – pH 8).

To figure out the best pH for your needs, do a little bit of research on the type of plants that you want to grow. Natural soil is typically between pH 4 and pH 8. If your soil's pH doesn't match the plants optimal range, you'll need to treat your soil.

Plants cannot absorb nutrients if the soil pH is too low or too high. When soil pH is off, nutrients such as calcium and phosphorus will bind up with other things in the soil. When the nutrients become bound up, plants will not be able to take in what they need to grow.

Most nutrients are available when the soil is slightly acidic, but different plants thrive in different pH ranges depending on their specific nutrient requirements. If the pH is too low, aluminum toxicity can occur. When this happens, aluminum becomes unbound and the plants take it in at toxic levels.

If the pH is too high, nutrients like iron become bound. Without adequate iron uptake, plants will lose their chlorophyll and start to turn yellow, indicating the plants can no longer make food for itself. Molybdenum poisoning can also occur in soils with alkaline pH, resulting in stunted crops.

## HI1292D

The HI1292D is a glass body, refillable, single junction pH electrode that is compatible with the HI99121 portable pH meter. This electrode has a triple ceramic junction in the outer reference cell and the conic pH sensing tip is made with low temperature glass. There is an integrated amplifier and built-in temperature sensor for automatically temperature compensated pH readings.

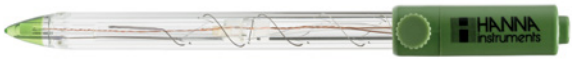
HI1292D works with HI99121 portable pH meter for soil testing.

D
DIN

**HI1292D**

Designed specifically for soil, soil slurries and soilless media (including rockwool, coconut coir, perlite and other soilless substrates).

GroLine



## HI1294D

The HI1294D is a glass body, refillable, single junction pH electrode that is compatible with the HI9814 GroLine portable pH/EC/TDS meter. This electrode has a triple ceramic junction in the outer reference cell and the conic pH sensing tip is made with low temperature glass. There is an integrated amplifier and built-in temperature sensor for automatically temperature compensated pH readings.

HI1294D works with HI9814 GroLine multiparameter portable meter.

D
DIN

**HI1294D**

Designed specifically for soil, soil slurries and soilless media (including rockwool, coconut coir, perlite and other soilless substrates).

B
BNC

**HI1413B**

Designed for flat surfaces such as skin, leather, and paper.

H1414D works with HI99171 portable pH meter for leather and paper.

D
DIN

**HI1414D**

Designed for leather, and paper.

H1414D/50 works with HI99181 portable pH meter for skin.

D
DIN

**HI1414D/50**

Designed specifically for skin.

HI62911D works with HI99131 portable pH meter for plating baths.

D
DIN

**HI62911D**

Designed specifically for plating baths.

## HI1413B

The HI1413B is a glass body, single reference junction pH electrode made with low temperature glass. The open junction design resists clogging.

## HI1414D

The HI1414D is a glass body, single reference junction pH electrode made with low temperature glass. This pre-amplified electrode features a built-in temperature sensor for temperature compensated measurements. The open junction design resists clogging.

## HI1414D/50

The HI1414D/50 is a glass body, single reference junction pH electrode made with low temperature glass. This pre-amplified electrode features a built-in temperature sensor for temperature compensated measurements. The open junction design resists clogging.

## HI62911D

The HI62911D is a titanium body, polymer filled, double reference junction pH electrode. The flat tip sensing portion of this electrode is made with general purpose glass. The HI62911D also has a PTFE type junction along with a built-in temperature sensor and amplifier.

## HI72911D

The HI72911D is a titanium body, polymer filled, double reference junction pH electrode. This flat tip sensing portion of this electrode is made with general purpose glass. The HI72911D also has a PTFE type junction along with a built-in temperature sensor and amplifier.

HI72911D works with HI99141 portable pH meter for boilers and cooling towers.

D
DIN

**HI72911D**

Designed specifically for boilers and cooling towers.

## HI12963, HI1296D

The HI12963 and HI1296D are titanium bodied, gel filled, single reference junction pH electrodes. The sensing portion of these electrodes are made with general purpose glass. The HI12963 and HI1296D also have an extendable cloth type junction, built-in temperature sensor, and an amplifier.

HI12963 works with HI98190 portable pH meter.

HI1296D works with HI991001 portable pH meter.

Q
QUICK DIN

D
DIN

**HI12963** **HI1296D**

Designed for municipal and industrial wastewater.

## HI1297D

The HI1297D is a titanium body, gel filled, single reference junction pH electrode. This sensing portion of this electrode is made with general purpose glass. The HI1297D also has an extendable cloth type junction along with a built-in temperature sensor and amplifier.

HI1297D works with HI991002 and HI991003 portable pH meters.

D
DIN

**HI1297D**

Designed for municipal and industrial wastewater, swimming pools, and field applications.

B
BNC

**HI3230B**

Designed for municipal water and quality control applications.

