



# HALO®

Wireless pH Meters

## Take lab grade measurements using a smart phone or tablet

HALO is the world's first professional pH probe with Bluetooth® Smart technology (Bluetooth® 4.0). This technology is energy efficient, allowing for low power consumption to maximize the life of the replaceable battery used in the pH electrode. HALO pH probes can be used virtually anywhere: in the field, laboratory, or classroom. Their versatility and ease of use revolutionizes the way pH is measured.

The Bluetooth® word mark and logos are registered trademarks owned by Bluetooth SIG, Inc.



## One Press Connect

Connect to the Hanna Lab App at the press of a button via Bluetooth® wireless technology (10 m (33') range). The LED halo light indicates that the probe is active and transmitting.



## One Button Sample Tagging

Pressing the button on the HALO pH probe or the probe icon in the Hanna Lab App will tag sample data for easy reference.



## Easy to Replace Battery

The HALO's CR2032 lithium ion battery is easily replaced and lasts for approximately 500 hours.

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HI11312

# HALO®

Ideal for lab applications



Hanna Lab App  
Compatible

The Hanna Lab App is  
available on the App Store®  
and on Google Play.

Compatible with  
edge®blu

HI11312 HALO is an innovative, pH electrode with Bluetooth® Smart technology that allows a compatible Apple or Android smart device to be used as a pH meter. The electrode is a general purpose, glass body pH electrode ideal for routine laboratory measurement.

- **Glass body**
  - Non-porous surface that withstands harsh chemicals
- **Double junction**
  - Silver free outer reference that is compatible with most samples
- **Built-in temperature sensor**
  - High accuracy temperature compensated measurements
- **Refillable**
  - Allows the filling of the reference cell with electrolyte fill solution

## Glass Body

The glass body of the HI11312 is resistant to many harsh chemicals and is easy to clean making it ideal for general laboratory use.

## Double Junction

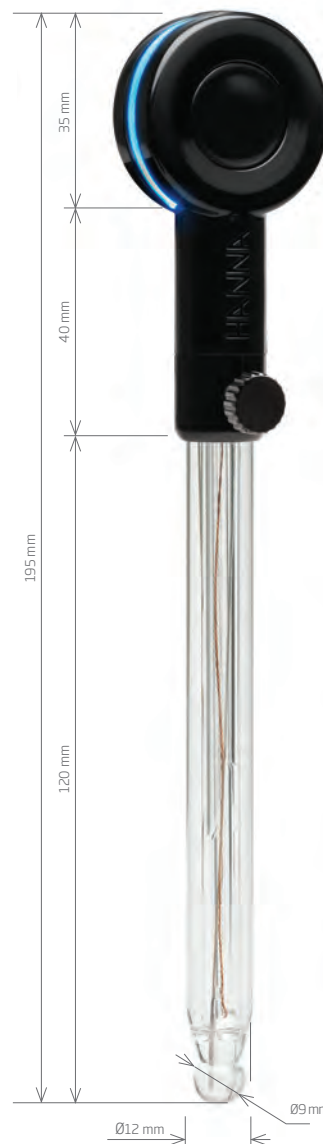
HI11312 is a double junction pH electrode in which the Ag/AgCl necessary for the reference cell is located behind an inner ceramic junction. The gel electrolyte between the inner and outer junction is silver free. This is important to prevent the precipitation of silver by Tris buffer, metals, and sulfides that would clog the junction leading to erratic readings.

## Built-in Temperature Sensor

HI11312 has a thermistor temperature sensor built into the tip of the pH electrode. A thermistor based temperature sensor provides for a high accuracy temperature reading while being in the tip of the electrode allows for a rapid determination of the temperature as it impacts the effect on the glass membrane potential.

## Refillable

HI11312 is a refillable pH electrode. Fill solution from the inside will diffuse through the ceramic junction as it is used and stored in storage solution. Electrolyte fill solution should be added to the probe when the level drops more than 1 cm (1/2") from the fill hole in order to maintain a good flow rate sustained by having adequate head pressure.



### HALO Specifications

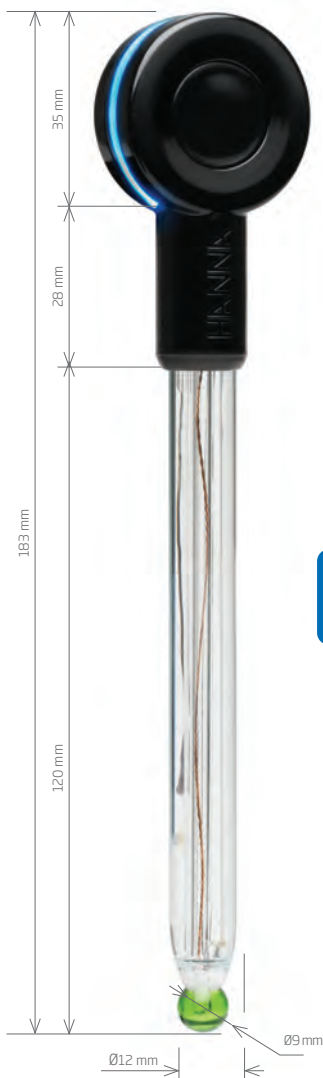
### HI11312

Measurement Range	0.00 to 13.00 pH
Reference Cell Type	double, Ag/AgCl
Junction Type	ceramic
Electrolyte	3.5M KCl (refillable)
Body Material	glass
Tip / Shape	spheric
Temperature Operating Range	-5 to 80°C (23 to 176°F)
Glass Type	HT (high temperature)
Body Length/Overall Length	120 mm / 195 mm
Temperature Sensor	integrated
Outer Diameter	12 mm (glass)
Connector Type	Bluetooth Smart (Bluetooth 4.0), 10 m (33') range
Battery Type/Life	CR2032 3V lithium ion / approximately 500 hours
Environment	0 to 50°C (32 to 122°F); electronic module is not waterproof

### Ordering Information

**HI11312** (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, fill solution, battery, quality certificate, and instruction sheet.

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Also included with edge®blu

HI11102

**HALO**®



Hanna Lab App  
Compatible

The Hanna Lab App is available on the App Store® and on Google Play.

Compatible with edge®blu

Ideal for lab applications

HI11102 HALO is an innovative, pH electrode with Bluetooth® Smart technology that allows a compatible Apple or Android smart device to be used as a pH meter. This general purpose, glass body pH electrode is ideal for users that would prefer a laboratory pH electrode without the refill solution maintenance.

