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# Introduction

## Single or Multiparameter Instrumentation

Hanna Instruments offers both single parameter and multiparameter instruments in order to meet a variety of testing requirements.

*Using Single Parameter*

Hanna single parameter instruments offer simple, accurate and efficient measurement focused on, as the name implies, a single parameter. They are well suited to applications where one parameter must be tested quickly and easily. They are generally simple to operate and can be used by non-technical users.

*Using Multiparameter*

The advantage of Hanna multiparameter instruments is that a user can choose a single meter with the ability to measure multiple parameters .

Multiparameter instruments offer different operating solutions well suited to meeting multiple requirements and are available in two primary configurations:

1. Multiparameter meters that can measure two or three parameters, but only one parameter at a time.
2. Multiparameter meters that offer two or three parameters measured simultaneously–useful on experimental and research applications where the influence between the parameters is an important factor. Multiple inputs provide the capability for simultaneous measurement.

## pH Measurement Input

Hanna meters generally come in two different electrode connection types: BNC or DIN.

BNC Connector: A BNC (Bayonet Neil-Concelman) is a common connector used for coaxial cable devices. A BNC connection is generally used for combined electrodes and half-cell electrodes that require a separate reference probe and separate reference input.

DIN Connector: A DIN (Deutches Institut für Normung) is a circular connector. It is used to connect amplified pH electrodes. Electrodes utilizing a DIN connector feature a built-in temperature sensor.

## Temperature Input

Temperature has an effect on pH measurements. As such, temperature compensation is required for accurate measurements. Temperature compensation can be obtained in three ways:

1. A separate probe specifically for measuring temperature
2. A probe with a temperature sensor built-in
3. Manual adjustment for temperature

If a temperature input is not present, many instruments still offer the ability to manually adjust the temperature according to an external temperature reference.

## pH Temperature Compensation

pH readings must be temperature compensated in order to obtain accurate results. The source of temperature measurement can be from a temperature sensor or from a trimmer that is manually adjusted. In either case, the instrument is adjusting the pH reading to compensate for changes in the pH sensor. Compensation in pH provides the actual pH at the temperature of measurement.

## mV Reading

Hanna meters with an mV feature offer the ability to read the mV potential from a pH, ORP, or ISE electrode. The relative mV allows the user to offset the mV difference generated from sensors or references.

## pH/ISE Calibration

pH calibration should be performed daily or every time a new lot of readings is started. Any errors during calibration will affect all the readings until a new calibration is performed. Errors during the calibration process can be eliminated if standard calibration procedures are followed.

Hanna recommends the following standard calibration procedure:

1. Clean and activate the electrode before the calibration.
2. Use fresh pH buffers and standards.
3. Rinse the electrode with purified water during the calibration process to avoid buffer contamination then rinse in buffer or standard.
4. Wait for a stable reading before the calibration point is confirmed.
5. Compensate the pH reading for temperature.

Calibration is a key component to ensuring accurate readings during pH measurement. With this in mind, Hanna supplies each of our pH instruments with a starter package of calibration solutions.

## pH CAL Check™

Many instruments feature Hanna's exclusive pH CAL Check technology. CAL Check is a diagnostics system that ensures accurate pH readings every time. By alerting users to potential problems during the calibration process, the CAL Check system eliminates erroneous readings due to dirty or faulty pH electrodes or contaminated pH buffer solutions during calibration.

During the calibration process, users are prompted with a step-by-step, on-screen tutorial. After calibration, the electrode is evaluated and the condition and response time is provided. Depending upon meter, this may be a graphic of GLP information.

## Calibration Errors

Instruments utilizing Hanna's CAL Check technology can evaluate an electrode during calibration and store a history of parameters that describe the quality of electrode to be compared from one calibration to another. During calibration, a very small degradation of these parameters is normal and can be expected. A big change in the parameters signifies an error in the calibration procedure, such as a dirty electrode.

## pH Buffer Contamination

pH buffers can be contaminated during the calibration procedure by numerous factors such as introducing a contaminated probe, using old buffers, or by reusing buffers. These factors may cause inaccurate calibration and subsequent measurements.

Hanna's CAL Check can often detect issues during calibration, giving warning messages to inform users about the identified issue.

## Response Time of Electrodes

Another parameter that is evaluated during the calibration with certain meters that have CAL Check technology is the response time of an electrode. This is evaluated based on the amount of time necessary to reach stability when the electrode is immersed in a new buffer that has a difference in pH larger than 3 pH units from the old one.

## Offset and Slope of pH Electrode

The offset and slope are the most important parameters that can describe the quality of an electrode. With Hanna's CAL Check technology, the offset of the electrode can be evaluated using one point calibration. Offset is generally determined using a 7.01 pH buffer, however, using CAL Check allows the offset to be based on any calibration point. The acceptable range for offset is ±30 mV although a warning may be displayed.

A minimum of two calibration points is necessary to determine the slope. Slope can be evaluated between two calibration points and normally should fall within a range of 92% to 110%, where 100% is 59.16 mV/pH @ 25°C.

## Calibration Points and pH buffers

The calibration of a pH electrode is normally performed using two points: 7 pH, and 4 or 10 pH. This is based on the assumption that the pH electrode is linear from 3 pH up to 10 pH. For the most accurate reading, Hanna recommends using a calibration point closest to the values received during normal measurement.

For a variety of applications and measuring points, many Hanna meters offer the ability to calibrate using more than two points. Many Hanna instruments offer 2, 3, or up to 5 calibration points for enhanced accuracy. pH buffers 1.68, 3.00, 4.01, 6.86, 7.01, 9.18, 10.01, and 12.45 cover the entire pH range.

During calibration, the recognized pH buffers are temperature compensated by the instrument in order to account for pH variation of buffers due to temperature. For example, a 10.01 pH buffer is 10.01 pH only @ 25°C. A table of temperature variation is printed on the label of each pH buffer.

## Custom pH Buffers

Hanna has implemented the concept of custom pH buffers into many of its instruments. This permits the user to add an industry specific buffer for calibration. However, temperature compensation during calibration is not implemented because the temperature variation correlation is unknown.

## Stability During Calibration

The stability of readings is important in order to avoid incorrect calibration. Based on this, the confirmation of a new calibration point is done only after stability is reached. Users are informed during all processes about the stability conditions, and any instability will restart the stability evaluation. The stability criteria during the calibration is more rigorous than during the measurement. This mode used in Hanna instrumentation avoids errors by confirmation of calibration points during unstable readings. This principle is respected in any type of calibration, manual or automatic.

## Out of Calibration Range

This is an important feature during measurement and is considered Good Laboratory Practice (GLP). The measurement is considered more accurate. If the measurement reading is in a range far from the calibration points, the "out of calibration range" message is displayed. The measured value is shown and the user can accept it, but with the warning from the instrument related to possible inaccuracy.

## Calibration Reminder

The calibration reminder, like "out of calibration range," is a GLP warning message. Regularly scheduled calibrations are crucial for accurate and repeatable measurements. A warning reminder will be displayed when the sensor needs calibration. Measurements can still be used under the warning reminder.

## Step-by-Step Calibration

In order to avoid errors during the calibration procedure, the meters display indicators that can be followed by the user for a successful calibration. If necessary, it is possible for the calibration steps to be performed in a different order by the user.

## Additional Features

GLP and ISO standards require the traceability of operations. Hanna's GLP document the quality of calibration, plus information to identify the instrument, operator, and the time at which calibration was performed.

Logging is a common feature for many instruments and can be used to record readings. Two working modes are available: log-on-demand and automatic or interval logging. With log-on-demand, measurements that are considered important can be saved with the press of the log button. With automatic or interval logging, the instrument saves all the readings according to a specified interval. Another logging mode is Auto-End logging or log on stability.

Many Hanna meters include graphic LCD's with features such as tutorials, contextual help, multi-language support, and icons and messages to guide the user through operation and calibration.

# Comparison Guides

## edge®

| | Bluetooth® Wireless Technology | Hanna Lab App Compatible | pH Measurement | EC/TDS Measurement | DO Measurement | pH CAL Check™ | 0.001 pH Resolution | Five-point pH Calibration | Two Custom pH Buffers | GLP Features | Capacitive Touch Buttons | Data Logging | 8 Hour Battery Life | PC Connectivity | Benchtop, Portable & Wall-Mount | 3.5 mm probe input | Page |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| edge®blu | • | • | • | | | • | • | • | • | • | • | • | • | • | • | • | 2.8 |
| edge | | | • | •* | •* | • | • | • | • | • | • | • | • | • | • | • | 2.34 |
| edge pH | | | • | | | • | • | • | • | • | • | • | • | • | • | • | 2.38 |

* with optional compatible edge electrode

## HALO®
### and Hanna Lab App

| | pH Range | 0.001 pH Resolution | Five-point pH Calibration | Calibration Buffers | GLP features | iPad Compatible | Bluetooth® Wireless Technology | Hanna Lab App Required | Data Logging | Body material | Recommended Application | Clogging Prevention | Battery Life (hours) | Page |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HI11312 | 0.00-13.00 | • | • | up to 7 | • | • | • | yes | • | glass | lab | | 500 | 2.16 |
| HI11102 | 0.00-12.00 | • | • | up to 7 | • | • | • | yes | • | glass | lab | | 500 | 2.17 |
| HI13302 | 0.00-12.00 | • | • | up to 7 | • | • | • | yes | • | glass | lab, test tube | | 500 | 2.18 |
| HI10832 | 0.00-13.00 | • | • | up to 7 | • | • | • | yes | • | glass | lab, small sample | | 500 | 2.19 |
| HI12302 | 0.00-12.00 | • | • | up to 7 | • | • | • | yes | • | PEI | field | | 500 | 2.20 |
| FC2022 | 0.00-12.00 | • | • | up to 7 | • | • | • | yes | • | PVDF | food | | 500 | 2.21 |
| HI10482 | 0.00-12.00 | • | • | up to 7 | • | • | • | yes | • | glass | wine, must and juice | • | 500 | 2.23 |
| FC2142 | 0.00-13.00 | • | • | up to 7 | • | • | • | yes | • | titanium | brewing | | 500 | 2.25 |
| HI12922 | 0.00-12.00 | • | • | up to 7 | • | • | • | yes | • | glass | direct soil | | 500 | 2.27 |
| HI14142 | 0.00-12.00 | • | • | up to 7 | • | • | • | yes | • | glass | flat surfaces | | 500 | 2.28 |
| HI10532 | 0.00-12.00 | • | • | up to 7 | • | • | • | yes | • | glass | food | | 500 | 2.29 |

# Research Grade pH Benchtop Meters

| | Two Channels | ISE Measurement | EC/TDS Measurement | CAL Check™ | 0.001 pH Resolution | Five-point pH Calibration | Five Custom pH Buffers | GLP Features | Real Time Graphing | Data Logging | Incremental Methods | PC Connectivity | Fully Customizable | Page |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HI5222 | • | • | | • | • | • | • | • | • | • | • | • | • | 2.42 |
| HI5221 | | | | • | • | • | • | • | • | • | | • | • | 2.46 |

# Laboratory Grade pH Benchtop Meters

| | mV | CAL Check | Temperature Measurement | Automatic Calibration | 0.001 pH Resolution | Five-point pH Calibration | Two Custom pH Buffers | GLP Features | Data Logging | PC Connectivity | Magnetic Stirrer | Built-in Printer | Built-in Solution Holders | Analog Output | Page |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HI122 | • | • | • | | • | • | • | • | | • | | • | | | 2.48 |
| HI2221 | • | • | • | • | | • | | • | • | • | | | | | 2.50 |
| HI2211 | • | | • | • | | | | | | | | | | | 2.51 |
| HI2210 | | | • | • | | | | | | | | | | | 2.51 |
| HI2209 | • | | | | | | | | | | | | • | | 2.52 |
| HI22091 | • | | | | | | | | | | | | • | • | 2.52 |
| HI208 | | | • | • | | | | | | | • | | | | 2.53 |
| HI207 | | | • | • | | | | | | | | | | | 2.53 |

# Comparison Guides

## Waterproof Portable pH Meters


| | ISE Measurement | mV Measurement | Temperature Measurement | 0.001 pH Resolution | pH Sensor Check™ | CAL Check | Automatic Calibration | Automatic Temperature Compensation | Log on Demand (records) | Two-point pH Calibration | Three-point Calibration | Five-point Calibration | Custom Buffers | Backlit LCD | GLP Features | PC Connectivity | Auto-off | Page |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HI98199 | | • | • | | | | • | • | 45k | • | • | | • | • | • | • | • | 2.54 |
| HI98190 | | • | • | • | | • | • | • | 200 | • | • | • | • | • | • | • | • | 2.58 |
| HI9126 | | • | • | • | | • | • | • | | • | | | • | | | | • | 2.114 |
| HI9125 | | • | • | | | | • | • | | • | | | | | | | • | 2.115 |
| HI9124 | | | • | | | | • | • | | • | | | | | | | • | 2.115 |
| HI991003 | | • | • | | • | | • | • | | • | | | | | | | • | 2.97 |
| HI991001 | | | • | | | | • | • | | • | | | | | | | • | 2.97 |

## Application Specific Waterproof Portable Meters


| | Temperature Measurement | BEPS | Automatic Temperature Compensation | Two-Point pH Calibration | Waterproof | Soil Measurement | Plating Baths | Boiler & Cooling Towers | Leather & Paper | Foodcare | Milk | Yogurt | Cheese | General Purpose Food | Drinking Water | Beer Analysis | Wine Analysis | Meat Measurement | pH of Skin | Page |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HI98161 | • | | • | • | • | | | | | • | | | | | | | | | | 2.62 |
| HI98162 | • | | • | • | • | | | | | | • | | | | | | | | | 2.66 |
| HI98163 | • | | • | • | • | | | | | | | | | | | | | • | | 2.70 |
| HI98164 | • | | • | • | • | | | | | | | • | | | | | | | | 2.74 |
| HI98165 | • | | • | • | • | | | | | | | | • | | | | | | | 2.78 |
| HI98167 | • | | • | • | • | | | | | | | | | | | • | | | | 2.82 |
| HI98169 | • | | • | • | • | | | | | | | | | | | | • | | | 2.86 |
| HI98168 | • | | • | • | • | • | | | | | | | | | | | | | | 2.90 |
| HI99121 | • | • | • | • | • | • | | | | | | | | | | | | | | 2.98 |
| HI99131 | • | • | • | • | • | | • | | | | | | | | | | | | | 2.99 |
| HI99141 | • | • | • | • | • | | | • | | | | | | | | | | | | 2.100 |
| HI99171 | • | • | • | • | • | | | | • | | | | | | | | | | | 2.101 |
| HI99181 | • | • | • | • | • | | | | | | | | | | | | | | • | 2.102 |
| HI99162 | • | • | • | • | • | | | | | | • | | | | | | | | | 2.103 |
| HI99164 | • | • | • | • | • | | | | | | | • | | | | | | | | 2.104 |
| HI99165 | • | • | • | • | • | | | | | | | | • | | | | | | | 2.105 |
| HI99161 | • | • | • | • | • | | | | | | | | | • | | | | | | 2.106 |
| HI99163 | • | • | • | • | • | | | | | | | | | | | | | • | | 2.107 |
| HI99192 | • | • | • | • | • | | | | | | | | | | • | | | | | 2.108 |
| HI99151 | • | • | • | • | • | | | | | | | | | | | • | | | | 2.110 |
| HI99111 | • | • | • | • | • | | | | | | | | | | | | • | | | 2.112 |

# Other Portable Meters

| | mV Measurement | Temperature Measurement | Automatic Calibration | Automatic Temperature Compensation | HOLD Function | Two-Point pH Calibration | Low Battery Indicator | Pre-amplified pH Electrode | Auto-off | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| HI8424 | • | • | • | • | • | • | • | | • | 2.116 |
| HI8314 | • | • | | • | | • | • | • | | 2.117 |
| HI83141 | • | • | | • | | • | • | | | 2.117 |
| HI8014 | • | | | | | • | | | | 2.118 |
| HI8010 | | | | | | • | | | | 2.118 |
| HI8427 | • | | | | | | • | | | 2.119 |
| HI931001 | • | | | | | | | | | 2.119 |

edge blu

# First pH meter in the world with a Bluetooth® Smart pH electrode

Free yourself from wires when performing pH measurements. Hanna Instruments is proud to introduce edge®blu, a pH meter that uses HALO® pH electrodes with Bluetooth® Smart technology (Bluetooth 4.0). Bluetooth® Smart technology is energy efficient, allowing for low power consumption to maximize the life of the replaceable battery used in the pH electrode.

HALO electrodes can also connect to a compatible smart phone or tablet running the Hanna Lab App.

# edge®blu technical features

## Rechargeable Battery

edge blu has a built in rechargeable battery that is charged when the meter plugged into the benchtop or wall mounted cradle. The battery can also be recharged through the micro USB port connected to a computer or directly to a power supply.

## Two USB ports

edge blu includes one standard USB for exporting data to a flash drive and one micro USB port for exporting files to your computer as well as for charging when the cradle is not available.


## Data logging

Log-on-demand, log-on-stability, and interval logging modes are all available. Up to 200 data points can be logged on demand and an additional 200 data points for samples logged upon a stable reading. The logging interval is adjustable from 5 seconds to 180 minutes. Up to 600 records can be stored in a maximum of 100 interval lots. Logging modes can be started from the meter or by simply pressing the button on the HALO pH probe.

## GLP

Data of the last calibration you perform is stored in the sensor including the date, time, and buffers used. When the sensor is connected to edge blu, GLP data is automatically transferred.


## CAL Check™

Hanna's exclusive CAL Check feature analyzes the pH electrode response in the pH buffers during the calibration process to alert the user of potential problems such as a contaminated buffer or dirty electrode. After calibration, indicators for probe condition are displayed on the measurement screen. The probe condition is based on offset and slope characteristics of the pH electrode.

## Bluetooth Smart Technology

HI11102 HALO® pH electrode use Bluetooth® Smart Technology (Bluetooth 4.0). This technology offers low power consumption allowing for a long 500 hour battery life. The range of the Bluetooth connection is 10 m (33') between the probe and receiving device.

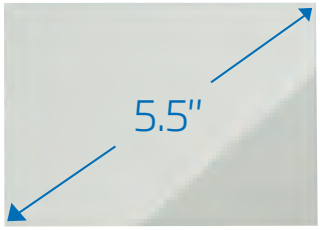
## Auto-detection

At a push of the button, the HALO pH electrode enters discovery mode and will be detected by edge blu. Once connected, the serial number, calibration information including date, time and buffers used, and the electrode specifications will be loaded into the meter. Having this information stored in the electrode allows for hot swapping to other pH electrodes without recalibrating. The details of the electrode and calibration information are stored with any logged readings.

# edge blu design features


## Capacitive touch keypad

edge blu features sensitive capacitive touch buttons for accurate keystrokes when navigating edge's menus and screens. Since they are part of the screen, the buttons can never get clogged with sample residue.




## Easy to read LCD

edge blu features a 5.5" (14 cm) LCD display that you can clearly view from over 5 m (16.4') away. The large display, with its wide 150° viewing angle, provides one of the easiest to read LCDs in the industry.


## Zero footprint

Using the wall mount cradle (included), edge blu can be placed on a wall, leaving zero footprint on the benchtop space. The cradle has a built-in connector to power the meter and charge the batteries.


## A hybrid meter that can be used in portable, wall-mount, and benchtop configurations

The versatile design of edge®blu enables it to be used as a portable, wall-mount, or benchtop meter. edge blu simplifies measurement, wirelessly using compatible HALO® pH electrodes with Bluetooth® Smart technology.


### Portable field unit

edge blu is ideal for field use due to its light weight, large screen, and thin design. It can easily be slipped into a backpack or messenger bag. The battery life lasts up to 8 hours when used as a portable device.

### Wall-mount cradle

The included wall-mount cradle makes it easy to conserve space on the benchtop while also charging edge blu with the AC adapter. The cradle is ideal for continuous monitoring applications.

### Electrode holder with built-in cradle

The electrode holder features a swivel, adjustable arm with a built-in cradle to hold edge blu securely in place at the optimum viewing angle.

HI181 magnetic stirrer and beaker not included.

| 4.0 | 0 | 0.5 | 8.8 | 8 | 5.5 | 2 |
|---|---|---|---|---|---|---|
| Bluetooth® Smart | footprint | inch thick (12.7 mm) | oz. weight (250 g) | hours battery life | inch display (14 cm) | USB ports |

## edge blu additional features

- Resolution selectable from 0.01 and 0.001 pH
- Range -2.000 to 16.000 pH
- Accuracy ±0.002 pH for 0.001 pH resolution; ±0.01 for 0.01 resolution
- Data logging
  - Manual log-on-demand
  - Manual log-on-stability
  - Interval logging
- Temperature readout (°C or °F)
- Automatic Temperature Compensation (ATC)
- CAL Check™ Indicators:
  - Probe condition
  - Response time
  - Check buffer
  - Clean electrode
- GLP data
  - Records date, time, offset, slope, and buffers used during calibration
- Five-point calibration
  - A choice of seven pre-programmed buffers plus two custom buffers
- Calibration tag on screen
  - Identifies buffers used for current calibration
- Calibration expiration warning
- Basic mode
  - edge®blu Basic Mode is ideal for routine measurements by displaying a simplified screen and features
- Standby mode
  - HALO® can be switched between standby and measurement mode by edge blu. When measurement is resumed, HALO is automatically recognized. Standby mode is ideal for applications such as aquariums when only periodic measurements are needed in the same sample.

# HI11102 HALO pH electrode with Bluetooth® Smart technology

edge blu® is supplied with the HI11102 HALO® professional pH probe with Bluetooth® Smart technology (Bluetooth 4.0). This probe is compatible with the edge blu and the Hanna Lab App[1].

The HI11102 HALO pH electrode is a glass body, gel filled, double junction pH electrode that has an indicating probe made with general purpose glass. The glass body is resistant to many chemicals and easy to clean. Being gel filled reduces maintenance since there are no fill solutions to add. The double junction design is suitable for a variety of solutions that can contain substances such as heavy metals or Tris buffer that will cause the silver chloride (AgCl) found in a single junction probe to precipitate and clog the junction.

- Gel filled glass pH electrode
- Double junction reference design
- Integrated temperature sensor
  - Ensures calibration and measurement is automatically temperature compensated, thus eliminating error
- Wide pH (0 to 12) and temperature (-5 to 80°C) range
- Clear the clutter
  - Data is wirelessly transmitted to the edge blu or compatible smart phone or tablet running the Hanna Lab App via Bluetooth® Smart technology[1]. HI11102 HALO provides up to 500 hours of battery life
- Calibration is stored
  - HI11102 HALO stores calibration information; no additional calibration is needed when switching to another edge blu or iPad
- Battery condition
  - The measurement screen of the edge blu and Hanna Lab App displays the name, battery life and condition of the HI11102 HALO probe

## Hanna Lab App

*pH Meter Application for use with HALO*

The Hanna Lab App turns compatible smart phone or tablet into a full-featured pH meter when used with a HALO pH probe via Bluetooth® Smart technology. Functions include calibration, measurement, data logging, graphing, and data sharing. Measurement and logging of pH and temperature at one second intervals start as soon as the probe is connected. Measurements can be displayed alone on the display, with tabulated data or as a graph. The graph can be panned and zoomed with pinch-to-zoom technology for enhanced viewing.


- Connects via Bluetooth® 4.0
- Calibration reminder
- Real-time data
  - Displays updated pH and temperature updated every second
- Measurement alarms
  - Alerts users if the measurement threshold is exceeded
- Basic GLP
  - Displays date and time of current calibration along with probe offset and average slope
- 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
- Fluid, dynamic graphing
  - Measurements can be displayed with tabulated data or as a graph
- One button sample tagging
- Data-logging with custom annotations
  - Data is automatically saved every hour
  - Saved log files may be annotated with measurement specific information
- Four ways to save and share data:
  - All data since last auto save
  - Annotations only
  - All data within a timed interval
  - Annotations within a timed interval
- Share data via email in CSV format
- Help and tutorials



[1] HALO electrodes can only be used with one compatible device at a time.

| Specifications | | edge®blu* |
|---|---|---|
| pH | Range[2] | -2.00 to 16.00 pH; -2.000 to 16.000 pH† |
| | Resolution | 0.01 pH; 0.001 pH† |
| | Accuracy (@25°C/77°F) | ±0.01 pH; ±0.002 pH† |
| | Calibration | Basic mode: Automatic, up to 3 points calibration 5 standard buffer<br>Standard mode: Automatic up to 5 points calibration 7 standard buffers (1.68†, 4.01 or 3.00, 6.86, 7.01, 9.18, 10.01, 12.45† ) and 2 custom buffers† |
| | Temperature Compensation[2] | automatic, -5.0 to 100.0°C (23.0 to 212.0°F) (using built-in temperature sensor) |
| | Electrode Diagnostics | standard mode: probe condition, response time, and out of calibration range |
| mV pH | Range | ±1000 mV |
| | Resolution | 0.1 mV |
| | Accuracy (@25°C/77°F) | ±0.2 mV |
| Temperature | Range[2] | -20.0 to 120.0°C; -4.0 to 248.0°F |
| | Resolution | 0.1°C; 0.1°F |
| | Accuracy | ±0.5°C; ±0.9°F |
| Additional Specifications | Probe | HI11102 HALO® glass body pH electrode with Bluetooth® Smart technology |
| | Logging | up to 1000† (400 for basic mode) records organized in: manual log-on-demand (max. 200 logs), manual log-on-stability (max. 200 logs), interval logging† (max. 600 samples; 100 lots) |
| | Connectivity | 1 USB port for storage; 1 micro USB port for charging and PC connectivity |
| | Environment | 0 to 50°C (32 to 122°F); RH max 95% non-condensing |
| | Power Supply | 5 VDC adapter (included) |
| | Dimensions | 202 x 140 x 12 mm (7.9" x 5.5" x 0.5") |
| | Weight | 250 g (8.82 oz.) |
| Ordering Information | **HI2202-01** (USA plug) and **HI2202-02** (European plug) edge blu includes: HI11102 HALO pH electrode with Bluetooth® Smart technology, pH 4 buffer solution sachets (4), pH 7 buffer solution sachets (2), pH 10 buffer solution sachets (2), electrode cleaning solution sachets (2), battery for HALO, benchtop docking station with electrode holder, wall-mount cradle, USB cable, 5 VDC power adapter, quality certificates, and instruction manual. | |

| HALO Specifications | HI11102 HALO (included) |
|---|---|
| Reference | double, Ag/AgCl |
| Junction | ceramic |
| Electrolyte | gel |
| Range | 0.00 to 12.00 pH<br>±420 mV |
| Bulb Shape | spheric |
| Outer Diameter (glass) | 12 mm (glass) |
| Overall Length | 183 mm |
| Solution Temperature | -5.0 to 80.0°C (23.0 to 176.0°F) |
| Body Material | glass |
| Environment | 0.0 to 50.0°C (32.0 to 122.0°F), electronic module is not waterproof |
| Temperature Sensor | integrated |
| Connection | Bluetooth® Smart (Bluetooth® 4.0), 10 m (33') range |
| Battery Type / Life | CR2032 3V lithium ion / approximately 500 hours |

| Hanna Lab App Specifications* | |
|---|---|
| Range[2] | -2.000 to 16.000 pH<br>±800 mV<br>-20.0 to 120.0°C (-4.0 to 248.0°F) |
| Resolution | 0.1; 0.01; 0.001 pH<br>1; 0.1 mV<br>0.1°C (0.1°F) |
| Accuracy (@25°C/77°F) | ±0.005 pH<br>±0.3 mV<br>±0.5°C (±1.0°F) |
| Calibration Points | up to five-point calibration with seven standard buffers (1.68, 3.00 or 4.01, 6.86, 7.01, 9.18, 10.01, 12.45 pH) |
| Temperature Compensation[2] | automatic from -5.0 to 100.0°C; 23.0 to 212.0°F |
| Compatibility/System Requirements | see www.hannainst.com for latest compatibility requirements |
| Download Information | Download on the App Store<br>ANDROID APP ON Google Play |

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

[2] Limits will be reduced to actual probe/sensor limits.
* HALO required for measurement use.
† Standard mode only

pH solutions begin on page 2.154


HALO®

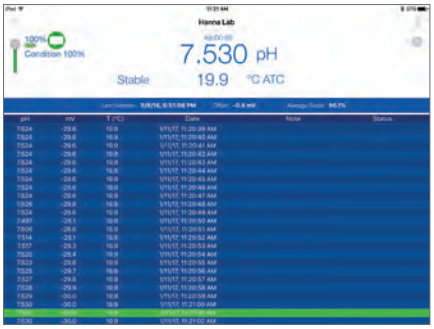
Wireless pH Meters

## 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.

## 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.

HI11312

# HALO®

Compatible with:
iOS
Android™
edge®blu

**Ideal for lab applications**

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

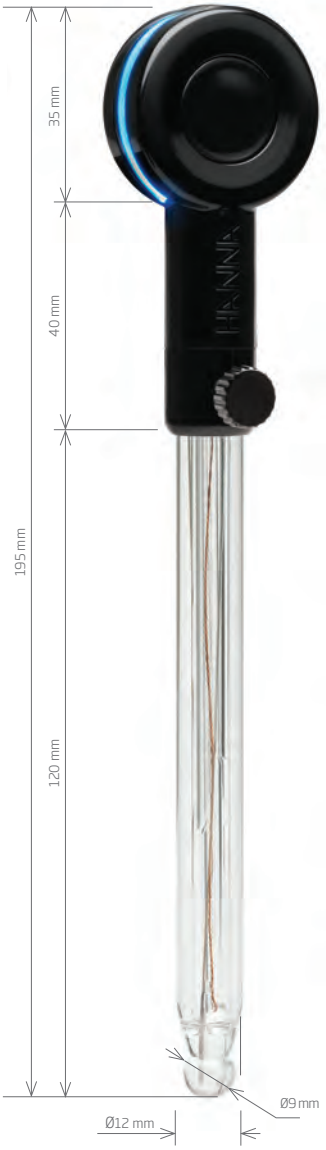
HI11312 is a double junction pH electrode in which the Ag/AgCl necessary for the reference cell is located behind an inner ceramic junction. The gel electrolyte between the inner and outer junction is silver free. This is important to prevent the precipitation of silver by Tris buffer, metals, and sulfides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





pH solutions begin on page 2.154


Also included with edge®blu

HI11102

# HALO®

Compatible with:
iOS
Android™
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 |
| Ordering Information | **HI11102** (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, battery, quality certificate, and instruction sheet. |



pH solutions begin on page 2.154

HI13302

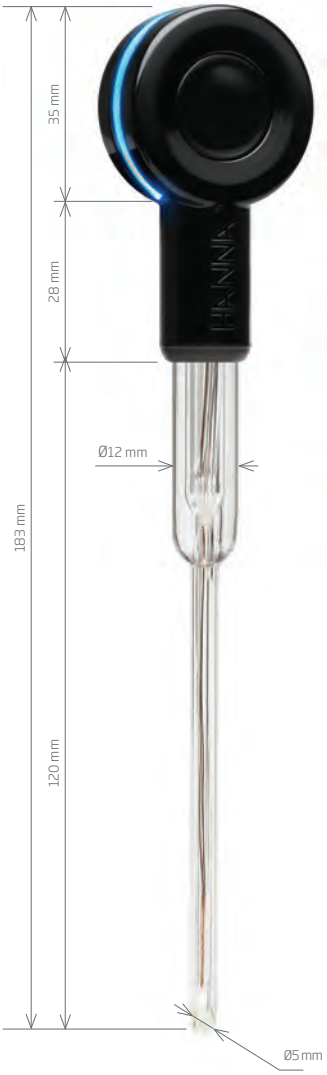
# HALO®

Compatible with:
iOS
Android™
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.

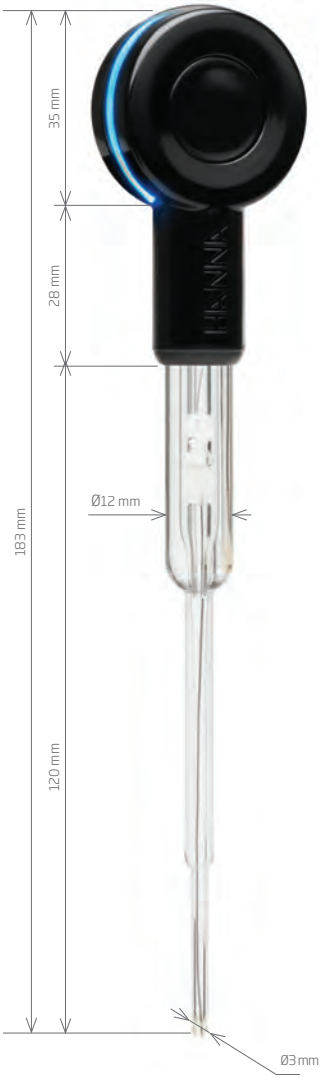
## Open Junction Design

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 |
| Ordering Information | **HI13302** (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, battery, quality certificate, and instruction sheet. |




HI10832

# HALO®

Compatible with:
iOS
Android™
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 13.00 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. |

pH solutions begin on page 2.154

HI12302

# HALO®

Compatible with:
iOS
Android™
edge®blu

**Ideal for field applications**

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.

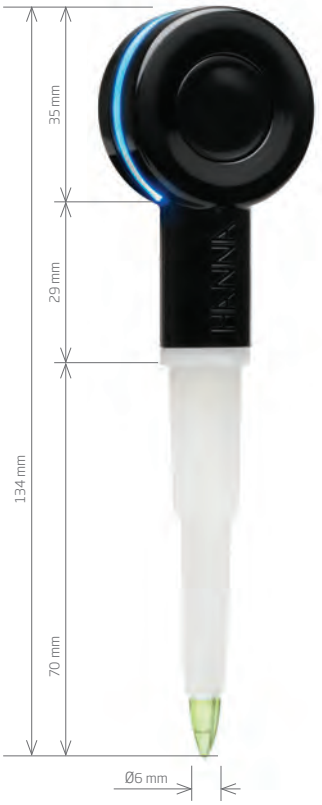
## Built-in Temperature Sensor

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 |
| Ordering Information | **HI12302** (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, battery, quality certificate, and instruction sheet. |




FC2022

# HALO®

Compatible with:
iOS
Android™
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 |
| Ordering Information | **FC2022** (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, battery, quality certificate, and instruction sheet. |

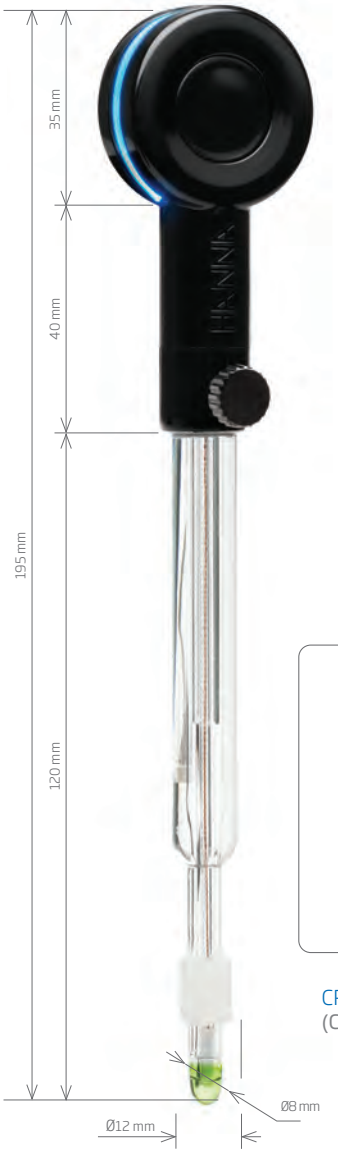


pH solutions begin on page 2.154

## 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.




CPS™
(Clogging Prevention System)

HI10482

# HALO®

Compatible with:
iOS
Android™
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.

| 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. |



pH solutions begin on page 2.154

## 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®

Compatible with:
iOS
Android™
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.

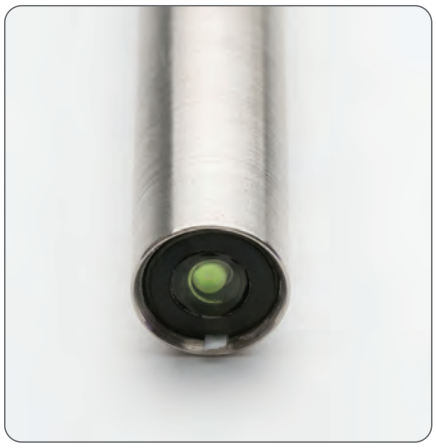
- Built-in temperature sensor
  - High accuracy temperature compensated measurements
- Titanium body
  - Provides protection even at high temperatures as well as stability of measurement

## 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.



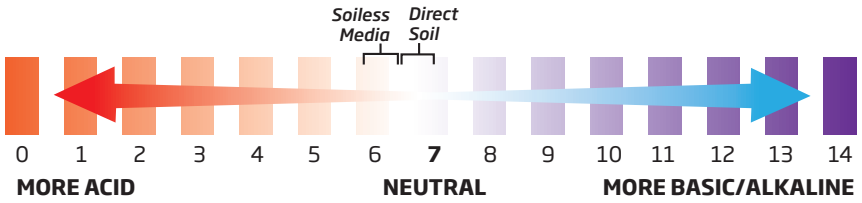
| HALO Specifications | FC2142 |
|---|---|
| Measurement Range | 0.00 to 13.00 pH |
| Reference Cell Type | double, Ag/AgCl |
| Junction Type | cloth |
| Electrolyte | gel |
| Body Material | titanium |
| Tip / Shape | flat |
| Temperature Operating Range | 0 to 80°C (32 to 176°F) |
| Glass Type | LT (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 |
| Ordering Information | **FC2142** (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, battery, quality certificate, and instruction sheet. |

pH solutions begin on page 2.154

# pH Measurements

pH is the measurement of hydrogen ion concentration (H+) 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.

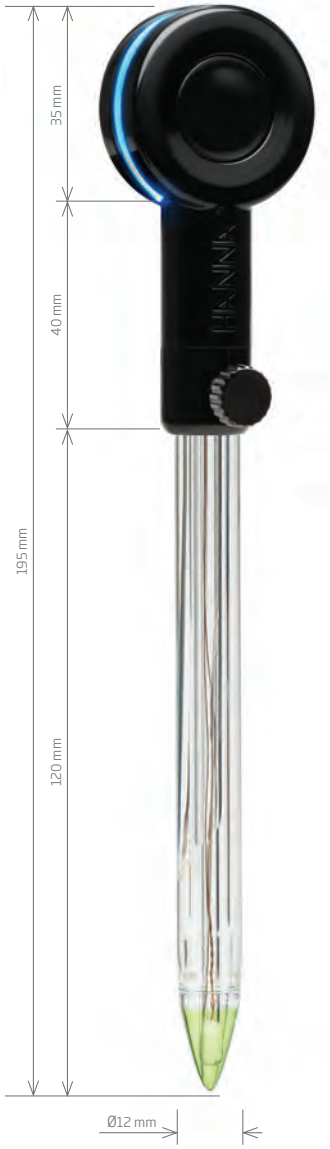



**Pounds of Sulfur to Lower the Soil pH per 100 sq. ft.**

| 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 |




| 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 HI721319 soil auger, storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, fill solution, battery, quality certificate, and instruction sheet. |

HI12922

# HALO®

Compatible with:
iOS
Android™
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 soiless 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 soiless media. Soiless 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 soiless 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.

## Includes soil auger

pH solutions begin on page 2.154

HI14142

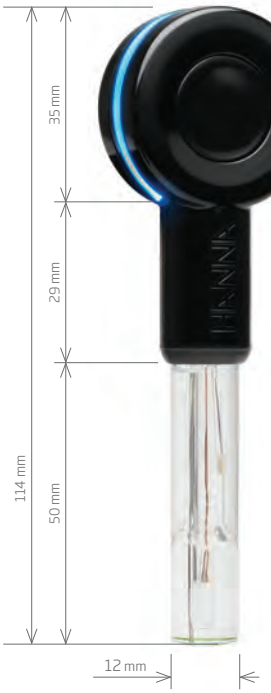
# HALO®

Compatible with:
iOS
Android™
edge®blu

**Ideal for flat surfaces**

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.

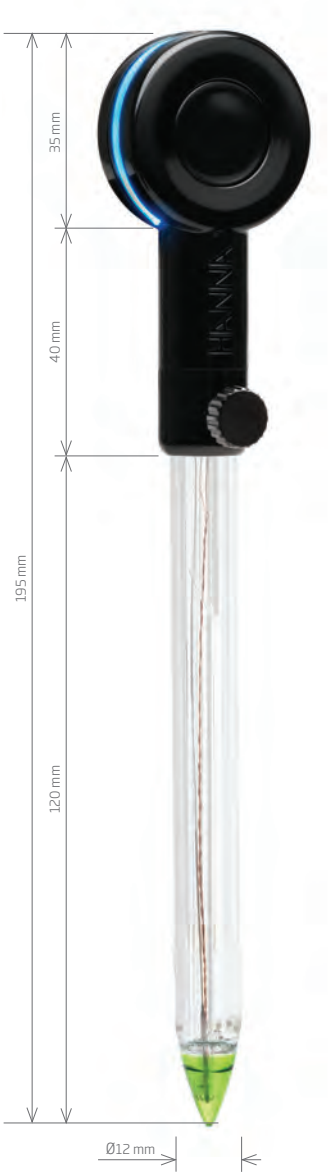
## Maintenance Free Gel-filled Reference

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 |
| Ordering Information | **HI14142** (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, battery, quality certificate, and instruction sheet. |




HI10532

# HALO®

Compatible with:
iOS
Android™
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

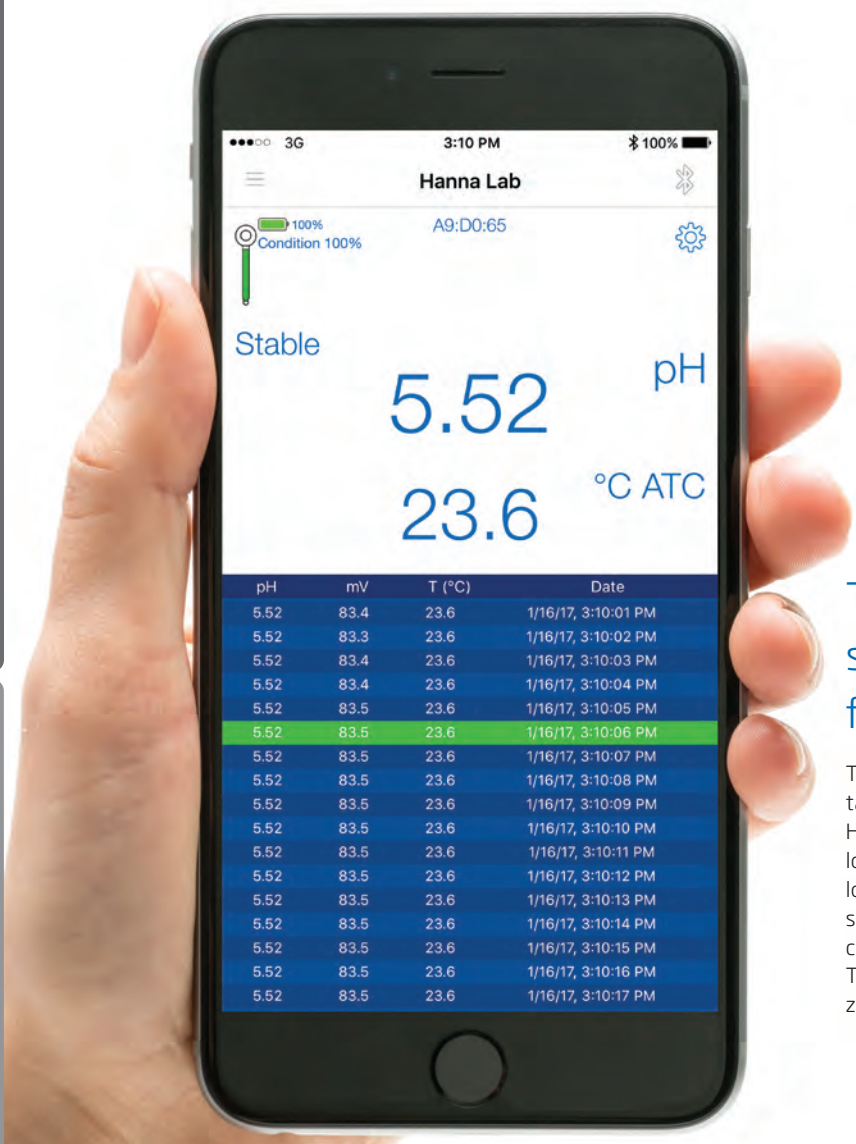
HI10532 is a refillable pH electrode. Fill solution from the inside will diffuse through the ceramic junctions as it is used and while stored in storage solution. Electrolyte fill solution should be added to the probe when the level drops more than 1 cm (1/2") from the fill hole in order to maintain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

pH solutions begin on page 2.154




# Hanna Lab App

Available on iOS and Android

## 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 HALO®. Functions include calibration, measurement, data logging, graphing, and data sharing. Measurement and logging of pH and temperature at one second intervals start as soon as the probe is connected. Measurements can be displayed alone, with tabulated data, or as a graph. The graph can be panned and zoomed with pinch-to-zoom technology.