## HI3230B

The HI3230B is a PEI body, single junction ORP electrode. This electrode has a single ceramic junction in the outer reference cell and the ORP sensing pin is made with platinum.

B
BNC

**HI4430B**

Designed for ozone and applications with other oxidants.

## HI4430B

The HI4430B is a PEI body, single junction ORP electrode. This electrode has a single ceramic junction in the outer reference cell and the ORP sensing pin is made with gold.

B
BNC

**HI2111B**

Designed for strong alkaline solutions as well as for general purpose.

## HI2111B

The HI2111B is a glass body pH half-cell electrode. This sensing electrode is made with high temperature glass and is to be used in conjunction with a reference half-cell electrode.

B
BNC

**HI2112B**

Designed for general purpose applications.

## HI2112B

HI2112B is a PEI body pH half-cell electrode. This sensing electrode is made with general purpose glass and is to be used in conjunction with a reference half-cell electrode.

## FC260B

The FC260B is a glass body pH half-cell electrode. A reference half-cell must be used in addition to the FC260B. The pH sensing portion of this electrode is a spherical bulb made of low temperature glass.

B
BNC

**FC260B**

Designed for food products with a high solids content such as sauces, dairy products, and slurries.

## HI3133B

The HI3133B is a glass body ORP half-cell electrode. This sensing electrode is made with a platinum pin and is to be used in conjunction with a reference half-cell electrode.

B
BNC

**HI3133B**

Designed for ORP titrations as well as for general purpose.

## HI5110B

The HI5110B is a glass body ORP half-cell electrode. The sensing electrode is made with a silver ring and is to be used in conjunction with a reference half-cell electrode.

B
BNC

**HI5110B**

Designed for argentometric titrations.

BANANA

**HI5412B**

Designed for use with ion selective electrodes, titrations, and general purpose applications in temperatures ranging from -5 to 60°C.

## HI5412B

The HI5412B is a glass body, refillable, double junction, half-cell reference electrode. This electrode has a single ceramic junction in the outer reference cell and calomel references.

BANANA

**HI5311B**

Designed for general purpose use with pH, ORP, or ion selective electrode half-cells, as well as for use in a variety of titrations.

## HI5311B

The HI5311B is a glass body, refillable, double junction, half-cell reference electrode. This electrode has a single ceramic junction in the outer reference cell and is made for use in temperatures ranging from -5 to 100°C.

BANANA

**HI5413B**

Designed for samples with suspended solids, and can also be used in a variety of titrations.

## HI5413B

The HI5413B is a glass body, refillable, single junction, half-cell reference electrode. This electrode has a PTFE sleeve junction in the outer reference cell, calomel references, and is made for use in temperatures ranging from -5 to 60°C.

BANANA

**HI5312B**

Designed for samples with suspended solids, and can also be used in a variety of titrations.

## HI5312B

The HI5312B is a glass body, refillable, double junction, half-cell reference electrode. This electrode has a PTFE sleeve junction in the outer reference cell and is made for use in temperatures ranging from -5 to 80°C.


### High pressure or high concentration of contaminants

Because of the special electrode recharge system of the HI5314 and HI5414, it is possible to connect an outside container. This will increase the amount of electrolyte of the reference half cell and thus, the pressure inside the electrode. By so doing, the junction has the ability to work in high pressure environments without the danger of implosion.

## HI5314B

The HI5314B is a glass body, refillable, double junction, half-cell reference electrode. This electrode has a double ceramic junction in the outer reference cell and a side arm construction.

b
BANANA

**HI5314B**

Designed for applications that require remote filling in temperatures ranging from -5 to 100°C.


## HI5414B

The HI5414B is a glass body, refillable, double junction, half-cell reference electrode. This electrode has a double ceramic junction in the outer reference cell, calomel references, and side arm construction.

b
BANANA

**HI5414B**

Designed for applications that require remote filling in temperatures ranging from -5 to 60°C.


## HI5313B

The HI5313B is a PEI body, refillable, single junction, half-cell reference electrode. This electrode has a single ceramic junction in the outer reference cell and is made for use in temperatures ranging from -5 to 60°C.

b
BANANA

**HI5313B**

Designed to be used with FC301B fluoride half-cell ion selective electrode.

## Hanna Lab App

Available on iOS and Android

## All of your results, all of the time.

The Hanna lab app collects all of your pH and temperature data just in case you missed something.

## Highlight your most important results.

Push button logging highlights your data of interest and can be noted for future reference and comparison.

## Sort and share your data.

Group your data by time or notation. Email it for storage and share it with friends and colleagues.

# HALO®

## Wireless pH Meters


### Take laboratory grade pH and temperature measurements using your smart phone or tablet.

Hanna HALO Bluetooth® pH meter is designed to help anyone get high quality pH and temperature results quickly and consistently.

WIRELESS

**HI11312**
**HALO**

Designed for routine laboratory applications.

To be used in conjunction with the Hanna Lab App for compatible smart devices or egde®blu.