- **Glass body**
  - Non-porous surface that withstands harsh chemicals
- **Double junction**
  - Silver free outer reference that is compatible with most samples
- **Built-in temperature sensor**
  - High accuracy temperature compensated measurements
- **Gel-filled reference**
  - Maintenance free with no fill solutions required

### Glass Body

The glass body of the HI11102 is ideal for laboratory use and for users that prefer to have a traditional laboratory pH electrode without having to maintain the proper fill solution level. The glass is resistant to many harsh chemicals and is easy to clean.

### Double Junction

HI11102 is a double junction pH electrode in which the Ag/AgCl necessary for the reference cell is located behind an inner ceramic junction. The gel electrolyte between the inner and outer junction is silver free. This is important to prevent the precipitation of silver by Tris buffer, metals, and sulfides that would clog the junction leading to erratic readings.

### Built-in Temperature Sensor

HI11102 has a thermistor temperature sensor built into the tip of the pH electrode. A thermistor based temperature sensor provides for a high accuracy temperature reading while being in the tip of the electrode allows for a rapid determination of the temperature as it impacts the effect on the glass membrane potential.

### Maintenance Free Gel-filled Reference

HI11102 contains a silver free gel in the outer reference cell. There is no fill solution to replenish as the probe is used. Other than routine calibration and cleaning, this probe is maintenance free.

HALO Specifications	HI11102
Measurement Range	0.00 to 12.00 pH
Reference Cell Type	double, Ag/AgCl
Junction Type	ceramic
Electrolyte	gel
Body Material	glass
Tip / Shape	spheric
Temperature Operating Range	-5 to 80°C (23 to 176°F)
Glass Type	LT (low temperature)
Body Length/Overall Length	120 mm / 183 mm
Temperature Sensor	integrated
Outer Diameter	12 mm (glass)
Connector Type	Bluetooth Smart (Bluetooth 4.0), 10 m (33') range
Battery Type/Life	CR2032 3V lithium ion / approximately 500 hours
Environment	0 to 50°C (32 to 122°F); electronic module is not waterproof
<b>Ordering Information</b>	<b>HI11102 (HALO)</b> is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, battery, quality certificate, and instruction sheet.

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HI13302

# HALO®


**Hanna Lab App  
Compatible**

 The Hanna Lab App is  
available on the App Store®  
and on Google Play.

 Compatible with  
edge®blu

**Ideal for test tube applications**

HI13302 HALO is an innovative, application specific, pH electrode with Bluetooth® Smart technology that allows a compatible Apple or Android smart device to be used as a pH meter. This electrode is designed for taking pH measurements in test tubes that are used by university, pharmaceutical, biotechnology, and food laboratories.

- **Small diameter bulb and body**
  - 5 mm diameter bulb fits easily into test tubes
- **Built-in temperature sensor**
  - Provides accurate temperature compensated pH measurements
- **Open junction**
  - Permits a predictable flow rate of reference electrolyte for stability
- **Gel-filled reference**
  - Maintenance free with no fill solutions required

### Small 5 mm Diameter Bulb and Body

HI13302 has a small pH-sensing bulb that is only 5 mm in diameter by 80 mm in length. The small diameter of the probe allows for pH measurements in test tubes, vials, and other small containers.

### Built-in Temperature Sensor

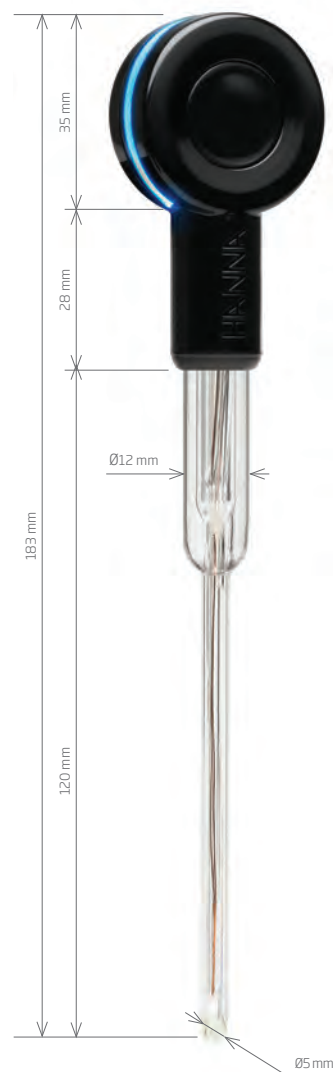
HI13302 has a thermistor temperature sensor built into the tip of the pH electrode. A thermistor based temperature sensor provides for high accuracy while being in the tip of the electrode allows for a rapid temperature compensated measurement.

### Open Junction Design

The reference half-cell has an open junction design in order to accommodate the 5 mm micro bulb and shaft. The open junction design is resistant to clogging from suspended solids and proteins found in biological samples. Any clogging that occurs will impede the measurement circuit between the indicating electrode and the internal reference resulting in slower response time and erratic readings.

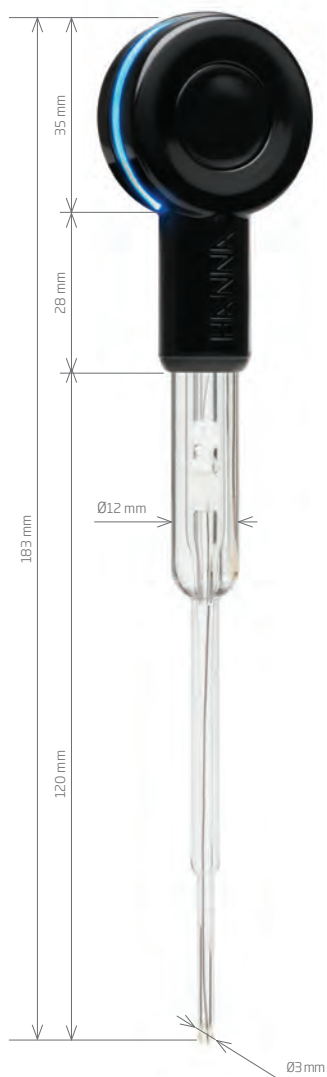
### Maintenance Free Gel-filled Reference

The open junction design consists of a solid gel (Viscolene) interface between the sample and internal ceramic reference junction. Other than routine calibration and cleaning, this probe is maintenance free.



HALO Specifications	HI13302
Measurement Range	0.00 to 12.00 pH
Reference Cell Type	double, Ag/AgCl
Junction Type	open junction
Electrolyte	Viscolene
Body Material	glass
Tip / Shape	spheric
Temperature Operating Range	-5 to 50°C (23 to 122°F)
Glass Type	LT (low temperature)
Body Length/Overall Length	120 mm / 183 mm
Temperature Sensor	integrated
Outer Diameter	5 mm (glass)
Connector Type	Bluetooth Smart (Bluetooth 4.0), 10 m (33') range
Battery Type/Life	CR2032 3V lithium ion / approximately 500 hours
Environment	0 to 50°C (32 to 122°F); electronic module is not waterproof
<b>Ordering Information</b>	<b>HI13302</b> (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, battery, quality certificate, and instruction sheet.