### Real-time Data

Displays updated pH and temperature every second

## Views


### Just the Essentials

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

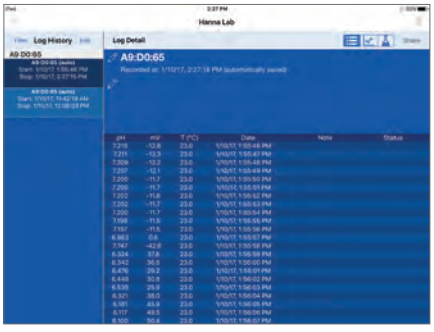

### All Information on Display

Table view is able to display 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

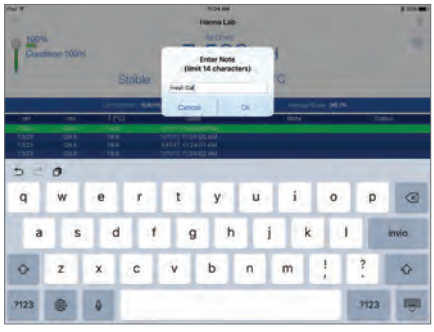



### Data-logging

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

Share data 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.

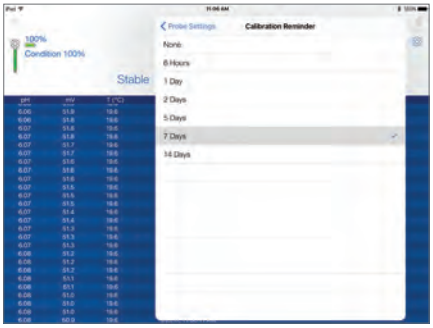

## Full GLP

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.

# Calibration


## Clear and Concise Calibration Screens

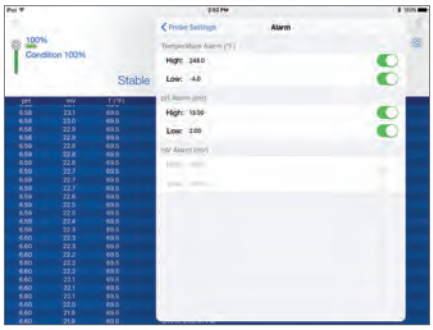
The Hanna Lab App allows for calibration of up to five points. The buffer value is automatically detected and temperature corrected to 25.0°C during calibration.




## Calibration Reminder

Alerts users when HALO needs calibration.

# 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 also features demo probe mode, general app information, general HALO information, pH tutorial, maintenance tutorial, and contact information.

## Hanna Lab App Specifications*

| | |
|---|---|
| Range** | -2.000 to 16.000 pH;<br>±800 mV;<br>-20.0 to 120.0°C (-4.0 to 248.0°F) |
| Resolution | 0.1; 0.01; 0.001 pH;<br>1; 0.1 mV;<br>0.1°C (0.1°F) |
| Accuracy (@25°C/77°F) | ±0.005 pH;<br>±0.3 mV;<br>±0.5°C (±1.0°F) |
| Calibration Points | up to five-point calibration with seven standard buffers<br>(1.68, 3.00 (HI10482 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 www.hannainst.com for latest compatibility requirements |
| Download Information | Download on the App Store<br>ANDROID APP ON Google Play |

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

# edge®

pH • EC • DO


## The world's most innovative pH, EC, and DO meter

edge's groundbreaking design is the culmination of Hanna's vision, design capabilities, integrated production, and world class R&D. The edge is rich in features to accommodate the needs of a vast amount of customers. For those that prefer very simplistic operation there is a basic mode operation with simplified menu and options while for those who require advanced features there is the full featured standard operating mode. edge is available as a pH, conductivity, or dissolved oxygen kit and any edge kit can be upgraded with additional probes to measure pH, conductivity, and dissolved oxygen.

# edge® technical features

## Rechargeable Battery

edge has a built in rechargeable battery that is charged when the meter is plugged in into the benchtop or wall mount cradle. The battery can also be recharged through the micro USB port with either a computer or the power supply.

## Two USB ports

edge includes one standard USB for exporting data to a flash drive, and one micro USB port for exporting files to your computer as well as for charging when the cradle is not available.


## Clear, full text readout

edge features clear, full text guides displayed on the bottom of the screen. There is no need to decipher scrambled abbreviations or symbols; these helpful messages guide you through every process quickly and easily.


## Data logging

edge allows you to store up to 1000 log records of data. Data sets include readings, GLP data, date, and time.


## GLP

Data of the last calibration you perform is stored in the sensor including the date, time, and buffers used. When the sensor is connected to edge, GLP data is automatically transferred.

## Two Operating Modes

edge can be used in Extended or Basic Operating Modes. Extended Mode enables all edge features while Basic Mode reduces features–ideal for routine measurements by displaying a simplified screen and features.


## CAL Check™

Hanna's exclusive CAL Check feature analyzes the pH electrode response in the pH buffers during the calibration process to alert the user of potential problems such as a contaminated buffer or dirty electrode. After calibration, indicators for probe condition are displayed on the measurement screen. The probe condition is based on offset and slope characteristics of the pH electrode.

## Sensor Check™ (pH only)

When used with Hanna's electrodes equipped with a matching pin, edge constantly checks the impedance of the pH measuring electrode to notify you in real time in the event of glass breakage. During calibration, Sensor Check checks the state of the junction. The reference junction is also evaluated and reported on the display.

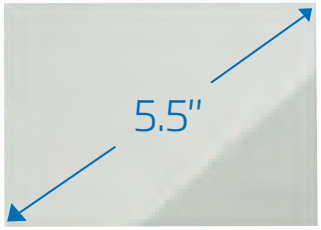
## ORP Measurement

edge measures ORP with edge compatible ORP probes.

# edge design features


## Capacitive touch keypad

edge features sensitive capacitive touch buttons for accurate keystrokes when navigating edge's menus and screens. Since they are part of the screen, the buttons can never get clogged with sample residue.




## Easy to read LCD

edge features a 5.5" (14 cm) LCD display that you can clearly view from over 5 m (16.4'). The large display, with its wide 150° viewing angle, provides one of the easiest to read LCDs in the industry.


## Zero footprint

Using the wall mount cradle (included), edge can be placed on a wall, leaving zero footprint on the benchtop space. The cradle has a built-in connector to power and charge the batteries.


# Hybrid meters that can be used in portable, wall-mount, and benchtop configurations

The versatile design of edge® enables it to be used as a portable, wall-mount, or benchtop meter. edge simplifies measurement, configuration, calibration, diagnostics, logging, and transferring data directly to a computer or USB drive.


## Portable field unit

edge is ideal for field use due to its light weight, large screen, and thin design. It can easily be slipped into a backpack or messenger bag. The battery life lasts up to 8 hours when used as a portable device.

## Wall-mount cradle

The included wall-mount cradle makes it easy to conserve space on the benchtop while also charging the edge with the AC adapter. The cradle is ideal for continuous monitoring applications.

## Electrode holder with built-in cradle

The electrode holder features a swivel, adjustable arm with a built-in cradle to hold the edge securely in place at the optimum viewing angle.


# Digital electrodes

edge® measures pH, conductivity and dissolved oxygen through its unique digital electrodes. These digital electrodes are auto-recognized, providing sensor type, calibration data, and a serial number when connected to edge by an easy to plug-in 3.5 mm connector.

- Simply connect each probe via the 3.5 mm jack, Digital Smart Electrodes are automatically recognized
- Resolution selectable from 0.01 and 0.001 pH
- Range -2.000 to 16.000 pH
- Accuracy ±0.002 pH for 0.001 pH resolution; ±0.01 for 0.01 resolution
- Data logging
  - Manual log-on-demand
  - Manual log-on-stability
  - Interval logging
- Temperature readout (°C or °F)
- Automatic Temperature Compensation (ATC)
- CAL Check™ Indicators:
  - Probe condition
  - Response time
  - Check buffer
  - Clean electrode
- Sensor Check™ Indicators:
  - Broken electrode
  - Clogged junction
- GLP data
  - Records date, time, offset, slope, and buffers used during calibration
- Five-point calibration
  - A choice of seven pre-programmed buffers plus two selectable custom buffers
- Calibration tag on screen
  - Identifies buffers used for current calibration
- Calibration expiration warning

## Sleek design

Incredibly thin and lightweight, edge measures just 1/2" (12 mm) thick and weighs just 8.8 ounces (250 g).

## All edge compatible pH, EC, and dissolved oxygen digital probes are interchangeable with edge.

| Specifications | | HI2020 |
|---|---|---|
| pH | Range* | -2.00 to 16.00 pH; -2.000 to 16.000 pH† |
| | Resolution | 0.01 pH; 0.001 pH† |
| | Accuracy (@25°C/77°F) | ±0.01 pH; ±0.002 pH† |
| | Calibration | automatic, up to three points (five points†) calibration, 5 standard (7 standard†) buffers available (1.68†, 4.01 or 3.00, 6.86, 7.01, 9.18, 10.01, 12.45†) and two custom buffers† |
| | Temperature Compensation* | automatic, -5.0 to 100.0°C (23.0 to 212.0°F) (using the built-in temperature sensor) |
| | Electrode Diagnostics | standard mode: probe condition, response time and out of calibration range |
| mV pH | Range | ±1000 mV |
| | Resolution | 0.1 mV |
| | Accuracy (@25°C/77°F) | ±0.2 mV |
| Temperature | Range* | -20.0 to 120.0°C; -4.0 to 248.0°F |
| | Resolution | 0.1°C; 0.1°F |
| | Accuracy | ±0.5°C; ±0.9°F |
| Additional Specifications | Probe (included in pH kit) | HI11310 digital glass body pH electrode with 3.5 mm (1/8") connector and 1 m (3.3') cable |
| | Logging | up to 1000† (400 for basic mode) records organized in: manual log-on-demand (max. 200 logs), manual log-on-stability (max. 200 logs), interval logging† (max. 600 samples; 100 lots) |
| | Connectivity | 1 USB port for storage; 1 micro USB port for charging and PC connectivity |
| | Environment | 0 to 50°C (32 to 122°F); RH max 95% non-condensing |
| | Power Supply | 5 VDC adapter (included) |
| | Dimensions / Weight | 202 x 140 x 12 mm (7.9" x 5.5" x 0.5") / 250 g (8.82 oz.) |
| Ordering Information | **HI2020-01** (USA plug) and **HI2020-02** (European plug) pH kit includes: HI11310 glass body, refillable pH electrode, pH 4 buffer solution sachets (4), pH 7 buffer solution sachets (2), pH 10 buffer solution sachets (2), and electrode cleaning solution sachets (2), benchtop docking station with electrode holder, wall-mount cradle, USB cable, 5 VDC power adapter, quality certificates, and instruction manual.<br>**HI2020-03** includes the above without electrode.<br>All edge compatible pH, EC and DO digital probes are interchangeable with HI2020 and can be ordered separately. | |

* limits will be reduced to actual probe limits
† standard mode only

edge pH digital electrodes begin on page 2.141; pH and ORP solutions begin on page 2.154

# edge® pH


## edge®pH–Innovation dedicated to a single parameter

edge pH's groundbreaking design is the culmination of Hanna's vision, design capabilities, integrated production, and world class R&D. edge pH is a single meter that can measure pH and ORP and is incredibly easy to use.

- Resolution selectable from 0.01 and 0.001 pH
- Range -2.000 to 16.000 pH
- Accuracy ±0.002 pH for 0.001 pH resolution; ±0.01 for 0.01 resolution
- Data logging
  - Manual log-on-demand
  - Manual log-on-stability
  - Interval logging
- Temperature readout (°C or °F)
- Automatic Temperature Compensation (ATC)
- CAL Check™ Indicators:
  - Probe condition
  - Response time
  - Check buffer
  - Clean electrode
- Sensor Check™ Indicators:
  - Broken electrode
  - Clogged junction
- GLP data
  - Records date, time, offset, slope, and buffers used during calibration
- Five-point calibration
  - A choice of seven pre-programmed buffers plus two selectable custom buffers
- Calibration tag on screen
  - Identifies buffers used for current calibration
- Calibration expiration warning

# edge®pH technical features

## Rechargeable Battery

edge pH has a built in rechargeable battery that is charged when the meter is plugged into benchtop or wall mount cradle. The battery can also be recharged through the micro USB port from a computer or the power supply.

## Two USB ports

edge pH includes one standard USB for exporting data to a flash drive, and one micro USB port for exporting files to your computer as well as for charging when the cradle is not available.


## Clear, full text readout

edge pH features clear, full text guides displayed on the bottom of the screen. There is no need to decipher scrambled abbreviations or symbols; these helpful messages guide you through every process quickly and easily.


## Data logging

edge pH allows you to store up to 1000 log records of data. Data sets include readings, GLP data, date, and time.


## GLP

Data of the last calibration you perform is stored in the sensor including the date, time, and buffers used. When the sensor is connected to edge pH, GLP data is automatically transferred.

## Two Operating Modes

edge pH can be used in Extended or Basic Operating Modes. Extended Mode enables all edge features while Basic Mode reduces features–ideal for routine measurements by displaying a simplified screen and features.


## CAL Check™

Hanna's exclusive CAL Check feature analyzes the pH electrode response in the pH buffers during the calibration process to alert the user of potential problems such as a contaminated buffer or dirty electrode. After calibration, indicators for probe condition are displayed on the measurement screen. The probe condition is based on offset and slope characteristics of the pH electrode.

## Sensor Check™

When used with Hanna's electrodes equipped with a matching pin, edge constantly checks the impedance of the pH measuring electrode to notify you in real time in the event of glass breakage. During calibration, Sensor Check checks the state of the junction. The reference junction is also evaluated and reported on the display.

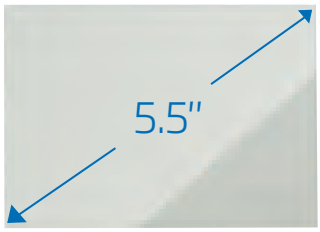
## ORP Measurement

edge pH measures ORP with edge compatible ORP probes.

# edge pH design features


## Capacitive touch keypad

edge pH features sensitive capacitive touch buttons for accurate keystrokes when navigating edge's menus and screens. Since they are part of the screen, the buttons can never get clogged with sample residue.




## Easy to read LCD

edge pH features a 5.5" (14 cm) LCD display that you can clearly view from over 5 m (16.4'). The large display, with its wide 150° viewing angle, provides one of the easiest to read LCDs in the industry.


## Zero footprint

Using the wall mount cradle (included), edge pH can be placed on a wall, leaving zero footprint on the benchtop space. The cradle has a built-in connector to power and charge the batteries.


## A hybrid meter that can be used in portable, wall-mount, and benchtop configurations

The versatile design of edge®pH enables it to be used as a portable, wall-mount, or benchtop meter. edge pH simplifies measurement, configuration, calibration, diagnostics, logging and transferring data directly to a computer or USB drive.


### Portable field unit

edge pH is ideal for field use due to its light weight, large screen, and thin design. It can easily be slipped into a backpack or messenger bag. The battery life lasts up to 8 hours when used as a portable device.

### Wall-mount cradle

The included wall-mount cradle makes it easy to conserve space on the benchtop while also charging edge pH with the AC adapter. The cradle is ideal for continuous monitoring applications.

### Electrode holder with built-in cradle

The electrode holder features a swivel, adjustable arm with a built-in cradle to hold edge pH securely in place at the optimum viewing angle.

## 3.5 mm probe input

Plugging an electrode in has never been simpler; no alignments or broken pins, simply connect the 3.5 mm plug and begin. Digital electrodes are automatically recognized.

## Sleek design

Incredibly thin and lightweight, edge®pH measures just 1/2" (12 mm) thick and weighs just 8.8 ounces (250 g).

## Specifications

| | | |
|---|---|---|
| pH | Range* | -2.00 to 16.00 pH; -2.000 to 16.000 pH† |
| | Resolution | 0.01 pH; 0.001 pH† |
| | Accuracy (@25°C/77°F) | ±0.01 pH; ±0.002 pH† |
| | Calibration | automatic, up to three points (five points†) calibration, 5 standard (7 standard†) buffers available (1.68†, 4.01 or 3.00, 6.86, 7.01, 9.18, 10.01, 12.45†) and two custom buffers† |
| | Temperature Compensation* | automatic, -5.0 to 100.0°C (23.0 to 212.0°F) (using built-in temperature sensor) |
| | Electrode Diagnostics | standard mode: probe condition, response time and out of calibration range |
| mV pH | Range | ±1000 mV |
| | Resolution | 0.1 mV |
| | Accuracy (@25°C/77°F) | ±0.2 mV |
| ORP | Range | ±2000 mV |
| | Resolution | 0.1 mV |
| | Accuracy (@25°C/77°F) | ±0.2 mV (±999.9 mV); ±1 mV (±2000 mV) |
| | Calibration | one-point calibration |
| Temperature | Range* | -20.0 to 120.0°C; -4.0 to 248.0°F |
| | Resolution | 0.1°C; 0.1°F |
| | Accuracy | ±0.5°C; ±0.9°F |
| Additional Specifications | Probe | HI11310 digital glass body pH electrode with 3.5 mm (1/8") connector and 1 m (3.3') cable |
| | Logging | up to 1000† (400 for basic mode) records organized in: manual log-on-demand (max. 200 logs), manual log-on-stability (max. 200 logs), interval logging† (max. 600 samples; 100 lots) |
| | Connectivity | 1 USB port for storage; 1 micro USB port for charging and PC connectivity |
| | Environment | 0 to 50°C (32 to 122°F); RH max 95% non-condensing |
| | Power Supply | 5 VDC adapter (included) |
| | Dimensions | 202 x 140 x 12 mm (7.9" x 5.5" x 0.5") |
| | Weight | 250 g (8.82 oz.) |
| Ordering Information | **HI2002-01** (USA plug) and **HI2002-02** (European plug) edge pH includes: HI11310 glass body, refillable pH electrode, pH 4 buffer solution sachets (4), pH 7 buffer solution sachets (2), pH 10 buffer solution sachets (2), electrode cleaning solution sachets (2), benchtop docking station with electrode holder, wall-mount cradle, USB cable, 5 VDC power adapter, quality certificates, and instruction manual.<br>**HI2002-03** includes the above without electrode. | |

* limits will be reduced to actual probe limits
† standard mode only

edge pH digital electrodes begin on page 2.141; pH and ORP solutions begin on page 2.154

HI5222

# Research Grade Meter

*pH/ORP/ISE and Temperature*


The HI5222 is a research grade benchtop pH/mV/ISE dual channel meter that is completely customizable with a large color LCD, capacitive touch keys, and USB port for computer connectivity.

The HI5222 features two galvanically isolated BNC connections for use with the expansive line of pH, ISE, and ORP electrodes that Hanna Instruments offers. The meter is supplied with the HI1131B glass body, double junction, combination pH electrode that operates over a wide temperature range from 0 to 100°C. All readings are automatically compensated for temperature variations with the separate HI7662-T temperature probe that is included.

As a pH meter the HI5222 can be calibrated up to five points with eight pre-programmed buffers or five custom buffers. The HI5222 features Hanna's exclusive CAL Check™ to alert the user to potential problems during the pH calibration process. Alerts displayed during calibration include "Electrode Dirty/ Broken" and "Buffer Contaminated." The overall probe condition based on the offset and slope characteristic of the electrode are displayed as a percentage after calibration is complete.

As an ISE meter the HI5222 can be calibrated up to five points with a choice of five fixed standards or five user standards defined in any concentration unit. The calibration data including date, time, standards used, and slope can be viewed at any time along with the current measurement by selecting the Good Laboratory Practice (GLP) display option.

Three selectable logging modes are available: automatic, manual, and AutoHold logging. Up to 100,000 data points per channel can be recorded in 100 lots, 50,000 records max/lot and exported to a computer for data review and storage.

## Customizable User Interface

The user interface of the HI5222 allows the user to show measurements in various modes: basic measurement with or without GLP information, real-time graphing, and logging data. Calibration stability criteria can be adjusted to fast, moderate, or accurate. Programmable alarm limits can be set to inside or outside allowable limits.

## Color Graphic LCD

The HI5222 features a color graphic LCD with on-screen help, graphic, and custom color configurations. The display allows for real-time graphing and the use of virtual keys provide for an intuitive user interface.

## Capacitive Touch

The HI5222 features sensitive capacitive touch buttons for accurate keystrokes when navigating menus and screens. There are four dedicated keys that are used for routine operations including calibration and switching measurement modes and four virtual keys that change based upon use. The capacitive touch technology ensures the buttons never get clogged with sample residue.

## Two Galvanically Isolated pH/ORP/ISE Channels

The HI5222 has two input channels that can be used for pH, ORP, and ISE electrodes. Each input channel has connectors for BNC probes, reference probes, and a temperature sensor. Each channel is galvanically isolated which means that two measurement probes can be in the same solution at the same time and the voltages produced will not interfere with each other.

## Choice of Calibration

Automatic buffer recognition, semi automatic, and direct manual entry pH calibration options are available for calibrating up to five points, from a selection of eight standard buffers and up to five custom buffers.

## GLP Data

HI5222 includes a GLP feature that allows users to view calibration data and calibration expiration information at the touch of a key. Calibration data include date, time, buffers used for calibration, and electrode offset and slope characteristics.

## CAL Check™

CAL Check alerts users to potential problems during the calibration of the pH electrode. Indicators include "Electrode Dirty/Broken," "Buffer Contaminated," electrode response time, and the overall probe condition as a percentage that is based on the offset and slope characteristics.

## ISE Measurement with Choice of Concentration Units

The HI5222 allows for calibration and readings in choice of concentration units. The choices of concentration units include ppt, g/L, mg/mL, ppm, mg/L, µg/mL, ppb, µg/L, mg/mL, M, mol/L, mmol/L, %w/v, and a user-defined unit.

## ISE Measurement with Incremental Methods

The known addition, known subtraction, analyte addition, and analyte subtraction incremental methods are pre-programmed into the HI5222. Simply follow the on screen guided procedure and the meter will perform the calculation automatically allowing for a higher level of accuracy to be obtained as compared to a direct ISE measurement.

## Data Logging

Three selectable logging modes are available on the HI5222: automatic, manual, and AutoHold logging. Automatic and manual logs up to 100 lots with 50,000 records max/lot with up to 100,000 total data points per channel. Automatic logging features the option to save data according to sampling period and interval.

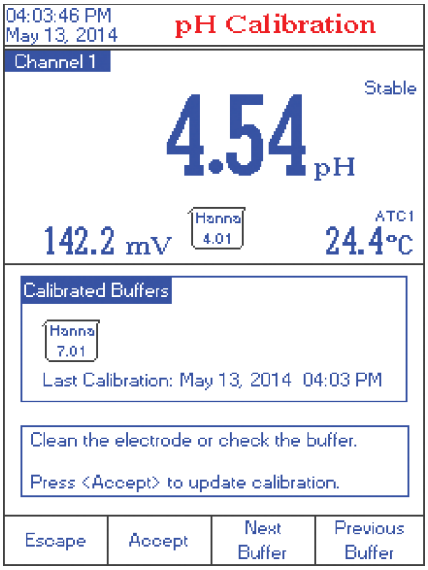
## Data Transfer

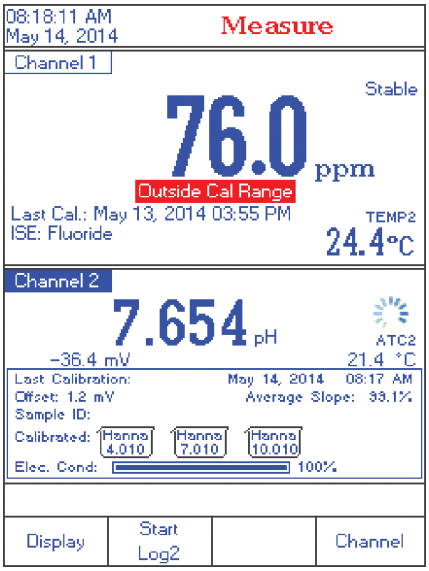
Data can be transferred to a PC with USB cable and HI92000 software (both sold separately).

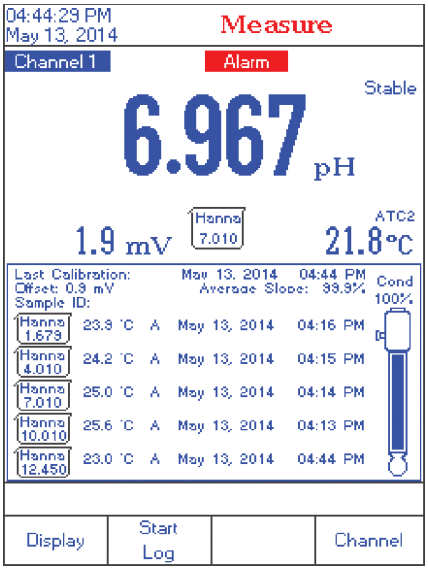
## Contextual Help

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.

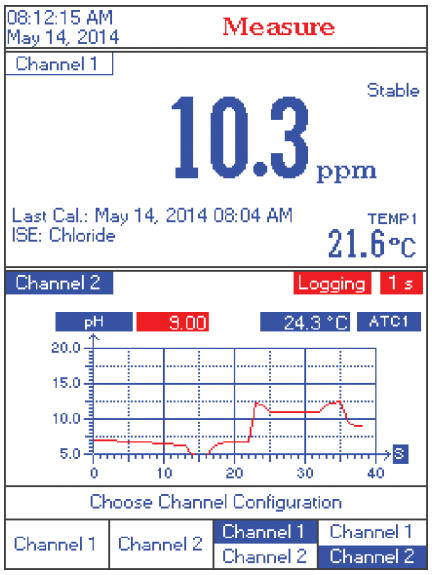
## CAL Check Screens



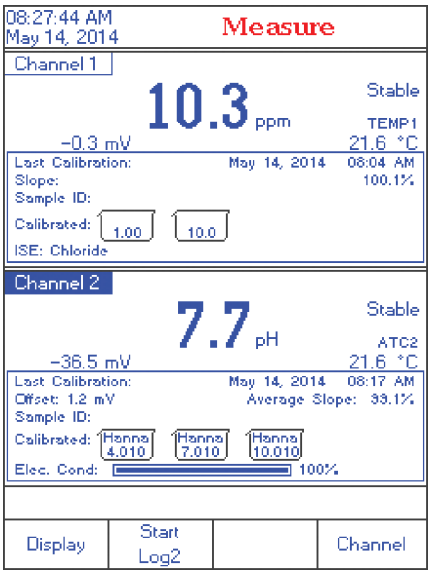



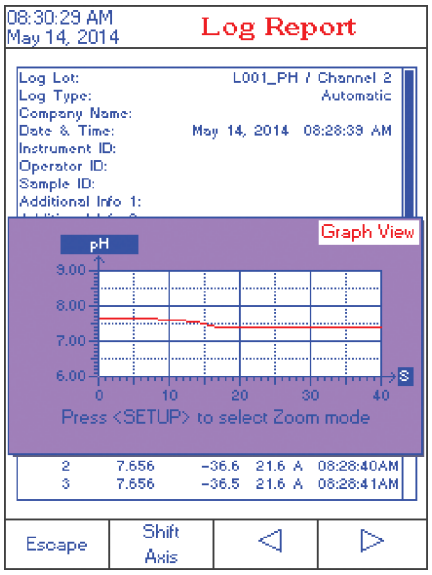
# Additional Features by Screen



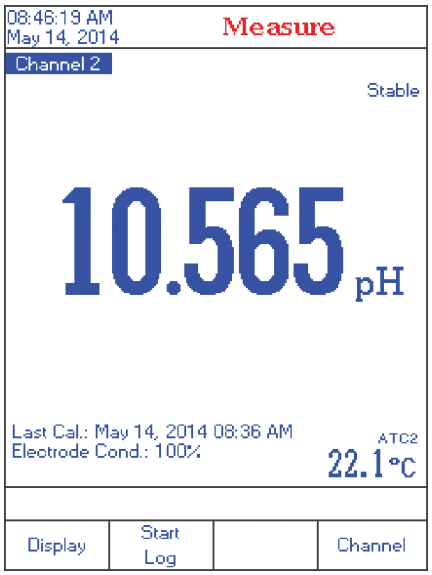

Channel Configuration



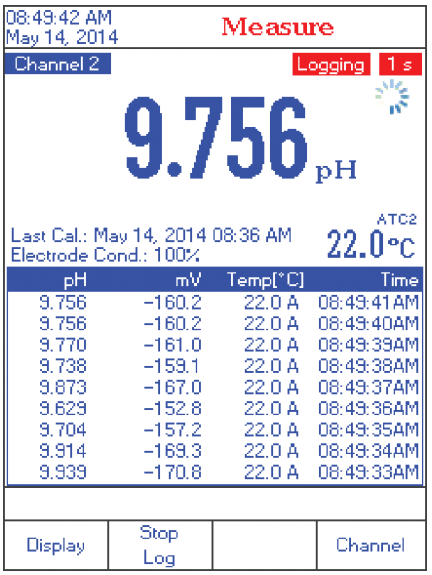

Good Laboratory Practices



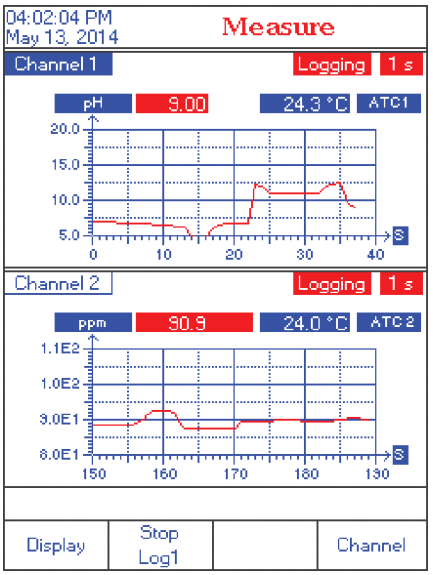

Log Recall




Basic Display




Real-Time Logging




Simultaneous Dual Channel Graphing


## Dual Channels

The two measurement channels of the HI5222 are galvanically isolated to eliminate noise and instability.

In ISE mode, this instrument provides a choice of several incremental methods. Communication is via opto-isolated USB.

| Specifications | | HI5222 |
|---|---|---|
| pH | Range | -2.0 to 20.0 pH; -2.00 to 20.00; -2.000 to 20.000 pH |
| | Resolution | 0.1 pH; 0.01 pH; 0.001 pH |
| | Accuracy | ±0.1 pH; ±0.01 pH; ±0.002 pH ±1 LSD |
| | Calibration | automatic, up to five point calibration, eight standard buffers available (1.68, 3.00, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45), and five custom buffers |
| | Temperature Compensation | automatic or manual from -20.0 to 120.0°C/-4.0 to 248.0°/253.15 to 393.15K |
| mV | Range | ±2000 mV |
| | Resolution | 0.1 mV |
| | Accuracy | ±0.2 mV ±1 LSD |
| | Relative mV Offset Range | ±2000 mV |
| ISE | Range | $1 \times 10^{-6}$ to $9.99 \times 10^{10}$ concentration |
| | Resolution | 1; 0.1; 0.01; 0.001 concentration |
| | Accuracy | ±0.5% (monovalent ions); ±1% (divalent ions) |
| | Calibration | automatic, up to five-point calibration, seven fixed standard solutions available for each measurement unit, and five user defined standards |
| Temperature* | Range | -20.0 to 120°C; -4.0 to 248.0°F; 253.15 to 393.15K |
| | Resolution | 0.1°C; 0.1°F; 0.1K |
| | Accuracy | ±0.2°C; ±0.4°F; ±0.2K |
| Additional Specifications | pH Electrode | HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included) |
| | Temperature Probe | HI7662-W stainless steel temperature probe with 1 m (3.3') cable (included) |
| | Input Channel(s) | 2 pH/ORP/ISE |
| | GLP | calibration points, calibration time stamp, probe offset, slope, date, time and buffers/standards used |
| | Logging | **record :** Up to 100 lots, 50,000 records max/lot / maximum 100,000 data points/channel; **interval:** 14 selectable between 1 second and 180 minutes; **type:** automatic, manual, AutoHOLD; |
| | Display | color graphic LCD 240x340 pixels |
| | PC Connection | USB |
| | Power Supply | 12 VDC adapter (included) |
| | Environment | 0 to 50°C (32 to 122°F; 273 to 323K) RH max 95% non-condensing |
| | Dimensions | 160 x 231 x 94 mm (6.3 x 9.1 x 3.7") |
| | Weight | 1.2 kg (2.64 lbs.) |
| Ordering Information | **HI5222-01** (115V) and **HI5222-02** (230V) are supplied with HI1131B pH electrode, HI7662-W temperature probe, pH 4.01 buffer solution sachet (2), pH 7.01 buffer solution sachet (2), HI700601 electrode cleaning solution sachet (2), HI7082 3.5M KCl electrolyte solution (30 mL), HI76404W electrode holder, 12 VDC adapter, capillary dropper pipette, quality certificate, quick start guide, and instruction manual.<br>**HI5222-03** includes the above without electrode. | |

(*) Reduced to actual probe limits

pH and ORP electrodes begin on page 2.134; pH and ORP solutions begin on page 2.154;
ISE electrodes and solutions begin on page 3.22

HI5221

# Research Grade Meter

*pH/ORP and Temperature*


The HI5221 is a research grade benchtop pH/mV meter that is customizable with a large color LCD, capacitive touch keys, and USB port for computer connectivity.

The HI5221 features a universal BNC connection for use with the expansive line of pH and ORP electrodes that Hanna Instruments offers. The meter is supplied with the HI1131B glass body, double junction, combination pH electrode that operates over a wide temperature range from 0 to 100°C. All readings are automatically compensated for temperature variations with the separate HI7662-T temperature probe that is included.

The HI5221 can be calibrated up to five points with a choice of eight pre-programmed buffers or five custom buffers. The HI5221 features Hanna's exclusive CAL Check™ to alert the user of potential problems during the pH calibration process. Alerts displayed during calibration include "Electrode Dirty/Broken" and "Buffer Contaminated." The overall probe condition based on the offset and slope characteristic of the electrode is displayed as a percentage after calibration is complete. The calibration data including date, time, buffers used, offset, and slope can be accessed at any time along with the current measurement by selecting the Good Laboratory Practice (GLP) display option.

Three selectable logging modes are available: automatic, manual, and AutoHold logging. Up to 100,000 data points can be recorded in 100 lots with 50,000 records max/lot and exported to a computer for data review and storage.

## Customizable User Interface

The user interface of the HI5221 allows the user to show measurements in various modes: basic measurement with or without GLP information, real-time graphing, and logging data. Calibration stability criteria can be adjusted to fast, moderate, or accurate. Programmable alarm limits can be set to inside or outside allowable limits.

## Color Graphic LCD

The HI5221 features a color graphic LCD with on-screen help, graphic, and custom color configurations. The display allows for real-time graphing and the use of virtual keys provide for an intuitive user interface.

## Capacitive Touch

The HI5221 features sensitive capacitive touch buttons for accurate keystrokes when navigating menus and screens. There are four dedicated keys that are used for routine operations including calibration and switching measurement modes and four virtual keys that change based upon use. The capacitive touch technology ensures the buttons never get clogged with sample residue.

## Choice of Calibration

Automatic buffer recognition, semiautomatic, and manual pH calibration options are available for calibrating up to five points, from a selection of eight standard buffers and up to five custom buffers.

## GLP Data

HI5221 includes a GLP feature that allows users to view calibration data and calibration expiration information at the touch of a key. Calibration data include date, time, buffers /standards used for calibration, and slope characteristics. The offset is also displayed for pH electrodes.

## CAL Check™

CAL Check alerts users to potential problems during the calibration of the pH electrode. Alerts include "Electrode Dirty/Broken," "Buffer Contaminated," electrode response time, and the overall probe condition as a percentage that is based on the offset and slope characteristics.

## Data Logging

Three selectable logging modes are available on the HI5221: automatic, manual, and AutoHold logging. Automatic and manual logs up to 100 lots with 50,000 records max/lot, with up to 100,000 total data points. Automatic logging features the option to save data according to sampling period and interval.

## Data Transfer

Data can be transferred to a PC with USB cable and HI92000 software (both sold separately).

## Contextual Help

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.

| Specifications | | HI5221 |
|---|---|---|
| pH | Range | -2.0 to 20.0 pH; -2.00 to 20.00; -2.000 to 20.000 pH |
| | Resolution | 0.1 pH; 0.01 pH; 0.001 pH |
| | Accuracy | ±0.1 pH; ±0.01 pH; ±0.002 pH ±1 LSD |
| | Calibration | automatic, up to five point calibration, eight standard buffers available (1.68, 3.00, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45), and five custom buffers |
| | Temperature Compensation | automatic or manual from -20.0 to 120.0°C/-4.0 to 248.0°/253.15 to 393.15K |
| mV | Range | ±2000 mV |
| | Resolution | 0.1 mV |
| | Accuracy | ±0.2 mV ±1 LSD |
| | Relative mV Offset Range | ±2000 mV |
| Temperature* | Range | -20.0 to 120°C; -4.0 to 248.0°F; 253.15 to 393.15K |
| | Resolution | 0.1°C; 0.1°F; 0.1K |
| | Accuracy | ±0.2°C; ±0.4°F; ±0.2K |
| Additional Specifications | pH Electrode | HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included) |
| | Temperature Probe | HI7662-W stainless steel temperature probe with 1 m (3.3') cable (included) |
| | Input Channel(s) | 1 pH/ORP |
| | GLP | calibration points, calibration time stamp, probe offset, slope, date, time and buffers/standards used |
| | Logging | **record :** Up to 100 lots, 50,000 records max/lot / maximum 100,000 data points/channel; **interval:** 14 selectable between 1 second and 180 minutes; **type:** automatic, manual, AutoHOLD; |
| | Display | color graphic LCD 240x340 pixels |
| | PC Connection | USB |
| | Power Supply | 12 VDC adapter (included) |
| | Environment | 0 to 50°C (32 to 122°F; 273 to 323K) RH max 95% non-condensing |
| | Dimensions | 160 x 231 x 94 mm (6.3 x 9.1 x 3.7") |
| | Weight | 1.2 kg (2.64 lbs.) |
| Ordering Information | **HI5221-01** (115V) and **HI5221-02** (230V) are supplied with HI1131B pH electrode, HI7662-W temperature probe, pH 4.01 buffer solution sachet (2), pH 7.01 buffer solution sachet (2), HI700601 electrode cleaning solution sachet (2), HI7082 3.5M KCl electrolyte solution (30 mL), HI76404W electrode holder, 12 VDC adapter, capillary dropper pipette, quality certificate, quick start guide, and instruction manual.<br>**HI5221-03** includes the above without electrode. | |

(*) Reduced to actual probe limits

pH and ORP electrodes begin on page 2.134; pH and ORP solutions begin on page 2.154

HI122

# pH Benchtop Meter

*with Built-in Printer*

The HI122 is a professional pH/mV and temperature benchtop meter with a built-in printer. The built-in impact printer incorporated into the HI122 allows measurement information to be printed while in various modes. The meter comes with Hanna's HI1131P glass pH electrode and the temperature probe HI7662-T to allow for automatic temperature compensation. The HI122 also allows for ORP measurements when used with the HI3131B ORP electrode (supplied seperately).


## CAL Check™

Hanna's exclusive CAL Check diagnostics system ensures accurate pH readings every time by alerting users to potential problems during the calibration process. The CAL Check system eliminates erroneous readings due to dirty or faulty pH electrodes or contaminated pH buffer solutions during calibration. After the guided calibration process, the probe condition is evaluated and an alert is displayed informing the user of the overall pH electrode status.

## Automatic Calibration

pH calibration can be performed with up to five points with seven standard buffers and two custom buffers.

## HI1131P pH Electrode

The HI122 is supplied with the HI1131P glass body, double junction, refillable pH electrode with an indicating sensor made of High Temperature (HT) glass. The double junction and HT glass design allows the HI1131P to be used in a wide variety of applications ranging from samples with metals and Tris buffer to samples at elevated temperatures.

## Temperature Compensation

Temperature for pH measurements can be compensated for automatically (ATC) or manually (MTC) from -20.0 to 120.0°C with the use of the supplied HI7662-T temperature probe.

## GLP Data

The calibration data for each channel including date, time, standards used, offset, and slope can be accessed at any time through the HI122 menu.

## Data Logging

The log-on-demand feature accepts the recording of 50 samples. Interval logging allows up to 1000 data points to be recorded and allows the user to specify time intervals from 5 seconds to 180 minutes.

## Data Transfer

With a built-in logging function, measurements are stored in non-volatile memory, and can be transferred to a PC through the RS232 port.


## Built-in Impact Printer

The built-in impact printer incorporated into the HI122 uses regular paper that does not fade with time. The information related to measurements being taken can be printed while in measurement mode, GLP, or Setup mode. This meter also allows users to print detailed information in four languages for specific help screens and instrument set-up.


## Secondary keypad

| Specifications | | HI122 |
|---|---|---|
| pH | Range | -2.00 to 16.00 pH; -2.000 to 16.000 pH |
| | Resolution | 0.01 pH; 0.001 pH |
| | Accuracy (@25°C) | ±0.01 pH; ±0.002 pH |
| | Calibration | automatic, up to five point calibration standard with seven buffers (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and two custom buffers |
| | Temperature Compensation | automatic or manual from -20.0 to 120°C (-4.0 to 248.0°F) |
| mV | Range | ±999.9; ±2000 mV |
| | Resolution | 0.1 mV; 1 mV |
| | Accuracy @25°C | ±0.2 mV (±699.9 mV); ±0.5 mV (±999.9 mV); ±1 mV (±2000 mV) |
| | Relative mV Offset Range | ±2000 mV |
| Temperature | Range | -20.0 to 120.0°C (-4.0 to 248.0°F) |
| | Resolution | 0.1°C (0.1°F) |
| | Accuracy @25°C | ±0.4°C (±0.7°F) |
| Additional Specifications | pH Electrode | HI1131P glass body pH electrode with BNC + pin connectors and 1 m (3.3') cable (included) |
| | Temperature Probe | HI7662-T temperature probe with 1 m (3.3') cable (included) |
| | Log-on-demand | 50 samples (25 per channel) |
| | Interval Logging | 5 second to 180 minutes, 1000 samples (500 per channel) |
| | Input Impedance | $10^{12}$ Ohm |
| | PC Connection | RS232 serial port, opto-isolated |
| | Printer | built-in dot matrix printer, with 44 mm plain paper |
| | Power Supply | 12 VDC adapter (included) |
| | Environment | 0 to 50°C (32 to 122°F); RH max 95% non-condensing |
| | Dimensions | 280 x 203 x 84 mm (11.0 x 8.0 x 3.3") |
| | Weight | 1.9 kg (4.2 lbs.) |
| Ordering Information | **HI122-01** (115V) and **HI122-02** (230V) are supplied with HI1131P pH electrode, HI7662-T temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI7082 3.5M KCL electrolyte solution (30 mL), (5) paper rolls, 12 VDC adapter, and instructions. | |
| Accessories | **HI710032** Paper rolls (10) | |
| | **HI710033** ink cartridge | |

HI2221

# Benchtop pH/mV Meter

*with CAL Check™ Electrode Diagnostics*

The HI2221 pH/mV benchtop meter features CAL Check, data logging capability, and USB port for computer connectivity. Readings for pH can be manually or automatically compensated for temperature variations with the separate HI7662 temperature probe from -20.0 to 120.0°C.