## HI11312 HALO®

HI11312 HALO is a glass body, refillable, double junction wireless pH electrode with an integrated temperature sensor for temperature compensated measurements.

WIRELESS

**HI11102**
**HALO**

Designed for routine laboratory applications.

To be used in conjunction with the Hanna Lab App for compatible smart devices or egde®blu.

## HI11102 HALO

HI11102 HALO is a glass body, gel-filled, double junction wireless pH electrode with an integrated temperature sensor for temperature compensated measurements. HI11102 contains a silver free gel in the outer reference cell. Other than routine calibration and cleaning, this probe is maintenance free with no fill solutions required.

## HI13302 HALO

WIRELESS

**HI13302**
**HALO**

Designed for test tubes

To be used in conjunction with the Hanna Lab App for compatible smart devices or egde®blu.

HI13302 HALO is a glass body, gel-filled, double junction wireless pH electrode with an integrated temperature sensor for temperature compensated measurements. The open junction design is resistant to clogging from suspended solids and proteins found in biological samples. Other than routine calibration and cleaning, this probe is maintenance free with no fill solutions required. The electrode's 5 mm diameter bulb fits easily into test tubes.

## HI10832 HALO

HI10832 HALO is a glass body, gel-filled, double junction wireless pH electrode. The open junction design is resistant to clogging from suspended solids and proteins found in biological samples. Other than routine calibration and cleaning, this probe is maintenance free with no fill solutions required. The 3 mm diameter micro bulb can measure the pH in samples as small as 100 µL.

WIRELESS

**HI10832**
**HALO**

Designed for 96 well plates, test tubes, vials, and samples as small as 100 µL.

To be used in conjunction with the Hanna Lab App for compatible smart devices or egde®blu.

## HI12302 HALO

HI12302 HALO is a PEI body, gel-filled, double junction wireless pH electrode with an integrated temperature sensor for temperature compensated measurements. This electrode has a single ceramic junction in the outer reference cell and the spherical pH sensing portion is made with general purpose glass. Other than routine calibration and cleaning, this probe is maintenance free with no fill solutions required.

WIRELESS

**HI12302**
**HALO**

Designed for field, lab, and general applications.

To be used in conjunction with the Hanna Lab App for compatible smart devices or egde®blu.

## HI14142 HALO

HI14142 HALO is a glass body, gel-filled, double junction wireless pH electrode with an integrated temperature sensor for temperature compensated measurements. It also features an open junction design with viscolene gel electrolyte, a sensing bulb made of low temperature glass, and a flat tip shape. The open junction design resists clogging and provides for a fast response time. Other than routine calibration and cleaning, this probe is maintenance free with no fill solutions required.

WIRELESS

**HI14142**
**HALO**

Designed for surface applications such as scalp, skin, leather, paper and emulsions.

To be used in conjunction with the Hanna Lab App for compatible smart devices or egde®blu.

WIRELESS

**HI12922**
**HALO**

Designed for agricultural, hydroponics and greenhouse growers that need to monitor the pH of soil, soil slurries, and soilless media (including rockwool, coconut coir, perlite, and other soilless substrates).

To be used in conjunction with the Hanna Lab App for compatible smart devices or egde®blu.

## HI12922 HALO®

HI12922 HALO is a glass body, refillable, single junction wireless pH electrode with an integrated temperature sensor for temperature compensated measurements. The HI12922 HALO has a triple ceramic junction in the outer reference cell and the conic pH sensing tip is made with low temperature glass. The conical shaped tip design allows for easy penetration of the sensor into soft solids and semi-solids such as soil and soilless media.

WIRELESS

**FC2022**
**HALO**

Designed for soft and semi-solid foods such as cheeses, yogurt, meats, and sauces.

To be used in conjunction with the Hanna Lab App for compatible smart devices or egde®blu.

## FC2022 HALO

FC2022 HALO is a PVDF body, gel-filled pH electrode with a built-in temperature sensor for temperature compensated measurements. It also features an open junction design with viscolene gel electrolyte, a sensing bulb made of low temperature glass, and a conical tip shape. The open junction design resists clogging and provides for a fast response time. Other than routine calibration and cleaning, this probe is maintenance free with no fill solutions required.

## HI10482 HALO

HI10482 HALO is a glass body, refillable, sleeve junction wireless pH electrode with an integrated temperature sensor for temperature compensated measurements. This electrode features a double junction reference, Hanna's Clogging Prevention System (CPS) technology and spherical glass sensing bulb made with general purpose glass. HI10482 HALO features a customized calibration buffer value of pH 3.00 to bracket the expected reading in wine.

WIRELESS

**HI10482**
**HALO**

Designed for wine must and juice.

### CPS technology

Anti-clogging PTFE sleeve that maintains stability and fast response.