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HI10832

**HALO**®



Hanna Lab App  
Compatible

The Hanna Lab App is  
available on the App Store®  
and on Google Play.

Compatible with  
edge@blu

Ideal for small sample  
lab applications

HI10832 HALO is an innovative, application specific, pH electrode with Bluetooth® Smart technology that allows a compatible Apple or Android smart device to be used as a pH meter. This pH electrode allows for the wireless measurement of very small sample sizes for laboratory customers in university, pharmaceutical, and biotechnology research.

- **Micro bulb tip**
  - The 3 mm diameter bulb can measure the pH in samples as small as 100 µL.
- **Open junction design**
  - Resists clogging and provides for fast response time
- **Gel-filled reference**
  - Maintenance free with no fill solutions required

### Micro Bulb Tip

HI10832 has an extremely small pH-sensing bulb that is only 3 mm in diameter. The small diameter of the probe allows for the measurement of pH in 96 well plates, test tubes, and vials. The HI10832 is ideal for use with expensive samples that offer little volume to work with.

### Open Junction Design

The reference half-cell has an open junction design in order to accommodate the 3 mm micro bulb and shaft. The open junction design is resistant to clogging from suspended solids and proteins found in biological samples. Any clogging that occurs will impede the measurement circuit between the indicating electrode and the internal reference resulting in slower response time and erratic readings.

### Maintenance Free Gel-filled Reference

The open junction design consists of a solid gel (viscolene) interface between the sample and internal ceramic reference junction. Other than routine calibration and cleaning, this probe is maintenance free.

HALO Specifications	HI10832
Measurement Range	0.00 to 12.00 pH
Reference Cell Type	double, Ag/AgCl
Junction Type	open
Electrolyte	Viscolene
Body Material	glass
Tip / Shape	spheric
Temperature Operating Range	0 to 50°C (32 to 122°F)
Glass Type	GP (general purpose)
Body Length/Overall Length	120 mm /183 mm
Temperature Sensor	none
Outer Diameter	3 mm (glass)
Connector Type	Bluetooth Smart (Bluetooth 4.0), 10 m (33') range
Battery Type/Life	CR2032 3V lithium ion / approximately 500 hours
Environment	0 to 50°C (32 to 122°F); electronic module is not waterproof

### Ordering Information

**HI10832** (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, battery, quality certificate, and instruction sheet.

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HI12302

# HALO®

Ideal for field applications



Hanna Lab App  
Compatible

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and on Google Play.

Compatible with  
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HI12302 HALO is an innovative, pH electrode with Bluetooth® Smart technology that allows a compatible Apple or Android smart device to be used as a pH meter. HI12302 is a general purpose, PEI plastic body pH electrode for routine measurements in the field, lab, or at home.

- **PEI plastic body**
  - Durable, chemically resistant plastic
- **Double junction**
  - Silver free outer reference that is compatible with most samples
- **Built-in temperature sensor**
  - High accuracy temperature compensated measurements
- **Gel-filled reference**
  - Maintenance free with no fill solutions required

## PEI Plastic Body

The body of the HI12302 is composed of polyetherimide (PEI) resin. PEI is a high quality plastic that is chemically resistant to many aggressive chemicals making it ideal for a wide range of applications. The PEI body excels in field measurements due to its durability. The shield around the spherical glass tip also helps to minimize breakage due to accidental bumping or dropping of the electrode.

## Double Junction

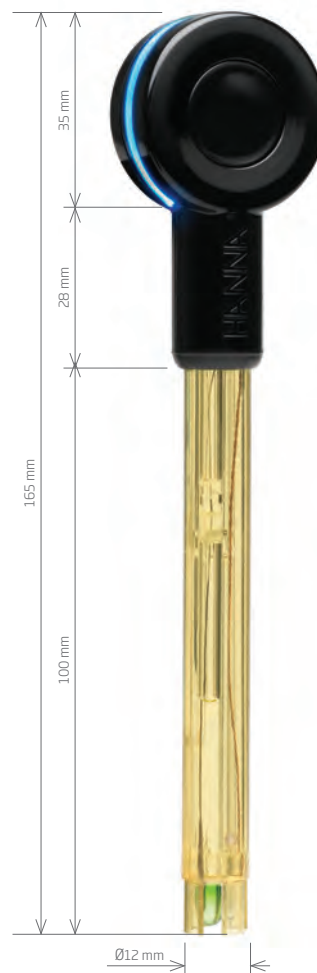
HI12302 is a double junction pH electrode in which the Ag/AgCl necessary for the reference cell is located behind an inner ceramic junction. The electrolyte between the inner and outer junction is silver free. This is important to prevent the precipitation of silver by Tris buffer, metals, and sulfides that would clog the junction leading to erratic readings.

## Built-in Temperature Sensor

A thermistor temperature sensor is built into the tip of the pH electrode. A thermistor based temperature sensor provides for a high accuracy temperature reading while being in the tip of the electrode allows for a rapid determination of the temperature as it impacts the effect on the glass membrane potential.

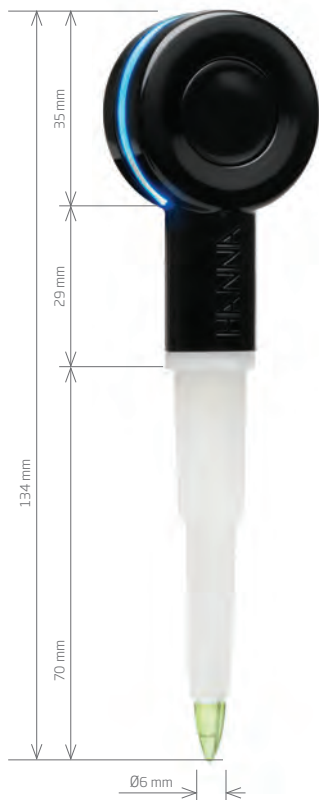
## Maintenance Free Gel-filled Reference

HI12302 contains a silver free gel in the outer reference cell. There is no fill solution to replenish as the probe is used. Other than routine calibration and cleaning, this probe is maintenance free.



HALO Specifications	HI12302
Measurement Range	0.00 to 12.00 pH
Reference Cell Type	double, Ag/AgCl
Junction Type	ceramic
Electrolyte	gel
Body Material	PEI
Tip / Shape	dome
Temperature Operating Range	-5 to 70°C (23 to 158°F)
Glass Type	LT (low temperature)
Body Length/Overall Length	100 mm / 165 mm
Temperature Sensor	integrated
Outer Diameter	12 mm (plastic)
Connector Type	Bluetooth Smart (Bluetooth 4.0), 10 m (33') range
Battery Type/Life	CR2032 3V lithium ion / approximately 500 hours
Environment	0 to 50°C (32 to 122°F); electronic module is not waterproof
<b>Ordering Information</b>	<b>HI12302</b> (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, battery, quality certificate, and instruction sheet.