## CAL Check

Hanna's exclusive CAL Check diagnostics system ensures accurate pH readings every time by alerting users of potential problems during the calibration process. The CAL Check system eliminates erroneous readings due to dirty or faulty pH electrodes or contaminated pH buffer solutions during calibration. After the guided calibration process, the probe condition is evaluated and an indicator is displayed informing the user of the overall pH electrode status.

## Automatic Calibration

Automatic pH calibration can be performed at up to 5 points using 7 standard buffers (1.68, 4.01, 6.86, 7.01, 9.18,10.01, and 12.45).

## GLP Data

The calibration data for each channel including date, time, standards used, offset, and slope can be accessed when the instrument is in pH measuring mode.

## HI1131P pH Electrode

The HI2221 is supplied with the HI1131P glass body, double junction, refillable pH electrode with a BNC and pin connector. This design is ideal for laboratory samples, liquid samples, and high temperature samples, as well as general purpose use.

## mV mode

HI2221 has a mV mode that can be used with ORP electrodes and for relative mV readings.

## Data Logging

The log-on-demand feature allows up to 100 data points to be recorded.

## Data Transfer

Data can be transferred to a PC with a USB cable and HI92000 software (both sold separately).

| Specifications | | HI2221 |
|---|---|---|
| pH | Range | -2.00 to 16.00 pH |
| | Resolution | 0.01 pH |
| | Accuracy | ±0.01 pH |
| | pH Calibration | automatic, up to five point calibration with seven standard buffer available (pH 1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) |
| | Temperature Compensation | Manual or Automatic from -20.0 to 120.0°C (-4.0 to 248.0°F) |
| mV | Range | ±699.9 mV; ±2000 mV |
| | Resolution | 0.1 mV (±699.9 mV); 1 mV (±2000 mV) |
| | Accuracy | ±0.2 mV (±699.9 mV); ±1 mV (±2000 mV) |
| Temperature | Range | -20.0 to 120.0°C (-4.0 to 248.0°F) |
| | Resolution | 0.1°C |
| | Accuracy | ±0.2°C (Excluding probe error) |
| Additional Specifications | pH Electrode | HI1131P glass body pH electrode with BNC + Pin connector and 1 m (3.3') cable (included) |
| | Logging Memory | log-on-demand up to 100 records |
| | Input Impedance | $10^{12}$ Ohm |
| | Connectivity | opto-isolated USB |
| | Power Supply | 12 VDC adapter (included) |
| | Environment | 0 to 50°C (32 to 122°F); RH max 95% non-condensing |
| | Dimensions / Weight | 235 x 222 x 109 mm (9.2 x 8.7 x 4.3") / 1.3 Kg (2.9 lb) |
| Ordering Information | | **HI2221-01** (115V) and **HI2221-02** (230V) are supplied with HI1131P pH electrode, HI7662 temperature probe, HI76404N electrode holder, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI7082S electrolyte solution, HI700661 cleaning solution sachet, 12 VDC adapter, and instructions. |



pH and ORP electrodes begin on page 2.134; pH and ORP solutions begin on page 2.154


HI2210 · HI2211

# pH Benchtop Meters

- Automatic temperature compensation (ATC)
- Two-point calibration
- Simple to operate
- Reading stability indicator
- Measurement recall

The HI2211 and HI2210 are accurate and affordable benchtop pH and °C meters. The HI2211 can also be used to measure Oxidation Reduction Potential (ORP) in the mV range.

The calibration process is guided step-by-step through graphics shown on the LCD.

These instruments also feature a reading stability indicator used during calibration and a measurement recall function .

pH measurements for both instruments can be compensated for the affects of temperature manually or automatically with the HI7662 temperature probe. These instruments are also equipped with an easy-to-read LCD which shows both the primary reading and °C.

| Specifications | | HI2210 | HI2211 |
|---|---|---|---|
| pH | Range | -2.00 to 16.00 pH | -2.00 to 16.00 pH |
| | Resolution | 0.01 pH | 0.01 pH |
| | Accuracy | ±0.01 pH | ±0.01 pH |
| | pH Calibration | automatic, one or two-point with five memorized buffer values (pH 4.01, 6.86, 7.01, 9.18, 10.01) | |
| | Temperature Compensation | automatic (with HI7662 probe) or manual from -20.0 to 120.0°C | |
| mV | Range | – | ±399.9 mV ; ±2000 mV |
| | Resolution | – | 0.1 mV; 1 mV |
| | Accuracy | – | ±0.2 mV (±399.9 mV); ±1 mV (±2000 mV) |
| Temperature | Range | -20.0 to 120.0°C (-4 to 248.0°F) | |
| | Resolution | 0.1°C | 0.1°C |
| | Accuracy | ±0.4°C (excluding probe error) | |
| Additional Specifications | pH Electrode | HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included) | |
| | Temperature Probe | HI7662 stainless steel temperature probe with 1 m (3.3') cable (included) | |
| | Input Impedance | $10^{12}$ Ohm | |
| | Power Supply | 12 VDC adapter (included) | |
| | Environment | 0 to 50°C (32 to 122°F); RH max 95% non-condensing | |
| | Dimensions / Weight | 235 x 222 x 109 mm (9.2 x 8.7 x 4.3"); 1.3 Kg (2.9 lbs) | |
| Ordering Information | **HI2210-01** (115V), **HI2210-02** (230V), **HI2211-01** (115V) and **HI2211-02** (230V) are supplied with HI1131B pH electrode, HI7662 temperature probe, HI76404N electrode holder, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI7082 3.5M KCl electrolyte solution (30 mL), HI700601 cleaning solution sachet, 12 VDC adapter, and instructions. | | |

pH and ORP electrodes begin on page 2.134; pH and ORP solutions begin on page 2.154

HI2209 · HI22091

# pH Benchtop Meters

*with Manual Temperature Compensation and Analog Output*

- Manual pH calibration
  - This simple to use feature provides the ability to demonstrate the concept of offset and slope. It can be calibrated to any value within the measurement ranges and is less expensive than models with automatic calibration
- Manual temperature compensation (MTC)
  - MTC provides the ability to demonstrate the effect of temperature on pH measurement. It is simple to use and allows for different temperature corrections based on the sample being tested.
- Analog output (HI22091 only)
  - Allows a recording device to be connected to the meter
- mV range
  - These pH/mV meters can also measure ORP (oxidation reduction potential) or ion concentration (ISE) in the extended mV range with optional electrodes.
- Large LCD
  - The large LCD is bright and easy to read
- Built-in solution holders
  - These meters have solution holders built into the casing. This convenient feature saves space and prevents solutions from tipping over

The HI22091 pH/mV Meter with manual temperature compensation (MTC) and analog output provides a simple to use, cost effective method for measuring pH. The HI22091 features a large, easy to read LCD and built-in solution holders. The HI2209 has all the features of the HI22091 with the exception of analog output.

In order to achieve maximum accuracy, the HI22091 and HI2209 feature manual pH calibration at one or two points. Manual calibration enables the user to select the instrument's calibration points closer to the desired range of measurement, making them ideal for applications that require custom calibration points. In some applications, a standard calibration curve such as pH 7 or pH 4 is too far from the value of the sample to achieve the highest accuracy.

| Specifications | | HI2209 | HI22091 |
|---|---|---|---|
| pH | Range | 0.00 to 14.00 pH | 0.00 to 14.00 pH |
| | Resolution | 0.01 pH | 0.01 pH |
| | Accuracy | ±0.01 pH | ±0.01 pH |
| | Calibration | manual, one or two-point | manual, one or two-point |
| | Temperature Compensation | manual from 0 to 100°C (32 to 212°F) | |
| mV | Range | ±1999 mV | ±1999 mV |
| | Resolution | 1 mV | 1 mV |
| | Accuracy | ±1 mV | ±1 mV |
| Additional Specifications | pH Electrode | HI1332B PEI body pH electrode with BNC connector and 1 m (3.3') cable (included) | |
| | Input Impedance | $10^{12}$ Ohm | $10^{12}$ Ohm |
| | Analog Output | – | 0 to 5 V according with: 0 to 14 pH or -1999 to +1999 mV, temperature: always 0 |
| | Power Supply | 12 VDC adapter (included) | |
| | Environment | 0 to 50°C (32 to 122°F); RH max 95% non-condensing | |
| | Dimensions / Weight | 235 x 222 x 109 mm (9.2 x 8.7 x 4.3") / 1.3 kg (2.9 lbs.) | |
| Ordering Information | | **HI2209-01** (115V), **HI2209-02** (230V), **HI22091-01** (115V) and **HI22091-02** (230V) are supplied with HI1332B pH electrode, 12 VDC adapter and instruction manual. | |



pH and ORP electrodes begin on page 2.134; pH and ORP solutions begin on page 2.154


HI207 • HI208

# Educational pH Meters

- Simple User Interface
  - Operation is simple with features that only require the use of a couple of buttons and readings are easy to view on the dual-level display.
- Built-in Stir Bar (HI208 only)
  - Integrated 500 rpm magnetic stirrer.
- One or Two-Point Calibration
  - Automatic calibration can be performed at 1 or 2 points with a choice of two sets of preprogrammed buffers (pH 4.01, 7.01, 10.01 or 4.01, 6.86, 9.18).
- HI1291D pH Electrode
  - The HI208 is supplied with the HI1291D PEI body, single junction, refillable pH electrode with an internal temperature sensor and DIN connector.
- Temperature Compensation
  - The HI208 offers automatic temperature compensation of pH measurements over a wide range from -5.0 to 105.0°C.
- Stability Indicator
  - The HI207 and HI208 feature a stability indicator. A clock icon appears on the display when there is instability in the reading. The clock icon disappears once the reading has stabilized. At that time a reading should be taken or stored.

| Specifications | | HI207 • HI208 |
|---|---|---|
| pH* | Range | -2.00 to 16.00 pH |
| | Resolution | 0.01 pH |
| | Accuracy | ±0.02 pH |
| | Calibration | automatic, one or two-point with two sets of memorized buffer values (pH 4.01, 7.01, 10.01 or 4.01, 6.86, 9.18) |
| | Temperature Compensation | automatic |
| Temperature* | Range | -5.0 to 105.0°C; 23.0 to 221.0°F |
| | Resolution | 0.1°C; 0.1°F |
| | Accuracy | ±0.5 (up to 60°C); ±1°C (outside);<br>±1°F (up to 140°F); ±2°F (outside) |
| Additional Specifications | pH Electrode | HI1291D amplified PEI body pH electrode with internal temperature sensor, DIN connector and 1 m (3.3') cable (included) |
| | Stirrer (HI208 only) | Built-in magnetic stirrer at 500 rpm |
| | Power Supply | 12 VDC adapter or 9V battery |
| | Battery Life | approximately 200 hours without stirrer |
| | Environment | 0 to 50°C (32 to 122°F); RH max 95% |
| | Dimensions / Weight | 192 x 104 x 134 mm (7.6 x 4.1 x 5.3") / 420 g (14.8 oz.) |
| Ordering Information | | **HI207-01** (115V), **HI207-02** (230V), **HI208-01** (115V) and **HI208-02** (230V) are supplied with HI1291D pH electrode, pH electrode holder and plastic beaker, rubber O-ring, magnetic stir bar, pH 4.01 buffer solution sachet, pH 7.01 buffer solution sachet, electrode cleaning solution sachet for agriculture, 12 VDC adapter, battery, and instructions. |
| Accessories | | **HI731316** Stir bars (5) |

* temperature range is limited to 80°C (176 °F) if using HI 1291D probe.

The HI207 and HI208 are basic affordable pH benchtop meters ideal for educational purposes. Operation is simplified with automatic pH calibration and automatic temperature compensation. These meters also feature extended pH range, dual-level LCD with icons for stability and buffer recognition, and temperature display in either Celsius or Fahrenheit. The HI208 incorporates a built-in 500 rpm magnetic stirrer,

These meters can be calibrated to 1 or 2 points with a choice of two sets of preprogrammed buffers (pH 4.01, 7.01, 10.01 or 4.01, 6.86, 9.18). The HI1291D two-in-one pH and temperature probe allows for automatic temperature compensation with accuracy of ±0.5°C (up to 60°C).

The compact design of the HI207 and HI208, makes them ideal for educational use by reducing clutter and utilizing a minimal amount of space on the desktop. The option to switch to battery power also allows the meter to be taken outside the classroom for field studies.

pH and ORP solutions begin on page 2.154

HI98199

# pH • EC • DO Waterproof Meter

*Use three professional probes with Hanna's Quick Connect*

The HI98199 is a versatile meter that can monitor pH, EC, and dissolved oxygen when paired with the respective probe. Hanna's pH probe is included with the HI98199 and the EC and DO probes can be ordered separately. Each digital probe features Hanna's Quick Connect DIN connector and the included carrying case contains all the accessories necessary to start taking pH measurements.


## Backlit Graphic LCD Display

The HI98199 features a backlit graphic LCD with on-screen help and the capability to display multiple parameters simultaneously. The use of virtual keys to provides for an intuitive user interface.

## Waterproof Protection

HI98199 is enclosed in an IP67 rated waterproof casing and can withstand immersion in water at a depth of 1 m for up to 30 minutes. The probes feature an IP68 rating for continuous immersion in water.

## Quick Connect Digital Probe

pH, EC, and DO probes feature a Quick Connect DIN connector that makes a waterproof connection with the meter.

## Auto-sensor Recognition

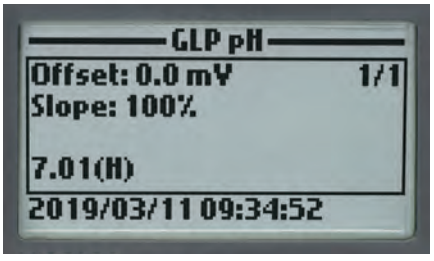
The probe and meter automatically recognize the sensors that are connected.


## Data Logging

The HI98199 allows users to store up to 45,000 continuous or log-on-demand samples with logging intervals from one second to three hours.

## PC Connectivity

Logged data can be transferred to a Window's compatible PC with the included micro USB cable and Hanna software.




## GLP Data

HI98199 includes a GLP feature that allows users to view calibration data and calibration expiration information at the touch of a key. Calibration data includes date, time, buffers/standards used for calibration, and slope characteristics.

## Dedicated Help Key

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.

## Long Battery Life

The meter displays a battery icon indicator to show the remaining power. The meter uses four 1.5V AA batteries that provide up to 360 hours of battery life.

# Versatility when you need it.

Each probe transmits readings digitally to the meter, where data points can be displayed and logged.


## pH

The HI98199 allows for the measurement of pH and temperature when used with the included HI829113 digital pH probe.

- Up to a three-point calibration with five standard buffers and one custom buffer available
- pH in mV option is useful for diagnostics
- GLP data
  - Offset, slope, date, time and buffers used
- Automatically temperature compensated readings
- pH sensor
  - Gel filled and maintenance free
  - Double junction for reduced contamination of reference cell

## Conductivity

The HI98199 allows for the measurement of conductivity, TDS (total dissolved solids), Resistivity, Salinity, seawater σ, and temperature when used with the optional HI763093 digital EC probe.

- Single-point calibration from six standards
- Temperature compensation
  - Automatic Temperature Compensation
  - Configurable temperature coefficient range from 0.00 to 6.00%/°C
  - Choice of reference temperatures at 20 or 25°C
  - Absolute conductivity can be displayed along with the temperature compensated value
- Auto-ranging
- Salinity readings
  - Practical Salinity Scale (PSU) based on conductivity calibration

## Dissolved Oxygen

The HI98199 allows for the measurement of dissolved oxygen, atmospheric pressure, and temperature when used with the optional HI764103 digital DO probe.

- Display units in % saturation or ppm (mg/L)
- Salinity compensation for saline waters
  - Manual entry of salinity values
  - Readings compensated for salinity effects
- Built-in barometer
  - Automatic compensation for changes in atmospheric pressure
  - User selectable units
- Temperature compensation
- Automatic polarization of probe at startup
- Ready-to-use HDPE pre-tensioned membrane caps are easy to replace


HANNA
172.3 mVpH
4.09 pH
24.98 °C
Log
Menu
HI98199
pH • EC • DO
ESC
HELP
1
2 abc
3 def
4 ghi
5 jkl
6 mno
7 pqrs
8 tuv
9 wxyz
0

| Specifications | | HI98199 |
|---|---|---|
| pH / mV (using included HI829113 pH Probe) | Range | 0.00 to 14.00 pH / ±600.0 mV |
| | Resolution | 0.01 pH / 0.1 mV |
| | Accuracy | ±0.02 pH / ±0.5 mV |
| | Calibration | automatic one, two, or three points of five standard buffers (pH 4.01, 6.86, 7.01, 9.18, 10.01) or one custom buffer |
| EC (using HI763093 EC Probe) | Range | 0 to 200 mS/cm |
| | Resolution | **manual:** 1 µS/cm; 0.001 mS/cm; 0.01 mS/cm; 0.1 mS/cm; 1 mS/cm; **automatic:** 1 µS/cm from 0 to 9999 µS/cm; 0.01 mS/cm from 10.00 to 99.99 mS/cm; 0.1 mS/cm from 100.0 to 200.0 mS/cm<br>**automatic mS/cm:** 0.001 mS/cm from 0.000 to 9.999 mS/cm; 0.01 mS/cm from 10.00 to 99.99 mS/cm; 0.1 mS/cm from 100.0 to 200.0 mS/cm |
| | Accuracy | ±1.5% of reading or ±2 µS/cm whichever is greater |
| | Calibration | automatic single point, with six standard solutions (84 µS/cm, 1413 µS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, 111.8 mS/cm) or custom point |
| TDS (using HI763093 EC Probe) | Range | 0.0 to 200.0 ppt (g/L) (the maximum value depends on the TDS factor) |
| | Resolution | **manual:** 1 ppm (mg/L); 0.001 ppt (g/L); 0.01 ppt (g/L); 0.1 ppt (g/L); 1 ppt (g/L);<br>**automatic:** 1 ppm (mg/L) from 0 to 9999 ppm (mg/L); 0.01 ppt (g/L) from 10.00 to 99.99 ppt (g/L); 0.1 ppt (g/L) from 100.0 to 200.0 ppt (g/L)<br>**automatic ppt (g/L):** 0.001 ppt (g/L) from 0.000 to 9.999 ppt (g/L); 0.01 ppt (g/L) from 10.00 to 99.99 ppt (g/L); 0.1 ppt (g/L) from 100.0 to 200.0 ppt (g/L) |
| | Accuracy | ±1% of reading or ±1 ppm (mg/L) whichever is greater |
| | Calibration | based on conductivity calibration |
| Resistivity (using HI763093 EC Probe) | Range | 0 to 999999 Ω•cm; 0 to 1000.0 kΩ•cm; 0 to 1.0000 MΩ•cm |
| | Resolution | 1 Ω•cm; 0.1 kΩ•cm; 0.0001 MΩ•cm |
| | Calibration | based on conductivity calibration |
| Salinity (using HI763093 EC Probe) | Range | 0.00 to 70.00 PSU |
| | Resolution | 0.01 PSU |
| | Accuracy | ±2% of reading or ±0.01 PSU whichever is greater |
| | Calibration | based on conductivity calibration |
| Seawater σ (using HI763093 EC Probe) | Range | 0.0 to 50.0 $\sigma_t$, $\sigma_0$, $\sigma_{15}$ |
| | Resolution | 0.1 $\sigma_t$, $\sigma_0$, $\sigma_{15}$ |
| | Accuracy | ±1 $\sigma_t$, $\sigma_0$, $\sigma_{15}$ |
| | Calibration | based on conductivity calibration |
| Dissolved Oxygen (using HI764103 DO Probe) | Range | 0.0 to 500.0%; 0.00 to 50.00 ppm (mg/L) |
| | Resolution | 0.1%; 0.01 ppm (mg/L) |
| | Accuracy | 0.0 to 300.0%: ±1.5% of reading or ±1.0% whichever is greater; 300.0 to 500.0%: ±3% of reading; 0.00 to 30.00 ppm (mg/L): ±1.5% of reading or ±0.10 ppm (mg/L), whichever is greater; 30.00 ppm (mg/L) to 50.00 ppm (mg/L): ±3% of reading |
| | Calibration | automatic one or two points at 0, 100% or one custom point |
| Atmospheric Pressure (using HI764103 DO Probe) | Range | 450 to 850 mm Hg; 17.72 to 33.46 in Hg; 600.0 to 1133.2 mbar; 8.702 to 16.436 psi; 0.5921 to 1.1184 atm; 60.00 to 113.32 kPa |
| | Resolution | 0.1 mm Hg; 0.01 in Hg; 0.1 mbar; 0.001 psi; 0.0001 atm; 0.01 kPa |
| | Accuracy | ±3 mm Hg within ±15°C from the temperature during calibration |
| | Calibration | automatic at one custom point |
| Temperature | Range | -5.00 to 55.00°C; 23.00 to 131.00°F; 268.15 to 328.15K |
| | Resolution | 0.01°C; 0.01°F; 0.01K |
| | Accuracy | ±0.15°C; ±0.27°F; ±0.15K |
| | Calibration | automatic at one custom point |
| Additional Specifications | Temperature Compensation | automatic from -5 to 55°C (23 to 131°F) |
| | Logging Memory | 45000 records (continuous logging or log-on-demand) |
| | Logging Interval | one second to three hours |
| | PC Connectivity | via USB (with Hanna PC software) |
| | Environment | 0 to 50°C (32 to 122°F); RH 100% IP67 |
| | Battery Type / Life | 1.5V AA batteries (4) / approximately 400 hours of continuous use without backlight (50 hours with backlight) |
| | Dimensions / Weight | 185.0 x 93.0 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.) |
| Ordering Information | **HI98199** is supplied with the HI829113 pH digital probe with 4m (13') cable, pH calibration solution sachets, PC software, micro USB cable, batteries, quality certificate, and instruction manual in a rugged carrying case. | |
| Probes | **HI829113** pH digital probe with 4m (13') cable | |
| | **HI763093** EC digital probe with 4m (13') cable | |
| | **HI764103** DO digital probe with 4m (13') cable | |
| Accessories | **HI710034** orange protective silicone rubber boot | |

pH and ORP solutions begin on page 2.154; EC/TDS solutions start on page 5.34

HI98190

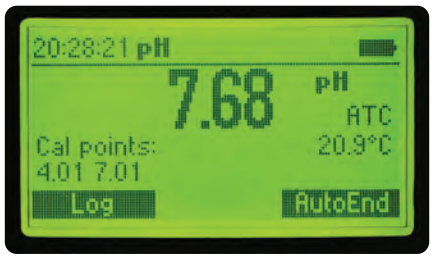
# Professional Waterproof Meter

*pH/ORP*

- Waterproof
  - IP67 rated waterproof, rugged enclosure
- CAL Check™
  - Alerts users to problems during calibration including dirty/broken electrode, contaminated buffer, and overall probe condition
- Automatic or manual temperature compensation
  - pH sensors incorporate a built-in temperature sensor
- Calibration
  - Up to a five-point calibration with seven standard buffers and five custom buffers available
- Approximately 200 hour battery life
  - Powered by (4) 1.5V AA batteries
- Clear display
  - Dot matrix display with multifunction virtual keys
- AutoHold
  - Automatically holds the first stable reading on the display
- Calibration timeout
  - Alerts when calibration is due at a specified interval
- Connectivity
  - PC connectivity via opto-isolated micro-USB with HI92000 software
- GLP
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- Intuitive keypad
  - Most of the available options such as GLP information, help, range, calibration, and backlight have a dedicated button
- Supplied complete
  - Each meter is supplied complete with sensor, calibration solution, beakers, PC software and connection cable, instruction manual, quick start guide, and batteries in a rugged, custom carrying case.


## Designed for professionals

The HI98190 is a rugged, portable pH meter with the performance and features of a benchtop meter. Exchange out the pH probe for an ORP probe to obtain mV readings in the ±2000 mV range. This professional, waterproof meter can easily be operated with one hand and complies with IP67 standards. The HI98190 is supplied with all necessary accessories to perform a pH/temperature measurement packaged into a durable carrying case.




## Backlit Graphic LCD Display

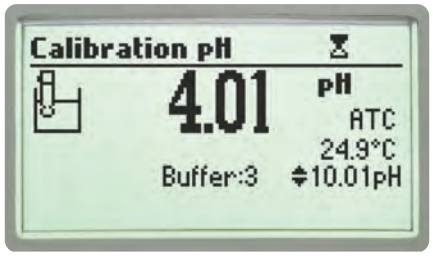
The HI98190 features a backlit graphic LCD with on-screen help. The graphic display allows for the use of virtual keys to provide for an intuitive user interface.

## Waterproof Protection

The meter is enclosed in an IP67 rated waterproof casing and can withstand immersion in water at a depth of 1 m for up to 30 minutes. The probe features an IP68 rating for continuous immersion in water.

## Quick Connect Probe

The HI98190 features the HI12963 titanium bodied pH/temperature electrode with a quick connect DIN connector to make attaching and removing the probe simple and easy.

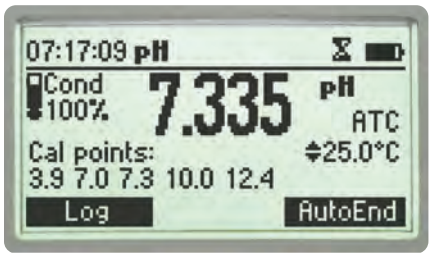



## pH Calibration

Choose from seven standard pH buffers and five custom pH buffers to obtain up to five point calibration and achieve high precision readings with a pH accuracy of ±0.002 and up to ±0.001 pH resolution.

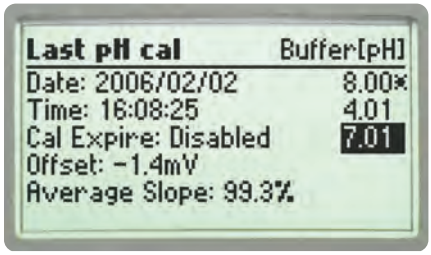
## Enhanced Calibration

An "out of calibration range" warning can be engaged to keep the user informed of the current calibration and help to avoid performing measurements that are out of range.



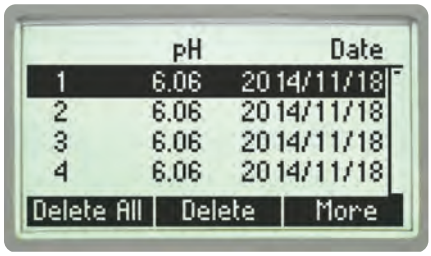

## CAL Check™

Hanna's CAL Check maintains a history of past calibrations and monitors the pH electrode and buffers during subsequent calibrations for any signs of wide variances due to a dirty or broken electrode or contaminated pH buffers. During calibration, users are alerted to problems should they occur. After calibration, the electrode's overall condition is displayed as a percentage.



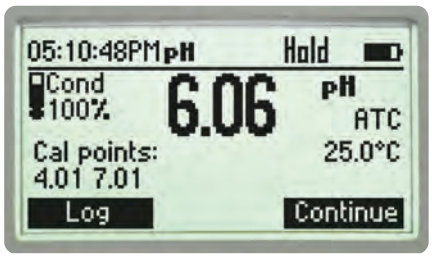

## GLP

Comprehensive GLP functions are directly accessible by pressing the GLP key. Calibration data, including date, time, and calibration values are stored for retrieval at a later time.




## Data Logging

The log-on-demand feature allows users to store up to 200 samples that can be later transferred to a PC with the HI920015 USB cable and HI92000 software.




## AutoHold

Pressing AutoHold during measurement will automatically hold the first stable reading on the display.

## Intuitive Keypad

The fitted rubber keypad has dedicated keys for power, backlight, up/down arrows, help, and alphanumeric characters. The meter also features two virtual soft keys that navigate the user through the configuration of each parameter, meter setup, and logging of data. The interface is intuitive for any user's level of experience.


## Dedicated Help Key

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.


## Setup Screen

Our extensive setup screen features a host of configurable options such as time, date, temperature units, and language for help screens and guides.

## Supplied Complete in a Rugged Custom Carrying Case

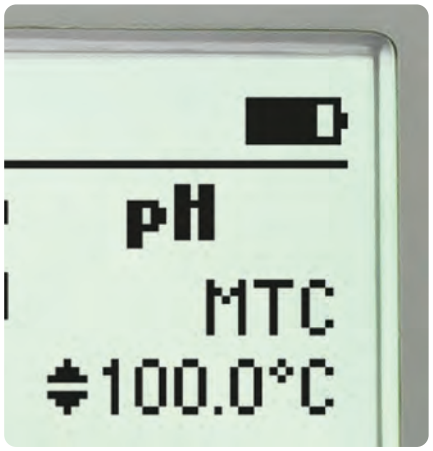
The HI98190 meter, probe, and accessories are supplied in the HI720190 rugged carrying case designed to provide years of use. The inside compartment of the carrying case is thermoformed to securely hold and protect all of the components.

## HI12963 pH Electrode

- Titanium body
  - Titanium construction provides an unbreakable structure and allows the transfer of heat to the internal temperature sensor for rapid temperature compensation.
- Maintenance free, gel-filled electrode
  - No fill solution required

## PC Connectivity

Logged data can be transferred to a Windows compatible PC with the included HI920015 micro USB cable and HI92000 software.

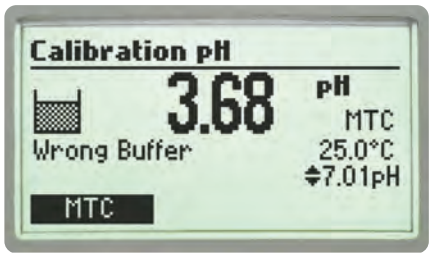



## Long Battery Life

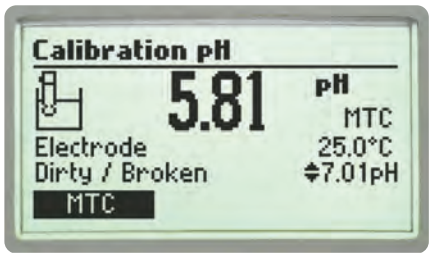
The display of the meter has a battery icon indicator to show the remaining power. The meter uses four 1.5V AA batteries that provide up to 200 hours of battery life.

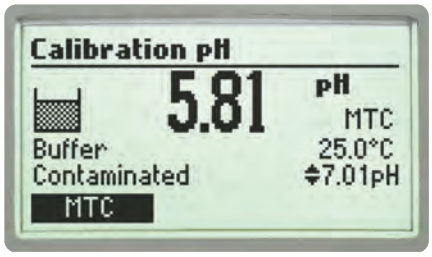
## Calibration Error Messages

Calibration is successfully performed if the reading is within certain limits.

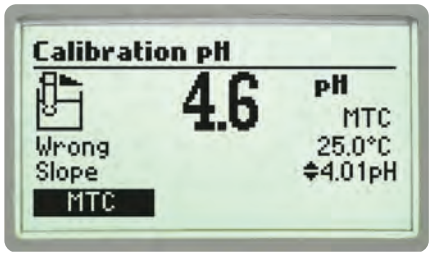



Wrong Buffer – The pH reading is not within range of the selected buffer.




Electrode Dirty/Broken alternatively with Buffer Contaminated –The offset of the electrode is not in the accepted range. Check if the electrode is broken or clean it following the Cleaning Procedure at the end of this section. Check the quality of the buffer. If necessary, change the buffer.




Wrong or Wrong Old Slope – An inconsistency between new and previous (old) calibration is detected.

## Calibrate right in the case with custom beaker holders

Our custom carrying case features beaker holders for calibration out in the field.


- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

  **HI710034** Orange

| Specifications | | HI98190 |
|---|---|---|
| pH* | Range | -2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH |
| | Resolution | 0.1 pH; 0.01 pH; 0.001 pH |
| | Accuracy | ±0.1 pH; ±0.01 pH; ±0.002 pH |
| | Calibration | up to five-point calibration, seven standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and five custom buffers |
| | Temperature Compensation | automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F) |
| mV* | Range | ±2000 mV |
| | Resolution | 0.1 mV |
| | Accuracy | ±0.2 mV |
| | Relative mV Offset Range | ±2000 mV |
| Temperature* | Range | -20.0 to 120.0 °C (-4.0 to 248.0°F) |
| | Resolution | 0.1°C (0.1°F) |
| | Accuracy | ±0.4°C (±0.8°F) (excluding probe error) |
| Additional Specifications | pH Probe | HI12963 titanium body, pH electrode with internal temperature sensor, quick DIN connector and 1 m (3.3' cable) |
| | Slope Calibration | from 80 to 110% |
| | Log-on-demand | 200 samples (100 each pH/mV range) |
| | PC Connection | opto-isolated USB with HI92000 software and micro USB cable |
| | Input Impedance | $10^{12}$ Ω |
| | Battery Type / Life | 1.5V AA batteries (4) / approximately 200 hours of continuous use without backlight (50 hours with backlight) |
| | Auto-off | user selectable: 5, 10, 30, 60 min, disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH 100% IP67 |
| | Dimensions / Weight | 185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.) |
| Ordering Information | **HI98190** is supplied with HI12963 pH electrode, HI7004M pH 4.01 buffer solution (230 mL), HI7007M pH 7.01 buffer solution (230 mL), electrode cleaning solution sachet (2), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), quick start guide, quality certificate, and instruction manual in an HI720190 rugged carrying case with custom insert.<br>**HI98190-03** includes the above without electrode. | |
| Accessories | **HI710034** orange protective rubber boot | |

* Limits will be reduced to actual sensor limits

pH and ORP solutions begin on page 2.154

HI98161

# pH / Temperature Meter for Food

HI98161 is a professional portable pH and temperature meter with a probe designed specifically for pH measurement in the Food sector.

- Waterproof
  - IP67 rated waterproof, rugged enclosure
- CAL Check™
  - Alerts users to problems during calibration including dirty/broken electrode, contaminated buffer, and overall probe condition
- Automatic or manual temperature compensation
  - pH sensors incorporate a built-in temperature sensor
- Calibration
  - Up to a five-point calibration with seven standard buffers and five custom buffers
- Approximately 200 hour battery life
  - Powered by 4 1.5V AA batteries
- Clear display
  - Dot matrix display with multifunction virtual keys
- Auto hold
  - Automatically holds the first stable reading on the display
- Calibration timeout
  - Alerts when calibration is due at a specified interval
- Connectivity
  - PC connectivity via opto-isolated micro-USB with HI92000 software
- GLP
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- Intuitive keypad
  - Important and often used functions such as GLP information, help, range, calibration, and backlight have a dedicated button
- Supplied complete
  - Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide, and batteries in a rugged, custom carrying case

# Foodcare pH Meter

## designed for food professionals

Hanna foodcare pH meters are rugged and portable with the performance and features of a benchtop. Eight models are available in this series to measure food, milk, meat, yogurt, cheese, beer, wine, and soil. Each model is supplied with an application specific electrode and cleaning solutions. These waterproof meters comply to IP67 standards and can be easily operated with one hand.


### Backlit Graphic LCD Display

These meters feature a backlit graphic LCD with on-screen help. The graphic display allows for the use of virtual keys to provide for an intuitive user interface.

### Waterproof Protection

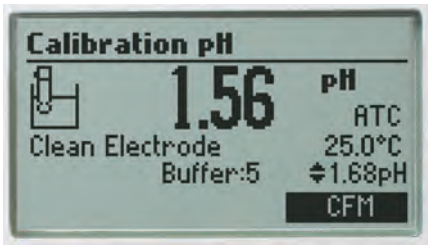
The meter is enclosed in an IP67 rated waterproof casing and can withstand immersion in water at a depth of 1 m for up to 30 minutes.

### Quick Connect Probe

Each meter features an application specific pH/temperature probe with a quick connect DIN connector to make attaching and removing the probe simple and easy.

### Calibration Timeout

Alerts when calibration is due at a specified interval.




### pH Calibration

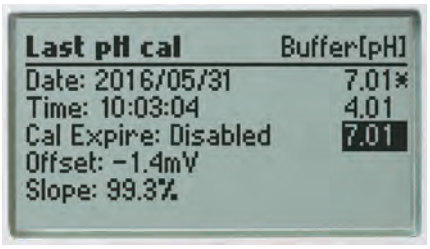
Choose from seven standard pH buffers and five custom values to obtain up to five point calibration and achieve high precision readings with a 0.001 pH resolution and a pH accuracy of ±0.002.

### Enhanced Calibration

An "out of calibration range" warning can be engaged to keep the user informed of the current calibration and help to avoid performing measurements that are out of the bracketed range.


### CAL Check™

Hanna's CAL Check maintains a history of past calibrations and monitors the pH electrode and buffers during subsequent calibrations for any signs of wide variances due to a dirty or broken electrode or contaminated pH buffers. During calibration, users are alerted to problems should they occur. After calibration, the electrode's overall condition is displayed as a percentage.




### GLP

Comprehensive GLP functions are directly accessible by pressing the GLP key. Calibration data including date, time and calibration values are stored with logged data for retrieval at a later time.


### Data Logging

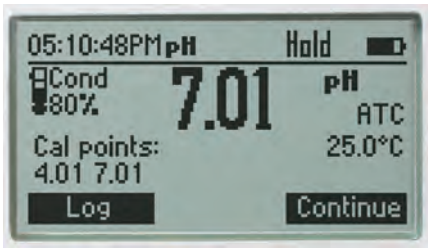
The log-on-demand feature allows users to store up to 200 samples that can later be transferred to a PC with the HI920015 USB cable and HI92000 software.

### Automatic Temperature Compensation

pH sensors incorporate a built-in temperature sensor in the tip of the electrode for a fast and accurate temperature compensated value.

### Intuitive Keypad

The fitted rubber keypad has dedicated keys for many important and often used functions. These meters also feature two virtual soft keys that navigate the user through setup and logging of data. The interface is intuitive for any user's level of experience.




## Auto Hold

Pressing AutoEnd during measurement will automatically hold the first stable reading on the display.


## Dedicated Help Key

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.


## Setup Screen

Our extensive setup screen features a host of configurable options such as time, date, temperature units, and language for help screens and guides.

## PC Connectivity

Logged data can be transferred to a Windows compatible PC with the included HI920015 micro USB cable and HI92000 software.

## Long Battery Life

The display of the meter has a battery icon indicator to show the remaining power. The meter uses four 1.5V AA batteries that provide up to 200 hours of battery life.

## Supplied Complete in a Rugged Custom Carrying Case

Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide, and batteries in a rugged, custom carrying case. The inside compartment of the carrying case is thermoformed to securely hold and protect all of the components.

| Specifications | | HI98161 |
|---|---|---|
| pH* | Range | -2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH |
| | Resolution | 0.1 pH; 0.01 pH; 0.001 pH |
| | Accuracy | ±0.1 pH; ±0.01 pH; ±0.002 pH |
| | Calibration | up to five-point calibration, seven standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and five custom buffers |
| | Temperature Compensation | automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F) |
| mV | Range | ±2000 mV |
| | Resolution | 0.1 mV |
| | Accuracy | ±0.2 mV |
| | Relative mV Offset Range | ±2000 mV |
| Temperature* | Range | -20.0 to 120.0 °C (-4.0 to 248.0°F) |
| | Resolution | 0.1°C (0.1°F) |
| | Accuracy | ±0.4°C (±0.8°F) (excluding probe error) |
| Additional Specifications | pH Probe | FC2023 PVDF body, pH electrode with internal temperature sensor, quick DIN connector and 1 m (3.3' cable) |
| | Slope Calibration | from 80 to 110% |
| | Log-on-demand | Up to 200 samples (100 pH, 100 mV) |
| | PC Connection | opto-isolated USB with HI92000 software and micro USB cable |
| | Input Impedance | $10^{12}$ Ω |
| | Battery Type / Life | 1.5V AA batteries (4) / approximately 200 hours of continuous use without backlight (50 hours with backlight) |
| | Auto-off | user selectable: 5, 10, 30, 60 min, disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH 100% IP67 |
| | Dimensions / Weight | 185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.) |
| Ordering Information | **HI98161** is supplied with FC2023 pH electrode, HI7004M pH 4.01 buffer solution (230 mL), HI7007M pH 7.01 buffer solution (230 mL), HI700641 electrode cleaning solution sachet for dairy deposits (2), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), quality certificate, and instruction manual in a rugged carrying case with custom insert. | |
| Accessories | **HI710035** blue protective rubber boot | |

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

- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710035** Blue



pH solutions begin on page 2.144; electrode cleaning solutions begin on page 2.168

FC2023

# pH / Temperature Probe for Food

When measuring pH, food products can pose a number of challenges. Samples can vary in consistency from solid, semi-solid, to a slurry with a high content of solids. These sample types can coat the sensitive glass membrane surface and/or clog the reference junction. Designed specifically for measuring pH in food, the FC2023 has a conic tip shape for easy penetration, an open junction to resist clogging, and a PVDF food grade plastic body that can be cleaned with sodium hypochlorite. The FC2023 is an ideal general purpose pH electrode for use in food manufacturing.

## PVDF body

Polyvinylidene fluoride (PVDF) is a food grade plastic that is resistant to most chemicals and solvents, including sodium hypochlorite. It has high abrasion resistance, mechanical strength, and resistance to ultraviolet and nuclear radiation. PVDF is also resistant to fungal growth.

## Low temperature glass

The FC2023 electrode uses Low Temperature (LT) glass for the sensing bulb. The LT glass tip is a lower resistance glass formulation. As the temperature of the sensing glass decreases, the resistance of the LT glass will increase approaching that of standard glass at ambient temperatures. The FC2023 is suitable to use with samples that measure from 0 to 50°C.

## Open junction reference

Clogging of the reference junction is a common challenge faced by food producers that measure pH in slurries and semi-solid products. The solids can easily clog the ceramic junction used with standard laboratory pH electrodes. The open junction design of the FC2023 resists clogging and continues to provide accurate, stable readings.

## Viscolene electrolyte

The viscolene electrolyte offers a hard gel interface between the inner electrode components and the sample being measured. The electrolyte is silver-free for use in food products and is maintenance-free.

## Conic tip shape

This design allows for penetration into semisolids and emulsions for the direct measurement of pH in a variety of food products including sauces, dough, and other semi-solids.

## Built-in temperature sensor

A thermistor temperature sensor is in the tip of the indicating pH electrode. A temperature sensor should be as close as possible to the indicating pH bulb in order to compensate for variations in temperature.

## Application Importance

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. Foods are generally broken into two groups based on their pH value. These groups include acid foods which have a naturally low pH of 4.6 or below and low-acid foods that have a finished equilibrium pH value greater than pH 4.6 and a water activity greater than 0.85. The low-acid foods can be pH adjusted with the addition of an acid to lower the final pH and become an acidified food.

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. While food safety is a crucial consideration, understanding the pH of a food product can also help to achieve consistent flavors and textures. Through fermentation and other biological processes, many foodstuffs only achieve their desired qualities at particular pH values or ranges. pH is an essential parameter that requires close observation throughout food production to provide the best possible product.

| Specifications | FC2023 |
|---|---|
| Description | pre-amplified pH/ temperature probe |
| Reference | single, Ag/AgCl |
| Junction | open |
| Electrolyte | viscolene |
| Max Pressure | 0.1 bar |
| Range | pH: 0 to 12 |
| Recommended Operating Temperature | 0 to 50°C (32 to 122°F) |
| Glass Type | LT (low temperature) |
| Tip /Shape | conic (dia: 6 x 10 mm) |
| Temperature Sensor | yes |
| Amplifier | yes |
| Body Material | PVDF |
| Cable | coaxial; 1 m (3.3') |
| Connection | quick connect DIN |

HI98162

# pH / Temperature Meter for Milk

HI98162 is a professional portable pH and temperature meter with a probe designed specifically for pH measurement in milk.