## FC2142 HALO

FC2142 is a titanium body, gel-filled, double reference junction wireless pH electrode with an integrated temperature sensor for temperature compensated measurements. This electrode features high temperature glass and an extractable cloth type junction also known as a fiber wick junction. The advantage of the cloth junction is that it can be extracted from the probe exposing a fresh surface. This is very important since one of the major contributors to unstable measurements is a clogged junction. This is likely to occur when measuring the pH of mash that has a high solids content. Having the ability to pull out a small portion (⅛") of the junction will clear any clogging resulting in increased life of the pH electrode

WIRELESS

**FC2142**
**HALO**

Designed for beer.

### Extractable cloth junction

Quickly renew the junction to increase stability and extend probe life.


### Two-point Calibration

To obtain precise and valid pH measurements, the pH meter and electrode must be calibrated at a minimum of two different points.

HI5000 Series

# pH Technical Buffer Solutions (±0.01 pH)

Calibrate your instrument to an accuracy of ±0.01 pH with these NIST traceable buffer solutions.

These solutions are dedicated to applications that require exceptionally accurate pH monitoring, and come with a certificate of analysis prepared by comparison against NIST standards.

Each bottle label is clearly marked with their respective value and includes a pH/temperature reference chart and a spot to mark when the bottle was opened. A twist off cap and inner foil seal with pull tab allows for easy opening.

# Bottles

| pH Value @25°C | Code | Package |
|---|---|---|
| 1.00 | **HI5001-012** | 120 mL |
| | **HI5001-025** | 250 mL |
| | **HI5001-050** | 500 mL |
| | **HI5001-100** | 1 L |
| 1.68 | **HI5016-012** | 120 mL |
| | **HI5016-025** | 250 mL |
| | **HI5016-050** | 500 mL |
| | **HI5016-100** | 1 L |
| 2.00 | **HI5002-012** | 120 mL |
| | **HI5002-025** | 250 mL |
| | **HI5002-050** | 500 mL |
| | **HI5002-100** | 1 L |
| 3.00 | **HI5003-012** | 120 mL |
| | **HI5003-025** | 250 mL |
| | **HI5003-050** | 500 mL |
| | **HI5003-100** | 1 L |
| 4.01 | **HI5004-012** | 120 mL |
| | **HI5004-025** | 250 mL |
| | **HI5004-050** | 500 mL |
| | **HI5004-100** | 1 L |
| | **HI5004-R** | 500 mL (color coded solution) |
| | **HI5004-R08** | 1 G (3.78 L) (2) (color coded solution) |
| 5.00 | **HI5005-012** | 120 mL |
| | **HI5005-025** | 250 mL |
| | **HI5005-050** | 500 mL |
| | **HI5005-100** | 1 L |
| 6.00 | **HI5006-012** | 120 mL |
| | **HI5006-025** | 250 mL |
| | **HI5006-050** | 500 mL |
| | **HI5006-100** | 1 L |

| pH Value @25°C | Code | Package |
|---|---|---|
| 6.86 | **HI5068-012** | 120 mL |
| | **HI5068-025** | 250 mL |
| | **HI5068-050** | 500 mL |
| | **HI5068-100** | 1 L |
| 7.01 | **HI5007-012** | 120 mL |
| | **HI5007-025** | 250 mL |
| | **HI5007-050** | 500 mL |
| | **HI5007-100** | 1 L |
| | **HI5007-G** | 500 mL (color coded solution) |
| | **HI5007-G08** | 1 G (3.78 L) (2) (color coded solution) |
| 7.41 | **HI5074-012** | 120 mL |
| | **HI5074-025** | 250 mL |
| | **HI5074-050** | 500 mL |
| | **HI5074-100** | 1 L |
| 8.00 | **HI5008-012** | 120 mL |
| | **HI5008-025** | 250 mL |
| | **HI5008-050** | 500 mL |
| | **HI5008-100** | 1 L |
| 9.00 | **HI5009 -012** | 120 mL |
| | **HI5009 -025** | 250 mL |
| | **HI5009 -050** | 500 mL |
| | **HI5009 -100** | 1 L |
| 9.18 | **HI5091-012** | 120 mL |
| | **HI5091-025** | 250 mL |
| | **HI5091-050** | 500 mL |
| | **HI5091-100** | 1 L |

| pH Value @25°C | Code | Package |
|---|---|---|
| 10.01 | **HI5010-012** | 120 mL |
| | **HI5010-025** | 250 mL |
| | **HI5010-050** | 500 mL |
| | **HI5010-100** | 1 L |
| | **HI5010-V** | 500 mL (color coded solution) |
| | **HI5010-V08** | 1 G (3.78 L) (2) (color coded solution) |
| 11.00 | **HI5011-012** | 120 mL |
| | **HI5011-025** | 250 mL |
| | **HI5011-050** | 500 mL |
| | **HI5011-100** | 1 L |

| pH Value @25°C | Code | Package |
|---|---|---|
| 12.00 | **HI5012-012** | 120 mL |
| | **HI5012-025** | 250 mL |
| | **HI5012-050** | 500 mL |
| | **HI5012-100** | 1 L |
| 12.45 | **HI5124-012** | 120 mL |
| | **HI5124-025** | 250 mL |
| | **HI5124-050** | 500 mL |
| | **HI5124-100** | 1 L |
| 13.00 | **HI5013-012** | 120 mL |
| | **HI5013-025** | 250 mL |
| | **HI5013-050** | 500 mL |
| | **HI5013-100** | 1 L |