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FC2022

**HALO**®



Hanna Lab App  
Compatible

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and on Google Play.

Compatible with  
edge@blu

Ideal for food applications

The FC2022 HALO is an innovative, application specific pH electrode with Bluetooth® Smart technology designed for food processing companies that need to monitor the pH of their product for quality and compliance.

- **Conic bulb**
  - Easy penetration into soft solids and semi-solids
- **Low temperature glass**
  - Fast and accurate measurement of refrigerated products
- **Open junction**
  - Resists clogging and provides fast response time
- **Gel-filled reference**
  - Maintenance free with no fill solutions required
- **Built-in temperature sensor**
  - High accuracy temperature compensated measurements

### Conic Bulb

The conical shaped tip design allows for the easy penetration of the sensor into soft solids and semi-solids such as cheeses, yogurt, meats, and sauces. It doesn't trap foods and is very easy to wipe clean.

### Low Temperature Glass

The glass tip is made with Low Temperature (LT) glass formulation that has a lower resistance than standard glass types used with ordinary pH electrodes. This is beneficial since many food products are stored at low temperatures. FC2022 HALO is suitable to be used for measurements between 0 to 10°C (32 to 50°F).

### Open Junction Design

The open junction design consists of a solid gel (viscolene) interface between the sample and internal reference. This interface not only prevents silver from entering the sample, but also makes it impermeable to clogging from food products, maintaining a fast response and stable reading.

### Maintenance Free Gel-filled Reference

Because the internal reference is gel, there is no fill solution to replenish as the probe is used. Other than routine calibration and cleaning, this a maintenance free probe.

### Built-in Temperature Sensor

The thermistor temperature sensor is built into the tip of the pH electrode. A thermistor based temperature sensor provides for a high accuracy temperature while being in the tip of the electrode allows for a rapid temperature compensated measurement.

HALO Specifications	FC2022
Measurement Range	0.00 to 12.00 pH
Reference Cell Type	double, Ag/AgCl
Junction Type	open
Electrolyte	Viscolene
Body Material	PVDF
Tip / Shape	conic
Temperature Operating Range	0 to 60°C (32 to 140°F)
Glass Type	LT (low temperature)
Body Length/Overall Length	70 mm / 134 mm
Temperature Sensor	integrated
Outer Diameter	12 mm to 8 mm taper (plastic)
Connector Type	Bluetooth Smart (Bluetooth 4.0), 10 m (33') range
Battery Type/Life	CR2032 3V lithium ion / approximately 500 hours
Environment	0 to 50°C (32 to 122°F); electronic module is not waterproof
<b>Ordering Information</b>	<b>FC2022 (HALO)</b> is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, battery, quality certificate, and instruction sheet.

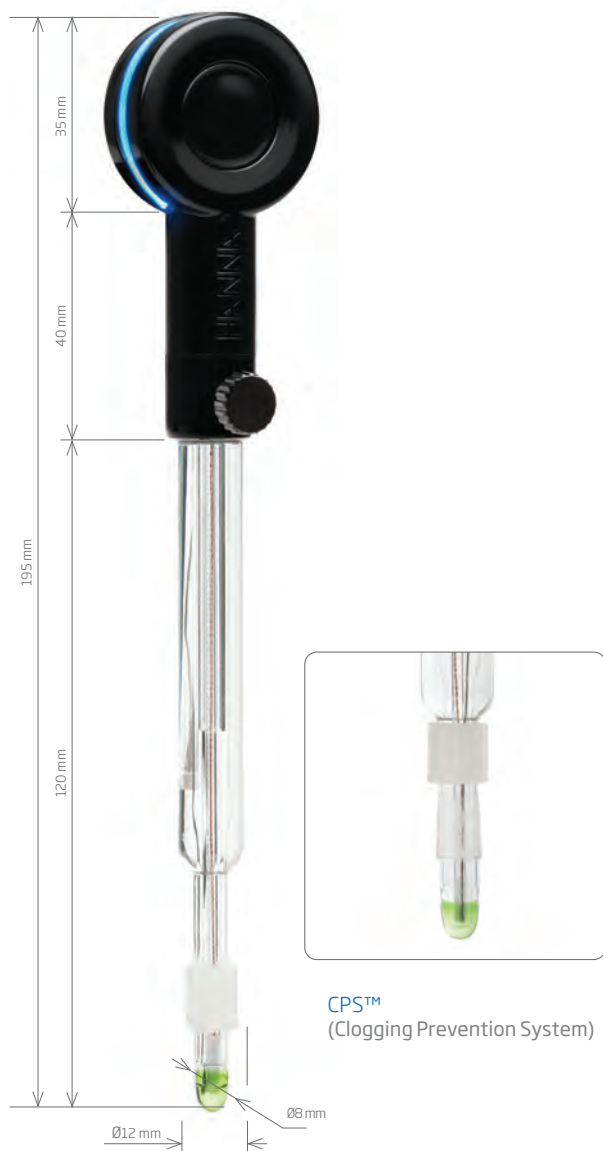
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## The Importance of pH in Wine Making

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 the 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 bacteria growth and fermentation.



CPTM™  
(Clogging Prevention System)

HALO Specifications	HI10482
Measurement Range	0.00 to 12.00 pH
Reference Cell Type	double, Ag/AgCl
Junction Type	movable open junction
Electrolyte	3.5M KCl (refillable)
Body Material	glass
Tip / Shape	dome
Temperature Operating Range	0 to 60°C (32 to 140°F)
Glass Type	LT (low temperature)
Body Length/Overall Length	120 mm / 195 mm
Temperature Sensor	integrated
Outer Diameter	12 mm (glass)
Connector Type	Bluetooth Smart (Bluetooth 4.0), 10 m (33') range
Battery Type/Life	CR2032 3V lithium ion / approximately 500 hours
Environment	0 to 50°C (32 to 122°F); electronic module is not waterproof

#### Ordering Information

**HI10482** (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 3.00 buffer solution, fill solution, battery, quality certificate, and instruction sheet.

HI10482

# HALO®



Hanna Lab App  
Compatible

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Compatible with  
edge@blu

Ideal for wine, must and juice

HI10482 HALO is an innovative, application specific pH electrode designed for the winemaker that needs to monitor the pH of wine, grape juice, and must.