- Waterproof
  - IP67 rated waterproof, rugged enclosure
- CAL Check™
  - Alerts users to problems during calibration including dirty/broken electrode, contaminated buffer, and overall probe condition
- Automatic or manual temperature compensation
  - pH sensors incorporate a built-in temperature sensor
- Calibration
  - Up to a five-point calibration with seven standard buffers and five custom buffers
- Approximately 200 hour battery life
  - Powered by four 1.5V AA batteries
- Clear display
  - Dot matrix display with multifunction virtual keys
- Auto hold
  - Automatically holds the first stable reading on the display
- Calibration timeout
  - Alerts when calibration is due at a specified interval
- Connectivity
  - PC connectivity via opto-isolated micro-USB with HI92000 software
- GLP
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- Intuitive keypad
  - Important and often used functions such as GLP information, help, range, calibration, and backlight have a dedicated button
- Supplied complete
  - Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide, and batteries in a rugged, custom carrying case

# Milk pH Meter

## designed for food professionals

Hanna foodcare pH meters are rugged and portable with the performance and features of a benchtop. Eight models are available in this series to measure food, milk, meat, yogurt, cheese, beer, wine, and soil. Each model is supplied with an application specific electrode and cleaning solutions. These waterproof meters comply to IP67 standards and can be easily operated with one hand.


### Backlit Graphic LCD Display

These meters feature a backlit graphic LCD with on-screen help. The graphic display allows for the use of virtual keys to provide for an intuitive user interface.

### Waterproof Protection

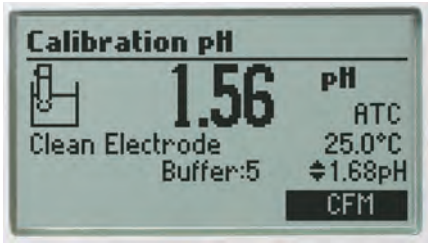
The meter is enclosed in an IP67 rated waterproof casing and can withstand immersion in water at a depth of 1 m for up to 30 minutes.

### Quick Connect Probe

Each meter features an application specific pH/temperature probe with a quick connect DIN connector to make attaching and removing the probe simple and easy.

### Calibration Timeout

Alerts when calibration is due at a specified interval.




### pH Calibration

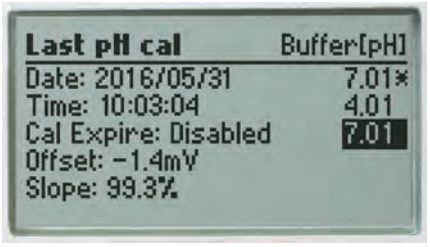
Choose from seven standard pH buffers and five custom values to obtain up to five point calibration and achieve high precision readings with a 0.001 pH resolution and a pH accuracy of ±0.002.

### Enhanced Calibration

An "out of calibration range" warning can be engaged to keep the user informed of the current calibration and help to avoid performing measurements that are out of the bracketed range.


### CAL Check™

Hanna's CAL Check maintains a history of past calibrations and monitors the pH electrode and buffers during subsequent calibrations for any signs of wide variances due to a dirty or broken electrode or contaminated pH buffers. During calibration, users are alerted to problems should they occur. After calibration, the electrode's overall condition is displayed as a percentage.




### GLP

Comprehensive GLP functions are directly accessible by pressing the GLP key. Calibration data including date, time, and calibration values are stored with logged data for retrieval at a later time.


### Data Logging

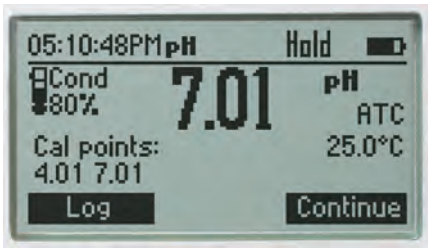
The log-on-demand feature allows users to store up to 200 samples that can later be transferred to a PC with the HI920015 USB cable and HI92000 software.

### Automatic Temperature Compensation

pH sensors incorporate a built-in temperature sensor in the tip of the electrode for a fast and accurate temperature compensated value.

### Intuitive Keypad

The fitted rubber keypad has dedicated keys for many important and often used functions. These meters also feature two virtual soft keys that navigate the user through setup and logging of data. The interface is intuitive for any user's level of experience.




## Auto Hold

Pressing AutoEnd during measurement will automatically hold the first stable reading on the display.


## Dedicated Help Key

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.


## Setup Screen

Our extensive setup screen features a host of configurable options such as time, date, temperature units, and language for help screens and guides.

## PC Connectivity

Logged data can be transferred to a Windows compatible PC with the included HI920015 micro USB cable and HI92000 software.

## Long Battery Life

The display of the meter has a battery icon indicator to show the remaining power. The meter uses four 1.5V AA batteries that provide up to 200 hours of battery life.

## Supplied Complete in a Rugged Custom Carrying Case

Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide, and batteries in a rugged, custom carrying case. The inside compartment of the carrying case is thermoformed to securely hold and protect all of the components.

| Specifications | | HI98162 |
|---|---|---|
| pH* | Range | -2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH |
| | Resolution | 0.1 pH; 0.01 pH; 0.001 pH |
| | Accuracy | ±0.1 pH; ±0.01 pH; ±0.002 pH |
| | Calibration | up to five-point calibration, seven standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and five custom buffers |
| | Temperature Compensation | automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F) |
| mV | Range | ±2000 mV |
| | Resolution | 0.1 mV |
| | Accuracy | ±0.2 mV |
| | Relative mV Offset Range | ±2000 mV |
| Temperature* | Range | -20.0 to 120.0 °C (-4.0 to 248.0°F) |
| | Resolution | 0.1°C (0.1°F) |
| | Accuracy | ±0.4°C (±0.8°F) (excluding probe error) |
| Additional Specifications | pH Probe | FC1013 PVDF body, pH electrode with internal temperature sensor, quick DIN connector and 1 m (3.3' cable) |
| | Slope Calibration | from 80 to 110% |
| | Log-on-demand | Up to 200 samples (100 pH, 100 mV) |
| | PC Connection | opto-isolated USB with HI92000 software and micro USB cable |
| | Input Impedance | $10^{12}$ Ω |
| | Battery Type / Life | 1.5V AA batteries (4) / approximately 200 hours of continuous use without backlight (50 hours with backlight) |
| | Auto-off | user selectable: 5, 10, 30, 60 min, disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH 100% IP67 |
| | Dimensions / Weight | 185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.) |
| Ordering Information | **HI98162** is supplied with FC1013 pH electrode, HI7004M pH 4.01 buffer solution (230 mL), HI7007M pH 7.01 buffer solution (230 mL), HI700640 electrode cleaning solution sachet for milk deposits (2), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), quality certificate, and instruction manual in a rugged carrying case with custom insert. | |
| Accessories | **HI710035** blue protective rubber boot | |

- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710035** Blue

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


pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168

FC1013

# pH / Temperature Probe for Milk

The FC1013 pH electrode has a built-in temperature sensor for simultaneous temperature compensated pH and temperature readings, and also contains a pH sensor preamplifier to provide measurements impervious to noise and electrical interferences.

FC1013 electrode is designed to prevent the typical problems of clogging in viscous and proteinaceous liquids ensuring a fast response and stable reading.

## PVDF body

The FC1013 is composed of food grade PVDF plastic. This material is highly durable and chemically resistant.

## General purpose glass

The FC1013 uses general purpose (GP) glass. The formulation allows for fast response over a wide range of temperatures. The FC1013 is suitable to use with samples that measure from 0 to 80°C.

## Refillable electrolyte

The silver-free electrolyte ensures no silver precipitate can clog the junction. An easy to use fill cap allows for quick refilling of electrolyte solution to maintain adequate head pressure.

## Single ceramic junction

A porous ceramic frit allows the silver-free electrolyte to flow slowly into solution, providing accurate readings for aqueous samples.

## Spheric tip shape

The shape of the sensing membrane provides a large surface area for contact with milk samples. The highly durable construction provides accurate measurements on the dairy farm as well as the production facility.

## Built-in temperature sensor

A thermistor temperature sensor is in the tip of the indicating pH bulb. A temperature sensor should be as close as possible to the indicating pH electrode in order to compensate for variations in temperature.

| Specifications | FC1013 |
|---|---|
| Description | pre-amplified pH/ temperature probe |
| Reference | double, Ag/AgCl |
| Junction | ceramic, single |
| Electrolyte | KCl 3.5M |
| Max Pressure | 0.1 bar |
| Range | pH: 0 to 13 |
| Recommended Operating Temperature | 0 to 80°C (32 to 176°F) |
| Glass Type | GP (general purpose) |
| Tip /Shape | spheric (dia: 7.5 mm) |
| Temperature Sensor | yes |
| Amplifier | yes |
| Body Material | PVDF |
| Cable | coaxial; 1 m (3.3') |
| Connection | quick connect DIN |

# Application Importance

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.

HI98163

# pH / Temperature Meter for Meat

HI98163 is a professional portable pH and temperature meter with a probe designed specifically for pH measurement in meat.

- Waterproof
  - IP67 rated waterproof, rugged enclosure
- CAL Check™
  - Alerts users to problems during calibration including dirty/broken electrode, contaminated buffer, and overall probe condition
- Automatic or manual temperature compensation
  - pH sensors incorporate a built-in temperature sensor
- Calibration
  - Up to a five-point calibration with seven standard buffers and five custom buffers
- Approximately 200 hour battery life
  - Powered by four 1.5V AA batteries
- Clear display
  - Dot matrix display with multifunction virtual keys
- Auto hold
  - Automatically holds the first stable reading on the display
- Calibration timeout
  - Alerts when calibration is due at a specified interval
- Connectivity
  - PC connectivity via opto-isolated micro-USB with HI92000 software
- GLP
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- Intuitive keypad
  - Important and often used functions such as GLP information, help, range, calibration, and backlight have a dedicated button
- Supplied complete
  - Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide, and batteries in a rugged, custom carrying case

# Meat pH Meter

## designed for food professionals

Hanna foodcare pH meters are rugged and portable with the performance and features of a benchtop. Eight models are available in this series to measure food, milk, meat, yogurt, cheese, beer, wine, and soil. Each model is supplied with an application specific electrode and cleaning solutions. These waterproof meters comply to IP67 standards and can be easily operated with one hand.


### Backlit Graphic LCD Display

These meters feature a backlit graphic LCD with on-screen help. The graphic display allows for the use of virtual keys to provide for an intuitive user interface.

### Waterproof Protection

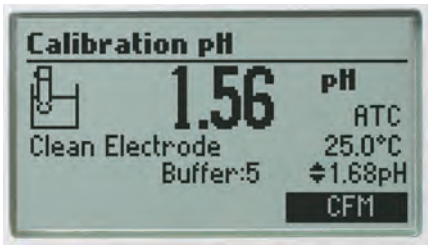
The meter is enclosed in an IP67 rated waterproof casing and can withstand immersion in water at a depth of 1 m for up to 30 minutes.

### Quick Connect Probe

Each meter features an application specific pH/temperature probe with a quick connect DIN connector to make attaching and removing the probe simple and easy.

### Calibration Timeout

Alerts when calibration is due at a specified interval.




### pH Calibration

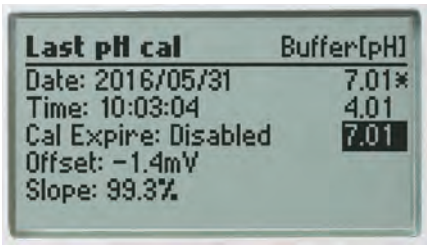
Choose from seven standard pH buffers and five custom values to obtain up to five point calibration and achieve high precision readings with a 0.001 pH resolution and a pH accuracy of ±0.002.

### Enhanced Calibration

An "out of calibration range" warning can be engaged to keep the user informed of the current calibration and help to avoid performing measurements that are out of the bracketed range.


### CAL Check™

Hanna's CAL Check maintains a history of past calibrations and monitors the pH electrode and buffers during subsequent calibrations for any signs of wide variances due to a dirty or broken electrode or contaminated pH buffers. During calibration, users are alerted to problems should they occur. After calibration, the electrode's overall condition is displayed as a percentage.




### GLP

Comprehensive GLP functions are directly accessible by pressing the GLP key. Calibration data including date, time, and calibration values are stored with logged data for retrieval at a later time.


### Data Logging

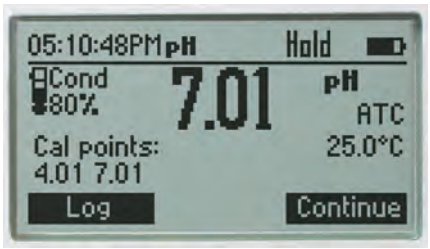
The log-on-demand feature allows users to store up to 200 samples that can later be transferred to a PC with the HI920015 USB cable and HI92000 software.

### Automatic Temperature Compensation

pH sensors incorporate a built-in temperature sensor in the tip of the electrode for a fast and accurate temperature compensated value.

### Intuitive Keypad

The fitted rubber keypad has dedicated keys for many important and often used functions. These meters also feature two virtual soft keys that navigate the user through setup and logging of data. The interface is intuitive for any user's level of experience.




## Auto Hold

Pressing AutoEnd during measurement will automatically hold the first stable reading on the display.


## Dedicated Help Key

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.


## Setup Screen

Our extensive setup screen features a host of configurable options such as time, date, temperature unit, and language for help screens and guides.

## PC Connectivity

Logged data can be transferred to a Windows compatible PC with the included HI920015 micro USB cable and HI92000 software.

## Long Battery Life

The display of the meter has a battery icon indicator to show the remaining power. The meter uses four 1.5V AA batteries that provide up to 200 hours of battery life.

## Supplied Complete in a Rugged Custom Carrying Case

Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide, and batteries in a rugged, custom carrying case. The inside compartment of the carrying case is thermoformed to securely hold and protect all of the components.

| Specifications | | HI98163 |
|---|---|---|
| pH* | Range | -2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH |
| | Resolution | 0.1 pH; 0.01 pH; 0.001 pH |
| | Accuracy | ±0.1 pH; ±0.01 pH; ±0.002 pH |
| | Calibration | up to five-point calibration, seven standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and five custom buffers |
| | Temperature Compensation | automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F) |
| mV | Range | ±2000 mV |
| | Resolution | 0.1 mV |
| | Accuracy | ±0.2 mV |
| | Relative mV Offset Range | ±2000 mV |
| Temperature* | Range | -20.0 to 120.0 °C (-4.0 to 248.0°F) |
| | Resolution | 0.1°C (0.1°F) |
| | Accuracy | ±0.4°C (±0.8°F) (excluding probe error) |
| Additional Specifications | pH Probe | FC2323 PVDF body, pH electrode with internal temperature sensor, quick DIN connector and 1 m (3.3' cable) |
| | Slope Calibration | from 80 to 110% |
| | Log-on-demand | Up to 200 samples (100 pH, 100 mV) |
| | PC Connection | opto-isolated USB with HI92000 software and micro USB cable |
| | Input Impedance | $10^{12}$ Ω |
| | Battery Type / Life | 1.5V AA batteries (4) / approximately 200 hours of continuous use without backlight (50 hours with backlight) |
| | Auto-off | user selectable: 5, 10, 30, 60 min, disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH 100% IP67 |
| | Dimensions / Weight | 185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.) |
| Ordering Information | **HI98163** is supplied with FC2323 pH electrode, FC099 meat piercing stainless steel blade, HI7004M pH 4.01 buffer solution (230 mL), HI7007M pH 7.01 buffer solution (230 mL), HI700630 electrode acid cleaning solution sachet for meat grease and fat deposits (2), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), quality certificate, and instruction manual in a rugged carrying case with custom insert. | |
| Accessories | **HI710035** blue protective rubber boot | |

- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

  **HI710035** Blue

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


pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168

FC2323

# pH / Temperature Probe for Meat

The FC2323 probe has been specially designed with a stainless steel blade tip for meat penetration.

## PVDF body

Polyvinylidene fluoride (PVDF) is a food grade plastic that is resistant to most chemicals and solvents, including sodium hypochlorite. It has high abrasion resistance, mechanical strength, and resistance to ultraviolet and nuclear radiation. PVDF is also resistant to fungal growth.

## Viscolene electrolyte

The viscolene electrolyte offers a hard gel interface between the inner electrode components and the sample being measured. The electrolyte is silver-free for use in food products and is maintenance-free.

## Stainless steel piercing blade

The FC099 (35mm; 1.38") stainless steel blade can be attached to the probe for easy meat penetration. Piercing into the meat will allow for the pH glass and reference junction to be in contact with the sample for a direct pH measurement without extensive sample preparation.

## Open junction reference

Clogging of the reference junction is a common challenge faced by food producers that measure pH in semi-solid products such as meat. The solids can easily clog the ceramic junction used with standard laboratory pH electrodes. The open junction design of the FC2323 resists clogging and continues to provide accurate, stable readings.

## Low temperature glass

The FC2323 electrode uses Low Temperature (LT) glass for the sensing bulb. The LT glass tip is a lower resistance glass formulation. As the temperature of the sensing glass decreases, the resistance of the LT glass will increase approaching that of standard glass at ambient temperatures. The FC2023 is suitable to use with samples that measure from 0 to 50°C.

## Built-in temperature sensor

A thermistor temperature sensor is in the tip of the indicating pH electrode. A temperature sensor should be as close as possible to the indicating pH bulb in order to compensate for variations in temperature.

## Conic tip shape

This design along with a piercing blade allows for the easy penetration into semisolids for the direct measurement of pH.

## Application Importance

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.

| Specifications | FC2323 |
|---|---|
| Description | pre-amplified pH/ temperature probe |
| Reference | single, Ag/AgCl |
| Junction | open |
| Electrolyte | viscolene |
| Max Pressure | 0.1 bar |
| Range | pH: 0 to 12 |
| Recommended Operating Temperature | 0 to 50°C (32 to 122°F) |
| Glass Type | LT (low temperature) |
| Tip /Shape | conic (dia: 6 x 10 mm) |
| Temperature Sensor | yes |
| Amplifier | yes |
| Body Material | PVDF |
| Cable | coaxial; 1 m (3.3') |
| Connection | quick connect DIN |

HI98164

# pH / Temperature Meter for Yogurt

HI98164 is a professional portable pH and temperature meter with a probe designed specifically for pH measurement in yogurt.

- Waterproof
  - IP67 rated waterproof, rugged enclosure
- CAL Check™
  - Alerts users to problems during calibration including dirty/broken electrode, contaminated buffer, and overall probe condition
- Automatic or manual temperature compensation
  - pH sensors incorporate a built-in temperature sensor
- Calibration
  - Up to a five-point calibration with seven standard buffers and five custom buffers
- Approximately 200 hour battery life
  - Powered by four 1.5V AA batteries
- Clear display
  - Dot matrix display with multifunction virtual keys
- Auto hold
  - Automatically holds the first stable reading on the display
- Calibration timeout
  - Alerts when calibration is due at a specified interval
- Connectivity
  - PC connectivity via opto-isolated micro-USB with HI92000 software
- GLP
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- Intuitive keypad
  - Important and often used functions such as GLP information, help, range, calibration, and backlight have a dedicated button
- Supplied complete
  - Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide, and batteries in a rugged, custom carrying case

# Yogurt pH Meter

## designed for food professionals

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### Backlit Graphic LCD Display

These meters feature a backlit graphic LCD with on-screen help. The graphic display allows for the use of virtual keys to provide for an intuitive user interface.

### Waterproof Protection

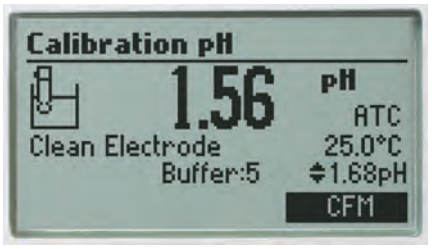
The meter is enclosed in an IP67 rated waterproof casing and can withstand immersion in water at a depth of 1 m for up to 30 minutes.

### Quick Connect Probe

Each meter features an application specific pH/temperature probe with a quick connect DIN connector to make attaching and removing the probe simple and easy.

### Calibration Timeout

Alerts when calibration is due at a specified interval.




### pH Calibration

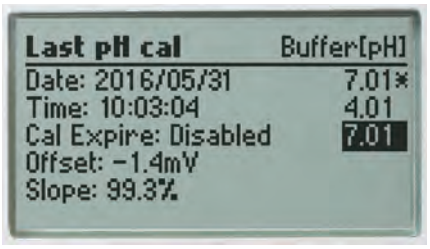
Choose from seven standard pH buffers and five custom values to obtain up to five point calibration and achieve high precision readings with a 0.001 pH resolution and a pH accuracy of ±0.002.

### Enhanced Calibration

An "out of calibration range" warning can be engaged to keep the user informed of the current calibration and help to avoid performing measurements that are out of the bracketed range.


### CAL Check™

Hanna's CAL Check maintains a history of past calibrations and monitors the pH electrode and buffers during subsequent calibrations for any signs of wide variances due to a dirty or broken electrode or contaminated pH buffers. During calibration, users are alerted to problems should they occur. After calibration, the electrode's overall condition is displayed as a percentage.




### GLP

Comprehensive GLP functions are directly accessible by pressing the GLP key. Calibration data, including date, time, and calibration values are stored with logged data for retrieval at a later time.


### Data Logging

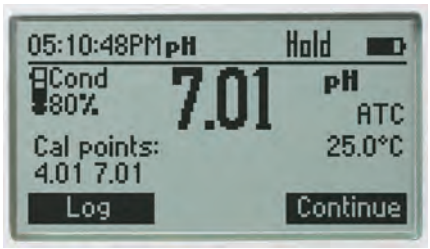
The log-on-demand feature allows users to store up to 200 samples that can later be transferred to a PC with the HI920015 USB cable and HI92000 software.

### Automatic Temperature Compensation

pH sensors incorporate a built-in temperature sensor in the tip of the electrode for a fast and accurate temperature compensated value.

### Intuitive Keypad

The fitted rubber keypad has dedicated keys for many important and often used functions. These meters also feature two virtual soft keys that navigate the user through setup and logging of data. The interface is intuitive for any user's level of experience.




## Auto Hold

Pressing AutoEnd during measurement will automatically hold the first stable reading on the display.


## Dedicated Help Key

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.


## Setup Screen

Our extensive setup screen features a host of configurable options such as time, date, temperature units, and language for help screens and guides.

## PC Connectivity

Logged data can be transferred to a Windows compatible PC with the included HI920015 micro USB cable and HI92000 software.

## Long Battery Life

The display of the meter has a battery icon indicator to show the remaining power. The meter uses four 1.5V AA batteries that provide up to 200 hours of battery life.

## Supplied Complete in a Rugged Custom Carrying Case

Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide, and batteries in a rugged, custom carrying case. The inside compartment of the carrying case is thermoformed to securely hold and protect all of the components.

| Specifications | | HI98164 |
|---|---|---|
| pH* | Range | -2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH |
| | Resolution | 0.1 pH; 0.01 pH; 0.001 pH |
| | Accuracy | ±0.1 pH; ±0.01 pH; ±0.002 pH |
| | Calibration | up to five-point calibration, seven standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and five custom buffers |
| | Temperature Compensation | automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F) |
| mV | Range | ±2000 mV |
| | Resolution | 0.1 mV |
| | Accuracy | ±0.2 mV |
| | Relative mV Offset Range | ±2000 mV |
| Temperature* | Range | -20.0 to 120.0 °C (-4.0 to 248.0°F) |
| | Resolution | 0.1°C (0.1°F) |
| | Accuracy | ±0.4°C (±0.8°F) (excluding probe error) |
| Additional Specifications | pH Probe | FC2133 glass body, pH electrode with internal temperature sensor, quick DIN connector and 1 m (3.3' cable) |
| | Slope Calibration | from 80 to 110% |
| | Log-on-demand | Up to 200 samples (100 pH, 100 mV) |
| | PC Connection | opto-isolated USB with HI92000 software and micro USB cable |
| | Input Impedance | $10^{12}$ Ω |
| | Battery Type / Life | 1.5V AA batteries (4) / approximately 200 hours of continuous use without backlight (50 hours with backlight) |
| | Auto-off | user selectable: 5, 10, 30, 60 min, disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH 100% IP67 |
| | Dimensions / Weight | 185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.) |
| Ordering Information | **HI98164** is supplied with FC2133 pH electrode, HI7004M pH 4.01 buffer solution (230 mL), HI7007M pH 7.01 buffer solution (230 mL), HI700643 electrode cleaning and disinfection solution sachet for yogurt products (2), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), quality certificate, and instruction manual in a rugged carrying case with custom insert. | |
| Accessories | **HI710035** blue protective rubber boot | |

- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710035** Blue

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


pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168

FC2133

# pH / Temperature Probe for Yogurt

The FC2133 pH electrode is rugged and easy to clean with a conical tip and built-in temperature sensor. The open junction design consists of a solid gel interface (viscolene) between the sample and internal Ag/AgCl reference. This interface not only prevents silver from entering the sample, but also makes it impermeable to clogging after measurements in semi-solid or viscous samples. The FC2133 electrode is designed to prevent the typical problems of clogging in viscous liquids, ensuring a fast response and stable reading.

## Glass body

The glass body of the FC2133 allows standards and samples to more quickly reach thermal equilibrium while also providing chemical resistance.

## Low temperature glass

The FC2133 electrode uses Low Temperature (LT) glass for the sensing bulb. The LT glass tip is a lower resistance glass formulation. As the temperature of the sensing glass decreases, the resistance of the LT glass will increase approaching that of standard glass at ambient temperatures. The FC2133 is suitable to use with samples that measure from 0 to 50°C.

## Viscolene electrolyte

The viscolene electrolyte offers a hard gel interface between the inner electrode components and the sample being measured. The electrolyte is silver-free for use in yogurt and is maintenance-free.

## Open junction reference

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 resists clogging and continues to provide accurate, stable readings.

## Conic tip shape

This design allows for penetration into semisolids and emulsions for the direct measurement of pH in yogurt products.

## Built-in temperature sensor

A thermistor temperature sensor is in the tip of the indicating pH electrode. A temperature sensor should be as close as possible to the indicating pH bulb in order to compensate for variations in temperature.

| Specifications | FC2133 |
|---|---|
| Description | pre-amplified pH / temperature probe |
| Reference | double, Ag/AgCl |
| Junction | open |
| Electrolyte | viscolene |
| Max Pressure | 0.1 bar |
| Range | pH: 0 to 12 |
| Recommended Operating Temperature | 0 to 50°C (32 to 122°F) |
| Glass Type | LT (low temperature) |
| Tip /Shape | conic |
| Temperature Sensor | yes |
| Amplifier | yes |
| Body Material | glass |
| Cable | coaxial; 1 m (3.3') |
| Connection | quick connect DIN |

# Application Importance

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.

HI98165

# pH / Temperature Meter for Cheese

HI98165 is a professional portable pH and temperature meter with a probe designed specifically for pH measurement in cheese.

- Waterproof
  - IP67 rated waterproof, rugged enclosure
- CAL Check™
  - Alerts users to problems during calibration including dirty/broken electrode, contaminated buffer, and overall probe condition
- Automatic or manual temperature compensation
  - pH sensors incorporate a built-in temperature sensor
- Calibration
  - Up to a five-point calibration with seven standard buffers and five custom buffers
- Approximately 200 hour battery life
  - Powered by four 1.5V AA batteries
- Clear display
  - Dot matrix display with multifunction virtual keys
- Auto hold
  - Automatically holds the first stable reading on the display
- Calibration timeout
  - Alerts when calibration is due at a specified interval
- Connectivity
  - PC connectivity via opto-isolated micro-USB with HI92000 software
- GLP
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- Intuitive keypad
  - Important and often used functions such as GLP information, help, range, calibration, and backlight have a dedicated button
- Supplied complete
  - Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide, and batteries in a rugged, custom carrying case

# Cheese pH Meter

## designed for food professionals

Hanna foodcare pH meters are rugged and portable with the performance and features of a benchtop. Eight models are available in this series to measure food, milk, meat, yogurt, cheese, beer, wine, and soil. Each model is supplied with an application specific electrode and cleaning solutions. These waterproof meters comply to IP67 standards and can be easily operated with one hand.


### Backlit Graphic LCD Display

These meters feature a backlit graphic LCD with on-screen help. The graphic display allows for the use of virtual keys to provide for an intuitive user interface.

### Waterproof Protection

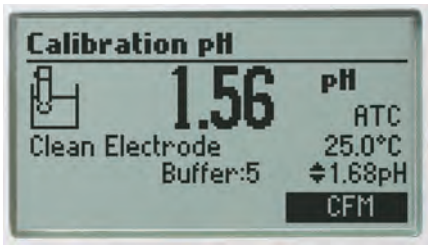
The meter is enclosed in an IP67 rated waterproof casing and can withstand immersion in water at a depth of 1 m for up to 30 minutes.

### Quick Connect Probe

Each meter features an application specific pH/temperature probe with a quick connect DIN connector to make attaching and removing the probe simple and easy.

### Calibration Timeout

Alerts when calibration is due at a specified interval.




### pH Calibration

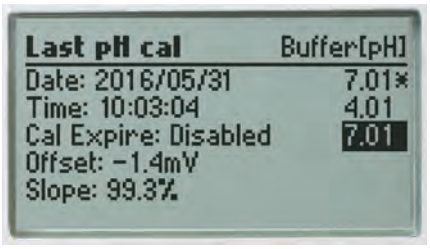
Choose from seven standard pH buffers and five custom values to obtain up to five point calibration and achieve high precision readings with a 0.001 pH resolution and a pH accuracy of ±0.002.

### Enhanced Calibration

An "out of calibration range" warning can be engaged to keep the user informed of the current calibration and help to avoid performing measurements that are out of the bracketed range.


### CAL Check™

Hanna's CAL Check maintains a history of past calibrations and monitors the pH electrode and buffers during subsequent calibrations for any signs of wide variances due to a dirty or broken electrode or contaminated pH buffers. During calibration, users are alerted to problems should they occur. After calibration, the electrode's overall condition is displayed as a percentage.




### GLP

Comprehensive GLP functions are directly accessible by pressing the GLP key. Calibration data, including date, time, and calibration values are stored with logged data for retrieval at a later time.


### Data Logging

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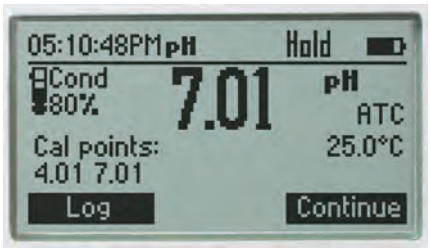
### Automatic Temperature Compensation

pH sensors incorporate a built-in temperature sensor in the tip of the electrode for a fast and accurate temperature compensated value.

### Intuitive Keypad

The fitted rubber keypad has dedicated keys for many important and often used functions. These meters also feature two virtual soft keys that navigate the user through setup and logging of data. The interface is intuitive for any user's level of experience.




## Auto Hold

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## Dedicated Help Key

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.


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## Long Battery Life

The display of the meter has a battery icon indicator to show the remaining power. The meter uses four 1.5V AA batteries that provide up to 200 hours of battery life.

## Supplied Complete in a Rugged Custom Carrying Case

Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide, and batteries in a rugged, custom carrying case. The inside compartment of the carrying case is thermoformed to securely hold and protect all of the components.

| Specifications | | HI98165 |
|---|---|---|
| pH* | Range | -2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH |
| | Resolution | 0.1 pH; 0.01 pH; 0.001 pH |
| | Accuracy | ±0.1 pH; ±0.01 pH; ±0.002 pH |
| | Calibration | up to five-point calibration, seven standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and five custom buffers |
| | Temperature Compensation | automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F) |
| mV | Range | ±2000 mV |
| | Resolution | 0.1 mV |
| | Accuracy | ±0.2 mV |
| | Relative mV Offset Range | ±2000 mV |
| Temperature* | Range | -20.0 to 120.0 °C (-4.0 to 248.0°F) |
| | Resolution | 0.1°C (0.1°F) |
| | Accuracy | ±0.4°C (±0.8°F) (excluding probe error) |
| Additional Specifications | pH Probe | FC2423 pre-amplified pH and temperature probe with titanium sheath, pH electrode with internal temperature sensor, quick DIN connector and 1 m (3.3' cable) |
| | Slope Calibration | from 80 to 110% |
| | Log-on-demand | Up to 200 samples (100 pH, 100 mV) |
| | PC Connection | opto-isolated USB with HI92000 software and micro USB cable |
| | Input Impedance | $10^{12}$ Ω |
| | Battery Type / Life | 1.5V AA batteries (4) / approximately 200 hours of continuous use without backlight (50 hours with backlight) |
| | Auto-off | user selectable: 5, 10, 30, 60 min, disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH 100% IP67 |
| | Dimensions / Weight | 185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.) |
| Ordering Information | **HI98165** is supplied with FC2423 pH electrode, HI7004M pH 4.01 buffer solution (230 mL), HI7007M pH 7.01 buffer solution (230 mL), HI700642 electrode cleaning solution sachet for cheese residues (2), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), quality certificate, and instruction manual in a rugged carrying case with custom insert. | |
| Accessories | **HI710035** blue protective rubber boot | |

- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710035** Blue

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


pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168

FC2423

# pH / Temperature Probe for Cheese

FC2423 electrode has a titanium sheath and conical tip to ensure quick, easy measurements, and fast response. FC2423 pH electrode features a built-in temperature sensor and is ideal for measurements in semi-solid samples such as cheeses.

## Low temperature glass

The FC2423 electrode uses Low Temperature (LT) glass for the sensing bulb. The LT glass tip is a lower resistance glass formulation. As the temperature of the sensing glass decreases, the resistance of the LT glass will increase approaching that of standard glass at ambient temperatures. The FC2423 is suitable to use with samples that measure from 0 to 50°C.

## Titanium body

The titanium body offers durability in the production facility and can withstand chloride concentrations that cause corrosion in other types of alloys.

## Viscolene electrolyte

The viscolene electrolyte offers a hard gel interface between the inner electrode components and the sample being measured. The electrolyte is silver-free for use in cheese products and is maintenance-free.

## Built-in temperature sensor

A thermistor temperature sensor is in the tip of the indicating pH electrode. A temperature sensor should be as close as possible to the indicating pH bulb in order to compensate for variations in temperature.

## Conic tip shape

This design allows for penetration into solids, semi solids, and emulsions for the direct measurement of pH in cheese products.

| Specifications | FC2423 |
|---|---|
| Description | pre-amplified pH / temperature probe |
| Reference | single, Ag/AgCl |
| Junction | open |
| Electrolyte | viscolene |
| Max Pressure | 0.1 bar |
| Range | pH: 0 to 12 |
| Recommended Operating Temperature | 0 to 50°C (32 to 122°F) |
| Glass Type | LT (low temperature) |
| Tip /Shape | conic |
| Temperature Sensor | yes |
| Amplifier | yes |
| Body Material | titanium |
| Cable | coaxial; 1 m (3.3') |
| Connection | quick connect DIN |

# Application Importance

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.

HI98167

# pH / Temperature Meter for Beer

The HI98167 is a rugged, waterproof, portable pH meter that measures pH and temperature during the brewing process. This meter is supplied with a specialized titanium body pH electrode with a built in temperature sensor that is ideal for measuring the pH of mash, cooled wort, and of the finished product.

- Waterproof
  - IP67 rated waterproof, rugged enclosure
- CAL Check™
  - Alerts users to problems during calibration including dirty/broken electrode, contaminated buffer, and overall probe condition
- Automatic or manual temperature compensation
  - pH sensors incorporate a built-in temperature sensor
- Calibration
  - Up to a five-point calibration with seven standard buffers and five custom buffers
- Approximately 200 hour battery life
  - Powered by four 1.5V AA batteries
- Clear display
  - Dot matrix display with multifunction virtual keys
- Auto hold
  - Automatically holds the first stable reading on the display
- Calibration timeout
  - Alerts when calibration is due at a specified interval
- Connectivity
  - PC connectivity via opto-isolated micro-USB with HI92000 software
- GLP
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- Intuitive keypad
  - Important and often used functions such as GLP information, help, range, calibration and backlight have a dedicated button
- Supplied complete
  - Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide, and batteries in a rugged, custom carrying case

# Beer pH Meter

## designed for beer making professionals

Hanna foocare pH meters are rugged and portable with the performance and features of a benchtop. Eight models are available in this series to measure food, milk, meat, yogurt, cheese, beer, wine, and soil. Each model is supplied with an application specific electrode and cleaning solutions. These waterproof meters comply to IP67 standards and can be easily operated with one hand.


### Backlit Graphic LCD Display

These meters feature a backlit graphic LCD with on-screen help. The graphic display allows for the use of virtual keys to provide for an intuitive user interface.

### Waterproof Protection

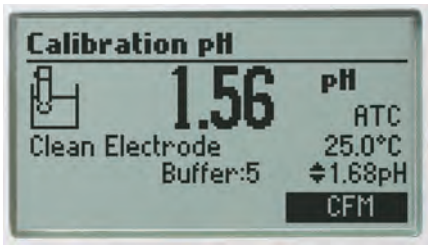
The meter is enclosed in an IP67 rated waterproof casing and can withstand immersion in water at a depth of 1 m for up to 30 minutes.

### Quick Connect Probe

Each meter features an application specific pH/temperature probe with a quick connect DIN connector to make attaching and removing the probe simple and easy.

### Calibration Timeout

Alerts when calibration is due at a specified interval.




### pH Calibration

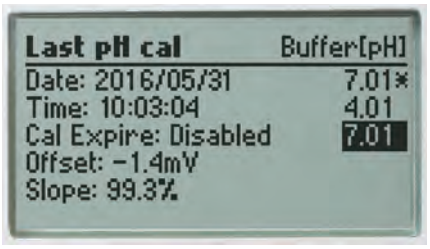
Choose from seven standard pH buffers and five custom values to obtain up to five point calibration and achieve high precision readings with a 0.001 pH resolution and a pH accuracy of ±0.002.

### Enhanced Calibration

An "out of calibration range" warning can be engaged to keep the user informed of the current calibration and help to avoid performing measurements that are out of the bracketed range.


### CAL Check™

Hanna's CAL Check maintains a history of past calibrations and monitors the pH electrode and buffers during subsequent calibrations for any signs of wide variances due to a dirty or broken electrode or contaminated pH buffers. During calibration, users are alerted to problems should they occur. After calibration, the electrode's overall condition is displayed as a percentage.




### GLP

Comprehensive GLP functions are directly accessible by pressing the GLP key. Calibration data, including date, time, and calibration values are stored with logged data for retrieval at a later time.


### Data Logging

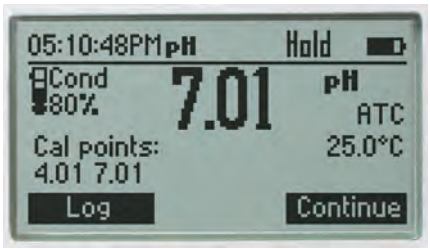
The log-on-demand feature allows users to store up to 200 samples that can later be transferred to a PC with the HI920015 USB cable and HI92000 software.

### Automatic Temperature Compensation

pH sensors incorporate a built-in temperature sensor in the tip of the electrode for a fast and accurate temperature compensated value.

### Intuitive Keypad

The fitted rubber keypad has dedicated keys for many important and often used functions. These meters also feature two virtual soft keys that navigate the user through setup and logging of data. The interface is intuitive for any user's level of experience.




## Auto Hold

Pressing AutoEnd during measurement will automatically hold the first stable reading on the display.


## Dedicated Help Key

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.


## Setup Screen

Our extensive setup screen features a host of configurable options such as time, date, temperature units, and language for help screens and guides.

## PC Connectivity

Logged data can be transferred to a Windows compatible PC with the included HI920015 micro USB cable and HI92000 software.

## Long Battery Life

The display of the meter has a battery icon indicator to show the remaining power. The meter uses four 1.5V AA batteries that provide up to 200 hours of battery life.

## Supplied Complete in a Rugged Custom Carrying Case

Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide, and batteries in a rugged, custom carrying case. The inside compartment of the carrying case is thermoformed to securely hold and protect all of the components.

| Specifications | | HI98167 |
|---|---|---|
| pH* | Range | -2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH |
| | Resolution | 0.1 pH; 0.01 pH; 0.001 pH |
| | Accuracy | ±0.1 pH; ±0.01 pH; ±0.002 pH |
| | Calibration | up to five-point calibration, seven standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and five custom buffers |
| | Temperature Compensation | automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F) |
| mV | Range | ±2000 mV |
| | Resolution | 0.1 mV |
| | Accuracy | ±0.2 mV |
| | Relative mV Offset Range | ±2000 mV |
| Temperature* | Range | -20.0 to 120.0 °C (-4.0 to 248.0°F) |
| | Resolution | 0.1°C (0.1°F) |
| | Accuracy | ±0.4°C (±0.8°F) (excluding probe error) |
| Additional Specifications | pH Probe | FC2143 Titanium body, flat tip, preamplified pH electrode with internal temperature sensor, quick DIN connector and 1 m (3.3' cable) |
| | Slope Calibration | from 80 to 110% |
| | Log-on-demand | Up to 200 samples (100 pH, 100 mV) |
| | PC Connection | opto-isolated USB with HI92000 software and micro USB cable |
| | Input Impedance | $10^{12}$ Ω |
| | Battery Type / Life | 1.5V AA batteries (4) / approximately 200 hours of continuous use without backlight (50 hours with backlight) |
| | Auto-off | user selectable: 5, 10, 30, 60 min, disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH 100% IP67 |
| | Dimensions / Weight | 185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.) |
| Ordering Information | **HI98167** is supplied with FC2143 pH electrode, HI7004M pH 4.01 buffer solution (230 mL), HI7007M pH 7.01 buffer solution (230 mL), HI700682 Electrode cleaning solution sachets for brewing deposits (2), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), instruction manual, and quality certificate in a HI720161 hard carrying case with custom insert. | |
| Accessories | **HI710035** blue protective rubber boot | |

- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710035** Blue

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


pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168

FC2143

# pH / Temperature Probe for Beer

The FC2143 pH electrode is a flat tip pH sensor made with specialized glass to provide a long life when measuring temperatures up to 80°C. A built in temperature sensor compensates for temperature variations. The probe has a built in amplifier and a titanium body that acts as a matching pin to reduce noise as a result from the effect that humidity has on probe connection to the meter. The FC2143 connects to the HI98167 with a quick-connect, waterproof DIN connector, allowing for a secure, non-threaded attachment.

## Titanium Body

A pH measurement is a very sensitive voltage measurement that is susceptible to interference. To reduce this susceptibility the titanium body serves as a matching pin. A matching pin is a differential measurement technique used to eliminate electrical noise in the measurement system.

## Flat Tip pH Sensor

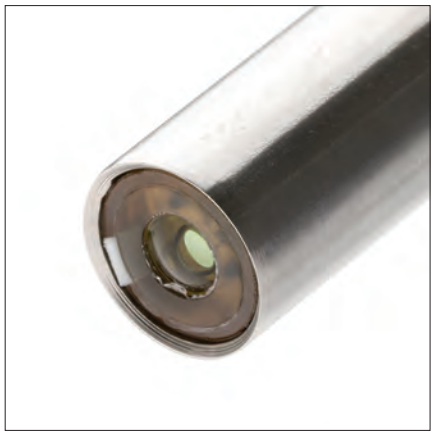
The flat tip sensor allows for easy cleaning of the pH sensing surface as solids from mash and cooled wort collect on the surface.

## Quick Connect DIN Connector

This secure waterproof connector allows for a single cable to be used for both pH and temperature measurements.

## Application Importance

The measurement of pH during the beer making process is important due to the effect it has on enzymatic activity in the mash, yeast activity in fermentation, and the incorporation of flavoring components. Monitoring and controlling the pH allows for a consistent flavor profile and ensures a stable product. The brewer is faced with a number of challenges when measuring pH. The mash has a high content of semi-solids and sugars are formed from the conversion of starch by enzymatic activity. Both can pose problems, including coating the glass and clogging the junction. The mash and cooled wort after boiling are typically above room temperature, which leads to the degradation of the sensitive glass. To overcome these challenges the HI98167 beer pH meter is supplied with a uniquely design titanium body pH electrode.



| Specifications | FC2143 |
|---|---|
| Description | pH electrode |
| Reference | single, Ag/AgCl |
| Junction | cloth |
| Electrolyte | gel |
| Max Pressure | 3 bar |
| Range | pH: 0 to 12 |
| Recommended Operating Temperature | 0 to 80°C (32 to 176°F) |
| Glass Type | LT (low temperature) |
| Tip /Shape | flat |
| Temperature Sensor | yes |
| Amplifier | yes |
| Body Material | titanium with HT glass sensor |
| Cable | coaxial; 1 m (3.3') |
| Connection | quick connect DIN |

HI98169

# pH / Temperature Meter for Wine

HI98169 is a rugged, waterproof, portable pH meter that measures pH and temperature of must in winemaking. This meter is supplied with a specialized pH probe that features an open junction with Clogging Prevention System (CPS™) technology.