## Easy Single Use Sachets

For the highest level of calibration accuracy for field instrumentation, technical solutions are available in convenient single use sachets in 10 or 25 pack quantities.


| pH Value @25°C | Code | Package |
|---|---|---|
| 1.00 | **HI50001-02** | 20 mL (25) |
| 1.68 | **HI50016-01** | 20 mL (10) |
| 1.68 | **HI50016-02** | 20 mL (25) |
| 2.00 | **HI50002-02** | 20 mL (25) |
| 3.00 | **HI50003-02** | 20 mL (25) |
| 4.01 | **HI50004-01** | 20 mL (10) |
| 4.01 | **HI50004-02** | 20 mL (25) |
| 5.00 | **HI50005-02** | 20 mL (25) |
| 6.86 | **HI50068-02** | 20 mL (25) |
| 7.01 | **HI50007-01** | 20 mL (10) |
| 7.01 | **HI50007-02** | 20 mL (25) |

| pH Value @25°C | Code | Package |
|---|---|---|
| 9.00 | **HI50009-02** | 20 mL (25) |
| 9.18 | **HI50091-02** | 20 mL (25) |
| 10.01 | **HI50010-01** | 20 mL (10) |
| 10.01 | **HI50010-02** | 20 mL (25) |
| 11.00 | **HI50011-02** | 20 mL (25) |
| 12.00 | **HI50012-01** | 20 mL (10) |
| 12.00 | **HI50012-02** | 20 mL (25) |
| 12.45 | **HI50124-02** | 20 mL (25) |
| 13.00 | **HI50013-02** | 20 mL (25) |


HI6000 Series

# pH Millesimal Buffer Solutions (±0.002 pH)

HI6000 series NIST buffers feature millesimal accuracy (±0.002 pH) and has been prepared to meet the increasing need for assured accuracy in pH measurements. Each bottle is provided with a certificate of analysis, prepared by comparison with NIST standards.

## Bottles

| pH Value @25°C | Code | Package |
|---|---|---|
| 1.000 | **HI6001** | 500 mL |
| 1.679 | **HI6016** | 500 mL |
| 2.000 | **HI6002** | 500 mL |
| 3.000 | **HI6003** | 500 mL |
| 4.010 | **HI6004** | 500 mL |
| 4.010 | **HI6004-01** | 1 L |
| 6.000 | **HI6006** | 500 mL |
| 6.862 | **HI6068** | 500 mL |
| 7.010 | **HI6007** | 500 mL |
| 7.010 | **HI6007-01** | 1 L |
| 7.413 | **HI6074** | 500 mL |
| 8.000 | **HI6008** | 500 mL |
| 9.000 | **HI6009** | 500 mL |
| 9.177 | **HI6091** | 500 mL |
| 10.010 | **HI6010** | 500 mL |
| 10.010 | **HI6010-01** | 1 L |
| 12.000 | **HI6012** | 500 mL |
| 12.450 | **HI6124** | 500 mL |
| 13.000 | **HI6013** | 500 mL |

## Sachets

| pH Value @25°C | Code | Package |
|---|---|---|
| 1.000 | **HI60001-02** | 20 mL (25) |
| 1.679 | **HI60016-02** | 20 mL (25) |
| 2.000 | **HI60002-02** | 20 mL (25) |
| 4.010 | **HI60004-02** | 20 mL (25) |
| 7.010 | **HI60007-02** | 20 mL (25) |
| 10.010 | **HI60010-02** | 20 mL (25) |

HI7000 Series

# pH Standard Buffer Solutions (±0.01 pH)

Hanna buffer solutions are prepared according to precise formulas and are standardized with a pH electrode and meter calibrated with NIST standards.


## Bottles

| pH Value @25°C | Code | Package |
|---|---|---|
| 1.68 | **HI7001M** | 230 mL |
| | **HI7001L** | 500 mL |
| 4.01 | **HI7004M** | 230 mL |
| | **HI7004L** | 500 mL |
| | **HI7004C** | 500 mL, color coded solution |
| | **HI7004/1L** | 1 L, color coded solution |
| | **HI7004/1G** | 1 G (3.78L), color coded solution |
| | **HI8004L** | 500 mL (FDA bottle) |
| 6.86 | **HI7006M** | 230 mL |
| | **HI7006L** | 500 mL |
| | **HI7006/1L** | 1 L |
| | **HI7006/1G** | 1 G (3.78L) |
| | **HI8006L** | 500 mL (FDA bottle) |

| pH Value @25°C | Code | Package |
|---|---|---|
| 7.01 | **HI7007M** | 230 mL |
| | **HI7007L** | 500 mL |
| | **HI7007C** | 500 mL, color coded solution |
| | **HI7007/1L** | 1 L, color coded solution |
| | **HI7007/1G** | 1 G (3.78L), color coded solution |
| | **HI8007L** | 500 mL (FDA bottle) |
| 8.20 | **HI70082M** | 230 mL |
| 8.30 | **HI70083M** | 230 mL |