- **Clogging prevention system (CPS) technology**
  - Anti-clogging PE sleeve that maintains stability and fast response
- **Refillable**
  - Allows the filling of the reference cell with electrolyte fill solution
- **Built-in temperature sensor**
  - High accuracy temperature compensated measurements
- **Customized calibration buffer value**
  - Calibration to pH 3.00 to bracket the expected reading in wine

### Clogging Prevention System (CPS) Technology

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 PE sleeve to prevent clogging. The ground glass allows proper flow of the liquid, while the PE 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 PE sleeve can be moved to clean the ground glass surface rejuvenating the junction and extending probe life.

### Refillable

HI10482 is a refillable double junction pH electrode. Fill solution from inside the probe will diffuse through the ground glass junction while it is in use and when it is stored in storage solution. Electrolyte fill solution should be added to the probe when the level drops more than 1 cm (.39") from the fill hole in order to maintain a good flow rate sustained by having adequate head pressure.

### Built-in Temperature Sensor

HI10482 has a built-in thermistor temperature sensor that is in the tip of the pH electrode. A thermistor temperature sensor provides a high accuracy temperature reading and should be as close as possible to the indicating pH electrode in order to compensate for the effect that temperature has on the membrane potential. Having a built in temperature sensor is important in wine since the measured pH values are more than 3 pH units away from the isopotential point. The further away from the isopotential point the greater the influence that temperature has on the observed reading.

### Customized Calibration Buffer Value

The average pH of wine influences the choice of calibration buffers that should be used. Generally, most wines have a finished pH between 3 and 4. To ensure a high accuracy measurement, the HI10482 will prompt for pH 3.00 buffer in place of pH 4.01. This allows the calibration to bracket the expected value to be measured.

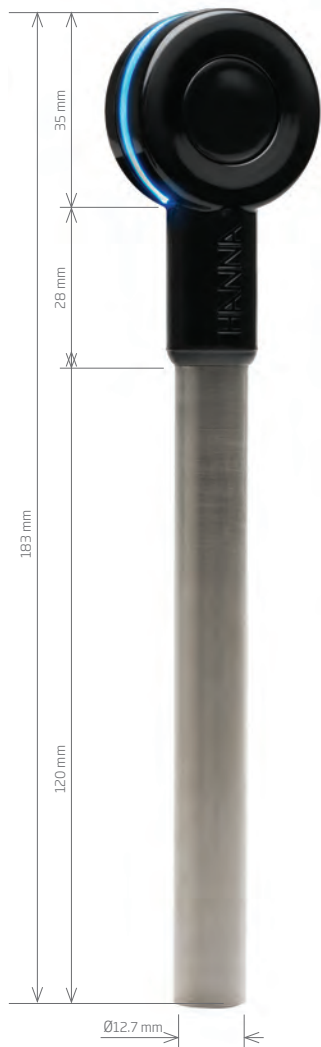
## pH in Beer

In the brewing process, the enzymes required to convert the starch into sugar are pH-sensitive with an optimal pH range between 5.2 pH and 5.6 pH. 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 4.9, even 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 increases. Unfortunately for hop lovers, a high pH also increases the release of tannins resulting in a harsher taste. Higher pH also favors elevated microbial activity.

As a living catalyst, yeast maintains a pH around 6.5 within its cells; however, the preference is to inhabit a more acidic environment. During the fermentation stage, the pH should be lower to accommodate the yeast and also to ensure microbial stability and consistent flavoring of the beer; an optimal pH range during fermentation is between pH 4.1 and 4.3.



FC2142

**HALO**®



Hanna Lab App  
Compatible

The Hanna Lab App is  
available on the App Store®  
and on Google Play.

Compatible with  
edge@blu

Ideal for brewers

FC2142 HALO is an innovative, application specific pH electrode designed for brewers to help monitor the pH of mash and wort.

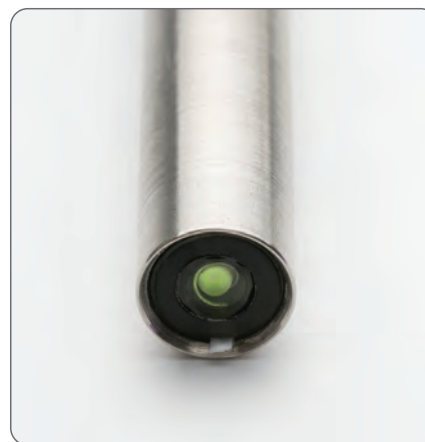
- **Built-in temperature sensor**
  - High accuracy temperature compensated measurements
- **Titanium body**
  - Provides protection even at high temperatures as well as stability of measurement

### Built-in Temperature Sensor

FC2142 has a thermistor temperature sensor built into the tip of the pH electrode to provide highly accurate temperature readings and temperature compensated pH measurements.

### Titanium Body

A pH measurement is a high impedance measurement, and as such is susceptible to interference from electrical noise and humidity. To overcome these issues a titanium body serves as a matching pin. A matching pin is a differential measurement technique used to eliminate electrical noise in the measurement system. The titanium body, being made of metal, is virtually unbreakable and offers additional protection from accidental breakage.



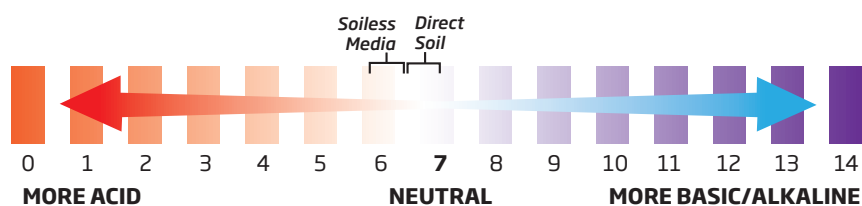
HALO Specifications	FC2142
Measurement Range	0.00 to 13.00 pH
Reference Cell Type	double, Ag/AgCl
Junction Type	cloth
Electrolyte	gel
Body Material	titanium
Tip / Shape	flat
Temperature Operating Range	0 to 80°C (32 to 176°F)
Glass Type	LT (low temperature)
Body Length/Overall Length	120 mm / 183 mm
Temperature Sensor	integrated
Outer Diameter	12.7 mm (titanium)
Connector Type	Bluetooth Smart (Bluetooth 4.0), 10 m (33') range
Battery Type/Life	CR2032 3V lithium ion / approximately 500 hours
Environment	0 to 50°C (32 to 122°F); electronic module is not waterproof
<b>Ordering Information</b>	<b>FC2142</b> (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, battery, quality certificate, and instruction sheet.

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## pH Measurements

pH is the measurement of hydrogen ion concentration (H<sup>+</sup>) in water or soil. A pH of 7 is considered neutral. A pH below 7 is considered more acidic and a pH above 7 is considered more basic or alkaline. Water pH is important for plant management because it affects the solubility of fertilizers and the effectiveness of insecticides and fungicides.