- Waterproof
  - IP67 rated waterproof, rugged enclosure
- CAL Check™
  - Alerts users to problems during calibration including dirty/broken electrode, contaminated buffer and overall probe condition
- Automatic or manual temperature compensation
  - pH sensors incorporate a built-in temperature sensor
- Calibration
  - Up to a five-point calibration with seven standard buffers and five custom buffers
- Approximately 200 hour battery life
  - Powered by four 1.5V AA batteries
- Clear display
  - Dot matrix display with multifunction virtual keys
- Auto hold
  - Automatically holds the first stable reading on the display
- Calibration timeout
  - Alerts when calibration is due at a specified interval
- Connectivity
  - PC connectivity via opto-isolated micro-USB with HI92000 software
- GLP
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- Intuitive keypad
  - Important and often used functions such as GLP information, help, range, calibration and backlight have a dedicated button
- Supplied complete
  - Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide, and batteries in a rugged, custom carrying case

# Wine pH Meter

## designed for wine making professionals

Hanna foodcare pH meters are rugged and portable with the performance and features of a benchtop. Eight models are available in this series to measure food, milk, meat, yogurt, cheese, beer, wine, and soil. Each model is supplied with an application specific electrode and cleaning solutions. These waterproof meters comply to IP67 standards and can be easily operated with one hand.


### Backlit Graphic LCD Display

These meters feature a backlit graphic LCD with on-screen help. The graphic display allows for the use of virtual keys to provide for an intuitive user interface.

### Waterproof Protection

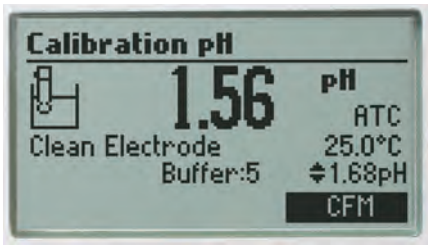
The meter is enclosed in an IP67 rated waterproof casing and can withstand immersion in water at a depth of 1 m for up to 30 minutes.

### Quick Connect Probe

Each meter features an application specific pH/temperature probe with a quick connect DIN connector to make attaching and removing the probe simple and easy.

### Calibration Timeout

Alerts when calibration is due at a specified interval.




### pH Calibration

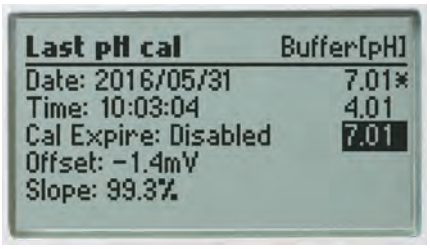
Choose from seven standard pH buffers and five custom values to obtain up to five point calibration and achieve high precision readings with a 0.001 pH resolution and a pH accuracy of ±0.002.

### Enhanced Calibration

An "out of calibration range" warning can be engaged to keep the user informed of the current calibration and help to avoid performing measurements that are out of the bracketed range.


### CAL Check™

Hanna's CAL Check maintains a history of past calibrations and monitors the pH electrode and buffers during subsequent calibrations for any signs of wide variances due to a dirty or broken electrode or contaminated pH buffers. During calibration, users are alerted to problems should they occur. After calibration, the electrode's overall condition is displayed as a percentage.




### GLP

Comprehensive GLP functions are directly accessible by pressing the GLP key. Calibration data, including date, time, and calibration values are stored with logged data for retrieval at a later time.


### Data Logging

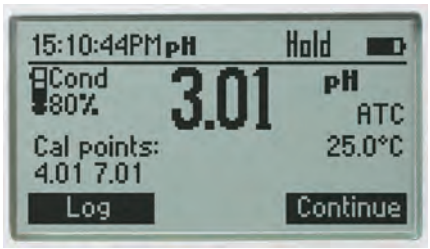
The log-on-demand feature allows users to store up to 200 samples that can later be transferred to a PC with the HI920015 USB cable and HI92000 software.

### Automatic Temperature Compensation

pH sensors incorporate a built-in temperature sensor in the tip of the electrode for a fast and accurate temperature compensated value.

### Intuitive Keypad

The fitted rubber keypad has dedicated keys for many important and often used functions. These meters also feature two virtual soft keys that navigate the user through setup and logging of data. The interface is intuitive for any user's level of experience.




## Auto Hold

Pressing AutoEnd during measurement will automatically hold the first stable reading on the display.


## Dedicated Help Key

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.


## Setup Screen

Our extensive setup screen features a host of configurable options such as time, date, temperature units, and language for help screens and guides.

## PC Connectivity

Logged data can be transferred to a Windows compatible PC with the included HI920015 micro USB cable and HI92000 software.

## Long Battery Life

The display of the meter has a battery icon indicator to show the remaining power. The meter uses four 1.5V AA batteries that provide up to 200 hours of battery life.

## Supplied Complete in a Rugged Custom Carrying Case

Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide, and batteries in a rugged, custom carrying case. The inside compartment of the carrying case is thermoformed to securely hold and protect all of the components.

| Specifications | | HI98169 |
|---|---|---|
| pH* | Range | -2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH |
| | Resolution | 0.1 pH; 0.01 pH; 0.001 pH |
| | Accuracy | ±0.1 pH; ±0.01 pH; ±0.002 pH |
| | Calibration | up to five-point calibration, seven standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and five custom buffers |
| | Temperature Compensation | automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F) |
| mV | Range | ±2000 mV |
| | Resolution | 0.1 mV |
| | Accuracy | ±0.2 mV |
| | Relative mV Offset Range | ±2000 mV |
| Temperature* | Range | -20.0 to 120.0 °C (-4.0 to 248.0°F) |
| | Resolution | 0.1°C (0.1°F) |
| | Accuracy | ±0.4°C (±0.8°F) (excluding probe error) |
| Additional Specifications | pH Probe | FC10483 preamplified pH and temperature probe with flat tip, DIN connector and 1 m (3.3') cable |
| | Slope Calibration | from 80 to 110% |
| | Log-on-demand | Up to 200 samples (100 pH, 100 mV) |
| | PC Connection | opto-isolated USB with HI92000 software and micro USB cable |
| | Input Impedance | $10^{12}$ Ω |
| | Battery Type / Life | 1.5V AA batteries (4) / approximately 200 hours of continuous use without backlight (50 hours with backlight) |
| | Auto-off | user selectable: 5, 10, 30, 60 min, disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH 100% IP67 |
| | Dimensions / Weight | 185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.) |
| Ordering Information | **HI98169** is supplied with FC10483 pH electrode, pH 3.00 buffer solution sachets (2), pH 7.01 buffer solution sachets (2), HI700635 Cleaning solution for wine deposits sachet, HI700636 cleaning solution for wine stains sachet, 100 mL plastic beaker (2), HI920015 micro USB cable, 1.5V AA batteries (4), instruction manual, guidebook for winemakers, and quality certificate in a HI720169 hard carrying case with custom insert. | |
| Accessories | **HI710035** blue protective rubber boot | |


pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168

# FC10483 pH electrode

- PE sleeve
- Refillable pH electrode
- Clogging prevention system (CPS™)

The HI98169 portable pH meter for wine uses the glass body FC10483 pH electrode with Hanna's unique Clogging Prevention System (CPS™). This electrode provides a fast stable response and resists clogging. The electrolyte solution in the electrode is refillable.

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; however, the CPS™ (Clogging Prevention System) is an innovation in electrode technology. Conventional pH electrodes use ceramic junctions that clog quickly when used in wine. When the junction is clogged, the electrode does not function. CPS™ technology utilizes the porousness of ground glass coupled with a PE sleeve to prevent clogging of the junction. The ground glass allows proper flow of the liquid, while the PE sleeve repels dirt. As a result, pH electrodes with CPS™ stay fresh up to 20 times longer than conventional electrodes.

To optimize the flow from the electrode the refill cap should be unscrewed so that it is open. This allows for positive head pressure to be created allowing for the electrolyte to drain more easily from the reference electrode.

## 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 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.

| Specifications | FC10483 |
|---|---|
| Description | pH electrode |
| Reference | double, Ag/AgCl |
| Junction | CPS™ |
| Electrolyte | KCl 3.5M |
| Max Pressure | 0.1 bar |
| Range | pH: 0 to 12 |
| Recommended Operating Temperature | -5 to 60°C (23 to 140°F) |
| Glass Type | LT (low temperature) |
| Tip /Shape | Dome (dia: 8 mm) |
| Temperature Sensor | yes |
| Amplifier | yes |
| Body Material | glass |
| Cable | coaxial; 1 m (3.3') |
| Connection | quick connect DIN |

GroLine

HI98168

# pH / Temperature Meter for Soil

The HI98168 is a rugged, waterproof, portable pH meter that allows for the direct measure of soil pH. This meter is supplied with a specialized pH electrode that has a rugged conical tip for insertion in soil.

- Waterproof
  - IP67 rated waterproof, rugged enclosure
- CAL Check™
  - Alerts users to problems during calibration including dirty/broken electrode, contaminated buffer, and overall probe condition
- Automatic or manual temperature compensation
  - pH sensors incorporate a built-in temperature sensor
- Calibration
  - Up to a five-point calibration with seven standard buffers and five custom buffers
- Approximately 200 hour battery life
  - Powered by four 1.5V AA batteries
- Clear display
  - Dot matrix display with multifunction virtual keys
- Auto hold
  - Automatically holds the first stable reading on the display
- Calibration timeout
  - Alerts when calibration is due at a specified interval
- Connectivity
  - PC connectivity via opto-isolated micro-USB with HI92000 software
- GLP
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- Intuitive keypad
  - Important and often used functions such as GLP information, help, range, calibration, and backlight have a dedicated button
- Supplied complete
  - Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide, and batteries in a rugged, custom carrying case

# Soil pH Meter

## designed for agriculture professionals

Hanna 98 series quality pH meters are rugged and portable with the performance and features of a benchtop. Seven models are available in this series to measure food, milk, meat, yogurt, cheese, beer, wine, and soil. Each model is supplied with an application specific electrode and cleaning solutions. These waterproof meters comply to IP67 standards and can be easily operated with one hand.


### Backlit Graphic LCD Display

These meters feature a backlit graphic LCD with on-screen help. The graphic display allows for the use of virtual keys to provide for an intuitive user interface.

### Waterproof Protection

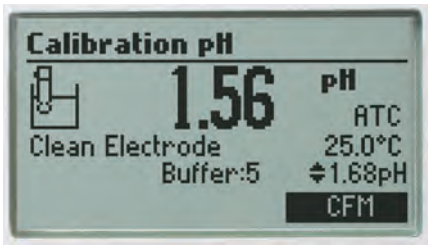
The meter is enclosed in an IP67 rated waterproof casing and can withstand immersion in water at a depth of 1 m for up to 30 minutes.

### Quick Connect Probe

Each meter features an application specific pH/temperature probe with a quick connect DIN connector to make attaching and removing the probe simple and easy.

### Calibration Timeout

Alerts when calibration is due at a specified interval.




### pH Calibration

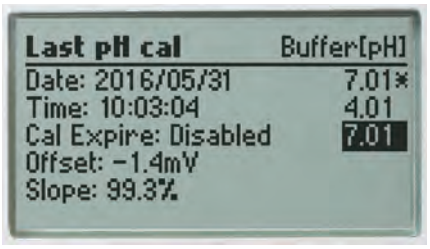
Choose from seven standard pH buffers and five custom values to obtain up to five point calibration and achieve high precision readings with a 0.001 pH resolution and a pH accuracy of ±0.002.

### Enhanced Calibration

An "out of calibration range" warning can be engaged to keep the user informed of the current calibration and help to avoid performing measurements that are out of the bracketed range.


### CAL Check™

Hanna's CAL Check maintains a history of past calibrations and monitors the pH electrode and buffers during subsequent calibrations for any signs of wide variances due to a dirty or broken electrode or contaminated pH buffers. During calibration, users are alerted to problems should they occur. After calibration, the electrode's overall condition is displayed as a percentage.




### GLP

Comprehensive GLP functions are directly accessible by pressing the GLP key. Calibration data, including date, time, and calibration values are stored with logged data for retrieval at a later time.


### Data Logging

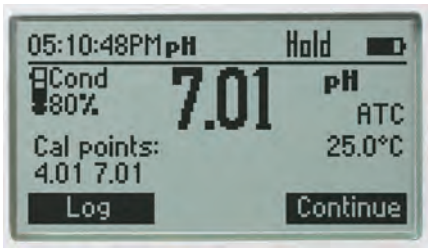
The log-on-demand feature allows users to store up to 200 samples that can later be transferred to a PC with the HI920015 USB cable and HI92000 software.

### Automatic Temperature Compensation

pH sensors incorporate a built-in temperature sensor in the tip of the electrode for a fast and accurate temperature compensated value.

### Intuitive Keypad

The fitted rubber keypad has dedicated keys for many important and often used functions. These meters also feature two virtual soft keys that navigate the user through setup and logging of data. The interface is intuitive for any user's level of experience.




## Auto Hold

Pressing AutoEnd during measurement will automatically hold the first stable reading on the display.


## Dedicated Help Key

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.


## Setup Screen

Our extensive setup screen features a host of configurable options such as time, date, temperature units and language for help screens and guides.

## PC Connectivity

Logged data can be transferred to a Windows compatible PC with the included HI920015 micro USB cable and HI92000 software.

## Long Battery Life

The display of the meter has a battery icon indicator to show the remaining power. The meter uses four 1.5V AA batteries that provide up to 200 hours of battery life.

## Supplied Complete in a Rugged Custom Carrying Case

Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide and batteries in a rugged, custom carrying case. The inside compartment of the carrying case is thermoformed to securely hold and protect all of the components.

| Specifications | | HI98168 |
|---|---|---|
| pH* | Range | -2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH |
| | Resolution | 0.1 pH; 0.01 pH; 0.001 pH |
| | Accuracy | ±0.1 pH; ±0.01 pH; ±0.002 pH |
| | Calibration | up to five-point calibration, seven standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and five custom buffers |
| | Temperature Compensation | automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F) |
| mV | Range | ±2000 mV |
| | Resolution | 0.1 mV |
| | Accuracy | ±0.2 mV |
| | Relative mV Offset Range | ±2000 mV |
| Temperature* | Range | -20.0 to 120.0 °C (-4.0 to 248.0°F) |
| | Resolution | 0.1°C (0.1°F) |
| | Accuracy | ±0.4°C (±0.8°F) (excluding probe error) |
| Additional Specifications | pH Probe | HI12923 Glass body, conical tip, refillable pH electrode with internal temperature sensor, quick DIN connector and 1 m (3.3' cable) |
| | Slope Calibration | from 80 to 110% |
| | Log-on-demand | Up to 200 samples (100 pH, 100 mV) |
| | PC Connection | opto-isolated USB with HI92000 software and micro USB cable |
| | Input Impedance | $10^{12}$ Ω |
| | Battery Type / Life | 1.5V AA batteries (4) / approximately 200 hours of continuous use without backlight (50 hours with backlight) |
| | Auto-off | user selectable: 5, 10, 30, 60 min, disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH 100% IP67 |
| | Dimensions / Weight | 185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.) |
| Ordering Information | **HI98168** is supplied with HI12923 pH electrode, HI721319 ground auger, HI7004M pH 4.01 buffer solution (230 mL), HI7007M pH 7.01 buffer solution (230 mL), HI700663 Cleaning solution sachet for soil deposits, HI700664 Cleaning solution for humus deposits, HI7051M Soil Test Solution (230 mL), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), instruction manual, and quality certificate in a HI720161 hard carrying case with custom insert. | |

- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710035** Blue


pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168

HI12923

# pH / Temperature Probe for Soil

The HI12923 pH electrode that is supplied with the HI98168 is uniquely designed with a conical tip and a triple ceramic junction for improved performance in soils that have a low moisture content. The probe has a built in amplifier to reduce noise from humidity that can effect the probe connection to the meter. The HI12923 connects to the HI98168 with a quick-connect, waterproof DIN connector, allowing for a secure, non-threaded attachment.

## Refillable

As electrolyte is lost over time it can be replenished to extend the life of the electrode.

## Triple ceramic junction

The outer reference has three ceramic frits that allow electrolyte to flow at a high rate from the inside of the probe to the outside. A higher flow rate allows for a pH measurement of soil with low moisture.

## Conical Tip

The conical tip is made of durable low temperature glass and allows for direct measurement in soils. In the case any rocks are present an auger is provided to make a hole for the probe.

## Quick Connect DIN Connector

This secure waterproof connector allows for a single cable to be used for both pH and temperature measurements.

| Specifications | HI12923 |
|---|---|
| Description | pH electrode |
| Reference | single, Ag/AgCl |
| Junction | ceramic, triple / 40-50 µL/h |
| Electrolyte | KCl 3.5M + AgCl |
| Max Pressure | 0.1 bar |
| Range | pH: 0 to 12 |
| Recommended Operating Temperature | -5 to 70°C (23 to 158°F) - LT |
| Glass Type | LT (low temperature) |
| Tip /Shape | conic (12 x 12 mm) |
| Temperature Sensor | yes |
| Amplifier | yes |
| Body Material | glass |
| Cable | coaxial; 1 m (3.3') |
| Connection | quick connect DIN |

# Application Importance

The measurement of pH in agricultural activities is very important due to the influence it has on the growth of the plant. Soil can be acid, neutral or alkaline, according to its pH value. Most plants prefer a pH range from 5.5 to 7.5; but some species prefer more acid or alkaline soils. Nevertheless, every plant requires a particular range of pH for optimum growth.

# A portable solution designed around you.

# 99 Series Portable Waterproof Meters

For scientists and professionals who require precision in the field or on the production floor, Hanna's 99 Series meters are durable, water-proof handhelds that deliver accurate results. It's the application-specific design you love with an all-new rugged construction to give you years of flawless measurements.

## Features

- Large LCD
  - A multilevel display provides at-a-glance readings of your most important numbers from any angle.
- User-friendly Design
  - With only two buttons, meter operation could not be simpler. Two buttons allow you to quickly adjust settings, select the measurement range, and choose calibration buffer sets.
- Application Specific Probe
  - Your measurements require detailed attention; so should your electrodes. Your probe has been carefully designed to meet the demands of your industry from body materials to junction type. Get top performance with a meter made for you.
- Probe Condition
  - An on-screen indicator provides visual confirmation that your probe is working at its best.
- Durable IP67 waterproof casing
  - Designed to withstand the knocks, drops, and spills of real life, the new IP67 body ensures top performance in any environment. These meters are protected against dust and water intrusion from any direction.


- Watertight Connection
  - A Quick Connect DIN connector makes attaching and removing the probe simple and easy. The rubber coating protects the cable and creates a sealed connection for added reliability.


- HOLD button
  - Freezes the reading on the display


- Selectable temperature unit (°C or °F)


- Battery life indication, low battery detection and Auto-off function
- Automatic pH calibration at one or two points within two memorized buffer sets (standard or NIST)
- On-screen calibration tags
- Electrode condition indicator
- mV of pH measurement for electrode check


Shown with: **HI710028**
Silicon rubber boot, orange


Shown with: **HI710029**
Silicon rubber boot, blue

1 Three level display
2 Two level display
3 Calibration tags
4 Automatic temperature compensation indicator
5 Selectable temperature unit, °C or °F
6 electrode condition indicator
7 Stability indicator
8 Power and MODE button
9 HOLD button to freeze readings on the diplay
10 Quick Connect DIN connector
11 **HI710028** Silicon rubber boot, orange
12 **HI710029** Silicon rubber boot, blue


HI991001 · HI991003

# pH/pH-mV/ORP and Temperature Meters

- Simultaneous pH, ORP, and temperature measurements on a large three-line LCD display (HI991003)
- Simultaneous pH and temperature measurements on a large dual-line LCD display (HI991001)
- User-friendly two button design
- Application specific probe
- Durable IP67 waterproof casing
- Watertight probe connection
- Probe condition indicator
- Automatic pH calibration at one or two points within two memorized buffer sets (standard or NIST)
- On-screen calibration tags
- mV measurement for electrode check
- Selectable temperature unit (°C or °F)
- Auto-off function
- Battery life indication and low battery detection

The HI991003 is a light weight, portable pH/ORP/temperature meter for pH and ORP measurements encountered in recreational waters (swimming pools and spas), plating baths, water treatment, manufacturing, and environmental testing applications. The meter is supplied with the HI12973 rugged probe protected with a titanium body specially designed for use on this meter.

HI991001 is a durable, portable, pH and temperature meter used for most pH measurements encountered in manufacturing and environmental testing protocols. The meter is provided with the HI12963 rugged titanium bodied electrode with built-in temperature sensor for temperature compensated pH and temperature readings.

| Specifications | | HI991001 | HI991003 |
|---|---|---|---|
| pH | Range* | -2.00 to 16.00 pH / -2.0 to 16.0 pH | |
| | Resolution | 0.01 pH / 0.1 pH | |
| | Accuracy (@25°C/77°F) | ±0.02 pH / ±0.1 pH | |
| | Calibration | Automatic, one or two-point selectable bufferset standard: 4.01; 7.01; 10.01 or NIST: 4.01; 6.86; 9.18 | |
| ORP | Range* | – | ±1999 mV |
| | Resolution | – | 1 mV |
| | Accuracy (@25°C/77°F) | – | ±2 mV |
| pH-mV | Range* | ±825 mV | ±825 mV |
| | Resolution | 1 mV | 1 mV |
| | Accuracy (@25°C/77°F) | ±1 mV | ±1 mV |
| Temperature | Range* | -5.0 to 105.0°C/23.0 to 221.0°F | |
| | Resolution | 0.1°C/0.1°F | |
| | Accuracy (@25°C/77°F) | ±0.5°C up to 60°C; ±1.0°C outside; ±1.0°F up to 140°F; ±2.0°F outside | |
| Additional Specifications | Temperature Compensation | automatic, from -5.0 to 105.0°C (23.0 to 221.0°F) | |
| | Probe (included) | HI12963 preamplified pH and temperature probe with titanium body, DIN connector and 1 m (3.3') cable | HI12973 preamplified pH/ORP with internal temperature sensor, DIN connector and 1 m (3.3') cable |
| | Battery type / life | 1.5V AAA (3) approx. 1400 hours of continuous use | |
| | Auto-Off | user selectable: after 8 min, 60 min, or disabled | |
| | Environment | 0 to 50°C (32 to 122°F); RH max. 100% | |
| | Meter Dimensions | 154 x 63 x 30 mm (6.1 x 2.5 x 1.2") | |
| | Meter Mass (with batteries) | 196 g (6.91 oz.) | |
| | Case Ingress Protection Rating | IP67 | |
| Ordering Information | | **HI991001** is supplied with HI12963 pH/temperature probe with titanium body and Quick Connect DIN connector with 1m (3.3') cable, pH 4.01 and 7.01 Buffer sachets, HI700601 electrode cleaning solution sachet (2), 100 mL beaker, 1.5V AAA batteries (3), calibration certificate of meter, calibration certificate of probe, instruction manual, and rugged carrying case.<br>**HI991003** is supplied with HI12973 pH/ORP/temperature probe with titanium body and Quick Connect DIN connector with 1m (3.3') cable, pH 4.01 and 7.01 Buffer sachets, HI700601 electrode cleaning solution sachet (2), 100 mL beaker, 1.5V AAA batteries (3), calibration certificate of meter, calibration certificate of probe, instruction manual, and HI710142 rugged carrying case. | |

* HI12963 and HI12973 is imited to be used from 0 to 13 pH and from 0 to 80 °C temperature (32 to 176 °F).

- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710028** Orange
**HI710029** Blue
**HI710030** Green

pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168

HI99121

# Direct Soil pH Meter

*with Measurement Kit*

- Simultaneous pH and temperature measurements on a large dual-line LCD display
- User-friendly two button design
- Application specific probe
- Durable IP67 waterproof casing
- Watertight probe connection
- Probe condition indicator
- Automatic pH calibration at one or two points within two memorized buffer sets (standard or NIST)
- On-screen calibration tags
- mV measurement for electrode check
- Selectable temperature unit (°C or °F)
- Auto-off function
- Battery life indication and low battery detection
- Soil preparation solution
  - For higher degrees of accuracy, or for stony ground where the electrode may be damaged, use the included HI7051M soil preparation solution


The HI99121 is the perfect portable pH meter for soil testing. With the HI99121 and HI12923 direct soil pre-amplified pH and temperature probe, users can test both the pH of soil directly or after preparation of a soil slurry with deionized water.

The HI12923 features a conical, rugged tip that can be directly used in soil. A plastic auger is supplied to perforate and loosen the soil prior to sensor measurement. Use this tool to prevent scratching the pH sensitive glass on nutrient crystals or small pebbles.

- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710028** Orange
**HI710029** Blue
**HI710030** Green

| Specifications | | HI99121 |
|---|---|---|
| pH | Range* | -2.00 to 16.00 pH / -2.0 to 16.0 pH |
| | Resolution | 0.01 pH / 0.1 pH |
| | Accuracy (@25°C/77°F) | ±0.02 pH / ±0.1 pH |
| | Calibration | Automatic, one or two-point selectable bufferset standard: 4.01; 7.01; 10.01 or NIST: 4.01; 6.86; 9.18 |
| pH-mV | Range* | ±825 mV |
| | Resolution | 1 mV |
| | Accuracy (@25°C/77°F) | ±1 mV |
| Temperature | Range* | -5.0 to 105.0°C; 23.0 to 221.0°F |
| | Resolution | 0.1°C; 0.1°F |
| | Accuracy(@25°C/77°F) | ±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside) |
| Additional Specifications | Temperature Compensation | automatic, from -5.0 to 105.0°C (23.0 to 221.0°F) |
| | Probe (included) | HI12923 glass body, pre-amplified pH electrode for soil measurement with internal temperature sensor, DIN connector and 1 m (3.3') cable |
| | Battery Type / Life | 1.5V AAA (3) approx. 1400 hours of continuous use |
| | Auto-off | user selectable: after 8 min, 60 min, or disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH max. 100% |
| | Meter Dimensions | 154 x 63 x 30 mm (6.1 x 2.5 x 1.2") |
| | Meter Mass (with batteries) | 196 g (6.91 oz.) |
| | Case Ingress Protection Rating | IP67 |
| Ordering Information | **HI99121** is supplied with HI12923 pH/temperature probe with glass body and Quick Connect DIN connector with 1m (3.3') cable, pH 4.01 and 7.01 Buffer sachets, HI700663 electrode cleaning solution sachet for soil deposits, HI700664 electrode cleaning solution sachet for humus deposits, HI7051M soil preparation solution, HI721319 ground auger, 100 mL beaker, 1.5V AAA batteries (3), calibration certificate of meter, calibration certificate of probe, instruction manual and HI710142 rugged carrying case. | |

* the HI12923 is limited to be used from 0-12 pH and from -5 to 70 °C temperature (23 to 158°F).



pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168


HI99131

# Portable pH Meter

*for Plating Baths*

- Simultaneous pH and temperature measurements on a large dual-line LCD display
- User-friendly two button design
- Application specific probe
- Durable IP67 waterproof casing
- Watertight probe connection
- Probe condition indicator
- Automatic pH calibration at one or two points within two memorized buffer sets (standard or NIST)
- On-screen calibration tags
- mV measurement for electrode check
- Selectable temperature unit (°C or °F)
- Auto-off function
- Battery life indication and low battery detection

Plating Baths can vary from acid to neutral to alkaline with many different chemical formulations used. The common necessity is the fast and accurate measurement of pH to ensure that additives and chemicals are working properly to provide even and consistent plating.

The HI99131 portable pH meter and HI629113 pH electrode are specially designed for pH measurements in plating baths.

The titanium electrode body acts like a Faraday cage, and allows stable readings even in samples where strong electrical fields are involved.

Moreover, a built-in temperature sensor allows simultaneous temperature compensated pH and temperature readings and a pH sensor preamplifier provides measurements impervious to noise and electrical interferences.

| Specifications | | HI99131 |
|---|---|---|
| pH | Range* | -2.00 to 16.00 pH / -2.0 to 16.0 pH |
| | Resolution | 0.01 pH / 0.1 pH |
| | Accuracy (@25°C/77°F) | ±0.02 pH / ±0.1 pH |
| | Calibration | Automatic, one or two-point selectable bufferset standard: 4.01; 7.01; 10.01 or NIST: 4.01; 6.86; 9.18 |
| pH-mV | Range* | ±825 mV |
| | Resolution | 1 mV |
| | Accuracy (@25°C/77°F) | ±1 mV |
| Temperature | Range* | -5.0 to 105.0°C; 23.0 to 221.0°F |
| | Resolution | 0.1°C; 0.1°F |
| | Accuracy (@25°C/77°F) | ±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside) |
| Additional Specifications | Temperature Compensation | automatic, from -5.0 to 105.0°C (23.0 to 221.0°F) |
| | Probe (included) | HI629113 preamplified pH probe with built-in temperature sensor and titanium cage working as matching pin, DIN connector with 1m (3.3') cable |
| | Battery Type / Life | 1.5V AAA (3) approx. 1400 hours of continuous use |
| | Auto-off | user selectable: after 8 min, 60 min, or disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH max. 100% |
| | Meter Dimensions | 154 x 63 x 30 mm (6.1 x 2.5 x 1.2") |
| | Meter Mass (with batteries) | 196 g (6.91 oz.) |
| | Case Ingress Protection Rating | IP67 |
| Ordering Information | **HI99131** is supplied with HI629113 preamplified pH probe with built-in temperature sensor and titanium body, Quick Connect DIN connector with 1m (3.3') cable, pH 4.01 and 7.01 Buffer sachets, HI700601 electrode cleaning solution sachets (2), 100 mL beaker, 1.5V AAA batteries (3), calibration certificate of meter, calibration certificate of probe, instruction manual, and HI710142 rugged carrying case. | |

* the HI629113 is limited to be used from 0 to 13 pH and from 0 to 80 °C temperature (32 to 176°F).

- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710028** Orange
**HI710029** Blue
**HI710030** Green

pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168

HI99141

# Portable pH Meter

*for Boiler and Cooling Towers*

- Simultaneous pH and temperature measurements on a large dual-line LCD display
- User-friendly two button design
- Application specific probe
- Durable IP67 waterproof casing
- Watertight probe connection
- Probe condition indicator
- Automatic pH calibration at one or two points within two memorized buffer sets (standard or NIST)
- On-screen calibration tags
- mV measurement for electrode check
- Selectable temperature unit (°C or °F)
- Auto-off function
- Battery life indication and low battery detection


The HI99141 pH meter is a portable, lightweight meter with two button operation that is simple to use. It is delivered with a rugged pH electrode protected by a titanium body that is perfect for the pH measurement of treated boiler, feed water, and steam condensate.

HI729113 is a rugged double junction pH electrode with a flat pH sensor and titanium body. The electrode has a peripheral Teflon® junction for maximum surface contact and flat pH tip is easy to clean and prevents solids from collecting on the sensor. Chemicals used to minimize scale, corrosion and foaming require an optimum pH. Measuring and controlling water quality helps minimize these effects.

A built-in temperature sensor allows simultaneous temperature compensated pH and temperature readings and a built-in pH sensor preamplifier provides measurements impervious to noise and electrical interferences.

- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710028** Orange
**HI710029** Blue
**HI710030** Green

| Specifications | | HI99141 |
|---|---|---|
| pH | Range* | -2.00 to 16.00 pH / -2.0 to 16.0 pH |
| | Resolution | 0.01 pH / 0.1 pH |
| | Accuracy (@25°C/77°F) | ±0.02 pH / ±0.1 pH |
| | Calibration | Automatic, one or two-point selectable bufferset standard: 4.01; 7.01; 10.01 or NIST: 4.01; 6.86; 9.18 |
| pH-mV | Range* | ±825 mV |
| | Resolution | 1 mV |
| | Accuracy (@25°C/77°F) | ±1 mV |
| Temperature | Range* | -5.0 to 105.0°C; 23.0 to 221.0°F |
| | Resolution | 0.1°C; 0.1°F |
| | Accuracy (@25°C/77°F) | ±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside) |
| Additional Specifications | Temperature Compensation | automatic, from -5.0 to 105.0°C (23.0 to 221.0°F) |
| | Probe (included) | HI729113 preamplified pH probe with built-in temperature sensor and titanium cage working as matching pin, DIN connector with 1m (3.3') cable |
| | Battery Type / Life | 1.5V AAA (3) approx. 1400 hours of continuous use |
| | Auto-off | user selectable: after 8 min, 60 min or disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH max. 100% |
| | Meter Dimensions | 154 x 63 x 30 mm (6.1 x 2.5 x 1.2") |
| | Meter Mass (with batteries) | 196 g (6.91 oz.) |
| | Case Ingress Protection Rating | IP67 |
| Ordering Information | **HI99141** is supplied with HI729113 preamplified pH probe with built-in temperature sensor and matching pin, Quick Connect DIN connector with 1m (3.3') cable, pH 4.01 and 7.01 buffer sachets, HI700601 electrode cleaning solution sachets (2), 100 mL beaker, 1.5V AAA batteries (3), calibration certificate of meter, calibration certificate of probe, instruction manual, and HI710142 rugged carrying case. | |

* the HI729113 is limited to be used from 0 to 13 pH and from 0 to 80°C temperature (32 to 176°F).



pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168


HI99171

# Portable pH Meter

*for Leather and Paper*

- Simultaneous pH and temperature measurements on a large dual-line LCD display
- User-friendly two button design
- Application specific probe
- Durable IP67 waterproof casing
- Watertight probe connection
- Probe condition indicator
- Automatic pH calibration at one or two points within two memorized buffer sets (standard or NIST)
- On-screen calibration tags
- mV measurement for electrode check
- Selectable temperature unit (°C or °F)
- Auto-off function
- Battery life indication and low battery detection

HI99171 is a light weight, portable pH meter supplied with a specially designed pH electrode intended for the direct determination of pH on flat surfaces, such as leather or paper.

The HI99171 portable pH meter together with a HI14143 combination pH electrode (when immersed in a drop of water on the surface of the sample), can determine the pH of the surface with high accuracy and repeatability without the requirement of sample destruction.

During production of cartons and paper used for food packaging, pH measurements provide a useful gauge of product compatibility. pH of a paper is usually considered one of the most reliable indices of the permanence of a paper. Conservators of historical documents (some of which are very valuable or irreplaceable) require a convenient non- destructive method to determine pH.

Leather technicians rely on a pH determination to optimize dyes, coating, and softening agents in order to preserve the fiber structure and prevent damage to leather. Leather is acidic. Its pH is measured at between 4.5 and 5.0. Surface pH measurements provide a non-destructive means to meet specifications and optimize product quality.

| Specifications | | HI99171 |
|---|---|---|
| pH | Range* | -2.00 to 16.00 pH / -2.0 to 16.0 pH |
| | Resolution | 0.01 pH / 0.1 pH |
| | Accuracy (@25°C/77°F) | ±0.02 pH / ±0.1 pH |
| | Calibration | Automatic, one or two-point selectable bufferset standard: 4.01; 7.01; 10.01 or NIST: 4.01; 6.86; 9.18 |
| pH-mV | Range* | ±825 mV |
| | Resolution | 1 mV |
| | Accuracy (@25°C/77°F) | ±1 mV |
| Temperature | Range* | -5.0 to 105.0°C; 23.0 to 221.0°F |
| | Resolution | 0.1°C; 0.1°F |
| | Accuracy (@25°C/77°F) | ±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside) |
| Additional Specifications | Temperature Compensation | automatic, from -5.0 to 105.0°C (23.0 to 221.0°F) |
| | Probe (included) | HI14143 preamplified pH and temperature probe with flat tip, DIN connector, and 1 m (3.3') cable |
| | Battery Type / Life | 1.5V AAA (3) approx. 1400 hours of continuous use |
| | Auto-off | user selectable: after 8 min, 60 min, or disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH max. 100% |
| | Meter Dimensions | 154 x 63 x 30 mm (6.1 x 2.5 x 1.2") |
| | Meter Mass (with batteries) | 196 g (6.91 oz.) |
| | Case Ingress Protection Rating | IP67 |
| Ordering Information | **HI99171** is supplied with HI14143 pH/temperature probe with flat tip and Quick Connect DIN connector with 1m (3.3') cable, pH 4.01 and 7.01 buffer sachets, HI700680 cleaning solution for ink stains sachets (2), HI70960 conductive electrolyte solution for pH measurement (30 mL), 100 mL beaker, 1.5V AAA batteries (3), calibration certificate of meter, calibration certificate of probe, instruction manual, and HI710142 rugged carrying case. | |

* the HI14143 is limited to be used from 0 to 12 pH and from 0 to 50 °C temperature (32 to 122 °F).

pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168

HI99181

# Portable pH Meter

*for Skin and Scalp*

- Simultaneous pH and temperature measurements on a large dual-line LCD display
- User-friendly two button design
- Application specific probe
- Durable IP67 waterproof casing
- Watertight probe connection
- Probe condition indicator
- Automatic pH calibration at one or two points within two memorized buffer sets (standard or NIST)
- On-screen calibration tags
- mV measurement for electrode check
- Selectable temperature unit (°C or °F)
- Auto-off function
- Battery life indication and low battery detection


HI99181 is a light weight, portable, pH, and temperature meter supplied with a specially designed pH electrode intended for the direct determination of pH on skin and scalp.

Researchers monitoring the compatibility between skin and cosmetics or pharmaceuticals use pH as essential marker of compatibility. The skin mantle has an acidic pH, ranging from pH 4 to 6. The acidic pH is a deterrent toward harmful microbes, pollution, and toxins. Age, genetics, sweat, and moisture can alter the pH of skin. Products are constantly created to restore the pH balance of skin and a reliable pH measurement of skin provides the scientific metrics.

The HI99181 portable pH meter together with a HI14143/50 combination pH electrode (when immersed in a drop of water on the skin surface), can determine the pH of the skin with high accuracy and repeatability.

The HI14143/50 probe offers numerous features that improve pH testing for skin measurements. The flat tip of the HI14143/50 provides optimal contact between the sample and the sensor.

- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710028** Orange
**HI710029** Blue
**HI710030** Green

| Specifications | | HI99181 |
|---|---|---|
| pH | Range* | -2.00 to 16.00 pH / -2.0 to 16.0 pH |
| | Resolution | 0.01 pH / 0.1 pH |
| | Accuracy (@25°C/77°F) | ±0.02 pH / ±0.1 pH |
| | Calibration | Automatic, one or two-point selectable bufferset standard: 4.01; 7.01; 10.01 or NIST: 4.01; 6.86; 9.18 |
| pH-mV | Range* | ±825 mV |
| | Resolution | 1 mV |
| | Accuracy (@25°C/77°F) | ±1 mV |
| Temperature | Range* | -5.0 to 105.0°C; 23.0 to 221.0°F |
| | Resolution | 0.1°C; 0.1°F |
| | Accuracy (@25°C/77°F) | ±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside) |
| Additional Specifications | Temperature Compensation | automatic, from -5.0 to 105.0°C (23.0 to 221.0°F) |
| | Probe (included) | HI14143/50 preamplified pH and temperature probe with flat tip 50 mm-long body, DIN connector, and 1 m (3.3') cable |
| | Battery Type / Life | 1.5V AAA (3) approx. 1400 hours of continuous use |
| | Auto-off | user selectable: after 8 min, 60 min, or disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH max. 100% |
| | Meter Dimensions | 154 x 63 x 30 mm (6.1 x 2.5 x 1.2") |
| | Meter Mass (with batteries) | 196 g (6.91 oz.) |
| | Case Ingress Protection Rating | IP67 |
| Ordering Information | **HI99181** is supplied with HI14143/50 pH/temperature probe with flat tip, 50 mm-long body, Quick Connect DIN connector and 1m (3.3') cable, pH 4.01 and 7.01 buffer sachets, HI700620 cleaning and disinfection solution sachet for skin residuals, HI700621 cleaning solution sachet for skin grease and sebum, 100 mL beaker, 1.5V AAA batteries (3), calibration certificate of meter, calibration certificate of probe, instruction manual, and HI710142 rugged carrying case. | |

* the HI14143/50 is limited to be used from 0 to 12 pH and from 0 to 50 °C temperature (32 to 122 °F).



pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168


**Foodcare**

HI99162

# pH / Temperature Meter for Milk

*with Application Specific Probe*

- Simultaneous pH and temperature measurements on a large dual-line LCD display
- User-friendly two button design
- Application specific probe
- Durable IP67 waterproof casing
- Watertight probe connection
- Probe condition indicator
- Automatic pH calibration at one or two points within two memorized buffer sets (standard or NIST)
- On-screen calibration tags
- mV measurement for electrode check
- Selectable temperature unit (°C or °F)
- Auto-off function
- Battery life indication and low battery detection

HI99162 is a portable pH and temperature meter designed specifically for pH measurement in milk. The measurement of pH in milk is important in testing for impurities, spoilage, and signs of infection. Fresh milk has a pH value close to pH 6.7. When the pH value of milk falls below pH 6.7, it typically indicates spoilage by bacterial degradation. Milk with pH values higher than pH 6.7 potentially indicate that milk may have come from cows with a mastitis infection.

The FC1013 pH electrode has a built-in temperature sensor for simultaneous temperature compensated pH and temperature readings, and also contains a pH sensor preamplifier to provide measurements impervious to noise and electrical interferences.

FC1013 electrode has a PVDF body, double junction reference with refillable bridge electrolyte and ceramic junction.

The HI99162 and FC1013 provide measurements where your milk is processed to optimize operations.

| Specifications | | HI99162 |
|---|---|---|
| pH | Range* | -2.00 to 16.00 pH / -2.0 to 16.0 pH |
| | Resolution | 0.01 pH / 0.1 pH |
| | Accuracy (@25°C/77°F) | ±0.02 pH / ±0.1 pH |
| | Calibration | Automatic, one or two-point selectable bufferset standard: 4.01; 7.01; 10.01 or NIST: 4.01; 6.86; 9.18 |
| pH-mV | Range* | ±825 mV |
| | Resolution | 1 mV |
| | Accuracy (@25°C/77°F) | ±1 mV |
| Temperature | Range* | -5.0 to 105.0°C; 23.0 to 221.0°F |
| | Resolution | 0.1°C; 0.1°F |
| | Accuracy (@25°C/77°F) | ±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside) |
| Additional Specifications | Temperature Compensation | automatic, from -5.0 to 105.0°C (23.0 to 221.0°F) |
| | Probe (included) | FC1013 preamplified pH and temperature probe, DIN connector and 1 m (3.3') cable |
| | Battery Type / Life | 1.5V AAA (3) approx. 1400 hours of continuous use |
| | Auto-off | user selectable: after 8 min, 60 min or disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH max. 100% |
| | Meter Dimensions | 154 x 63 x 30 mm (6.1 x 2.5 x 1.2") |
| | Meter Mass (with batteries) | 196 g (6.91 oz.) |
| | Case Ingress Protection Rating | IP67 |
| Ordering Information | **HI99162** is supplied with FC1013 preamplified pH/temperature probe with Quick Connect DIN connector and 1 m (3.3') cable, pH 4.01 and 7.01 buffer sachets, HI700640 electrode cleaning solution sachet for milk deposits (2), 100 mL beaker, 1.5V AAA batteries (3), calibration certificate of meter, calibration certificate of probe, instruction manual, and HI710142 rugged carrying case. | |

* the FC1013 is limited to be used from 0 to 13 pH and from 0 to 80 °C temperature (32 to 176 °F).

pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168

Foodcare

HI99164

# pH / Temperature Meter for Yogurt

*with Application Specific Probe*

- Simultaneous pH and temperature measurements on a large dual-line LCD display
- User-friendly two button design
- Application specific probe
- Durable IP67 waterproof casing
- Watertight probe connection
- Probe condition indicator
- Automatic pH calibration at one or two points within two memorized buffer sets (standard or NIST)
- On-screen calibration tags
- mV measurement for electrode check
- Selectable temperature unit (°C or °F)
- Auto-off function
- Battery life indication and low battery detection


- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710028** Orange
**HI710029** Blue
**HI710030** Green

HI99164 is a portable pH and temperature meter designed specifically for pH measurement in yogurt.