### FDA approved bottles available

For maximum reliability choose our solutions in bottles that meet FDA standards (US Food & Drug Administration) which protect the solutions from extended exposure to light.

| pH Value @25°C | Code | Package |
|---|---|---|
| 9.18 | **HI7009M** | 230 mL |
| | **HI7009L** | 500 mL |
| | **HI7009/1L** | 1 L, color coded solution |
| | **HI7009/1G** | 1 G (3.78L), color coded solution |
| | **HI8009L** | 500 mL (FDA bottle) |
| 10.01 | **HI7010M** | 230 mL |
| | **HI7010L** | 500 mL |
| | **HI7010C** | 500 mL, color coded solution |
| | **HI7010/1L** | 1 L, color coded solution |
| | **HI7010/1G** | 1 G (3.78L), color coded solution |
| | **HI8010L** | 500 mL (FDA bottle) |


## Sachets

| pH Value @25°C | Code | Package |
|---|---|---|
| 4.01 | **HI70004P** | 20 mL, 25 pcs |
| 4.01 and 7.01 | **HI77400P** | 20 mL, 10 pcs., 5 ea |
| 6.86 | **HI70006P** | 20 mL, 25 pcs |
| 7.01 | **HI70007P** | 20 mL, 25 pcs |
| 9.18 | **HI70009P** | 20 mL, 25 pcs |
| 10.01 | **HI70010P** | 20 mL, 25 pcs |
| 10.01 and 7.01 | **HI770710P** | 20 mL, 10 pcs., 5 ea |


## ORP Test and Pretreatment Solution

ORP standard solutions allows users to test the precision of ORP electrodes. For example, by immersing the electrode in HI7020 solution, readings should fall within the 200 to 275 mV range (@25°C/77°F).

If the reading is outside the indicated interval, clean and condition your ORP electrode in Hanna pretreatment solution.

| Code | Description | Size |
|---|---|---|
| **HI7020M** | ORP test solution @200 to 275 mV (@25°C) | 230 mL |
| **HI7020L** | ORP test solution @200 to 275 mV (@25°C) | 500 mL |
| **HI7021M** | ORP test solution @240 mV (@25°C) | 230 mL |
| **HI7021L** | ORP test solution @240 mV (@25°C) | 500 mL |
| **HI7022M** | ORP test solution @470 mV (@25°C) | 230 mL |
| **HI7022L** | ORP test solution @470 mV (@25°C) | 500 mL |
| **HI7091M** | pretreatment reducing solution | 230 mL |
| **HI7091L** | pretreatment reducing solution | 500 mL + 14g (set) |
| **HI7092M** | oxidizing pretreatment solution | 230 mL |
| **HI7092L** | oxidizing pretreatment solution | 500 mL |

### Clean Sensors Weekly

Clean the sensing portion of your electrodes weekly to prevent fouling and to maintain accuracy. Immerse the electrode in the proper cleaning solution for at least 15 to 20 minutes, rehydrate in storage solution and calibrate before use.


# Specific Use Electrode Cleaning Solutions

In many applications, electrodes become contaminated from use and produce inaccurate results. Since these contaminants cannot be removed during normal rinsing, special cleaning solutions are needed.

The Cleaning Series ensures maximum efficiency and accuracy of your sensors when used for its designated application. Electrode cleaning is a fast and effective routine that should be performed on a regular basis as a preventative measure against using a dirty electrode and to ensure that the junction is not clogged.

## Bottles

| Code | Description | Size |
|---|---|---|
| **HI70630L** | acid cleaning solution for meat grease and fats **(food industry)** | 500 mL |
| **HI70631L** | alkaline cleaning solution for meat grease and fats **(food industry)** | 500 mL |
| **HI70632L** | cleaning and disinfection solution for blood products **(medical industry)** | 500 mL |
| **HI70635L** | cleaning solution for wine deposits **(winemaking)** | 500 mL |
| **HI70636L** | cleaning solution for wine stains **(winemaking)** | 500 mL |
| **HI70640L** | cleaning solution for milk deposits **(food industry)** | 500 mL |
| **HI70641L** | cleaning and disinfection solution for dairy products **(food industry)** | 500 mL |
| **HI70642L** | cleaning solution for cheese residues **(food industry)** | 500 mL |
| **HI70643L** | cleaning and disinfection solution for yogurt products **(food industry)** | 500 mL |
| **HI70663L** | cleaning solution for soil deposits **(agriculture)** | 500 mL |
| **HI70664L** | cleaning solution for humus deposits **(agriculture)** | 500 mL |
| **HI70670L** | cleaning solution for salt deposits **(industrial processes)** | 500 mL |
| **HI70671L** | cleaning and disinfection solution for algae, fungi and bacteria **(industrial processes)** | 500 mL |
| **HI70681L** | cleaning solution for ink stains **(printing industry)** | 500 mL |