Below is a pH scale that ranges from 0 - 14 pH. Most plants have an optimal pH between 5.8 and 6.4 pH in soil-less media. For direct soil applications, a typical pH range of 6.5 - 7.0 pH is more common.



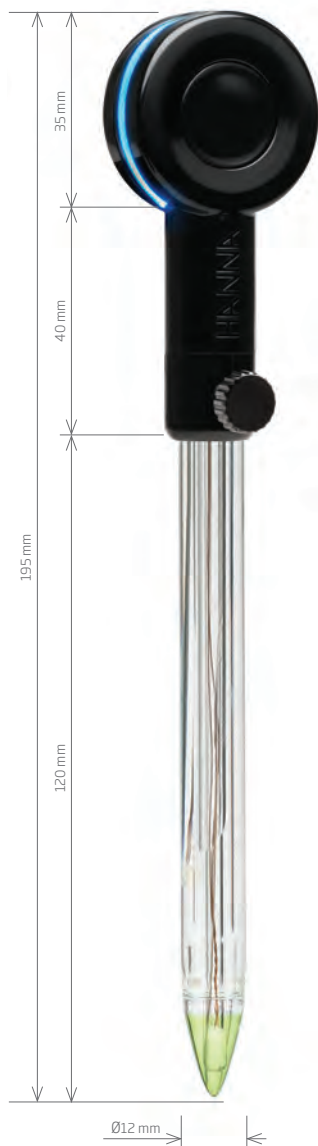
### Pounds of Sulfur to Lower the Soil pH per 100 sq. ft.

Present pH	Desired pH				
	6.5	6.0	5.5	5.0	4.5
	lbs. to add				
8.0	3.0	4.0	5.5	7.0	8.0
7.5	2.0	3.5	4.5	6.0	7.0
7.0	1.0	2.0	3.5	5.0	6.0
6.5		1.0	2.5	4.0	4.5
6.0			1.0	2.5	3.5

Increase amount by 1/2 for clay soil, reduce amount by 1/3 for sandy soil, multiply by 6 if aluminum sulfate is used

### Pounds of Lime to Raise the Soil pH

pH Value from Soil Test	Amount of Lime to Add/1,000 sq. ft.
Below 5.0	100 lb. agricultural lime
5.0-6.0	50 lb. agricultural lime
Above 6.0	Do not use lime



HI12922

**HALO**®



Hanna Lab App  
Compatible

The Hanna Lab App is  
available on the App Store®  
and on Google Play.

Compatible with  
edge@blu

Ideal for direct soil applications

The HI12922 HALO is an innovative, application specific pH electrode with Bluetooth® Smart technology that allows a compatible Apple or Android smart device to be used as a pH meter. This electrode is designed for agricultural, hydroponics, and greenhouse growers that need to monitor the pH of soil and soilless media in order to optimize plant growth.

- **Conic bulb**
  - Easy penetration into soft solids and semi-solids
- **Triple ceramic junction**
  - High flow rate for fast and stable response in slightly hydrated media
- **Refillable**
  - Allows the filling of the reference cell with electrolyte fill solution
- **Built-in temperature sensor**
  - High accuracy temperature compensated measurements

### Conic Bulb

The conical shaped tip design allows for the easy penetration of the sensor into soft solids and semi-solids such as soil and soilless media. Soilless media includes hydroponics growing media including rockwool, coconut coir, and perlite.

### Triple Ceramic Junction

The refillable HI12922 has three ceramic junctions in the reference cell. All pH electrodes have a reference junction that provides continuity between the internal reference wire and the sample. Utilizing a triple ceramic junction design allows for a higher flow rate of fill solution which helps provide for a fast and stable response in damp soil and soilless media.

### Refillable

HI12922 is a refillable pH electrode. Fill solution from the inside will diffuse through the ceramic junctions as it is used and while stored in storage solution. Electrolyte fill solution should be added to the probe when the level drops more than 1 cm (1/2") from the fill hole in order to maintain a good flow rate sustained by having adequate head pressure (optional).

### Built-in Temperature Sensor

The HI12922 has a thermistor temperature sensor built into the tip of the pH electrode. A thermistor based temperature sensor provides high accuracy while being in the tip of the electrode allows for a rapid temperature compensated measurement.

HALO Specifications	HI12922
Measurement Range	0.00 to 12.00 pH
Reference Cell Type	double, Ag/AgCl
Junction Type	triple ceramic
Electrolyte	3.5M KCl (refillable)
Body Material	glass
Tip / Shape	conic
Temperature Operating Range	-5 to 70°C (23 to 158°F)
Glass Type	LT (low temperature)
Body Length/Overall Length	120 mm / 195 mm
Temperature Sensor	integrated
Outer Diameter	12 mm (glass)
Connector Type	Bluetooth Smart (Bluetooth 4.0), 10 m (33') range
Battery Type/Life	CR2032 3V lithium ion / approximately 500 hours
Environment	0 to 50°C (32 to 122°F); electronic module is not waterproof

### Ordering Information

**HI12922** (HALO) is supplied with HI7121319 soil auger, storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, fill solution, battery, quality certificate, and instruction sheet.

Includes soil auger



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HI14142

# HALO®

Ideal for flat surfaces



Hanna Lab App  
Compatible

The Hanna Lab App is  
available on the App Store®  
and on Google Play.

Compatible with  
edge®blu

The HI14142 HALO is an innovative pH electrode with Bluetooth® Smart technology designed for flat surfaces.

- **Flat bulb**
  - Measure pH on flat surfaces or small volume samples
- **Low temperature glass**
  - Fast and accurate measurement at lower temperatures
- **Open junction**
  - Resists clogging and provides fast response time
- **Gel-filled reference**
  - Maintenance free with no fill solutions required
- **Built-in temperature sensor**
  - High accuracy temperature compensated measurements

## Flat Tip Bulb

The flat shaped tip design allows for easy measurement on surfaces or samples with a small volume.

## Low Temperature Glass

The glass tip is made with Low Temperature (LT) glass formulation that has a lower resistance than standard glass types used with ordinary pH electrodes.

## Open Junction Design

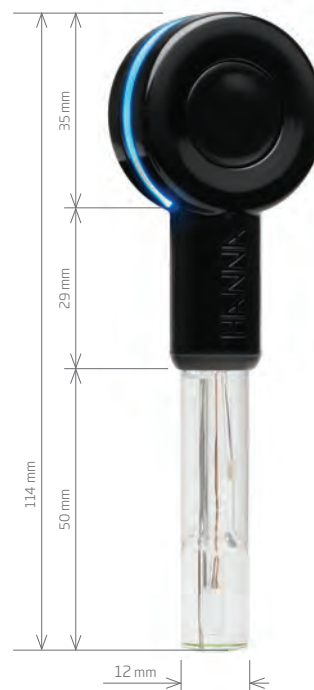
The open junction design consists of a solid gel (viscolene) interface between the sample and internal reference. This interface not only prevents silver from entering the sample, but also makes it impermeable to clogging from food products, maintaining a fast response and stable reading.