Monitoring pH is crucial in producing consistent, quality yogurt. Yogurt is made by fermentation of milk with live bacterial cultures. Once milk is pasteurized, live culture is added and the mixture of milk and bacteria is incubated. Yogurt producers cease incubation once a specific pH level is reached. 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.

The FC2133 pH electrode is rugged and easy to clean with a conical tip and built-in temperature sensor. The open junction design consists of a solid gel interface (viscolene) between the sample and internal Ag/AgCl reference. This interface not only prevents silver from entering the sample, but also makes it impermeable to clogging after measurements in semi-solid or viscous samples. FC2133 electrode is designed to prevent the typical problems of clogging in viscous liquids, ensuring a fast response and stable reading.

| Specifications | | HI99164 |
|---|---|---|
| pH | Range* | -2.00 to 16.00 pH / -2.0 to 16.0 pH |
| | Resolution | 0.01 pH / 0.1 pH |
| | Accuracy (@25°C/77°F) | ±0.02 pH / ±0.1 pH |
| | Calibration | Automatic, one or two-point selectable bufferset standard: 4.01; 7.01; 10.01 or NIST: 4.01; 6.86; 9.18 |
| pH-mV | Range* | ±825 mV |
| | Resolution | 1 mV |
| | Accuracy (@25°C/77°F) | ±1 mV |
| Temperature | Range* | -5.0 to 105.0°C; 23.0 to 221.0°F |
| | Resolution | 0.1°C; 0.1°F |
| | Accuracy (@25°C/77°F) | ±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside) |
| Additional Specifications | Temperature Compensation | automatic, from -5.0 to 105.0°C (23.0 to 221.0°F) |
| | Probe (included) | FC2133 preamplified pH and temperature probe, DIN connector, and 1 m (3.3') cable |
| | Battery Type / Life | 1.5V AAA (3) approx. 1400 hours of continuous use |
| | Auto-off | user selectable: after 8 min, 60 min, or disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH max. 100% |
| | Meter Dimensions | 154 x 63 x 30 mm (6.1 x 2.5 x 1.2") |
| | Meter Mass (with batteries) | 196 g (6.91 oz.) |
| | Case Ingress Protection Rating | IP67 |
| Ordering Information | **HI99164** is supplied with FC2133 pH/temperature probe and Quick Connect DIN connector with 1m (3.3') cable, pH 4.01 and 7.01 buffer sachets, HI700643 cleaning solution sachets for yogurt deposits (2), 100 mL beaker, 1.5V AAA batteries (3), calibration certificate of meter, calibration certificate of probe, instruction manual, and HI710142 rugged carrying case. | |

* the FC2133 is limited to be used from 0 to 12 pH and from 0 to 50°C temperature (32 to 122°F).



pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168


Foodcare

HI99165

# pH / Temperature Meter for Cheese

*with Application Specific Probe*

- Simultaneous pH and temperature measurements on a large dual-line LCD display
- User-friendly two button design
- Application specific probe
- Durable IP67 waterproof casing
- Watertight probe connection
- Probe condition indicator
- Automatic pH calibration at one or two points within two memorized buffer sets (standard or NIST)
- On-screen calibration tags
- mV measurement for electrode check
- Selectable temperature unit (°C or °F)
- Auto-off function
- Battery life indication and low battery detection

Throughout the cheese making process, pH measurement is perhaps the most important cheese making management tool. It is an essential parameter in achieving the desired characteristics, quality, and shelf-life of the finished product.

The HI99165 is a waterproof portable pH and temperature meter designed for pH measurement in cheese.

The FC2423 is a penetration style pH electrode with a conical sensing tip and features an easy to clean, stainless steel sheath and single junction gel filled reference with a free diffusion sleeve style reference junction. The electrode is designed for penetration into solids and emulsions for direct measurement of pH in cheese products.

| Specifications | | HI99165 |
|---|---|---|
| pH | Range* | -2.00 to 16.00 pH / -2.0 to 16.0 pH |
| | Resolution | 0.01 pH / 0.1 pH |
| | Accuracy (@25°C/77°F) | ±0.02 pH / ±0.1 pH |
| | Calibration | Automatic, one or two-point selectable bufferset standard: 4.01; 7.01; 10.01 or NIST: 4.01; 6.86; 9.18 |
| pH-mV | Range* | ±825 mV |
| | Resolution | 1 mV |
| | Accuracy (@25°C/77°F) | ±1 mV |
| Temperature | Range* | -5.0 to 105.0°C; 23.0 to 221.0°F |
| | Resolution | 0.1°C; 0.1°F |
| | Accuracy (@25°C/77°F) | ±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside) |
| Additional Specifications | Temperature Compensation | automatic, from -5.0 to 105.0°C (23.0 to 221.0°F) |
| | Probe (included) | FC2423 preamplified pH and temperature probe, DIN connector, and 1 m (3.3') cable |
| | Battery Type / Life | 1.5V AAA (3) approx. 1400 hours of continuous use |
| | Auto-off | user selectable: after 8 min, 60 min, or disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH max. 100% |
| | Meter Dimensions | 154 x 63 x 30 mm (6.1 x 2.5 x 1.2") |
| | Meter Mass (with batteries) | 196 g (6.91 oz.) |
| | Case Ingress Protection Rating | IP67 |
| Ordering Information | **HI99165** is supplied with FC2423 preamplified pH/temperature probe with Quick Connect DIN connector and 1 m (3.3') cable, pH 4.01 and 7.01 buffer sachets, HI700642 cleaning solution for cheese deposits (2), 100 mL beaker, 1.5V AAA batteries (3), calibration certificate of meter, calibration certificate of probe, instruction manual, and HI710142 rugged carrying case. | |

* the FC2423 is limited to be used from 0 to 12 pH and from 0 to 50°C temperature (32 to 122°F).

- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710028** Orange
**HI710029** Blue
**HI710030** Green

pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168

Foodcare

HI99161

# Portable pH Meter

*for yogurt, cheese, and semi-solids*

- Simultaneous pH and temperature measurements on a large dual-line LCD display
- User-friendly two button design
- Application specific probe
- Durable IP67 waterproof casing
- Watertight probe connection
- Probe condition indicator
- Automatic pH calibration at one or two points within two memorized buffer sets (standard or NIST)
- On-screen calibration tags
- mV measurement for electrode check
- Selectable temperature unit (°C or °F)
- Auto-off function
- Battery life indication and low battery detection


The HI99161 is a portable, lightweight meter with two button operation that is simple to use. It is designed specifically for use in yogurt, cheese, and semi-solids.

The meter is supplied with the FC2023 pH electrode specially designed for use in the food sector.

The FC2023 is a penetration style pH electrode with a conical sensing tip and features an easy to clean, PVDF body and double junction gel filled reference with a free diffusion sleeve style reference junction. The electrode is ideal for measurements in semisolid foods such as processed meats, soft cheeses, soups, sauces, condiments, jams, jellies, dough, ice cream and sushi rice.

| Specifications | | HI99161 |
|---|---|---|
| pH | Range* | -2.00 to 16.00 pH / -2.0 to 16.0 pH |
| | Resolution | 0.01 pH / 0.1 pH |
| | Accuracy (@25°C/77°F) | ±0.02 pH / ±0.1 pH |
| | Calibration | Automatic, one or two-point selectable bufferset standard: 4.01; 7.01; 10.01 or NIST: 4.01; 6.86; 9.18 |
| pH-mV | Range* | ±825 mV |
| | Resolution | 1 mV |
| | Accuracy (@25°C/77°F) | ±1 mV |
| Temperature | Range* | -5.0 to 105.0°C; 23.0 to 221.0°F |
| | Resolution | 0.1°C; 0.1°F |
| | Accuracy (@25°C/77°F) | ±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside) |
| Additional Specifications | Temperature Compensation | automatic, from -5.0 to 105.0°C (23.0 to 221.0°F) |
| | Probe (included) | FC2023 preamplified pH/temperature probe with DIN connector, and 1 m (3.3') cable |
| | Battery Type / Life | 1.5V AAA (3) approx. 1400 hours of continuous use |
| | Auto-off | user selectable: after 8 min, 60 min, or disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH max. 100% |
| | Meter Dimensions | 154 x 63 x 30 mm (6.1 x 2.5 x 1.2") |
| | Meter Mass (with batteries) | 196 g (6.91 oz.) |
| | Case Ingress Protection Rating | IP67 |
| Ordering Information | **HI99161** is supplied with FC2023 preamplified pH/temperature probe with conical tip, Quick Connect DIN connector and 1 m (3.3') cable, pH 4.01 and 7.01 buffer sachets, HI700601 electrode cleaning solution sachets (2), 100 mL beaker, 1.5V AAA batteries (3), calibration certificate of meter, calibration certificate of probe, instruction manual, and HI710142 rugged carrying case. | |

* the FC2023 is limited to be used from 0 to 12 pH and from 0 to 50°C temperature (32 to 122°F).

- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710028** Orange
**HI710029** Blue
**HI710030** Green



pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168


Foodcare

HI99163

# Portable pH Meter

*and Sensor for Meat*

- Simultaneous pH and temperature measurements on a large dual-line LCD display
- User-friendly two button design
- Application specific probe
- Durable IP67 waterproof casing
- Watertight probe connection
- Probe condition indicator
- Automatic pH calibration at one or two points within two memorized buffer sets (standard or NIST)
- On-screen calibration tags
- mV measurement for electrode check
- Selectable temperature unit (°C or °F)
- Auto-off function
- Battery life indication and low battery detection

A reliable pH measurement is an important factor in meat processing. pH affects many quality factors including color, grading, tenderness, texture, and process characteristics. A direct measurement of muscle pH, deep in the muscle is the best way to determine pH.

HI99163 is a portable pH and temperature meter with a special probe, dedicated to the measurement of pH in meat processing. The meter works at cold store operating temperatures to 0°C (32°F).

The FC2323 probe has been specially designed for meat processing and comes with a removable stainless steel lance for meat/muscle penetration. The FC2323 is a penetration style pH electrode with a conical sensing tip and features an easy to clean, PVDF body and single junction gel filled reference with a free diffusion sleeve style reference junction.

A pH sensor preamplifier provides measurements impervious to noise and electrical interferences often experienced at cold temperatures with conventional pH equipment.

| Specifications | | HI99163 |
|---|---|---|
| pH | Range* | -2.00 to 16.00 pH / -2.0 to 16.0 pH |
| | Resolution | 0.01 pH / 0.1 pH |
| | Accuracy (@25°C/77°F) | ±0.02 pH / ±0.1 pH |
| | Calibration | Automatic, one or two-point selectable bufferset standard: 4.01; 7.01; 10.01 or NIST: 4.01; 6.86; 9.18 |
| pH-mV | Range* | ±825 mV |
| | Resolution | 1 mV |
| | Accuracy (@25°C/77°F) | ±1 mV |
| Temperature | Range* | -5.0 to 105.0°C; 23.0 to 221.0°F |
| | Resolution | 0.1°C; 0.1°F |
| | Accuracy (@25°C/77°F) | ±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside) |
| Additional Specifications | Temperature Compensation | automatic, from -5.0 to 105.0°C (23.0 to 221.0°F) |
| | Probe (included) | FC2323 amplified pH/temperature probe with stainless steel blade, DIN connector, and 1 m (3.3') cable |
| | Battery Type / Life | 1.5V AAA (3) approx. 1400 hours of continuous use |
| | Auto-off | user selectable: after 8 min, 60 min, or disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH max. 100% |
| | Meter Dimensions | 154 x 63 x 30 mm (6.1 x 2.5 x 1.2") |
| | Meter Mass (with batteries) | 196 g (6.91 oz.) |
| | Case Ingress Protection Rating | IP67 |
| Ordering Information | **HI99163** is supplied with FC2323 amplified pH/temperature probe with stainless steel blade, Quick Connect DIN connector and 1 m (3.3') cable, pH 4.01 and 7.01 buffer sachets, HI700630 grease and fats acid cleaning solution sachets (2), 100 mL beaker, 1.5V AAA batteries (3), calibration certificate of meter, calibration certificate of probe, instruction manual, and HI710142 rugged carrying case. | |

* the FC2323 is limited to be used from 0 to 12 pH and from 0 to 50°C temperature (32 to 122°F).

pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168

Foodcare

HI99192

# Portable pH Meter

*for Drinking Water*

- Simultaneous pH and temperature measurements on a large dual-line LCD display
- User-friendly two button design
- Application specific probe
- Durable IP67 waterproof casing
- Watertight probe connection
- Probe condition indicator
- Automatic pH calibration at one or two points within two memorized buffer sets (standard or NIST)
- On-screen calibration tags
- mV measurement for electrode check
- Selectable temperature unit (°C or °F)
- Auto-off function
- Battery life indication and low battery detection


- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710028** Orange
**HI710029** Blue
**HI710030** Green

HI99192 is a portable, lightweight pH meter that is supplied with a FC2153 pH electrode designed specifically for measuring the pH of potable waters.

The pair are ideal for on-site spot checks of drinking water. The pH of potable water is fundamental to ensure safe water quality. If the pH is too low, drinking water will be corrosive to the distribution system and water pipes in homes. If it is too high, it can reduce the effectiveness of disinfectants. The pH of water also influences aesthetic or cosmetic properties including taste, odor, and clarity. Most public water operations maintain pH between 6.5 and 8.5.

The HI99192 together with the FC2153 pH electrode solves all the problems found with standard pH systems. This specialized electrode offers numerous features that improve pH testing in drinking water. The spherical pH bulb features a low resistance pH glass that responds quickly to the sample (even at cold temperatures). It also has a refillable single junction Ag/AgCl reference that is used with a KCl electrolyte and has three ceramic junctions to ensure continuity and provide quick and reproducible measurements (even in low ionic strength waters).

| Specifications | | HI99192 |
|---|---|---|
| pH | Range* | -2.00 to 16.00 pH / -2.0 to 16.0 pH |
| | Resolution | 0.01 pH / 0.1 pH |
| | Accuracy (@25°C/77°F) | ±0.02 pH / ±0.1 pH |
| | Calibration | Automatic, one or two-point selectable bufferset standard: 4.01; 7.01; 10.01 or NIST: 4.01; 6.86; 9.18 |
| pH-mV | Range* | ±825 mV |
| | Resolution | 1 mV |
| | Accuracy (@25°C/77°F) | ±1 mV |
| Temperature | Range* | -5.0 to 105.0°C; 23.0 to 221.0°F |
| | Resolution | 0.1°C; 0.1°F |
| | Accuracy (@25°C/77°F) | ±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside) |
| Additional Specifications | Temperature Compensation | automatic, from -5.0 to 105.0°C (23.0 to 221.0°F) |
| | Probe (included) | FC2153 pH electrode with internal temperature sensor, with DIN connector, and 1 m (3.3') cable |
| | Battery Type / Life | 1.5V AAA (3) approx. 1400 hours of continuous use |
| | Auto-off | user selectable: after 8 min, 60 min, or disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH max. 100% |
| | Meter Dimensions | 154 x 63 x 30 mm (6.1 x 2.5 x 1.2") |
| | Meter Mass (with batteries) | 196 g (6.91 oz.) |
| | Case Ingress Protection Rating | IP67 |
| Ordering Information | **HI99192** is supplied with FC2153 pH electrode with internal temperature sensor, with Quick Connect DIN connector and 1 m (3.3') cable, pH 4.01 and 7.01 buffer sachets, HI700601 general electrode cleaning solution sachets (2), 100 mL beaker, 1.5V AAA batteries (3), calibration certificate of meter, calibration certificate of probe, instruction manual, and HI710142 rugged carrying case. | |

* the FC2153 is limited to be used from 0 to 12 pH and from 0 to 70 °C temperature (32 to 158 °F).



pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168

Triple ceramic junction

# FC2153 Amplified pH Electrode

- Built-in temperature sensor
  - For automatic compensation of temperature variations
- Refillable pH electrode
- Amplified electrode
  - For fast, stable response that is immune to electrical noise due to humidity
- Triple ceramic junction design

The HI99192 drinking water pH meter uses the glass body FC2153 amplified pH electrode. The amplified electrode provides a fast stable response that is immune to electrical noise due to humidity. The electrode contains an internal temperature probe to allow for automatic compensation for any variances in temperature. The electrolyte solution in the electrode is refillable.

An integral part of any pH electrode is the reference junction. The reference junction 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 FC2153 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 with 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.

## The pH of Drinking Water

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 efficiency of disinfection. 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 FC2153 amplified pH electrode. The FC2153 has three ceramic junctions in the outer reference cell that allows for pH measurement in low conductivity solutions.

* Limits will be reduced to actual sensor limits

Foodcare

HI99151

# Portable pH Meter

*for Beer Analysis*

- Simultaneous pH and temperature measurements on a large dual-line LCD display
- User-friendly two button design
- Application specific probe
- Durable IP67 waterproof casing
- Watertight probe connection
- Probe condition indicator
- Automatic pH calibration at one or two points within two memorized buffer sets (standard or NIST)
- On-screen calibration tags
- mV measurement for electrode check
- Selectable temperature unit (°C or °F)
- Auto-off function
- Battery life indication and low battery detection


HI99151 is a portable, microprocessor-based pH and temperature meter specifically designed for beer brewing.

It is supplied with the FC2143 rugged double junction pH electrode with a flat pH sensor profile, cloth reference junction, and titanium body perfect for brewing operations.

There are no crevices to collect solids and the pH and temperature specifications are pertinent to most brewing operations.

Together, they are versatile tools for measuring the pH in brewing operations such as mashing and wort separations, measuring the pH of the cooled wort boil, checking the fermentation pH, and checking the finished or conditioned beer.

- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710028** Orange
**HI710029** Blue
**HI710030** Green

| Specifications | | HI99151 |
|---|---|---|
| pH | Range* | -2.00 to 16.00 pH / -2.0 to 16.0 pH |
| | Resolution | 0.01 pH / 0.1 pH |
| | Accuracy (@25°C/77°F) | ±0.02 pH / ±0.1 pH |
| | Calibration | Automatic, one or two-point selectable bufferset standard: 4.01; 7.01; 10.01 or NIST: 4.01; 6.86; 9.18 |
| pH-mV | Range* | ±825 mV |
| | Resolution | 1 mV |
| | Accuracy (@25°C/77°F) | ±1 mV |
| Temperature | Range* | -5.0 to 105.0°C; 23.0 to 221.0°F |
| | Resolution | 0.1°C; 0.1°F |
| | Accuracy (@25°C/77°F) | ±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside) |
| Additional Specifications | Temperature Compensation | automatic, from -5.0 to 105.0°C (23.0 to 221.0°F) |
| | Probe (included) | FC2143 preamplified pH/temperature probe with DIN connector, and 1 m (3.3') cable, titanium body |
| | Battery Type / Life | 1.5V AAA (3) approx. 1400 hours of continuous use |
| | Auto-off | user selectable: after 8 min, 60 min, or disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH max. 100% |
| | Meter Dimensions | 154 x 63 x 30 mm (6.1 x 2.5 x 1.2") |
| | Meter Mass (with batteries) | 196 g (6.91 oz.) |
| | Case Ingress Protection Rating | IP67 |
| Ordering Information | **HI99151** is supplied with FC2143 preamplified pH/temperature probe with Quick Connect DIN connector and 1 m (3.3') cable, pH 4.01 and 7.01 buffer sachets, HI700682 electrode cleaning solution for brewing deposits sachets (2), 100 mL beaker, 1.5V AAA batteries (3), calibration certificate of meter, calibration certificate of probe, instruction manual, and HI710142 rugged carrying case. | |

* the FC2143 is limited to be used from 0 to 12 pH and from 0 to 80°C temperature (32 to 176°F)



pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168

## FC2143 Amplified pH Electrode

- Amplified electrode
  - Provides a fast, stable response that is immune to electrical noise due to static discharge
- Maintenance free gel filled electrode
  - No fill solution required
- Highly durable titanium body
- Low temperature glass

The HI99151 beer pH meter uses the titanium bodied FC2143 amplified pH electrode with built-in temperature sensor. The amplified electrode provides a fast, stable response that is immune to electrical noise due to static discharge. The body of the electrode is made from titanium, which provides an unbreakable structure.

## 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 pH 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 tends to favor elevated microbial activity.

Foodcare

HI99111

# Portable pH Meter

*for Wine Analysis*

- Simultaneous pH and temperature measurements on a large dual-line LCD display
- User-friendly two button design
- Application specific probe
- Durable IP67 waterproof casing
- Watertight probe connection
- Probe condition indicator
- Automatic pH calibration at one or two points within two memorized buffer sets (standard or NIST)
- On-screen calibration tags
- mV measurement for electrode check
- Selectable temperature unit (°C or °F)
- Auto-off function
- Battery life indication and low battery detection


HI99111 is a portable, microprocessor-based pH and temperature meter. Main features include: extended pH and temperature ranges; waterproof and compact casing; large dual-line display; low battery detection; automatic pH calibration at one or two points within two memorized buffer sets (standard or NIST); selectable temperature unit (°C or °F).

The FC10483 pH probe features an open junction with Clogging Prevention System (CPSTM) technology, has a built-in temperature sensor for simultaneous temperature compensated pH and temperature readings, and also contains a pH sensor preamplifier to provide measurements impervious to noise and electrical interferences.

- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710028** Orange
**HI710029** Blue
**HI710030** Green

## Specifications

| | | HI99111 |
|---|---|---|
| pH | Range* | -2.00 to 16.00 pH / -2.0 to 16.0 pH |
| | Resolution | 0.01 pH / 0.1 pH |
| | Accuracy (@25°C/77°F) | ±0.02 pH / ±0.1 pH |
| | Calibration | Automatic, one or two-point selectable bufferset standard: 4.01; 7.01; 10.01 or NIST: 4.01; 6.86; 9.18 |
| pH-mV | Range* | ±825 mV |
| | Resolution | 1 mV |
| | Accuracy (@25°C/77°F) | ±1 mV |
| Temperature | Range* | -5.0 to 105.0°C; 23.0 to 221.0°F |
| | Resolution | 0.1°C; 0.1°F |
| | Accuracy (@25°C/77°F) | ±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside) |
| Additional Specifications | Temperature Compensation | automatic, from -5.0 to 105.0°C (23.0 to 221.0°F) |
| | Probe (included) | FC10483 preamplified pH and temperature probe with a flat tip, DIN connector, and 1 m (3.3') cable |
| | Battery Type / Life | 1.5V AAA (3) approx. 1400 hours of continuous use |
| | Auto-off | user selectable: after 8 min, 60 min, or disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH max. 100% |
| | Meter Dimensions | 154 x 63 x 30 mm (6.1 x 2.5 x 1.2") |
| | Meter Mass (with batteries) | 196 g (6.91 oz.) |
| | Case Ingress Protection Rating | IP67 |
| Ordering Information | **HI99111** is supplied with FC10483 pH/temperature probe with flat tip and Quick Connect DIN connector with 1m (3.3') cable, pH 3.00 and 7.01 buffer sachets, HI700635 Cleaning solution for wine deposits sachets (2), HI700636 Cleaning solution for wine stains (2), 100 mL beaker, 1.5V AAA batteries (3), calibration certificate of meter, calibration certificate of probe, instruction manual, and HI710142 rugged carrying case. | |

* the FC10483 is limited to be used from 0 to 12 pH and from 0 to 80°C temperature (32 to 176 °F).



pH solutions begin on page 2.154; electrode cleaning solutions begin on page 2.168

## 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 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.

## FC10483 pH electrode

- PE sleeve for cleaning
- Refillable pH electrode
- Clogging prevention system (CPS™)

The HI99111 portable pH meter for wine uses the glass body FC10483 pH electrode with Hanna's unique Clogging Prevention System (CPS™). This electrode provides a fast stable response and resists clogging. The electrolyte solution in the electrode is refillable.

An integral part of any pH electrode is the reference junction. The reference junction 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; however, the CPS™ (Clogging Prevention System) is an innovation in electrode technology. Conventional pH electrodes use ceramic junctions that clog quickly when used in wine. When the junction is clogged, the electrode does not function. CPS™ technology utilizes the porousness of ground glass coupled with a PE sleeve to prevent clogging of the junction. The ground glass allows proper flow of the liquid, while the PE sleeve repels dirt. As a result, pH electrodes with CPS™ stay fresh up to 20 times longer than conventional electrodes.

To optimize the flow from the electrode the refill cap should be unscrewed so that it is open. This allows for positive head pressure to be created allowing for the electrolyte to drain more easily from the reference electrode.

HI9126

# Portable pH/mV Meter

- CAL Check™
  - Alerts users to calibration status
- Backlight
  - Backlit, multi-level LCD display
- Battery Error Prevention System (BEPS)
  - Automatically shuts off meter when battery is too low to take accurate readings
- Battery indicator
  - Battery percentage displayed on startup
- Help feature
  - Tutorial messages displayed on LCD

The HI9126 includes Hanna's exclusive CAL Check technology. CAL Check monitors the pH bulb every time the instrument is calibrated. In the event of a dirty pH electrode, CAL Check warns users that maintenance may be needed.

Calibrated buffers are continuously displayed in measurement mode to remind users of the instrument's calibration point. Users can easily determine if readings are taken too far outside the calibration range.

The HI9126 can store and recall a reading at the touch of a button and features a real-time clock.

HI9126 utilizes the HI1230B double junction pH electrode. The double junction design helps to minimize junction contamination for consistently accurate results. The HI9126 can also measure ORP in the mV range using an optional ORP probe.


| Specifications | | HI9126 |
|---|---|---|
| pH* | Range | -2.00 to 16.00 pH |
| | Resolution | 0.01 pH |
| | Accuracy | ±0.01 pH |
| | Calibration | automatic, one or two-point with seven standard buffers available (pH 1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and two custom buffers |
| | Temperature Compensation | automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F) |
| mV | Range | ±699.9 mV; ±1999 mV |
| | Resolution | 0.1 mV; 1 mV |
| | Accuracy | ±0.2 mV; ±1 mV |
| Temperature* | Range | -20.0 to 120.0°C; -4.0°F to 248.0°F |
| | Resolution | 0.1°C; 0.1 °F |
| | Accuracy | ±0.4°C; ±0.8°F |
| Additional Specifications | pH Electrode | HI1230B PEI body pH electrode with BNC connector and 1 m (3.3') cable (included) |
| | Temperature Probe | HI7662 stainless steel temperature probe with 1 m (3.3') cable (included) |
| | Slope / Offset Calibration | from 80 to 108% / ±1 pH |
| | Input Impedance | $10^{12}$ Ohm |
| | Battery Type / Life | 1.5V (3) AAA / approximately 200 hours of continuous use without backlight (50 hours with backlight) |
| | Auto-off | after 20 minutes of non-use (can be disabled) |
| | Environment | 0 to 50°C (32 to 122°F); RH max 100% |
| | Dimensions / Weight | 185 x 72 x 36 mm (7.3 x 2.8 x 1.4") / 300 g (10.6 oz.) |
| Ordering Information | | **HI9126** is supplied with HI1230B pH electrode, HI7662 temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer sachet, HI700601 electrode cleaning solution sachet, 100 mL plastic beaker, 1.5V AAA batteries (3), instructions, and hard carrying case. |

* Limits will be reduced to actual sensor limits



pH and ORP electrodes begin on page 2.134; pH and ORP solutions begin on page 2.154


HI9124 · HI9125

# Portable pH/mV Meters

- Automatic Temperature Compensation (ATC)
- Two-point calibration
- Waterproof casing
- Battery Error Prevention System (BEPS)
  - Automatically shuts off meter when battery is too low to take accurate readings
- Battery life indicator
  - Battery percentage displayed on startup
- Help feature
  - Tutorial messages displayed on LCD

The HI9124 and HI9125 are portable, waterproof pH meters. The HI9125 can utilize ORP (oxidation reduction potential) electrodes and display results in the mV range.

A large dual-level LCD displays both the pH and temperature along with an operational guide. Graphic symbols are displayed to help the users during the calibration process.

The pH calibration procedure is automatic with five memorized pH buffer values.

These meters utilize the HI1230B double junction pH electrode. The double junction helps to minimize junction contamination for accurate, consistent results.


| Specifications | | HI9124 | HI9125 |
|---|---|---|---|
| pH* | Range | -2.00 to 16.00 pH | -2.00 to 16.00 pH |
| | Resolution | 0.01 pH | 0.01 pH |
| | Accuracy | ±0.01 pH | ±0.01 pH |
| | Calibration | one or two-point with five standard buffer values (pH 4.01, 6.86, 7.01, 9.18, 10.01) | one or two-point with five standard buffer values (pH 4.01, 6.86, 7.01, 9.18, 10.01) |
| | Temperature Compensation | automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F) without temperature probe | automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F) without temperature probe |
| mV | Range | – | ±699.9 mV; ±1999 mV |
| | Resolution | – | 0.1 mV; 1 mV |
| | Accuracy | – | ±0.2 mV; ±1 mV |
| Temperature* | Range | -20.0 to 120.0°C (-4.0°F to 248.0°F) | -20.0 to 120.0°C (-4.0°F to 248.0°F) |
| | Resolution | 0.1°C (0.1°F) | 0.1°C (0.1°F) |
| | Accuracy | ±0.4°C (±0.8°F) | ±0.4°C (±0.8°F) |
| Additional Specifications Both All Meters | pH Electrode | HI1230B PEI body pH electrode with BNC connector and 1 m (3.3') cable (included) | |
| | Temperature Probe | HI7662 stainless steel temperature probe with 1 m (3.3') cable (included) | |
| | Slope / Offset Calibration | from 80 to 108% / ±1 pH | |
| | Input Impedance | $10^{12}$ Ohm | |
| | Battery Type / Life | 1.5V AAA (3) / approximately 200 hours of continuous use. | |
| | Auto-off | auto-off after 20 minutes of non-use (can be disabled) | |
| | Environment | 0 to 50°C (32 to 122°F); RH max 100% | |
| | Dimensions / Weight | 185 x 72 x 36 mm (7.3 x 2.8 x 1.4") / 300 g (10.6 oz.) | |
| Ordering Information | | **HI9124** and **HI9125** are supplied with HI1230B pH electrode, HI7662 temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, 100 mL plastic beaker, batteries, instructions, and hard carrying case. | |

* Limits will be reduced to actual sensor limits

pH and ORP electrodes begin on page 2.134; pH and ORP solutions begin on page 2.154

HI8424

# General Purpose pH/mV Meter

- Automatic Temperature Compensation (ATC)
- Waterproof
  - Compact, heavy-duty, and waterproof protected casing
- Two-point calibration
  - Automatic one or two-point calibration
- HOLD function
  - Holds stabilized pH value on LCD
- Battery indicator
  - Low battery indicator

The HI8424 is a highly accurate, portable pH/mV meter. It is one of the most popular pH meters on the market. This instrument is able to perform pH, mV, and temperature measurements with a high degree of accuracy and fast response.

Calibration is automatic at one or two points, with three memorized buffer values (pH 4.01, pH 7.01 and pH 10.01). Once the instrument has been calibrated, the buffer values used during calibration are displayed with tags on the LCD. This feature keeps users informed of the current calibration and helps to avoid taking measurements that are out of range.

Users can exchange the pH probe for an ORP probe to obtain ORP readings in the mV range. The HI8424 also offers measurements in °C and °F and has an auto-off feature to preserve battery life.


| Specifications | | HI8424 |
|---|---|---|
| pH* | Range | -2.00 to 16.00 pH |
| | Resolution | 0.01 pH |
| | Accuracy | ±0.01 pH |
| | Calibration | one or two-point , three standard buffers available (4.01, 7.01, 10.01) |
| | Temperature Compensation | automatic from -20.0 to 120.0°C (-4.0 to 248.0°F) or manual without temperature probe |
| mV | Range | ±699.9 mV; ±1999 mV |
| | Resolution | 0.1 mV; 1 mV |
| | Accuracy | ±0.2 mV; ±1 mV |
| Temperature* | Range | -20.0 to 120.0°C ; -4.0 to 248.0°F |
| | Resolution | 0.1°C ; 0.1°F |
| | Accuracy | ±0.4°C; ±0.8°F |
| Additional Specifications | pH Electrode | HI1230B PEI body pH electrode with BNC connector and 1 m (3.3') cable (included) |
| | Temperature Probe | HI7662 stainless steel temperatures probe with 1 m (3.3') cable (included) |
| | Slope / Offset Calibration | from 75 to 110% / ±1 pH |
| | Input Impedance | $10^{12}$ Ohm |
| | Battery Type / Life | 9V / approximately 150 hours of continuous use |
| | Auto-off | after 20 minutes of non-use (can be disabled) |
| | Environment | 0 to 50°C (32 to 122°F); RH max 100% |
| | Dimensions / Weight | 164 x 76 x 45 mm (6.5 x 3.0 x 1.8") / 180 g (6.3 oz.) |
| Ordering Information | | **HI8424** is supplied with HI1230B pH electrode, HI7662 temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachets (2), battery, protective case, and instructions. |
| Accessories | | **HI710015** blue shockproof rubber boot |

* Limits will be reduced to actual sensor limits



pH and ORP electrodes begin on page 2.134; pH and ORP solutions begin on page 2.154

HI83141 · HI8314

# Analog pH/mV Meters

- Automatic Temperature Compensation (ATC)
- Two-point Calibration
- Water-resistant
  - Compact, heavy-duty casing
- Battery indicator
  - Low battery indicator
- Auto shut-off


The HI83141 and HI8314 are portable pH/mV meters designed to be accurate, reliable and easy to use.

The HI8314 uses the HI1217D pre-amplified pH electrode with built-in internal temperature sensor.

The HI83141 uses the HI1230B pH electrode and HI7669AW temperature probe using separate connections.

Manual calibration is performed at one or two points by adjusting the trimmers on the front panel. Capable of measuring pH/mV and temperature, these meters are great for field work, providing one meter for multiple uses.

This instrument is ideal for applications that require a custom calibration point. Manual calibration can be extremely useful in order to achieve better accuracy.

These instruments can also be used for ORP measurements with the optional probes below:

HI83141: **HI3131B**

HI8314: **HI3618D** or **HI4619D**


| Specifications | | HI83141 | HI8314 |
|---|---|---|---|
| pH* | Range | 0.00 to 14.00 pH | 0.00 to 14.00 pH |
| | Resolution | 0.01 pH | 0.01 pH |
| | Accuracy | ±0.01 pH | ±0.01 pH |
| | Calibration | manual, two-point, via trimmers | |
| | Temperature Compensation | automatic, 0 to 70°C (32 to 158 °F) | |
| mV | Range | ±1999 mV | ±1999 mV |
| | Resolution | 1 mV | 1 mV |
| | Accuracy | ±1 mV | ±1 mV |
| Temperature* | Range | 0.0 to 100.0°C; 32.0 to 212.0°F | |
| | Resolution | 0.1°C; 0.1°F | 0.1°C; 0.1°F |
| | Accuracy | ±0.4°C; ±0.8F (excluding probe error) | |
| Additional Specifications | pH Electrode | HI1230B PEI body pH electrode with BNC connector and 1 m (3.3') cable (included) | HI1217D PEI body, pre-amplified pH electrode with internal temperature sensor, DIN connector, and 1 m cable (included) |
| | Temperature Probe | HI7669AW stainless steel temperature probe, BNC connector (included) | – |
| | Slope / Offset Calibration | from 80 to 110% / ±1 pH | |
| | Battery Type / Life | 9V / approximately 450 hours of continuous use | |
| | Auto Shut-Off | after 8 minutes of non-use | |
| | Environment | 0 to 50°C (32 to 122°F); RH max 95% non-condensing | |
| | Dimensions | 145 x 80 x 36 mm (5.7 x 3.1 x 1.4") | |
| | Weight | 230 g (8.1 oz.) | |
| Ordering Information | | **HI83141** is supplied with HI1230B pH electrode and HI7669AW temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachets (2), calibration screwdriver, battery, protective case, and instructions.<br>**HI8314** is supplied with HI1217D pH electrode, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachets (2), calibration screwdriver, battery, protective case, and instructions. | |
| Accessories | | **HI710007** blue shockproof rubber boot | |
| | | **HI710008** orange shockproof rubber boot | |

* Limits will be reduced to actual sensor limits

pH and ORP electrodes begin on page 2.134; pH and ORP solutions begin on page 2.154

HI8010 · HI8014

# Educational pH Meters

- Automatic Temperature Compensation (ATC)
- Two-point calibration

Hanna Instruments manufactures meters for all levels of use, from education to research grade. HI8010 and HI8014 are rugged, handheld pH meters specifically designed with ease of use in mind. These affordable meters are ideal for education and field applications.

HI8010 and HI8014 perform pH measurements with manual temperature compensation. HI8014 also performs ORP measurements using the mV range and optional ORP electrode (HI3131B).

Two-point calibration can be performed with trimmers on the front panel. Temperature is manually compensated by using the trimmer.

These rugged, manual pH meters are perfect for teaching students the fundamentals of pH measurement.



| Specifications | | HI8010 | HI8014 |
|---|---|---|---|
| pH* | Range | 0.00 to 14.00 pH | 0.00 to 14.00 pH |
| | Resolution | 0.01 pH | 0.01 pH |
| | Accuracy | ±0.01pH | ±0.01pH |
| | Calibration | manual, two point, through trimmers (offset ±1 pH; slope: 85 to 105%) | manual, two point, through trimmers (offset ±1 pH; slope: 85 to 105%) |
| | Temperature Compensation | manual from 0 to 100°C (32 to 212°F) | manual from 0 to 100°C (32 to 212°F) |
| mV | Range | – | ±1999 mV |
| | Resolution | – | 1 mV |
| | Accuracy | – | ±1 mV |
| Additional Specifications | pH Electrode | HI1230B PEI body pH electrode with BNC connector and 1 m (3.3') cable (included) | |
| | Slope/Offset Calibration | from 80 to 105%/±1 pH | |
| | Input Impedance | $10^{12}$ Ohm | |
| | Battery Type / Life | 9V / approximately 100 hours of continuous use | |
| | Environment | 0 to 50°C (32 to 122°F); RH max 95% | |
| | Dimensions / Weight | 185 x 82 x 53 mm (7.3 x 3.2 x 2.1") / 265 g (9.3 oz.) | |
| Ordering Information | | **HI8010** and **HI8014** are supplied with HI1230B pH electrode, calibration screwdriver, battery and instructions. | |
| Accessories | | **HI710009** Blue shockproof rubber boot | |

* Limits will be reduced to actual sensor limits



pH and ORP electrodes begin on page 2.134; pH and ORP solutions begin on page 2.154

HI8427 · HI931001

# pH/mV Precision Simulators

- Simulate pH or ORP sensors to troubleshoot your meter
- Simulate temperature
- Provided with universal BNC connector


HI8427 is designed specifically to simulate pH and ORP electrodes to confirm proper functioning of your meter. Standard pH and mV ranges are selectable with a dial on the front panel and pH can simulate sensor response at temperatures between 0 to 50°C.

Provided with a universal BNC connector, this unit is also a high impedance tester for cable and connector inspection with a leakage sensitivity of $10^9$ ohm. This unique tester eliminates the need for very expensive MΩ meters.

Sometimes it is difficult to recognize whether a particular malfunction is due to the meter or the electrode. By simply connecting HI931001 to your meter's input socket and turning the dials, pH readings can be simulated from 0 to 14 pH in 0.01 steps. The output signals all correspond to pH values at 25°C.

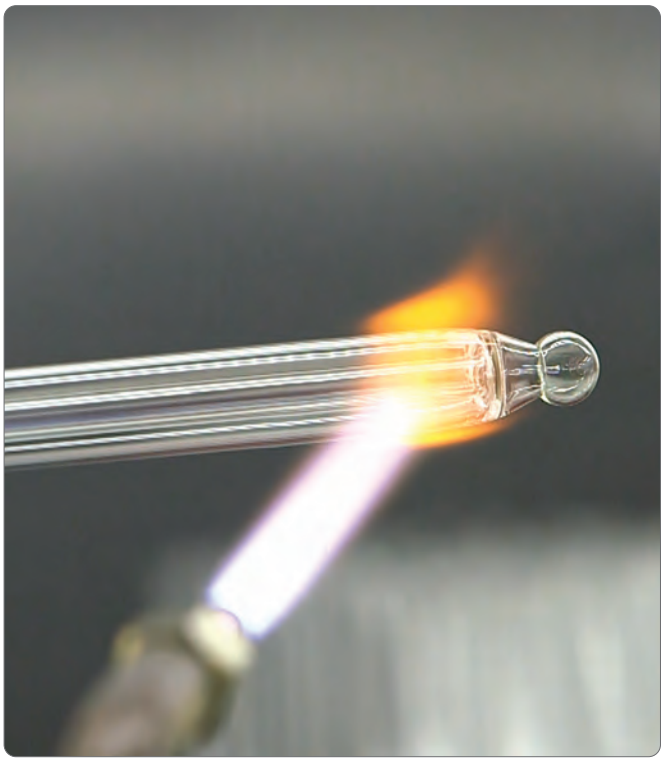
For the mV range, HI931001 can simulate output from -1000 to +1000 mV in 1 mV steps.

| Specifications | | HI931001 | HI8427 |
|---|---|---|---|
| pH* | Range | 0.00 to 14.00 pH | 0, 2, 4, 7, 10, 12, 14 pH |
| | Resolution | 0.01 pH | – |
| | Accuracy | ±0.01 pH | ±0.1 pH |
| mV | Range | -1000 to 1000 mV | -1900, -350, 350, 1900 mV |
| | Resolution | 1 mV | – |
| | Accuracy | ±1 mV | ±5 mV |
| Additional Specifications | Impedance Test | – | $10^9$ Ohm |
| | Temperature Compensation | all output values are simulated at 25°C | manual from 0 to 50°C (32 to 122°F) |
| | Battery Type / Life | 9V / approximately 500 hours of use | 9V / approximately 100 hours of use |
| | Weight | 320 g (11.3 oz.) | 255 g (9.0 oz.) |
| | Environment | 0 to 50°C (32 to 122°F); RH max 95% | 0 to 50°C (32 to 122°F); RH max 95% |
| | Dimensions | 185 x 82 x 53 mm (7.3 x 3.2 x 2.1") | 185 x 82 x 53 mm (7.3 x 3.2 x 2.1") |
| Ordering Information | **HI8427** and **HI931001** are supplied with HI7858/1 BNC/BNC coaxial cable | | |
| Accessories | **HI710009** Blue shockproof rubber boot | | |

* Limits will be reduced to actual sensor limits

# pH Electrodes

*Designed and Manufactured by Hanna*



## At the Forefront of Electrode Technology

Hanna is the largest family-owned manufacturer of scientific analytical instrumentation, and a major European producer of electrodes. Hanna has helped propel the field of sensor technology with it's innovative methodology. The Hanna line of pH electrodes is produced in state of the art manufacturing facilities, and is available with glass or thermal plastic bodies.

In 1981, Hanna developed its own formulation for sensing glass with the help of the Experimental Institute for Glass in Murano Italy. From that point forward, the company has continued to offer these premium pH sensing glass electrodes that cannot be imitated. While other companies have reduced their offerings, Hanna has continued to expand their electrode line to support a multitude of specific applications. An extensive variety of cleaning and maintenance solutions are also available to keep electrodes at peak performance.

### pH Electrode Manufacturing

Other electrode producers use the continuous fusion technique in crucibles with induction furnaces. In this practice, the glass is exposed to the fusion temperature for hours, where it is difficult to retain the quality of the product due to the evaporation of some of its components. Hanna uses glass blowing technology typical of the Murano masters, with sensitive glass sticks fused in controlled batches. Only this technique, which exposes the sensitive glass to the high fusion temperature for a matter of seconds, can guarantee the consistency and quality of the pH half-cell.

## pH Theory and Measurement

The most common pH measurement system utilizes glass pH electrodes. The system consists of a pH sensor (whose voltage varies proportionately to the hydrogen ion activity of the solution), a reference electrode (which provides a stable and constant reference voltage), a conductive measurement solution, and a special meter to measure and display the pH.