## Sachets

| Code | Description | Size |
|---|---|---|
| **HI700601P** | general purpose cleaning solution for **(laboratories)** | 20 mL (25) |
| **HI700630P** | acid cleaning solution for meat grease and fats **(food industry)** | 20 mL (25) |
| **HI700635P** | cleaning solution for wine deposits **(winemaking)** | 20 mL (25) |
| **HI700636P** | cleaning solution for wine stains **(winemaking)** | 20 mL (25) |
| **HI700640P** | cleaning solution for milk deposits **(food industry)** | 20 mL (25) |
| **HI700641P** | cleaning and disinfection solution for dairy products **(food industry)** | 20 mL (25) |
| **HI700642P** | cleaning solution for cheese residues **(food industry)** | 20 mL (25) |
| **HI700643P** | cleaning and disinfection solution for yogurt products **(food industry)** | 20 mL (25) |
| **HI700661P** | general purpose cleaning solution **(agriculture)** | 20 mL (25) |
| **HI700663P** | cleaning solution for soil deposits **(agriculture)** | 20 mL (25) |
| **HI700664P** | cleaning solution for humus deposits **(agriculture)** | 20 mL (25) |
| **HI700670P** | cleaning solution for salt deposits **(industrial processes)** | 20 mL (25) |

### Clean Sensors Weekly

Clean the sensing portion of your electrodes weekly to prevent fouling and to maintain accuracy. Immerse the electrode in the proper cleaning solution for at least 15 to 20 minutes and rehydrate in storage solution before use.

## General Use Electrode Cleaning Solutions

| Code | Application | Package |
|---|---|---|
| **HI70000P** | rinsing | 20 mL sachet (25) |
| **HI7061L** | general purpose | 500 mL bottle |
| **HI8061L** | general purpose | 500 mL FDA bottle |
| **HI7061-050** | general purpose (GroLine) | 500 mL bottle |
| **HI7061-023** | general purpose (GroLine) | 230 mL bottle |
| **HI7061-012** | general purpose (GroLine) | 120 mL bottle |
| **HI7073L** | proteins | 500 mL bottle |
| **HI7073M** | proteins | 230 mL bottle |
| **HI8073L** | proteins | 500 mL FDA bottle |
| **HI7074L** | inorganic substances | 500 mL bottle |
| **HI7074M** | inorganic substances | 230 mL bottle |
| **HI7077L** | oil and fats | 500 mL bottle |
| **HI7077M** | oil and fats | 230 mL bottle |
| **HI8077L** | oil and fats | 500 mL FDA bottle |


## Electrode Storage Solutions

| Code | Description | Package |
|---|---|---|
| **HI70300L** | electrode storage solution | 500 mL bottle |
| **HI70300M** | electrode storage solution | 230 mL bottle |
| **HI70300-050** | electrode storage solution (GroLine) | 500 mL bottle |
| **HI70300-023** | electrode storage solution (GroLine) | 230 mL bottle |
| **HI70300-012** | electrode storage solution (GroLine) | 120 mL bottle |
| **HI80300L** | electrode storage solution | 500 mL FDA bottle |
| **HI80300M** | electrode storage solution | 230 mL FDA bottle |

## Electrode Filling Solutions

| Code | Description | Package |
|---|---|---|
| **HI7082** | electrolyte solution, 3.5M KCl | 30 mL bottle (4) |
| **HI7082M** | electrolyte solution, 3.5M KCl | 230 mL bottle |
| **HI7082L** | electrolyte solution, 3.5M KCl | 460 mL bottle |
| **HI8082** | electrolyte solution, 3.5M KCl | 30 mL FDA bottle (4) |

## Electrode Filling Accessories

| Code | Description |
|---|---|
| **HI740157P** | Electrode filling pipettes (20) |

### Keep Bulb and Junctions Moist

To minimize junction clogging and ensure fast response time, always keep the glass bulb and the junction of your pH electrode moist. Store the electrode with a few drops of HI70300 storage solution in the protective cap.

### Check and top-off electrolyte levels if needed

The electrolyte level in refillable electrodes should be checked before performing any measurement. If the level is low, refill with the proper electrolyte solution to ensure correct electrode performance. This simple maintenance helps guarantee adequate head pressure to keep the liquid junction flowing.


HI181 • HI180

# Compact Magnetic Stirrers

**Available With and Without Detachable Electrode Holder**

- Maximum stirring capacity of 1 liter (0.26 gallons)
- Adjustable speed control
- Chemical resistant housing

Common stirrers are manufactured with steel and aluminum components. These units are often too large and heavy to fit in the limited space of a laboratory. Hanna HI181 and HI180 models are compact, lightweight, and inexpensive.