## Maintenance Free Gel-filled Reference

Because the internal reference is gel, there is no fill solution to replenish as the probe is used. Other than routine calibration and cleaning, this a maintenance free probe.

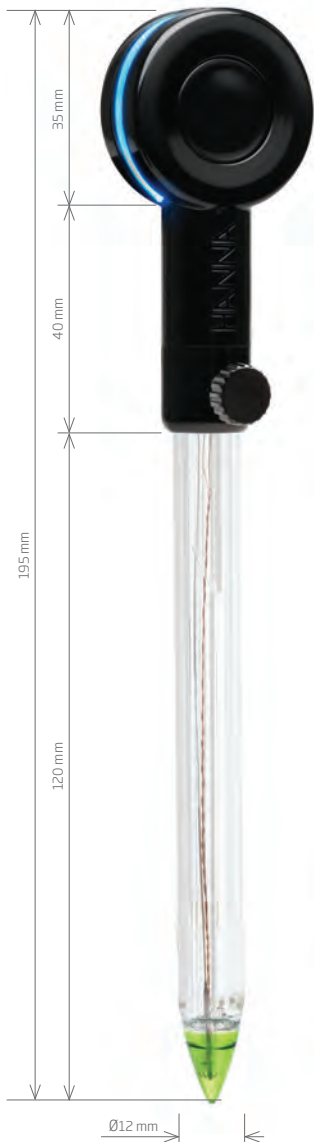
## Built-in Temperature Sensor

The thermistor temperature sensor built into the tip of the pH electrode. A thermistor based temperature sensor provides high accuracy while being in the tip of the electrode allows for a rapid temperature compensated measurement.



HALO Specifications	HI14142
Measurement Range	0.00 to 12.00 pH
Reference Cell Type	double, Ag/AgCl
Junction Type	open
Electrolyte	Viscolene
Body Material	glass
Tip / Shape	flat
Temperature Operating Range	0 to 50°C (32 to 122°F)
Glass Type	LT (low temperature)
Body Length/Overall Length	50 mm / 114 mm
Temperature Sensor	integrated
Outer Diameter	12 mm (glass)
Connector Type	Bluetooth Smart (Bluetooth 4.0), 10 m (33') range
Battery Type/Life	CR2032 3V lithium ion / approximately 500 hours
Environment	0 to 50°C (32 to 122°F); electronic module is not waterproof
<b>Ordering Information</b>	<b>HI14142</b> (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, battery, quality certificate, and instruction sheet.

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HI10532

**HALO**®



Hanna Lab App  
Compatible

The Hanna Lab App is  
available on the App Store®  
and on Google Play.

Compatible with  
edge®blu

Ideal for food applications

The HI10532 HALO is a Bluetooth pH electrode that turns a smart device into a fully functional pH meter for measuring the pH of food products. The HI10532 features a conic shaped sensing tip along with a triple ceramic junction in the outer reference for stable and reliable measurements in samples that would be a challenge for standard pH electrode designs.

- **Bluetooth® Smart Connectivity**
  - Connects to smart devices such as phones and tablets
- **Conic bulb**
  - Easy penetration into soft solids and semi-solids
- **Triple ceramic junction**
  - High flow rate for fast and stable response
- **Refillable**
  - Allows the filling of the reference cell with electrolyte fill solution
- **Built-in temperature sensor**
  - High accuracy temperature compensated measurements

### Low Temperature Glass

Low Temperature (LT) glass allows the probe to be used from -5 to 70°C (23 to 158°F)

### Conical Glass Tip

The conical shaped tip design allows for penetration into solids, semi-solids, and emulsions and is ideal for the direct measurement of pH in food products

### Triple Ceramic Junction

The triple ceramic junction allows a higher flow rate of electrolyte from the reference cell into the measurement sample. The increased flow provides greater continuity between the reference electrode and the sample making ideal for slurries and low conductivity samples

### Refillable

HI10532 is a refillable pH electrode. Fill solution from the inside will diffuse through the ceramic junctions as it is used and while stored in storage solution. Electrolyte fill solution should be added to the probe when the level drops more than 1 cm (1/2") from the fill hole in order to maintain a good flow rate sustained by having adequate head pressure (optional).

### Built-in Temperature Sensor

The temperature reading is necessary in order to compensate for temperature variations that affect the electrode response.

#### HALO Specifications

#### HI10532

Measurement Range	0 to 12 pH (resolution displayed by device selectable up to 0.001pH)
Reference Cell Type	double, Ag/AgCl
Junction / Flow Rate	triple ceramic / 40 to 50 µL/h
Electrolyte	3.5M KCl (refillable)
Body Material	glass
Tip / Shape	conic
Temperature Operating Range	-5 to 70°C (23 to 158°F)
Glass Type	LT (low temperature)
Body Length/Overall Length	120 mm / 195 mm
Outer Diameter	12 mm (glass)
Temperature Sensor	yes
Amplifier	yes
Connector Type	Bluetooth Smart (Bluetooth 4.0), 10 m (33') range
Battery Type/Life	CR2032 3V lithium ion / approximately 500 hours
Environment	0 to 50°C (32 to 122°F); electronic module is not waterproof

#### Ordering Information

**HI10532 (HALO)** is supplied with pH 7.01 buffer solution sachets (2), pH 4.01 buffer solution sachets (2), electrode cleaning solution sachets (2), storage solution (30 mL), refill electrolyte solution (30 mL), refilling pipette, battery, electrode quality testing certificate, and instruction manual.

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## Hanna Lab App

The Hanna Lab App is available on the App Store® and on Google Play.



The first app that turns a smart phone or tablet into a full-featured pH meter.

The Hanna Lab App turns a compatible smart phone or tablet into a full-featured pH meter when used with compatible Hanna electrodes with Bluetooth® wireless technology. Functions include calibration, measurement and data logging (at one second intervals), graphing, and data sharing. Measurements can be displayed alone, with tabulated data, or as a graph. The graph can be panned and zoomed with pinch-to-zoom technology.

# Measurement Screen

## Name, Battery Status, and Electrode Condition on Display

The measurement screen of the Hanna Lab App displays the name, battery life and condition of the probe.

## Real-Time Data

Displays updated pH and temperature every second.