The pH sensor incorporates a thin membrane of hydrogen-sensitive glass blown on the end of an inert glass tube. This tube is filled with a buffered electrolyte and an Ag/AgCl wire. This system is called a pH half-cell.

A complementary system produces a constant voltage; it also contains a Ag/AgCl wire and an electrolyte (often a KCl solution saturated with AgCl). A small "filter", often a porous ceramic component, connects this tube to the external sample. This system is called a reference half-cell.

The meter measures the voltage difference between the pH half-cell and the reference half cell in DC millivolts. The measurement is read by the meter and displayed in either mV or pH units. The mV response by a pH electrode follows the Nernst Equation:

$$E^{obs} = E^{c} + \ln(10)(RT / nF)(\log[a_{H^+}])$$

$E^{obs}$ = Observed potential
$E^{c}$ = Reference potential including other stable and fixed potentials
$a_{H^+}$ = The hydrogen ion activity
**T** = Temperature in Kelvin (C° + 273.15)
**n** = Valence of the ion measured (1)
**F** = Faraday's constant ($9.6485 \times 10^4$)
**R** = Gas constant (8.31432J / KMol)

From this equation one can see that if the temperature (T) changes, the term ln(10)RT / nF known as the slope factor, will change also. The table below illustrates the change in slope factor for changes in temperature.

| Temperature (°C) | Slope Factor (mV/pH) |
|---|---|
| 05 | 55.18 |
| 10 | 56.18 |
| 15 | 57.18 |
| 20 | 58.17 |
| 25 | 59.16 |
| 30 | 60.15 |
| 35 | 61.14 |

### How Temperature Affects Solution pH

Samples change pH as a function of temperature due to changes in ion dissociation; as temperature increases, ion activity also increases. An example of this is pH buffers, whose well-characterized values are published on the buffer bottles. With very pure water, a change of ~1.3 pH is observed between 0 and 100°C. This example shows that even a neutral solution can have a large temperature coefficient. All samples have a temperature coefficient that is variable for actual samples. Changes in pH due to the sample temperature coefficient are not compensated for. There is, however, an exception to this; because buffers are well-characterized, they are compensated for during calibration on intelligent pH meters. The buffers will display a 25°C value during calibration but will change after the calibration to read their actual pH at the temperature of measurement.

# pH Electrodes

*Designed and Manufactured by Hanna*

## pH Measuring System

### pH Electrode

The sensor half-cell of an electrochemical cell is typically composed of a special glass membrane that responds to a hydrogen ion concentration.

### Reference Electrode

The half-cell of an electrochemical cell that supplies a stable voltage that is known, constant, and completely insensitive to the measurement solution. Changes in voltages generated from the pH sensor are measured versus this electrode's voltage.

### High Input Impedance Meter

The measurement device that processes the voltage from the electrochemical cell and converts it into a meaningful measurement unit (pH). The measurement is done with virtually zero current flow to prevent polarization of the electrodes. Modern pH meters also may provide sensor diagnostics, automatic buffer recognition, calibration reminders and user prompts.

### Chemical pH Buffers

Buffers are stable, well-characterized standards used for calibration. Two or more pH buffers that bracket the sample pH range are suggested for the most accurate results.

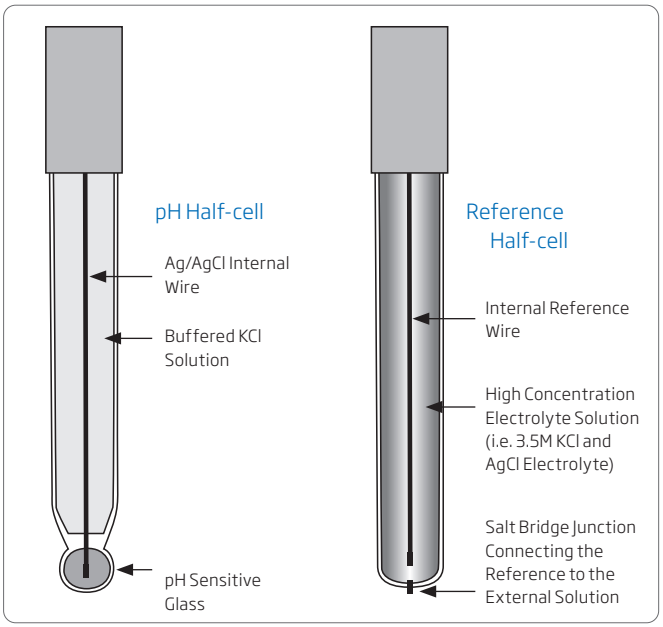
### Thermometer or Temperature Probe

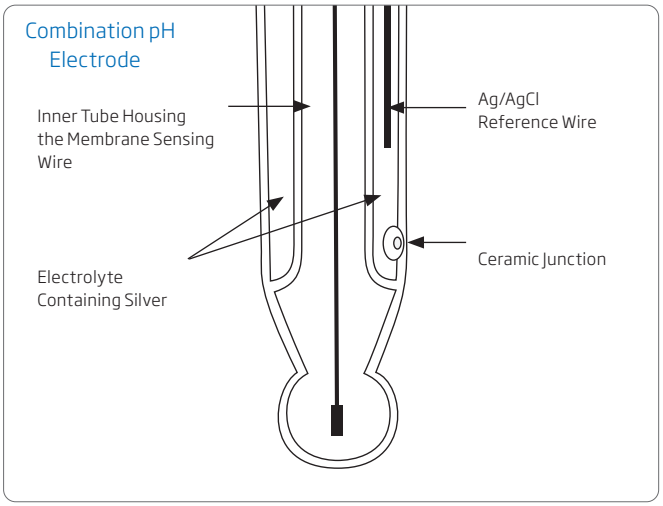
A temperature measurement is desired during calibration and measurement to make adjustments to the Nernst slope factor. An auxiliary or built-in temperature probe ensures both calibration and measurement are automatically temperature compensated, thus eliminating error.

### Magnetic Stirrer

Used in a laboratory setting, a magnetic stirrer together with magnetic stir bars continually agitate the buffer and/or samples to keep them homogenous, eliminating temperature or sample gradients.

## Electrode Design




### Half-cells vs. Combination pH electrodes

Until the 1970s, it was a common practice to offer two half cells separately, a glass pH sensor and a reference electrode. Today it is more common to use a single combined electrode that has both sensing and reference components. Reference electrodes still enjoy use in other electrochemical techniques and their use is often preferred with ion selective electrodes (ISE) half-cells.

# pH Electrodes

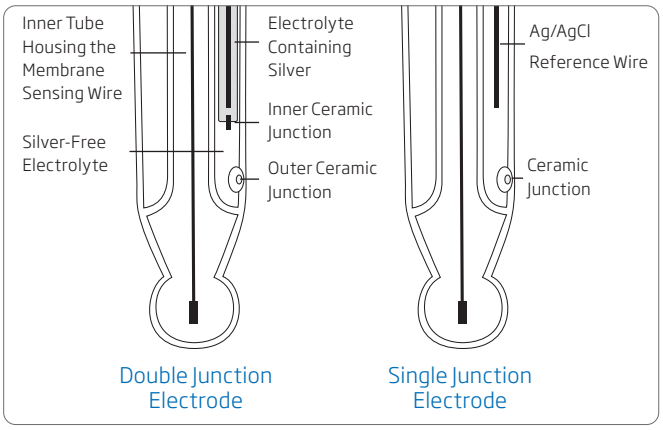
*Designed and Manufactured by Hanna*

## Single Junction vs. Double Junction

Conventional electrodes are normally single junction. As depicted by the figure below, these electrodes have only a single junction, which serves to put the reference electrode system in contact with the sample. Under adverse conditions, such as high pressure, high temperature, highly acidic or alkaline solutions etc., the positive flow of the electrolyte through the junction is often reversed resulting in the ingress of sample solution into the reference compartment. If this is left unchecked, the reference electrode can become contaminated, leading to complete electrode failure. Another potential problem with single junction electrodes is the clogging of the junction due to AgCl precipitation. AgCl is less soluble in the sample than the reference electrolyte solution. Therefore, when the electrolyte solution makes contact with the sample, some AgCl will precipitate on the external face of the junction. The result is drifty readings obtained from the sensor.

Hanna's double junction system, as the name implies, has two junctions, only one of which is in contact with the sample as shown in the figure below. Under adverse conditions, the same tendency of sample ingress is possible. However, as the reference electrode system is separated physically from the intermediate electrolyte area, the contamination of the electrode is minimized. The likelihood of clogging of the junction is also reduced with a double junction electrode since the outer reference cell uses a fill solution that is "silver-free." Since there is no silver present, no precipitate can form to clog the junction.

*Single junction electrodes use a fill solution such as the HI7071 that contains 3.5M KCl + AgCl, while double junction electrodes typically use HI7082 that contains 3.5M KCl.*

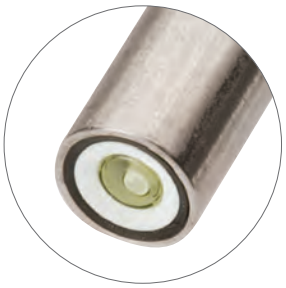



# Types of Junctions:

## Porous Ceramic

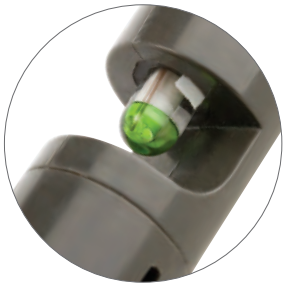
Normally used in electrodes with glass bodies because ceramic with the correct expansion coefficient is easily welded to glass. Ceramic is available with different porosities and diameters. It may also be referred to as a diaphragm.

## Porous PTFE (Polytetrafluoroethylene)



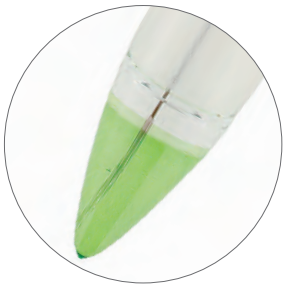
Porous PTFE is a hydrophobic material that is available with different porosities. Because of its chemical resistance, PTFE is widely used in industrial applications.

## Fiber Wick



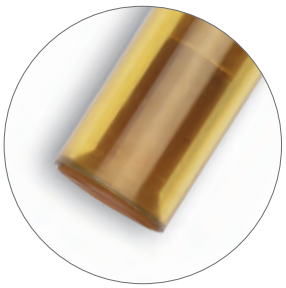
This type of junction is often used on plastic bodied electrodes with gel electrolytes.

## Open Junction



This type of junction is often found in foodcare pH electrodes and is filled with a special gel which comes into direct contact with the solution to be measured. An advantage of an open junction is low contact resistance and low clogging potential.

## Cone Style



This style junction is also renewable. As the sleeve or collar is moved, fresh fill solution cleans out the junction with fresh electrolyte. This has a higher flow rate than a ceramic type and is often specified for ISE measurements.

*Other types of junctions include:*

## Capillary Junction

This type of junction can be made with smooth or frosted glass. The advantage of a capillary junction is a fast flow rate and an open channel. It is typically used with thickened electrolytes.

## Open Platinum

This style junction is made by partially sealing fine Pt wires through the stem glass, creating a leakage path. These have high flow rates.

## Fiberglass

This style junction is very similar to a fiber wick. The junction is typically renewable and may have a high flow rate depending on strand number in the bundle.

# Four Different pH Sensitive Glass Formulations

Application driven design has influenced our offering of pH glass formulations. Hanna has selected the best glass compositions possible for each sensor to ensure the most accurate measurements in a given application. The characteristics of the sensitive glass used in the manufacture of pH electrodes are extremely important in determining how the electrode will respond. Characteristics of pH glass include workability (what shapes can be made with a certain glass composition), impedance of the glass (influenced by shape and thickness), pH range, alkaline error, acid error, hydrofluoric acid resistance and abrasion resistance.

Hanna utilizes four different types of pH sensitive glass to cover the vast number of applications. For instance, some electrodes with low impedance glass are particularly suited at performing measurements in solutions with low conductivity or cold solutions. As a general rule, the pH of glass impedance doubles for every 10°C (50°F) drop in temperature. Very high impedance results in a very noisy, erratic signal that is prone to errors in measurement. Hanna offers low temperature (LT) glass, a low impedance glass for these applications. At elevated temperatures, glass can dissolve readily, shortening the life and performance of the sensor. Hanna offers high temperature (HT) glass for these applications.

## GP Glass

Hanna's general purpose (GP) hydrogen sensitive glass provides the best response over the entire pH range and can be used for a wide range of applications. Great results are obtained with a sphere geometry with a diameter of 9.5 mm (0.37"), achieving a system with 100 MΩ impedance. The GP glass is also used on smaller diameter spheres. As the diameter of the sphere is reduced, the system impedance increases. The response time then increases from the usual 2 seconds for the 9.5 mm (0.37") sphere to about 6 seconds with a 3 mm (0.12") sphere. The color of the GP glass is green.

## LT Glass

Due to low impedance, LT glass is used on flat and conical shaped membranes, as well as sensors used at cold temperatures. If an electrode has very high impedance, the measurement response will be sluggish, and a voltage drop causing error can occur. At temperatures below -8°C (17°F) the internal buffer may freeze and expand, causing the mechanical destruction of the sensor. This glass has a more limited pH range, and is colored dark green.

## HT Glass

Designed for extended use at elevated temperature, the impedance of HT glass has a temperature coefficient of about 14.3% per degree Celsius. HT sensitive glass has an impedance of 400 MΩ at approximately 25°C (77°F). At extremely high temperatures the impedance drops significantly; HT glass makes it possible to obtain accurate, high temperature pH measurements for extended periods of time at 90°C (194°F) and for several weeks at 100°C (212°F). At room temperature, the response time may increase so additional time for equilibration in buffers should be allowed. The color of HT glass is clear.

## HF Glass

Hydrofluoric acid can dissolve glass rapidly. Hanna uses HF resistant glass for aggressive applications that have fluoride ions. Electrodes manufactured with this glass live ten times longer than electrodes made with standard pH glass formulations (from 10 days to 100 days). The alkaline error is very high for this glass, so it is not suited for pH measurements above pH 10. The recommended pH range with this glass is from 2 to 10 pH and for samples with less than 2 g/L fluoride.

## Different Shaped Membranes (Tips)

The pH membranes used as the sensor on pH electrodes can be fabricated with different shaped membranes; spherical, conical, and flat tips are used in Hanna's products. For analysis of small samples, microelectrodes are also available.


Spherical

A **spherical tip** is recommended for general use in aqueous or liquid solutions and provides a wide surface of contact with the sample.


Conical

A **conical tip** is recommended for semi-solid products, emulsions, cheese, meat, and food in general.

A **flat tip** is recommended for direct surface measurement on skin, leather, paper, etc.


Flat

## Body Material

Combination pH electrodes are often made entirely of glass. The bodies of these electrodes are lead free glass, which is not pH sensitive. All glass electrodes are ideal for routine laboratory work because they respond quickly to temperature changes, are easily cleaned, and are compatible with organic solvents. However, in the hands of some, glass can be very breakable.

The electrode body can be made less fragile by incorporating an outer body made from a thermoplastic. Hanna uses PEI resin, PVDF and PP as examples of materials utilized for outer body construction. Some industrial sensors utilize additional materials such as PVC and/or titanium, the space age metal. A titanium body increases immunity to electrostatic and magnetic fields and features strong corrosion resistance, even in seawater. Our titanium bodied electrodes' outer casing also serves as a matching pin.

# pH Electrodes

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## Matching Pin

A matching pin is a differential measurement technique used to eliminate ground loops and common mode perturbations for a measurement system. In a system without a matching pin, electrical currents in the sample can affect the reference half cell voltage that is connected via the liquid junction with the sample. In this case, the reference electrode picks up the electromagnetic fields and the measurement of the pH is altered. The matching pin isolates these current/magnetic fields from the reference electrode. Hanna manufactures a number of models with the matching pin design for safe precise pH measurements.

## Types of Connectors

Most Hanna meters accept pH electrodes with one of the connectors listed below.

*The BNC connector is the most versatile since it can be used with any meter that utilizes BNC, regardless of brand.*

DIN, 3.5 mm, Screw, and T-type connections are generally proprietary to the meters they are supplied with. Screw and T-Type connectors attach directly to the meter.

Even though both Screw and T-type connectors attach directly to the meter, they can also be made interchangeable with other meters by using Hanna BNC extension cables.


DIN


Quick Connect DIN


BNC


BNC + PIN


T-Type


Screw


3.5 mm digital

# Water Conductivity and pH Measurement

pH is the measurement of hydrogen ion activity. Ultrapure water is the perfect solvent and readily dissolves many things. The pH glass surface can actually become dehydrated if stored or used in deionized or distilled water as ions are leached from the sensing surface. pH electrodes require ions in a solution, preferably with a conductivity of or exceeding 200 µS/cm to function properly.

*In the case of low conductivity samples that are below 200 µS/cm, we suggest the use of specific electrodes, such as the HI1053 which has LT glass suitable for low temperatures. This pH electrode has a triple ceramic junction that allows a higher flow rate of reference electrolyte to help provide electrical conductivity.*

# Alkaline Error

Alkaline error exists in high pH solutions when the hydrogen ions in the gel layer are partially or completely substituted with alkali ions; the resulting pH displayed is lower than it actually should be.

The difference between the theoretical and measured pH is called the alkaline error. Sodium ions are typically the ions that are responsible, but potassium and lithium ions can also contribute to this error. In earlier glass compositions, the alkaline error was seen to start at 9 pH. Newer glass formulations and ones especially formulated to minimize this error now exhibit an error starting at 12 or 13 pH.

To solve the problem of alkaline error, Hanna's high temperature (HT) glass minimizes alkali error in highly alkaline solutions. The tables below show the alkaline error that exists with Hanna glass types at ambient temperatures:

**Alkaline Error with 0.1 M Sodium**

| pH | GP | HT | LT | HF |
|---|---|---|---|---|
| 10.0 | | | | |
| 10.5 | | | | 0.06 |
| 11.0 | | | | 0.15 |
| 11.5 | | | 0.05 | 0.22 |
| 12.0 | 0.01 | | 0.18 | 0.30 |
| 12.5 | 0.11 | 0.05 | 0.28 | |
| 13.0 | 0.23 | 0.11 | 0.35 | |
| 13.5 | 0.35 | 0.16 | 0.45 | |
| 14.0 | 0.48 | 0.20 | 0.54 | |

**Alkaline Error with 1.0 M Sodium**

| pH | GP | HT | LT | HF |
|---|---|---|---|---|
| 10.0 | | | 0.01 | 0.25 |
| 10.5 | | | 0.14 | 0.25 |
| 11.0 | 0.02 | | 0.30 | 0.48 |
| 11.5 | 0.11 | 0.01 | 0.46 | 0.71 |
| 12.0 | 0.21 | 0.06 | 0.62 | |
| 12.5 | 0.32 | 0.11 | 0.79 | |
| 13.0 | 0.43 | 0.15 | | |
| 13.5 | 0.45 | 0.21 | | |
| 14.0 | 0.65 | 0.27 | | |

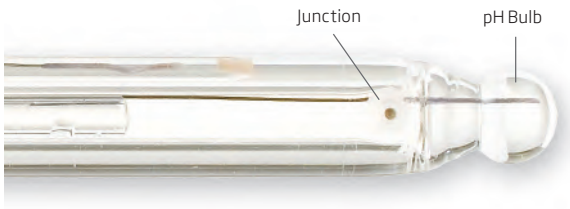
# Calibration

## pH Electrode Preparation Procedure

A clean, conditioned Hanna pH electrode will provide the best measurements possible. When using a new electrode, remove the protective bulb cap and inspect the electrode.

*As water may have evaporated during shipping or storage, salt crystals may be found in and around the protective cap or on the pH bulb, this is normal .*

Rinse off with water. During transport, air bubbles may have formed inside the glass bulb. Shake down the electrode as you would with a spirit filled thermometer. Condition the sensing tip; soak the pH bulb and junction in HI70300 storage solution for at least one hour or longer. If possible, an overnight soak is best. This will hydrate a dehydrated glass sensor and thoroughly wet a dried reference junction.




## Rinse Electrode with Purified Water

Prior to placing the electrode in calibration solution, it should be thoroughly rinsed with clean, purified water to prevent any contamination to the pH buffer. The electrode should always be rinsed with purified water after placing it in any solution.

## Use Fresh pH Buffer for Calibration

The calibration of the pH electrode is only as good as the buffer used. Once a bottle of buffer is open, it should be discarded after six months of use. To prevent cross-contamination, never pour buffer back into the bottle. If the same buffer is to be used for multiple calibrations, it is better to pour a small amount of buffer in a separate container that can be sealed. If using a separate container, the buffer should be changed frequently (i.e. daily, weekly).

*It is important to note that pH buffers at higher values (i.e. pH 10.01) are less stable than lower values, this is due to atmospheric $CO_2$ diffusing into the buffer, forming carbonic acid. If the buffer is old, the actual value might be less than stated on the bottle, resulting in a low slope.*

## Open Reference Fill Cap on Refillable Electrodes

If using a refillable pH electrode, the fill cap should be removed prior to calibration and measurement. Removing the cap creates positive head pressure in the reference cell allowing for higher flow rate of electrolyte through the outer junction. A higher flow rate will result in a faster and more stable reading.

## Submerse Electrode Past Junction

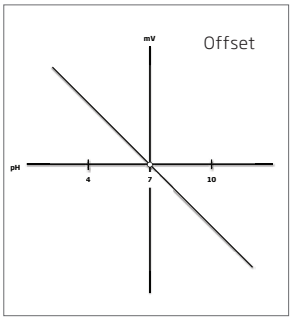
It is critical that the junction of the electrode be completely submersed in the pH buffer or sample. Failure to do so will result in erratic readings.

## Use a Magnetic Stirrer

For benchtop meters, it is beneficial to use a magnetic stirrer. A magnetic stirrer will ensure that the pH buffer or sample is homogenous. The movement of the solution will also increase the response time of the electrode in the solution.

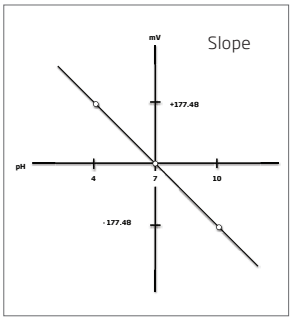
## One-point Calibration

For one-point calibration it is important to calibrate the pH electrode in pH 7.0. This calibration determines the offset value. The mV value at pH 7.00 ideally should be 0.0.



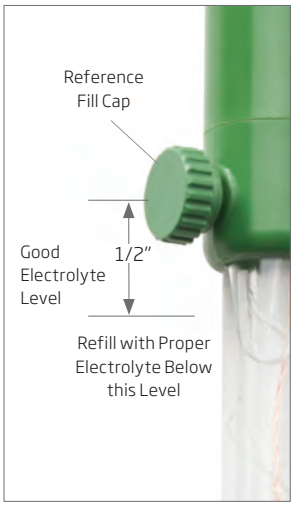

## Multiple-point Calibration

For improved accuracy it is recommend to calibrate a minimum of two points. The second point determines the slope of the line. It is important to use buffers that bracket the expected value of the sample to be tested. For example, if the expected value is pH 8, the electrode should be calibrated using pH 7.01 and pH 10.01 buffer.




## Electrode Fill Solutions

The electrolyte level in refillable electrodes should be checked before performing any calibration. If the level is low (1 cm or ½" below fill hole), refill with the proper electrolyte solution to ensure the optimum electrode performance. This simple maintenance step helps guarantee adequate head pressure to promote efficient and precise reading.




*Always use the appropriate fill solution for your pH electrode. Typically single junction pH electrodes use the HI7071 electrolyte solution (3.5M KCl + AgCl) while double junction pH electrodes use HI7082 electrolyte solution (3.5M KCl).*

# pH Electrodes

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## Maintenance and Storage

### General Maintenance Tips

*Periodically check the offset and slope characteristic of the pH electrode.*

If your meter does not have GLP (Good Laboratory Practice) capability to display this information, see below on how to use the mV function of a pH meter to determine offset and slope characteristics. A probe should have an offset (pH 7.01) voltage of ± 30 mV. Values outside this range could indicate that an electrode needs to be cleaned or the reference fill solution is contaminated. A probe should have a slope greater than 85% (50 mV/pH @ 25°C). Many Hanna meters will alert the user if the offset exceeds ±8.0 mV or if the slope is less than 94%.

*If it is not possible to check offset and slope of the electrode with your meter, it is recommended to change the pH electrode yearly to ensure that accurate readings are obtained.*

*How to calculate offset and slope*

- Must have a pH meter that can be placed in mV mode
- Must use fresh buffers

The procedure below is based on calibration buffers at 25°C. At this temperature the theoretical 100% slope is 59.16 mV/pH change from pH 7.0. A pH electrode in calibration buffer at 50°C will generate 64 mV/pH, while at 0°C the response will be 54 mV/pH.

**Step 1** Measure mV of pH 7.01 buffer and record value
**Step 2** Measure mV value of pH 4.01 buffer and record value
**Step 3** Calculate the absolute mV difference
(pH 4.01 value – pH 7.01 value)

*Examples:*

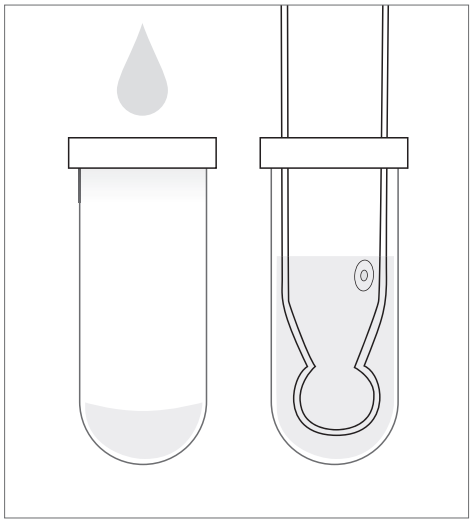
**Electrode 1** pH 7.01 = -15 mV
pH 4.01 = +160 mV
Absolute mV difference is +160 mV – (-15 mV) = +175 mV

**Electrode 2** pH 7.01 = +15 mV
pH 4.01 = +160 mV
Absolute mV difference is +160 mV – (-15 mV) = +145 mV

At 25°C pH 7.01 (offset) = ±30 mV.
The absolute mV difference should be 150 mV (85% slope) to 186 mV (105% slope).

**Conclusion:** Electrode 1 is working properly while electrode 2 has an unacceptable slope. Try cleaning and if possible replace fill solution. If slope is still low then replace the pH electrode.

*Important note: A pH 7.01 mV value outside ±30 mV is an indicator of a build up/coating on the pH bulb. The electrode should be cleaned.*



### Electrode Storage Solutions

To minimize junction clogging and ensure fast response time, always keep the glass bulb and the junction of your pH electrode hydrated. For benchtop meters used in the lab pour a small amount of the HI70300 storage solution in a small beaker and lower the electrode into it making sure that the junction is covered. For portable meters, store the electrode with a few drops of HI70300 storage solution in the protective cap.

Storage solutions are designed to keep the pH electrode hydrated while minimizing growth on the electrode from bacteria and algae. Placing a probe in water will result in a growth on the electrode that might not be visible to the naked eye. This growth will affect the performance and accuracy. To minimize growth it is recommended to use pH 4 buffer if storage solution is not available. Solutions with lower pH values can inhibit growth. If pH 4 buffer is not available, it is advisable to use pH 7 buffer.

***Never store a pH electrode in purified water as it will dehydrate the bulb.*** *The concentration of the fill solution is 3.5M KCl. The reference cell with this concentration generates a specific voltage. Placing a probe in purified water will have an osmotic effect causing water to move into the reference cell. There will also be a higher rate of diffusion of electrolyte from the reference cell into the water due to a concentration gradient. Both will result in a different reference electrolyte concentration, which will result in a change in the reference potential. If using a non-refillable probe in which the reference electrolyte cannot be changed, storage in purified water may result in premature failure and ultimately replacement of the electrode.*

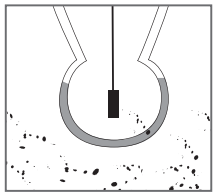
Inspect the electrode for any scratches or cracks on the bulb or stem.
If any are present, replace the electrode.

# Electrode Cleaning

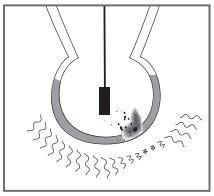
## Cleaning Procedure

The most common cause for pH measurement inaccuracies is an unclean or improperly cleaned electrode. This is very important to note, because during calibration, the instrument assumes that the electrode is clean and that the standardization curve created during the calibration process will remain a valid reference until the next calibration. pH meters on the market today will allow an offset voltage of approximately ±60 mV. The deviation from 0 mV is not unusual but ideally should be no greater than ±30 mV. The calibration process compensates for the change in offset voltage.

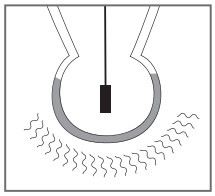
Calibrating a meter with a dirty electrode will result in inaccurate readings. If the mV offset continues to deviate with a properly cleaned electrode, it is a good indication that the electrode may need to be replaced.



In time, particles during routine measurement can contaminate the sensor tip. Mishandled and aged solutions can also be affected.



Your meter can still be calibrated even if the electrode sensor tip is not properly cleaned before calibration. If the contamination dissapates, the calibration is no longer valid and the readings are inaccurate.



A proper cleaning and fresh solution ensures the whole surface of the sensor tip is reading correctly, ensuring an accurate calibration.

## General Cleaning

Soak in Hanna HI7061 General Cleaning Solution for approximately 30 minutes to dissolve mineral deposits and other general coatings.

## Protein Coating

Soak in Hanna HI7073 Protein Cleaning Solution for 15 minutes to enzymatically dissolve deposits from protein sources.

## Inorganic Soak

Soak in Hanna HI7074 Inorganic Cleaning Solution for 15 minutes. This cleaner is especially effective at removal of precipitates caused by reaction with the silver in the filling solution that may form on a ceramic junction.

## Oil and Grease Rinse

Oil and grease removal require the correct chemicals to solubilize the coating, but are mild enough to leave the electrode unaffected. Use Hanna HI7077 Oil and Fat Cleaning Solution.

*After performing any of the cleaning procedures, rinse the electrode thoroughly with purified water and then soak the electrode in HI70300 or HI80300 storage solution for at least 1 hour before taking measurements.*

# Troubleshooting

## Drifting/Erratic Readings

Potential problems include:

**Build up on glass electrode** – Clean electrode

**Clogged junction** – Depending on the material clogging the electrode, use application specific cleaning solutions. It may be possible to dissolve in high purity water or place in an acid such as 0.1M HCl or 0.1M $HNO_3$ at elevated temperature (50°C) for about an hour to clear the clog.

*If the junction is constantly clogging due to measuring in semi solids or viscous samples, use a pH electrode that has an open junction design or cloth junction.*

**Low conductivity solution** – Use an electrode that has a high flow rate or add high purity KCl to sample to increase EC.

**Electrode is not properly hydrated** – Soak in storage solution for at least 1 hour, if not longer.

## Frozen pH Reading

**Broken electrode** – Possible short between internal pH electrode and reference. pH meter displays the same value when placed in different buffers. The electrode should then be replaced.

## Inaccurate Reading:

**Improper calibration** – Make sure that pH electrode was rinsed with purified water between buffers to prevent cross-contamination and the electrode is at thermal equilibrium with the buffer.

Check offset and slope of electrode. Offset mV value in pH 7.0 should be ±30 mV; if outside of this range, try cleaning the electrode. Slope (difference in mV from pH 7.0 to pH 4.0) must be greater than 150 mV (85%). If the slope is less than 85% then use fresh buffers, change fill solution, and clean electrode. If the slope cannot be increased to an acceptable value, replace electrode.

**Important note:** *A low slope can be due to a bad buffer. If calibrating to pH 7 and 10, it is possible that pH 10 buffer is no longer valid. pH 10 buffer is susceptible to diffusion of $CO_2$ from the air. When this happens, the pH 10 buffer will have a lower pH value and result in a low slope percentage value. Tracking the mV values of the buffer by writing the value on the bottle when opened is a way to have a reference point of a good buffer.*

*85% slope is the absolute threshold of an acceptable slope percentage. There are industries that require a slope of 90% or higher.*

# pH Electrodes

*Designed and Manufactured by Hanna*

**Calibrating and measuring at different temperatures–**Either use a meter that has automatic temperature compensation or calibrate and measure at same temperature. Note that the buffer pH at various temperatures is noted on the bottle.

**Measuring at high pH (>pH 10.0) introduces alkaline error–** Use a pH electrode that has HT glass to minimize alkaline error.

**Calibration with an electrode that was not clean–**Any coating that comes off the electrode during use will alter the electrode characteristic, resulting in the calibration being no longer valid.

**Electrical noise interference can interfere with obtaining an accurate pH measurement–**Noise from rectifiers in plating baths, motors or pumps can interfere with the high impedance measuring circuit.

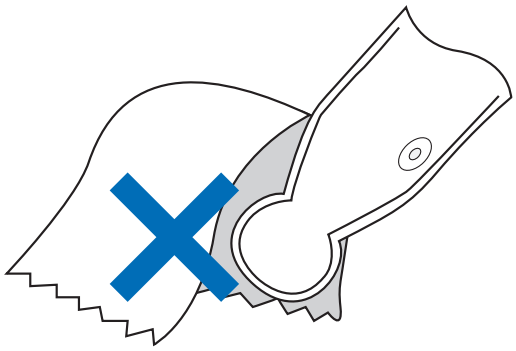
## pH Electrode has a Short Life Span (< 6 months)

Elevated temperatures reduce the life span of pH electrodes. At room temperature (25°C) a pH electrode will typically last 1 to 2 years. A general rule is that for every 25°C increase the electrode life will decrease by ½. Temperature cycling has the most detrimental effect.

| Operating Temperature | Average Lifespan |
|---|---|
| 25°C | 1 to 2 years |
| 50°C | 6 to 12 months |
| 75°C | 3 to 6 months |
| 100°C | <1 month |

*If measuring samples at temperatures greater than 50 °C, use a pH electrode with high temperature (HT) glass such as the HI1043.*

**Storing a pH electrode in purified water will shorten the life span of pH electrode–**If using a refillable pH electrode, replace fill solution; if using a gel-filled electrode, the electrode will have to be replaced. Store in storage solution.



**Wiping a pH electrode with tissue will harm an electrode**–It is important to blot a pH electrode. Wiping the electrode can produce a static charge on the sensor that will destabilize the measurement thus requiring additional time before stable measurements can be obtained.

*Solutions with hydrofluoric acid will dissolve the glass at a pH less than pH 5. Use electrodes with HF resistant glass. The HI1143 will resist HF up to 2 g/L @ pH 2 and temperatures less than 60°C.*

# ORP Theory and Applications

## ORP (Oxidation Reduction Potential)

Similar to the manner in which acidic or alkaline solutions are quantified by pH measurements, solutions can also be graded as oxidizing or reducing based on measurements of ORP (sometimes called "redox").

When an oxidizing and/or reducing agent is dissolved into an aqueous sample, they may react with materials present and produce a voltage, or electromotive force (EMF), that is related to the ratio of oxidized to reduce species in the sample. An electron exchange can develop between this solution and an inert metal sensor immersed in the solution, and the voltage can be measured (when compared to a reference electrode) with a pH/mV meter. This type of measurement is known as redox or ORP. The units of measurement are in mV. At a glance, an ORP electrode may look very similar to a pH electrode. Like a combination pH electrode, both the sensor and the reference are housed in a common body.

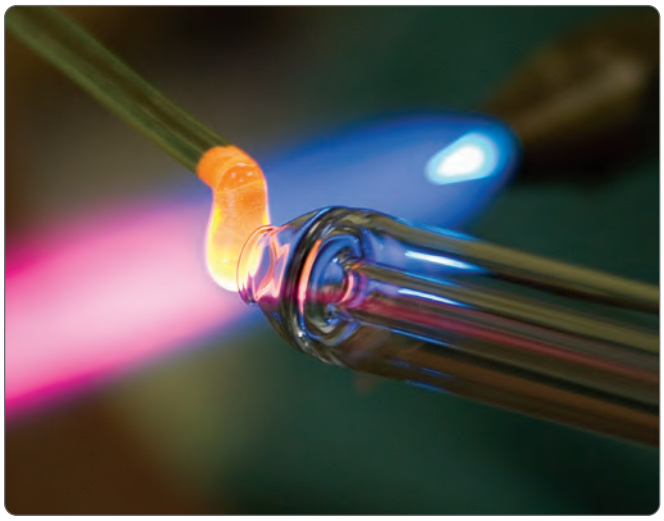
The scale of measurement may be positive (indicating oxidizing potential) or negative (indicating reducing). It should be noted that when zero mV is observed, it is really an oxidizing situation because the reference voltage (~200 mV for an Ag/AgCl with KCl electrolyte) is included in the observed mV value. In some cases the user may wish to offset the reading to remove the reference contribution. The mV is then said to be approaching the absolute mV scale that references a SHE (standard hydrogen electrode). This type of calibration is called relative mV calibration.

An ORP sensor must be chemically inert; it cannot be oxidized or reduced itself. It must also have the proper surface characteristics to promote rapid electron exchange, a property known as high exchange current density. Two noble metals have proven to work well for this purpose: pure platinum and pure gold are both used in the construction of ORP sensors.

The platinum sensor is often preferred because it is mechanically simpler and safer to produce. Platinum can be welded to glass and has the same thermal coefficient. Sensors made of gold cannot be welded to the glass and are often placed in plastic supports applied to the glass or plastic tube by means of tiny elastomeric bungs. The gold or platinum sensor signal is carried through the electrode body, and together with the reference signal is conducted to the measurement meter via a coaxial cable with BNC connector.

An ORP system does not have a high impedance source (like a pH bulb), but is a potentiometric device that produces a voltage. It also uses similar cables, connectors, and calibration solutions. For this reason, a high impedance electronic meter (pH) with many user friendly features are a benefit for this measurement also.

Because of the close relationship between pH and ORP, there is a scale that takes into account the ratio (mV) ORP/pH, the rH scale. The rH range varies from 0 to 42, where the extreme values represent the reducing effect of an atmosphere of pure hydrogen (rH=0) and to the oxidizing effect of an atmosphere of pure oxygen (rH=42), respectively.



The formula for obtaining the rH value is as follows:

$$rH = \frac{mV}{0.0992\,(273.15 + T_c)} - 2\,pH$$

In this equation, where T is the temperature (°C) of the sample, mV is the ORP (mV) reading, and pH is the pH value of the sample.

The rH scale is not used in the instruments available on the market. A direct mV reading from the electrode is preferred, within the ±2000 mV range, without compensation/correlation with the pH/temperature value.

## ORP Applications

ORP measurements are based on the potential difference measured between the platinum or gold electrode and a reference electrode. The identical reference system utilized for the pH electrode (Ag/AgCl) is also used for redox measurements.

Redox electrodes are used to monitor many chemical processes particularly those involving reversible reactions. Common applications include the following:

## Industrial Wastewater Treatment

The redox systems used in water treatment are the reduction of chromates and oxidation of cyanides. Waste hexavalent chromium is reduced to trivalent chromium by the addition of sodium bisulfite or sulphur dioxide. In the case of cyanide, chlorine or sodium hypochlorite is used to oxidize the cyanide, followed by the hydrolysis of cyanate to ammonia and carbon dioxide.

## Water Sanitation

ORP measurements are being increasingly used as an effective measure of the sanitizing activity in pool, spa, and potable water. The kill time of E. coli bacteria in water depends on the ORP value. ORP is a reliable indicator of bacteriological water quality. Water having an ORP value equal to or higher than 650 mV are well within accepted sanitization levels for pool and spa waters.

# Electrode Feature Guide: A Quick Glance

## CAL Check™ System

When used in tandem with a Hanna CAL Check meter, our CAL Check equipped electrodes allow users to be informed if they have performed a proper calibration. In the event of a dirty or broken electrode or contaminated buffer solution, the system alerts the user to either check the electrode, replace the buffer solution, or both. The system also reminds users when the instrument should be recalibrated.

## Smart Electrodes

With models that feature our SMART circuitry, an exclusive microchip embedded inside the electrode retains the calibration data and assigns an identity code to the host unit. As soon as the electrode is connected to a pH meter in the SMART series, it is recognized and its characteristics retrieved. The meter then uses the accessed calibration data as a reference for future measurements. Once each SMART electrode is calibrated, these electrodes can be used in succession without requiring new calibration. Hanna's SMART electrodes help eliminate errors and save time when working with more than one electrode.

## Pre-amplified Electrodes

Pre-amplifiers are encapsulated in many of Hanna's pH electrodes. The pre-amplifier converts the high impedance signal from the pH glass to a low impedance signal; this allows the user to use long runs of sensor cable with ordinary connectors without noise or voltage drops that result in erroneous measurements.

## Clogging Prevention System (CPS™)

Conventional pH electrodes use ceramic junctions that may clog quickly when used in biological samples, such as wine or must. When the junction is blocked, the entire electrode will not function properly. Electrodes that feature CPS technology utilize a ground glass/PE sleeve junction which controls a steady, predictable flow of fill solution, thus keeping the junction open. The hydrophobic property of PE sleeve repels wetness and coatings.

## Sensor Check™ for edge® Meters

When used with Hanna's electrodes equipped with a matching pin, edge constantly checks the impedance of the pH measuring electrode to notify the user, in real-time, in the event of glass breakage. During calibration, Sensor Check also verifies the state of the junction.

## Titanium Casings

Our electrodes that feature titanium bodies offer durability and shielding that is required in many industrial applications.