## Speedsafe™ Speed Control

Often in the lab, a sample is removed from a stirrer before reducing the speed. Normally, this would cause the motor to accelerate until it is destroyed. Hanna stirrers incorporate electronic controls that allow the user to regulate the speed with greater precision. In addition to speed control, the Speedsafe mechanism will assure that the maximum speed is never exceeded.

## 11 Colors to Choose From

Both models of mini-stirrers are available in eleven colors. The various colors can allow easy sample identification at a distance.

# HI181 Ordering Information

All models include detachable electrode holder, micro stir bar and instructions.

**HI181-1** Black
mini-stirrer (115V)

**HI181W-1** Arctic white
mini-stirrer (115V)

**HI181F-1** Blue
mini-stirrer (115V)

**HI181M-1** Moss green
mini-stirrer (115V)

**HI181K-1** Orange
mini-stirrer (115V)

**HI181L-1** Lavender
mini-stirrer (115V)

**HI181J-1** Charcoal
mini-stirrer (115V)

**HI181I-1** Ivory
mini-stirrer (115V)

**HI181C-1** Glacier blue
mini-stirrer (115V)

**HI181E-1** Green
mini-stirrer (115V)

**HI181A-1** Yellow
mini-stirrer (115V)

# HI180 Ordering Information

All models include micro stir bar and instructions.

**HI180-1** Black
mini-stirrer (115V)

**HI180W-1** Arctic white
mini-stirrer (115V)

**HI180F-1** Blue
mini-stirrer (115V)

**HI180M-1** Moss green
mini-stirrer (115V)

**HI180K-1** Orange
mini-stirrer (115V)

**HI180L-1** Lavender
mini-stirrer (115V)

**HI180J-1** Charcoal
mini-stirrer (115V)

**HI180I-1** Ivory
mini-stirrer (115V)

**HI180C-1** Glacier blue
mini-stirrer (115V)

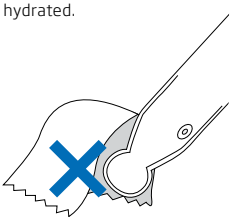
**HI180E-1** Green
mini-stirrer (115V)

**HI180A-1** Yellow
mini-stirrer (115V)

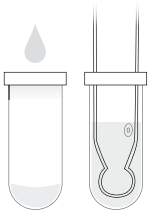
Best Practices For Great Results



Keep your electrode hydrated.

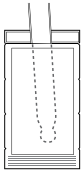


Rinse, don't wipe your electrode.



Store your electrode in storage solution.

Clean your electrode regularly.



Calibrate your electrode often.

# Troubleshooting

## "My pH readings are drifting/erratic!"

**It might be...**

**...contamination on the sensing glass.**

- Remember to clean and condition your electrodes regularly.

**...a clogged junction.**

- Remember to clean and condition your electrodes regularly.

**...a low conductivity sample.**

- Use an electrode with a high flow rate junction.

**...a dehydrated electrode.**

- Condition your electrode in storage solution for at least 1 hour.

**...electrical noise in your process.**

- Take a grab sample and perform the measurement outside of the process.

## "My pH readings just aren't accurate!"

**It might be...**

**...that someone wiped the electrode.**

- Condition your electrode in storage solution and remember, rinse, don't wipe the electrode clean.

**...improperly calibrated.**

- Recalibrate the electrode. Be sure to check the freshness of you buffers and rinse in between each buffer.

**...a different temperature from buffer to sample.**

- Recalibrate the electrode at the same temperature as your sample or be sure you are using a meter with automatic temperature compensation.

•

## "My pH readings are frozen!"

**It might be...**

**...a broken electrode.**

- Inspect your electrode for cracks or breakage. Call our Service Department if you have further questions.

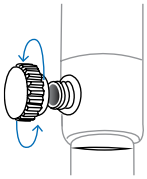
## "I have conditioned my electrode but the readings are still wrong!"

**It might be...**

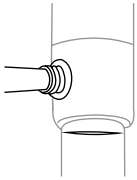
**...a clogged cloth junction.**

- Pull out 2 mm (1/8") of the cloth junction to renew the electrode reference and recalibrate the meter.

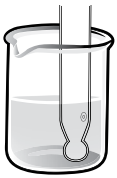
Select the right electrode for your application.



Open or loosen your electrolyte fill cap.



Keep your electrolyte level full.



Properly submerge your electrode junction, membrane tip, and temperature sensor.

Inspect your electrode before use.

# Thank you for choosing us.

We understand the challenges you are faced with in scientific testing and work to develop simple and accurate solutions. Each day we live and work by our mission statement:

*To empower our customers to achieve quality by supplying intuitive, accurate, and reliable analytical instrumentation with exceptional service and value.*

Today, we manufacture over 3,000 products in factories located around the world. We are proud to offer unique solutions for our customers, unsurpassed customer service, and friendly technical support.

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