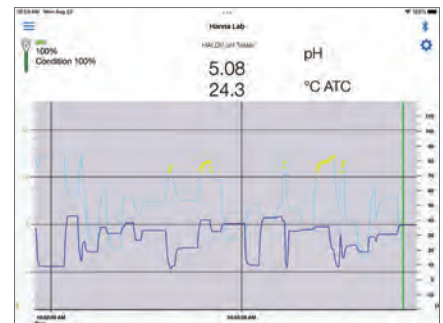
## Just the Essentials

Basic view provides measurement information in a clean, straightforward manner.



## All Information on Display

Table view displays measurement, time and date, annotations, and alarm status in a continuously updated table.



## Fluid, Dynamic Graphing

Graph view provides measurement information linearly. Graph axes may be expanded using pinch-to-zoom technology for enhanced viewing.



## Data Logging

pH	mV	T (°C)	Date
9.97	-24.8	33.1	8/22/22, 10:54:10 AM
9.97	-24.7	33.1	8/22/22, 10:54:11 AM
9.97	-24.8	33.1	8/22/22, 10:54:12 AM
9.97	-24.9	33.1	8/22/22, 10:54:13 AM
9.97	-24.9	33.1	8/22/22, 10:54:14 AM
9.97	-25.0	33.1	8/22/22, 10:54:15 AM
9.97	-25.0	33.1	8/22/22, 10:54:16 AM
9.97	-25.1	33.1	8/22/22, 10:54:17 AM
9.97	-25.1	33.1	8/22/22, 10:54:18 AM
9.97	-25.1	33.1	8/22/22, 10:54:19 AM
9.97	-25.1	33.1	8/22/22, 10:54:20 AM
9.97	-25.1	33.1	8/22/22, 10:54:21 AM
9.97	-25.1	33.1	8/22/22, 10:54:22 AM
9.97	-25.1	33.1	8/22/22, 10:54:23 AM
9.97	-25.1	33.1	8/22/22, 10:54:24 AM
9.97	-25.1	33.1	8/22/22, 10:54:25 AM
9.97	-25.1	33.1	8/22/22, 10:54:26 AM
9.97	-25.1	33.1	8/22/22, 10:54:27 AM
9.97	-25.1	33.1	8/22/22, 10:54:28 AM
9.97	-25.1	33.1	8/22/22, 10:54:29 AM
9.97	-25.1	33.1	8/22/22, 10:54:30 AM
9.97	-25.1	33.1	8/22/22, 10:54:31 AM
9.97	-25.1	33.1	8/22/22, 10:54:32 AM
9.97	-25.1	33.1	8/22/22, 10:54:33 AM
9.97	-25.1	33.1	8/22/22, 10:54:34 AM
9.97	-25.1	33.1	8/22/22, 10:54:35 AM
9.97	-25.1	33.1	8/22/22, 10:54:36 AM
9.97	-25.1	33.1	8/22/22, 10:54:37 AM
9.97	-25.1	33.1	8/22/22, 10:54:38 AM
9.97	-25.1	33.1	8/22/22, 10:54:39 AM
9.97	-25.1	33.1	8/22/22, 10:54:40 AM
9.97	-25.1	33.1	8/22/22, 10:54:41 AM
9.97	-25.1	33.1	8/22/22, 10:54:42 AM
9.97	-25.1	33.1	8/22/22, 10:54:43 AM
9.97	-25.1	33.1	8/22/22, 10:54:44 AM
9.97	-25.1	33.1	8/22/22, 10:54:45 AM
9.97	-25.1	33.1	8/22/22, 10:54:46 AM
9.97	-25.1	33.1	8/22/22, 10:54:47 AM
9.97	-25.1	33.1	8/22/22, 10:54:48 AM
9.97	-25.1	33.1	8/22/22, 10:54:49 AM
9.97	-25.1	33.1	8/22/22, 10:54:50 AM
9.97	-25.1	33.1	8/22/22, 10:54:51 AM
9.97	-25.1	33.1	8/22/22, 10:54:52 AM
9.97	-25.1	33.1	8/22/22, 10:54:53 AM
9.97	-25.1	33.1	8/22/22, 10:54:54 AM
9.97	-25.1	33.1	8/22/22, 10:54:55 AM
9.97	-25.1	33.1	8/22/22, 10:54:56 AM
9.97	-25.1	33.1	8/22/22, 10:54:57 AM
9.97	-25.1	33.1	8/22/22, 10:54:58 AM
9.97	-25.1	33.1	8/22/22, 10:54:59 AM
9.97	-25.1	33.1	8/22/22, 10:55:00 AM



### Data-logging

Data is automatically saved every hour. There are four ways to save and share data: all data since last auto save, annotations only, all data within a timed interval, and annotations within a timed interval.

### Export Data

Saved data may be shared via email in PDF or CSV format.

### Custom Annotations

Saved data points may be annotated with measurement specific information.

## GLP (Good Laboratory Practice)



### Basic GLP

Displays date and time of current calibration along with probe offset and average slope. For tablet displays, basic GLP can be also displayed in table and graph views.



### Full GLP

Displays date and time of current calibration, probe offset, and average slope along with calibrated buffers, mV values, temperature and slopes between each buffer. For tablet displays, full GLP can be also displayed in table and graph views.

#### Hanna Lab App Specifications\*

Range**	-2.000 to 16.000 pH ±800 mV -20.0 to 120.0°C (-4.0 to 248.0°F)
Resolution	0.1; 0.01; 0.001 pH 1; 0.1 mV; 0.1 °C (0.1°F)
Accuracy (@25°C/77°F)	±0.005 pH ±0.3 mV ±0.5 °C (±1.0°F)
Calibration Points	up to five-point calibration with seven standard buffers (1.68, 3.00 (HI10482, HI981033, HI9810332 only) or 4.01, 6.86, 7.01, 9.18, 10.01, 12.45 pH)
Temperature Compensation**	automatic from -5.0 to 100.0°C – 23.0 to 212.0°F
Compatibility/System Requirements	see <a href="http://www.hannainst.com">www.hannainst.com</a> for latest compatibility requirements

#### Download Information



\* \* Limits will be reduced to actual probe/sensor limits.

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## Calibration



### Clear and Concise Calibration Screens

The Hanna Lab App allows for calibration of up to five points. The buffer value is automatically detected and temperature corrected to 25.0°C (77°F) during calibration.



### Calibration Reminder

Alerts users when calibration is needed.

## Additional Features



### Measurement Alerts

Readings that exceed user-defined alarm thresholds are highlighted in yellow on the measurement screen, graph, and table. Readings that exceed the probe specifications are highlighted in red.



### Settings

Tap the gear icon in the top right corner of the measurement screen to access the Settings menu.



### Help and Tutorials

The Hanna Lab App features demo probe mode, general app information, general information, pH tutorial, maintenance tutorial, and contact information.