# pH Electrode Application Guides





Abbreviation Guide

| | |
|---|---|
| Spheric (S) | Glass (G) |
| Dome (D) | Plastic (P) |
| Conic (C) | Metal (M) |
| Flat (F) | |

| Application | Recommended Electrodes | Tip Shape | Body Material | Single Reference | Double Reference | Cloth Junction | Ceramic Junction | Open Junction | Viscolene Electrolyte | Gel Electrolyte | KCl 3.5M Electrolyte | KCl 3.5M + AgCl Electrolyte | Refillable | SMART | Temperature Sensor | Amplifier | Pressure (Bar) | Page |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acids, Strong | HI1043B, HI1043P | S | G | | • | | • | | | | • | | • | | | | 0.1 | 2.134 |
| | HI10430* | S | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.141 |
| Alkaline, Strong | HI2111B (half-cell) + HI5311 | S | G | | • | | • | | | | • | | | | | | 0.1 | 2.151, 2.152 |
| Aquariums | HI1332B/P/D | S | P | | • | | • | | | | • | | • | | | | 0.1 | 2.140 |
| Bases, Strong | HI1043B, HI1043P | S | G | | • | | • | | | | • | | • | | | | 0.1 | 2.134 |
| | HI10430* | S | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.141 |
| Beer | FC2143 | F | M | • | | • | | | | • | | | | | • | • | 3 | 2.146 |
| | HI1131B, HI1131P | S | G | | • | | • | | | | • | | • | | | | 0.1 | 2.135 |
| | HI11313 | S | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.135 |
| | HI11310* | S | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.141 |
| | HI11311* | S | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.141 |
| Biotechnology (< 100 µl) | HI1083B, HI1083P | S | G | • | | | | • | • | | | | | | | | 0.1 | 2.134 |
| Boilers and Cooling Towers | HI729113 | F | M | | • | | PTFE | | | | Polymer | | | | • | • | 3 | 2.150 |
| Cheese | FC200B/D | C | P | • | | | | • | | • | | | | | | | 0.1 | 2.144 |
| | FC2423, FC2423-1 | C | M | • | | | • | | • | | | | | | • | • | 0.1 | 2.147 |
| | FC240B | C | M | • | | | | • | | • | | | | | | | 0.1 | 2.145 |
| | FC2023, FC2053 | C | P | | • | | | • | • | | | | | • | • | • | 0.1 | 2.146 |
| Chemicals | HI1332B/P/D | S | P | | • | | • | | | | • | | • | | | | 0.1 | 2.140 |
| Conductivity, Low | HI10430* | S | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.141 |
| | HI1053B, HI1053P | C | G | | • | | • | | | | • | | • | | | | 0.1 | 2.134 |
| | HI10530* | C | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.141 |
| | HI10533 | C | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.134 |
| Conductivity, High | HI1043B, HI1043P | S | G | | • | | • | | | | • | | • | | | | 0.1 | 2.134 |
| Creams | FC210B | C | G | | • | | | • | • | | | | | | | | 0.1 | 2.144 |
| | FC220B | S | G | • | | | • | | | | | • | • | | | | 0.1 | 2.145 |
| | FC911B | S | P | | • | | • | | | | • | | • | | | • | 0.1 | 2.146 |
| Dairy (general use) | HI2031B | C | G | • | | | • | | | | | • | • | | | | 0.1 | 2.137 |
| | FC100B | S | P | | • | | • | | | | • | | • | | | | 0.1 | 2.144 |
| | FC1013 | S | P | | • | | • | | | | • | | • | | • | • | 0.1 | 2.144 |
| Emulsions | HI1053B, HI1053P | C | G | | • | | • | | | | • | | • | | | | 0.1 | 2.134 |
| | HI10530* | C | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.141 |
| | HI10533 | C | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.134 |
| | HI1612D | C | G | • | | | • | | | | | • | • | | • | • | 0.1 | 2.139 |
| | HI1413B | F | G | • | | | | • | • | | | | | | | | 0.1 | 2.148 |
| | HI14143 | F | G | • | | | | • | • | | | | | | • | • | 0.1 | 2.148 |
| Fats and Creams | HI1053B, HI1053P | C | G | | • | | • | | | | • | | • | | | | 0.1 | 2.134 |
| | HI10530* | C | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.141 |
| | HI10533 | C | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.134 |
| Flasks | HI1331B | S | G | • | | | • | | | | | • | • | | | | 0.1 | 2.136 |
| Fluoride, Samples with | HI1143B | S | G | | • | | • | | | | • | | • | | | | 0.1 | 2.136 |
| Food Industry (General Use) | FC100B | S | P | | • | | • | | | | • | | • | | | | 0.1 | 2.144 |
| | FC911B | S | P | | • | | • | | | | • | | • | | | • | 0.1 | 2.146 |
| Food, Semi-solid | FC2023, FC2053 | C | P | | • | | | • | • | | | | | • | • | • | 0.1 | 2.146 |
| | FC200B/D | C | P | • | | | | • | | • | | | | | | | 0.1 | 2.144 |

*edge® specific electrode

# pH Electrode Application Guides

**Abbreviation Guide**

| | |
|---|---|
| Spheric (S) | Glass (G) |
| Dome (D) | Plastic (P) |
| Conic (C) | Metal (M) |
| Flat (F) | |

| Application | Recommended Electrodes | Tip Shape | Body Material | Single Reference | Double Reference | Cloth Junction | Ceramic Junction | Open Junction | Viscolene Electrolyte | Gel Electrolyte | KCl 3.5M Electrolyte | KCl 3.5M + AgCl Electrolyte | Refillable | SMART | Temperature Sensor | Amplifier | Pressure (Bar) | Page |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fruits | FC200B/D | C | P | • | | | | • | | • | | | | | | | 0.1 | 2.144 |
| | FC2023, FC2053 | C | P | | • | | | • | • | | | | | • | • | • | 0.1 | 2.146 |
| Fruit Juices, Organic | FC220B | S | G | • | | | • | | | | | • | • | | | | 0.1 | 2.145 |
| | FC911B | S | P | | • | | • | | | | • | | • | | | • | 0.1 | 2.146 |
| Frozen, Semi | FC230B | C | P | • | | | | • | • | | | | | | | | 0.1 | 2.145 |
| Ham and Sausages | FC200B/D | C | P | • | | | | • | | • | | | | | | | 0.1 | 2.144 |
| | FC2023, FC2053 | C | P | | • | | | • | • | | | | | • | • | • | 0.1 | 2.146 |
| | FC230B | C | P | • | | | | • | • | | | | | | | | 0.1 | 2.145 |
| Humidity, High | FC911B | S | P | | • | | • | | | | • | | • | | | • | 0.1 | 2.146 |
| Hydrocarbons | HI1043B, HI1043P | S | G | | • | | • | | | | • | | • | | | | 0.1 | 2.134 |
| | HI10430* | S | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.141 |
| Laboratory (General Use) | HI1131B, HI1131P | S | G | | • | | • | | | | • | | • | | | | 0.1 | 2.135 |
| | HI11313 | S | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.135 |
| | HI1230B | S | P | | • | | • | | | • | | | | | | | 2 | 2.136 |
| | HI12303 | S | P | | • | | • | | | • | | | | • | • | • | 2 | 2.136 |
| | HI1217D, HI1291D | S | P | • | | | • | | | • | | | | | • | • | 2 | 2.138 |
| | HI1610D | S | G | • | | | • | | | | | • | • | | • | • | 0.1 | 2.139 |
| | HI11310* | S | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.141 |
| | HI11311* | S | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.141 |
| | HI12300* | S | P | | • | | • | | | • | | | | • | • | • | 2 | 2.143 |
| | HI12301* | S | P | | • | | • | | | • | | | | • | • | • | 2 | 2.143 |
| | HI1110B | S | G | • | | | • | | | • | | | | | | | 0.1 | 2.136 |
| | HI11103 | S | G | • | | | • | | | • | | | | • | • | • | 0.1 | 2.136 |
| Leather | HI1413B | F | G | • | | | | • | • | | | | | | | | 0.1 | 2.148 |
| | HI14143 | F | G | • | | | | • | • | | | | | | • | • | 0.1 | 2.148 |
| Meats | FC230B | C | P | • | | | | • | • | | | | | | | | 0.1 | 2.145 |
| | FC400B | C | P | | • | | | • | • | | | | | | | | 0.1 | 2.145 |
| | FC2323 | C | P | • | | | | • | • | | | | | | • | • | 0.1 | 2.147 |
| | FC2023, FC2053 | C | P | | • | | | • | • | | | | | • | • | • | 0.1 | 2.146 |
| | FC2320* | C | P | | • | | | • | • | | | | | • | • | • | 0.1 | 2.142 |
| Milk | FC100B | S | P | | • | | • | | | | • | | • | | | | 0.1 | 2.144 |
| | FC1013 | S | P | | • | | • | | | | • | | • | | • | • | 0.1 | 2.144 |
| | FC260B (half-cell) | S | G | | | | | | | | | | | | | | | 2.151 |
| Monitoring, Continuous | HI1135B | S | G | | • | | • | | | | • | | • | | | | 3 | 2.135 |
| | HI1611D | S | G | • | | | • | | | • | | | | | • | • | 2 | 2.139 |
| Must in Winemaking | HI1048B/P, HI1048B/50 | D | G | | • | | | • | | | • | | • | | | | 0.1 | 2.146 |
| | FC10483 | D | G | | • | | | • | | | • | | • | | • | • | 0.1 | 2.146 |
| | HI10480* | D | G | | • | | | • | | | • | | • | • | • | • | 0.1 | 2.142 |
| NMR Tubes | HI1093B, HI1093P | S | G | • | | | | • | • | | | | | | | | 0.1 | 2.135 |
| Paints | HI1043B, HI1043P | S | G | | • | | • | | | | • | | • | | | | 0.1 | 2.134 |
| | HI10430* | S | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.141 |
| Paper | HI1413B | F | G | • | | | | • | • | | | | | | | | 0.1 | 2.148 |
| | HI14143 | F | G | • | | | | • | • | | | | | | • | • | 0.1 | 2.148 |
| Photographic Chemicals | HI1230B | S | P | | • | | • | | | • | | | | | | | 2 | 2.136 |
| | HI12303 | S | P | | • | | • | | | • | | | | • | • | • | 2 | 2.136 |
| Plating Baths | HI629113 | F | M | | • | | PTFE | | | Polymer | | | | | • | • | 3 | 2.150 |
| Quality Control | HI1332B/P/D | S | P | | • | | • | | | | • | | • | | | | 0.1 | 2.140 |
| | FC240B | C | M | • | | | | • | | • | | | | | | | 0.1 | 2.145 |

*edge® specific electrode

Unsure about which electrode to choose? Give your local Hanna office a call for assistance.

# pH Electrode Application Guides

| | |
|---|---|
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| Dome (D) | Plastic (P) |
| Conic (C) | Metal (M) |
| Flat (F) | |

| Application | Recommended Electrodes | Tip Shape | Body Material | Single Reference | Double Reference | Cloth Junction | Ceramic Junction | Open Junction | Viscolene Electrolyte | Gel Electrolyte | KCl 3.5M Electrolyte | KCl 3.5M + AgCl Electrolyte | Refillable | SMART | Temperature Sensor | Amplifier | Pressure (Bar) | Page |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sauces | FC220B | S | G | • | | | • | | | | | • | • | | | | 0.1 | 2.145 |
| | FC911B | S | P | | • | | • | | | | • | | • | | | | 0.1 | 2.146 |
| Seawater | HI1043B, HI1043P | S | G | | • | | • | | | | • | | • | | | | 0.1 | 2.134 |
| | HI10430* | S | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.141 |
| Semi-solid Products | HI1053B, HI1053P | C | G | | • | | • | | | | • | | • | | | | 0.1 | 2.134 |
| | HI10530* | C | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.141 |
| | HI10533 | C | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.134 |
| | HI1612D | C | G | • | | | • | | | | | • | • | | • | • | 0.1 | 2.139 |
| | FC200B/D | C | P | • | | | | • | • | | | | | | | | 0.1 | 2.144 |
| | HI2031B | C | G | • | | | • | | | | | • | • | | | | 0.1 | 2.137 |
| Skin, Scalp | HI1413B | F | G | • | | | | • | • | | | | | | | | 0.1 | 2.148 |
| | HI14143/50 | F | G | • | | | | • | • | | | | | | • | • | 0.1 | 2.148 |
| Soil, Direct | HI12923 | C | G | • | | | • | | | | | • | • | | • | • | 0.1 | 2.148 |
| | HI12943** | C | G | • | | | • | | | | | • | • | | • | • | 0.1 | 2.149 |
| Soil Solution | HI1053B, HI1053P | C | G | | • | | • | | | | • | | • | | | | 0.1 | 2.134 |
| | HI10530* | C | G | | • | | • | | | | • | | • | • | • | | 0.1 | 2.141 |
| | HI10533 | C | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.134 |
| | HI1230B | S | P | | • | | • | | | • | | | | | | | 2 | 2.136 |
| | HI12923 | C | G | • | | | • | | | | | • | • | | • | • | 0.1 | 2.148 |
| | HI12943** | C | G | • | | | • | | | | | • | • | | • | • | 0.1 | 2.149 |
| Solvents | HI1043B, HI1043P | S | G | | • | | • | | | | • | | • | | | | 0.1 | 2.134 |
| | HI10430* | S | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.141 |
| Surface Measurements | HI1413B | F | G | • | | | | • | • | | | | | | | | 0.1 | 2.148 |
| | HI14143 | F | G | • | | | | • | • | | | | | | • | • | 0.1 | 2.148 |
| | HI14140* | F | G | • | | | | • | • | | | | | • | • | • | 0.1 | 2.142 |
| Swimming Pools | HI12973 | C | M | • | | • | | | | • | | | | | • | • | 3 | 2.149 |
| Titrations, Non Aqueous | HI1049B | D | G | | • | | | • | | | • | | • | | | | 0.1 | 2.148 |
| | HI1151B | S | G | | • | | • | | | | | • | • | | | | 0.1 | 2.135 |
| Tris Buffer | HI1043B, HI1043P | S | G | | • | | • | | | | • | | • | | | | 0.1 | 2.134 |
| | HI10430* | S | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.141 |
| | HI1144 | S | G | • | | | • | | | | • | | • | | | | 0.1 | 2.137 |
| | HI1343B | S | P | • | | | • | | | | • | | • | | | | 0.1 | 2.137 |
| Vials and Test Tubes | HI1330B, HI1330P | S | G | • | | | • | | | | | • | • | | | | 0.1 | 2.137 |
| Wastewater | HI12963 | S | M | • | | • | | | | • | | | | | • | • | 3 | 2.149 |
| | HI12973 | C | M | • | | • | | | | • | | | | | • | • | 3 | 2.149 |
| Water, High Purity | HI1053B, HI1053P | C | G | | • | | • | | | | • | | • | | | | 0.1 | 2.134 |
| | HI10530* | C | G | | • | | • | | | | • | | • | • | • | | 0.1 | 2.141 |
| | HI10533 | C | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.134 |
| Water, Municipal | HI12973 | C | M | • | | • | | | | • | | | | | • | • | 3 | 2.149 |
| Water, Potable | HI1053B, HI1053P | C | G | | • | | • | | | | • | | • | | | | 0.1 | 2.134 |
| | HI10530* | C | G | | • | | • | | | | • | | • | • | • | | 0.1 | 2.141 |
| | HI10533 | C | G | | • | | • | | | | • | | • | • | • | • | 0.1 | 2.134 |
| | FC2153 | S | G | • | | | • | | | | | • | • | | • | • | 0.1 | 2.149 |
| Water Treatment | HI12973 | C | M | • | | • | | | | • | | | | | • | • | 3 | 2.149 |
| Yogurt | FC200B/D | C | P | • | | | | • | • | | | | | | | | 0.1 | 2.144 |
| | FC210B | C | G | | • | | | • | • | | | | | | | | 0.1 | 2.144 |
| | FC2133 | C | G | | • | | | • | • | | | | | | • | • | 0.1 | 2.147 |
| | FC2023, FC2053 | C | P | | • | | | • | • | | | | | • | • | • | 0.1 | 2.146 |
| | FC2100* | C | G | | • | | | • | • | | | | | • | • | • | 0.1 | 2.142 |
| | FC2020* | C | P | | • | | | • | • | | | | | • | • | • | 0.1 | 2.142 |

*edge® specific electrode; **HI9814 GroLine portable meter specific electrode

# ORP Electrode Application Guides

Abbreviation Guide

Platinum (Pt) Gold (Au) Glass (G) Plastic (P)

| Application | Recommended Electrodes | Sensor | Body Material | Single Reference | Double Reference | Cloth Junction | Ceramic Junction | Open Junction | Gel Electrolyte | KCl 3.5M Electrolyte | KCl 3.5M + AgCl Electrolyte | Refillable | SMART | Temperature Sensor | Amplifier | Pressure (Bar) | Page |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Field | HI36203 | Pt | P | • | | | • | | • | | | | | • | • | 2 | 2.140 |
| Laboratory (General Use) | HI3131B | Pt | G | • | | | • | | | | • | • | | | | 0.1 | 2.138 |
| | HI3618D, HI36183 | Pt | G | • | | | • | | | | • | • | | • | • | 0.1 | 2.138 |
| | HI36180* | Pt | G | | • | | • | | | | • | • | • | • | • | 0.1 | 2.143 |
| | HI36200* | Pt | P | • | | | • | | • | | | | • | • | • | 2 | 2.143 |
| Must in Winemaking | HI3149B | Pt | G | | • | | | • | | • | | • | | | | 0.1 | 2.138 |
| Oxidants | HI4430B | Au | P | • | | | • | | • | | | | | | | 2 | 2.140 |
| Ozone | HI4430B | Au | P | • | | | • | | • | | | | | | | 2 | 2.140 |
| Quality Control | HI3230B | Pt | P | • | | | • | | • | | | | | | | 2 | 2.140 |
| Titrations, ORP | HI3131B | Pt | G | • | | | • | | | | • | • | | | | 0.1 | 2.138 |
| Water, Municipal | HI3230B | Pt | P | • | | | • | | • | | | | | | | 2 | 2.140 |
| Must in Winemaking | HI3148B | Pt | G | | • | | | • | | • | | • | | | | 0.1 | 2.146 |

*edge® specific electrode

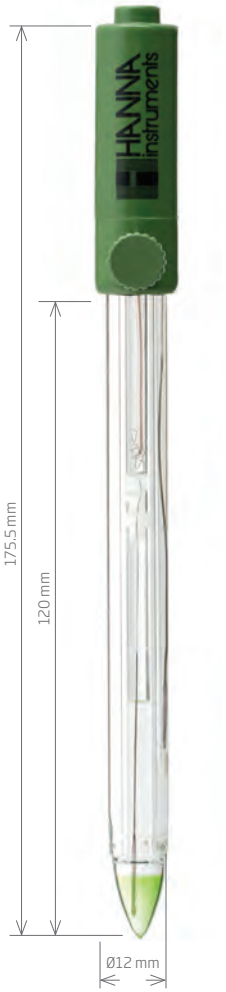
# Half-Cell and Reference Electrode Application Guides

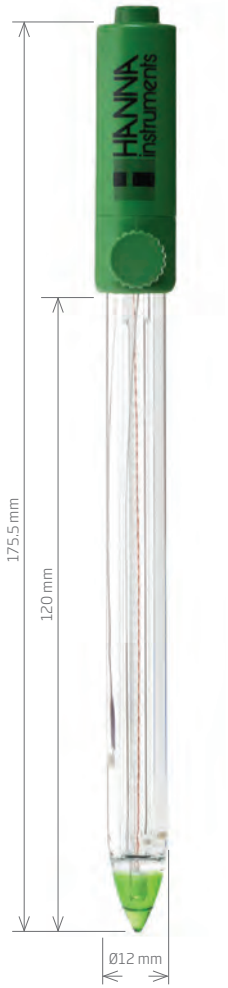
Abbreviation Guide

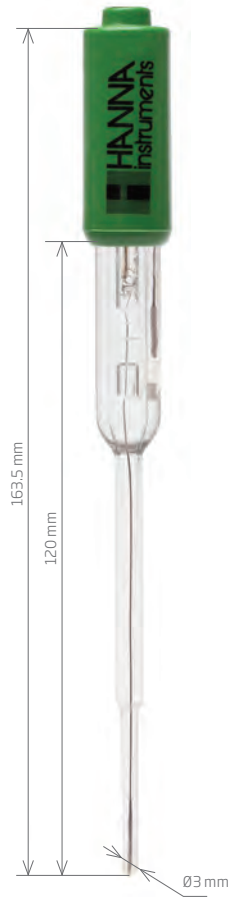
Spheric (S) Cylindric (C) Platinum (Pt) Gold (Au) Glass (G) Plastic (P)

| Application | Recommended Electrodes | pH Half Cell | ORP Half Cell | Reference | Tip Shape | Body Material | Single Reference | Double Reference | PE Sleeve Junction | Ceramic Junction | KCl 3.5M Electrolyte | Pressure (Bar) | Page |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Laboratory (General Use) | HI2111B | • | | | S | G | | | | | | | 2.151 |
| | HI2112B | • | | | S | P | | | | | | | 2.151 |
| | HI3133B | | • | | Pt | G | | | | | | | 2.151 |
| | HI5412 | | | • | | G | • | | | • | • | 0.1 | 2.152 |
| | HI5311 | | | • | | G | | • | | • | • | 0.1 | 2.152 |
| Milk | FC260B | • | | | S | G | | | | | | | 2.151 |
| Remote Filling | HI5314 | | | • | | G | | • | | • | • | 3 | 2.152 |
| | HI5414 | | | • | | G | • | | | • | • | 3 | 2.152 |
| Strong Alkaline Solutions | HI2111B | • | | | S | G | | | | | | | 2.151 |
| Suspended Solids | HI5413 | | | • | | G | • | | • | | • | 0.1 | 2.153 |
| | HI5312 | | | • | | G | | • | • | | • | 0.1 | 2.153 |
| | HI5313 | | | • | | P | • | | | • | | 0.1 | 2.153 |
| Titration, Argentometric | HI5110B | | • | | C | G | | | | | | | 2.151 |
| Titrations, General | HI5412 | | | • | | G | • | | | • | • | 0.1 | 2.152 |
| | HI5311 | | | • | | G | | • | | • | • | 0.1 | 2.152 |
| | HI5312 | | | • | | G | | • | • | | • | 0.1 | 2.153 |
| | HI5313 | | | • | | P | • | | | • | | 0.1 | 2.153 |
| Titration, Potentiometric | HI3133B | | • | | Pt | G | | | | | | | 2.151 |

# Combination Electrodes

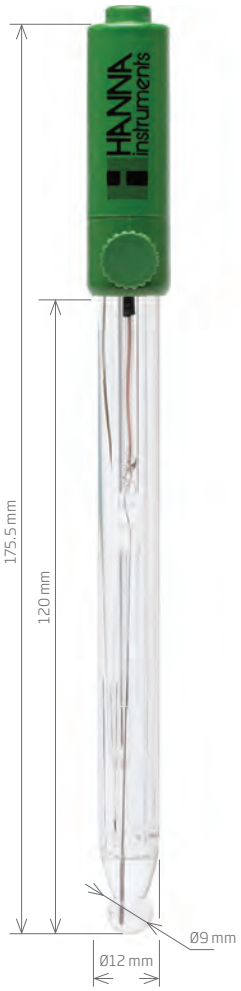




| Code | HI1043[ ] | HI1053[ ] | HI10533 | HI1083[ ] |
|---|---|---|---|---|
| Description | refillable, combination pH electrode w/ double junction | refillable, combination pH electrode w/ conical tip | refillable, combination pH electrode w/ conical tip | combination pH electrode w/micro bulb for small samples |
| Reference | double, Ag/AgCl | double, Ag/AgCl | double, Ag/AgCl | double, Ag/AgCl |
| Junction / Flow Rate | ceramic, double / 30-40 µL/h | ceramic, triple / 40-50 µL/h | ceramic, triple / 40-50 µL/h | open |
| Electrolyte | KCl 3.5M | KCl 3.5M | KCl 3.5M | viscolene |
| Max Pressure | 0.1 bar | 0.1 bar | 0.1 bar | 0.1 bar |
| Range | pH: 0 to 14 | pH: 0 to 12 | pH: 0 to 12 | pH: 0 to 13 |
| Recommended Operating Temp. | 0 to 100°C (32 to 212°F) | -5 to 70°C (23 to 158°F) | -5 to 70°C (23 to 158°F) | 0 to 50°C (32 to 122°F) |
| Glass Type | HT (high temperature) | LT (low temperature) | LT (low temperature) | GP (general purpose) |
| Tip /Shape | spheric (dia: 9.5 mm) | conic (12 x 12 mm) | conic (12 x 12 mm) | spheric (dia: 3 mm) |
| Temperature Sensor | no | no | yes | no |
| Amplifier | no | no | yes | no |
| Body Material | glass – HT | glass – LT | glass – LT | glass – GP |
| Cable | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') |
| Recommended Use | hydrocarbons, paints, solvents, sea water, strong acids and bases, high conductivity samples, tris buffer | fats and creams, high purity water, soil samples, potable water, semi-solid products, low conductivity solutions, emulsions | fats and creams, high purity water, soil samples, potable water, semi-solid products, low conductivity solutions, emulsions | biotechnology, samples < 100 µL |
| Connection | **HI1043B** BNC<br>**HI1043P** BNC + pin* | **HI1053B** BNC<br>**HI1053P** BNC + pin* | **HI10533** Quick Connect DIN | **HI1083B** BNC<br>**HI1083P** BNC + pin* |
| | * For pH meters with CAL Check™ system | * For pH meters with CAL Check system | | * For pH meters with CAL Check system |

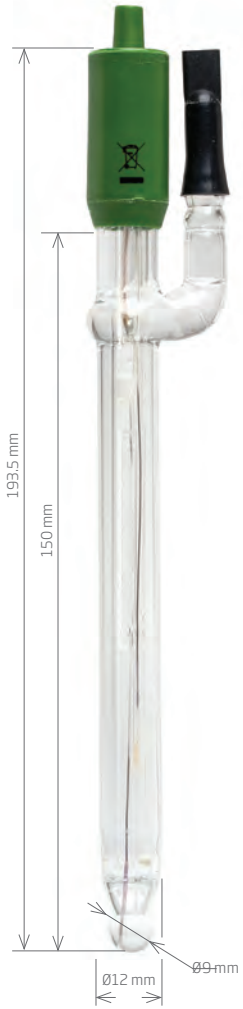


Unsure about which electrode to choose? Give your local Hanna office a call for assistance.

# Combination Electrodes






| Code | HI1093B | HI1131[ ] | HI1151B | HI1135B |
|---|---|---|---|---|
| Description | combination pH electrode w/ extended length and micro bulb | refillable, combination pH electrode | refillable, combination pH electrode | refillable, combination pH electrode w/ side arm construction and fast flow rate |
| Reference | single, Ag/AgCl | double, Ag/AgCl | double, Ag/AgCl | double, Ag/AgCl |
| Junction / Flow Rate | open | ceramic, single / 15-20 µL/h | ceramic, single / 15-20 µL/h | ceramic, double / 30-40 µL/h |
| Electrolyte | viscolene | KCl 3.5M | – | KCl 3.5M |
| Max Pressure | 0.1 bar | 0.1 bar | 0.1 bar | 3 bar with back pressure |
| Range | pH: 0 to 14 | pH: 0 to 14 | pH: 0 to 13 | pH: 0 to 14 |
| Recommended Operating Temp. | 0 to 50°C (32 to 122°F) | 0 to 100°C (32 to 212°F) | 0 to 100°C (32 to 212°F) | 0 to 100°C (32 to 212°F) |
| Glass Type | GP (general purpose) | HT (high temperature) | HT (high temperature) | HT (high temperature) |
| Tip /Shape | spheric (dia: 3 mm) | spheric (dia: 9.5 mm) | spheric (dia: 9.5 mm) | spheric (dia: 9.5 mm) |
| Temperature Sensor | no | DIN model only | no | no |
| Amplifier | no | DIN model only | no | no |
| Body Material | glass – GP | glass | glass | glass |
| Cable | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') |
| Recommended Use | NMR tubes | laboratory general purpose, beer | non-aqueous titration | continuous monitoring with remote filling |
| Connection | **HI1093B** BNC<br>**HI1093P** BNC + pin* | **HI1131B** BNC<br>**HI1131P** BNC + pin*<br>**HI11313** Quick Connect DIN | **HI1151B** BNC | **HI1135B** BNC |

* For pH meters with CAL Check™ system

* For pH meters with CAL Check™ system

# Combination Electrodes

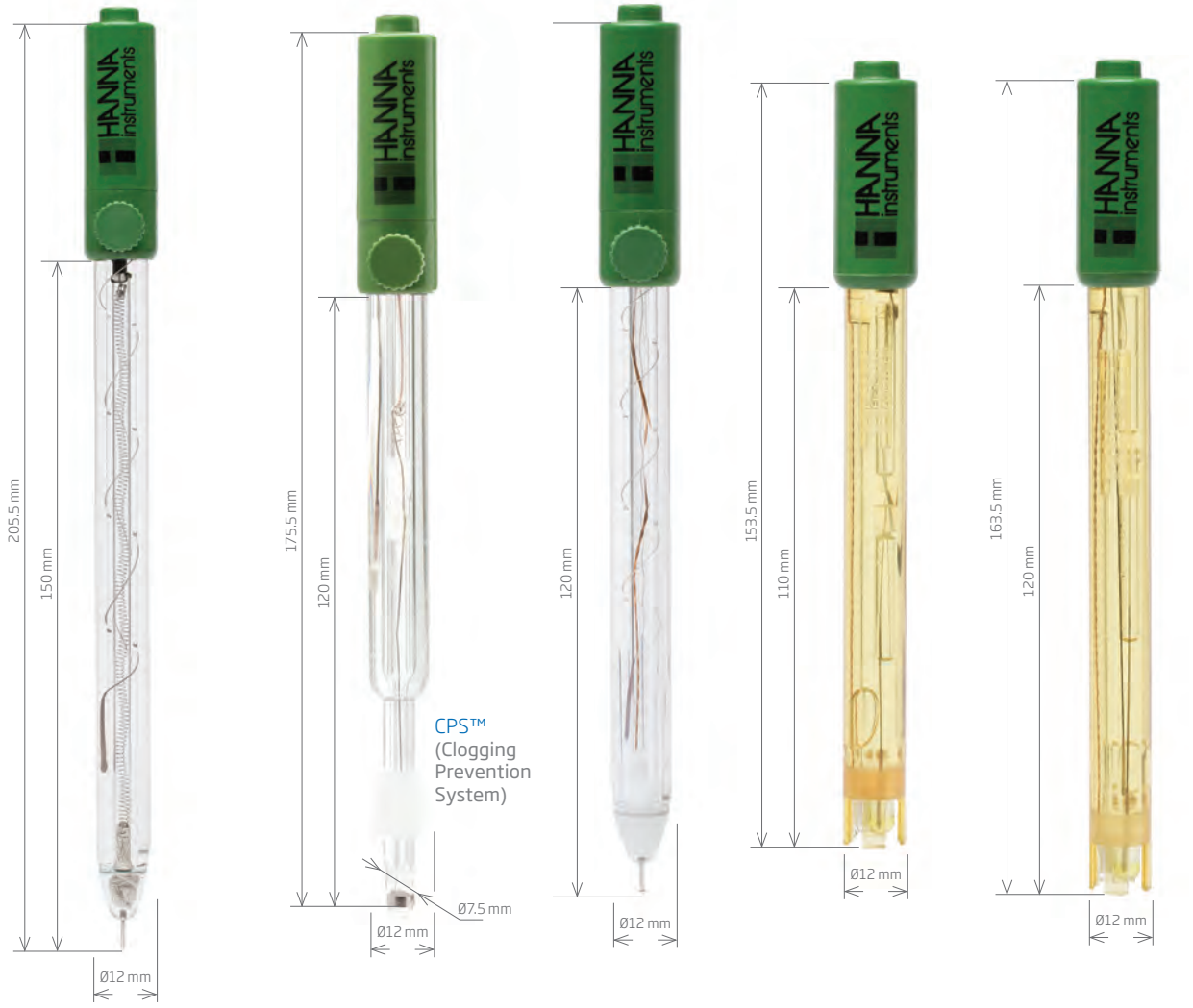

| Code | HI1143B | HI1110[ ] | HI1331B | HI1230[ ] |
|---|---|---|---|---|
| Description | refillable, combination pH electrode for fluoride applications | combination pH electrode | combination pH electrode | combination pH electrode |
| Reference | double, Ag/AgCl | single, Ag/AgCl | single, Ag/AgCl | double, Ag/AgCl |
| Junction / Flow Rate | ceramic, single / 15-20 µL/h | ceramic, single / 15-20 µL/h | ceramic, single / 15-20 µL/h | ceramic, single / 15-20 µL/h |
| Electrolyte | KCl 3.5M | gel | KCl 3.5M + AgCl | gel |
| Max Pressure | 0.1 bar | 0.1 bar | 0.1 bar | 2 bar |
| Range | pH: 0 to 10 | pH: 0 to 13 | pH: 0 to 13 | pH: 0 to 12 |
| Recommended Operating Temp. | -5 to 60°C (23 to 140°F) – HF | 0 to 80°C (32 to 176°F) – GP | 0 to 70°C (32 to 158°F) – GP | -5 to 70°C (23 to 158°F) – LT |
| Glass Type | HF (hydrofluoric acid resistant) | GP (general purpose) | GP (general purpose) | LT (low temperature) |
| Tip /Shape | spheric (dia: 9.5 mm) | spheric (dia: 9.5 mm) | spheric (dia: 7.5 mm) | spheric (dia: 7.5 mm) |
| Temperature Sensor | no | DIN model only | no | DIN model only |
| Amplifier | no | DIN model only | no | DIN model only |
| Body Material | glass | glass | glass | PEI |
| Cable | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') |
| Recommended Use | samples with fluoride (max 2 g/L @ pH 2 and temperature < 60°C) | general purpose | specific for flasks | field applications, soil solution, photographic chemicals, laboratory (general use) |
| Connection | **HI1143B** BNC | **HI1110B** BNC<br>**HI11103** Quick Connect DIN | **HI1331B** BNC | **HI1230B** BNC<br>**HI12303** Quick Connect DIN |

# Combination Electrodes


| Code | HI1144B | HI1330[ ] | HI1343B | HI2031B |
|---|---|---|---|---|
| Description | refillable, combination pH electrode with calomel references | refillable, combination pH electrode | combination pH electrode | refillable, conical tip combination pH electrode |
| Reference | single, $Hg/Hg_2Cl_2$ | single, Ag/AgCl | single, $Hg/Hg_2Cl_2$ | single, Ag/AgCl |
| Junction / Flow Rate | ceramic / 15-20 µL/h | ceramic, single / 15-20 µL/h | ceramic, single / 15-20 µL/h | ceramic, single / 15-20 µL/h |
| Electrolyte | KCl 3.5M | KCl 3.5M + AgCl | KCl 3.5M | KCl 3.5M + AgCl |
| Max Pressure | 0.1 bar | 0.1 bar | 0.1 bar | 0.1 bar |
| Range | pH: 0 to 14 | pH: 0 to 12 | pH: 0 to 14 | pH: 0 to 12 |
| Recommended Operating Temp. | 0 to 60°C (32 to 140°F) – HT | -5 to 70°C (23 to 158°F) - LT | 0 to 60°C (32 to 140°F) - HT | -5 to 70°C (23 to 158°F) - LT |
| Glass Type | HT (high temperature) | LT (low temperature) | HT (high temperature) | LT (low temperature) |
| Tip /Shape | spheric (dia: 9.5 mm) | spheric (dia: 5 mm) | spheric (dia: 7.5 mm) | conic (6 x 10 mm) |
| Temperature Sensor | no | no | no | no |
| Amplifier | no | no | no | no |
| Body Material | glass | glass | PEI | glass |
| Cable | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') |
| Recommended Use | tris buffer | specific for vials and test tubes | specific for Tris buffer | dairy and semi-solid products |
| Connection | **HI1144B** BNC | **HI1330B** BNC<br>**HI1330P** BNC + pin* | **HI1343B** BNC | **HI2031B** BNC |

* For pH meters with CAL Check™ system

# Special pH and ORP Electrodes




| Code | HI3131B | HI3149B | HI3618D/HI36183 | HI1217D | HI1291D |
|---|---|---|---|---|---|
| Description | refillable combination ORP electrode | ORP electrode | ORP combination electrode | pH electrode | pH electrode |
| Reference | single, Ag/AgCl | double, Ag/AgCl | single, Ag/AgCl | single, Ag/AgCl | single, Ag/AgCl |
| Junction / Flow Rate | ceramic, single / 15-20 µL/h | CPS™ | ceramic, single / 15-20 µL/h | ceramic, single | ceramic, single |
| Electrolyte | KCl 3.5M + AgCl | KCl 3.5M | KCl 3.5M + AgCl | gel | gel |
| Max Pressure | 0.1 bar | 0.1 bar | 0.1 bar | 2 bar | 2 bar |
| Range | ORP: ±2000 mV | ORP: ±2000 mV | ORP: ±2000 mV | pH: 0 to 13 | pH: 0 to 12 |
| Recommended Operating Temp. | -5 to 70°C (23 to 158°F) | -5 to 60°C (23 to 140°F) | -5 to 70°C (23 to 158°F) | 0 to 70°C (32 to 158°F) | 0 to 70°C (32 to 158°F) |
| Glass Type | – | – | – | GP (general purpose) | GP (general purpose) |
| Tip /Shape | platinum pin | platinum ring | platinum pin | spheric (dia: 5.0 mm) | spheric (dia: 5.0 mm) |
| Temperature Sensor | no | no | yes | yes | yes |
| Amplifier | no | no | yes | yes | yes |
| Body Material | glass | glass | glass | PEI | PEI |
| Cable | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') | 5-pole; 1 m (3.3') | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') |
| Recommended Use | laboratory general use, ORP titrations | non-aqueous titrations | laboratory | general purpose | general purpose, education, laboratory |
| Connection | **HI3131B** BNC | **HI3149B** BNC | **HI36183** Quick Connect DIN<br>**HI3618D** DIN** | **HI1217D** DIN** | **HI1291D** DIN** |

** Recommended for use with HI8314 pH meter

** Recommended for use with HI8314 pH meter

** Recommended for use with HI207 and HI208 pH meters

# pH Electrodes with Temperature Sensor


| Code | HI1610D | HI1611D | HI1612D |
|---|---|---|---|
| Description | pH electrode | pH electrode | pH electrode |
| Reference | single, Ag/AgCl | single, Ag/AgCl | single, Ag/AgCl |
| Junction / Flow Rate | ceramic, single / 15-20 µL/h | ceramic, single | ceramic, triple / 40-50 µL/h |
| Electrolyte | KCl 3.5M + AgCl | gel | KCl 3.5M + AgCl |
| Max Pressure | 0.1 bar | 2 bar | 0.1 bar |
| Range | pH: 0 to 13 | pH: 0 to 14 | pH: 0 to 12 |
| Recommended Operating Temp. | 0 to 70°C (32 to 158°F) | 0 to 70°C (32 to 158°F) | -5 to 70°C (23 to 158°F) |
| Glass Type | GP (general purpose) | HT (high temperature) | LT (low temperature) |
| Tip /Shape | spheric (dia: 9.5 mm) | spheric (dia: 9.5 mm) | conic (12 x 12 mm) |
| Temperature Sensor | yes | yes | yes |
| Amplifier | yes | yes | yes |
| Body Material | glass | glass | glass |
| Cable | 5-pole; 1 m (3.3') | 5-pole; 1 m (3.3') | 5-pole; 1 m (3.3') |
| Recommended Use | laboratory general use | continuous monitoring | emulsions, semi-solid samples |
| Connection | **HI1610D** DIN* | **HI1611D** DIN* | **HI1612D** DIN* |
| | * Recommended for use with HI8314 pH meter | * Recommended for use with HI8314 pH meter | * Recommended for use with HI8314 pH meter |

## Tips for the Most Accurate Measurements

### Keep Electrode Hydrated

Ideally, pH electrodes should be kept in a storage solution when not in use. Placing the electrode in a small glass filled with storage solution is suitable. An option for pocket meters is to place a small piece of sponge into the meter's cap and pour storage solution into the cap to wet the sponge. Pouring off any excess solution beforehand, the cap can then be placed on the meter.

If a storage solution is not available the next best option is to use pH 4.01 buffer (pH 7.01 is also suitable to a lesser extent).

### Clean Electrodes Before Use

Clean the junction of your electrodes once a day or at least once a week to prevent junction clogging and to maintain accuracy. Immerse the electrode in the proper cleaning solution for at least 15 to 20 minutes. Hanna offers a wide range of cleaning solutions for general purpose and specific applications.

### Replace Electrodes Once a Year

If your electrode takes too long to stabilize a reading, or readings fluctuate wildly, it is most likely time to replace the electrode. The typical life span of any pH electrode is from 6 months to 1.5 years.

### Additional Tips

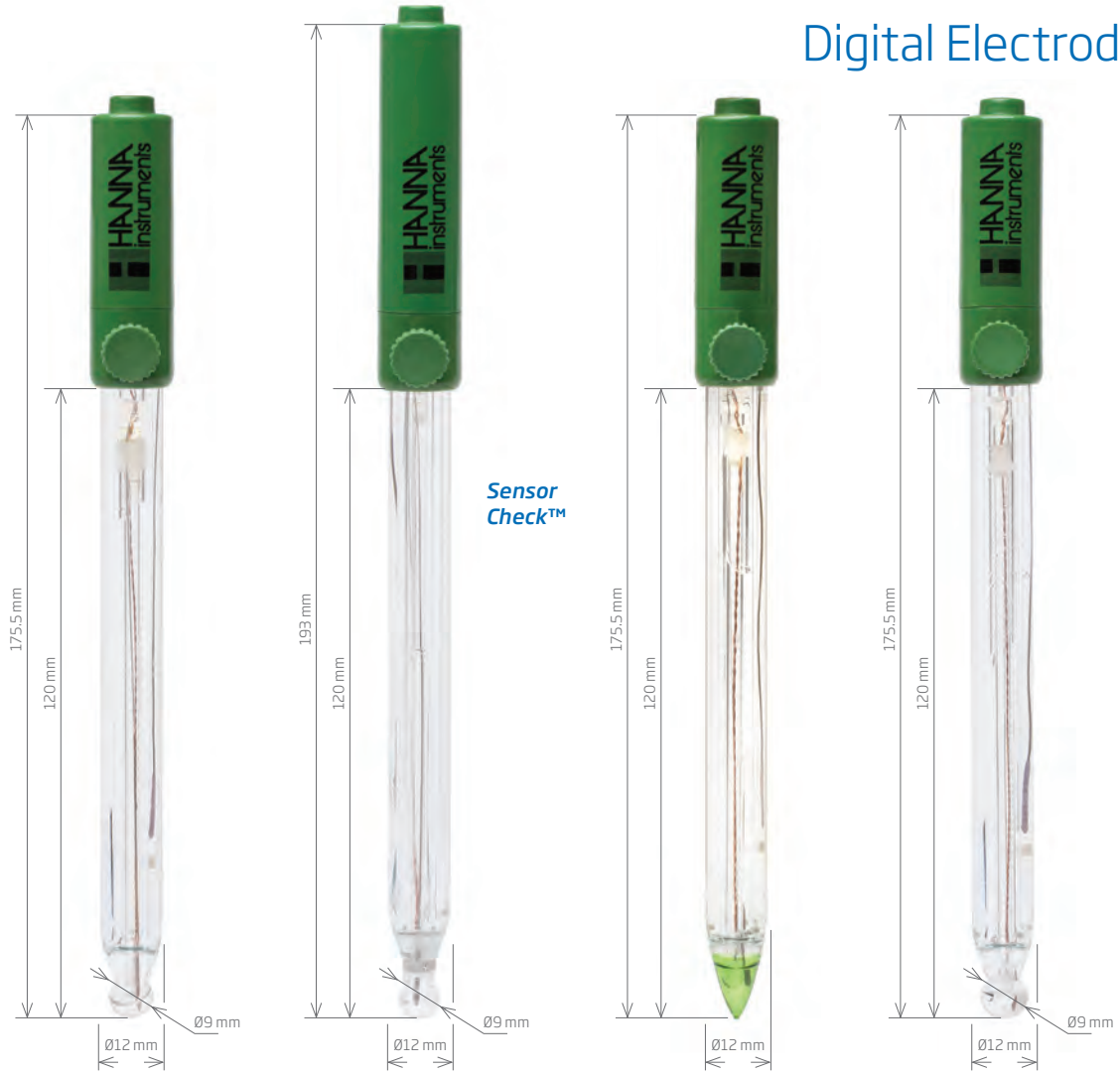
- Calibration and storage solutions should be changed regularly (i.e. monthly).
- Calibrate the meter often if a high degree of accuracy is required.
- Remember that the calibration is as only as good the buffer being used (i.e. old or contaminated buffer may not have the same value on the label).
- Single-use calibration sachets, as opposed to bottles, ensure that your buffer solution is always fresh.
- If the meter takes an unusually long time to get a stable reading, the junction may be clogged.
- Rinse the probe with purified water after each use.

# Rugged pH and ORP Electrodes


| Code | HI1332[ ] | HI3230B | HI36203 | HI4430B |
|---|---|---|---|---|
| Description | pH electrode | gel-filled, combination ORP electrode w/ platinum contact | ORP probe | gel-filled, combination ORP electrode w/ gold contact |
| Reference | double, Ag/AgCl | single, Ag/AgCl | single, Ag/AgCl | single, Ag/AgCl |
| Junction / Flow Rate | ceramic, single / 15-20 µL/h | ceramic, single | ceramic, single | ceramic, single |
| Electrolyte | KCl 3.5M | gel | gel | gel |
| Max Pressure | 0.1 bar | 2 bar | 2 bar | 2 bar |
| Range | pH: 0 to 13 | ORP: ±2000 mV | ORP: ±2000 mV | ORP: ±2000 mV |
| Recommended Operating Temp. | 0 to 70°C (32 to 158°F) - GP | -5 to 70°C (23 to 158°F) | -5 to 70°C (23 to 158°F) | -5 to 70°C (23 to 158°F) |
| Glass type | GP (general purpose) | – | – | – |
| Tip /Shape | spheric (dia: 7.5 mm) | platinum pin | platinum pin | gold pin |
| Temperature Sensor | no | no | yes | no |
| Amplifier | no | no | yes | no |
| Body Material | PEI | PEI | PEI | PEI |
| Cable | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') |
| Recommended Use | chemicals, field applications, quality control, aquariums | municipal water, quality control | field applications | oxidants, ozone |
| Connection | **HI1332B** BNC<br>**HI1332P** BNC + pin*<br>**HI1332D** DIN | **HI3230B** BNC | **HI36203** Quick Connect DIN | **HI4430B** BNC |

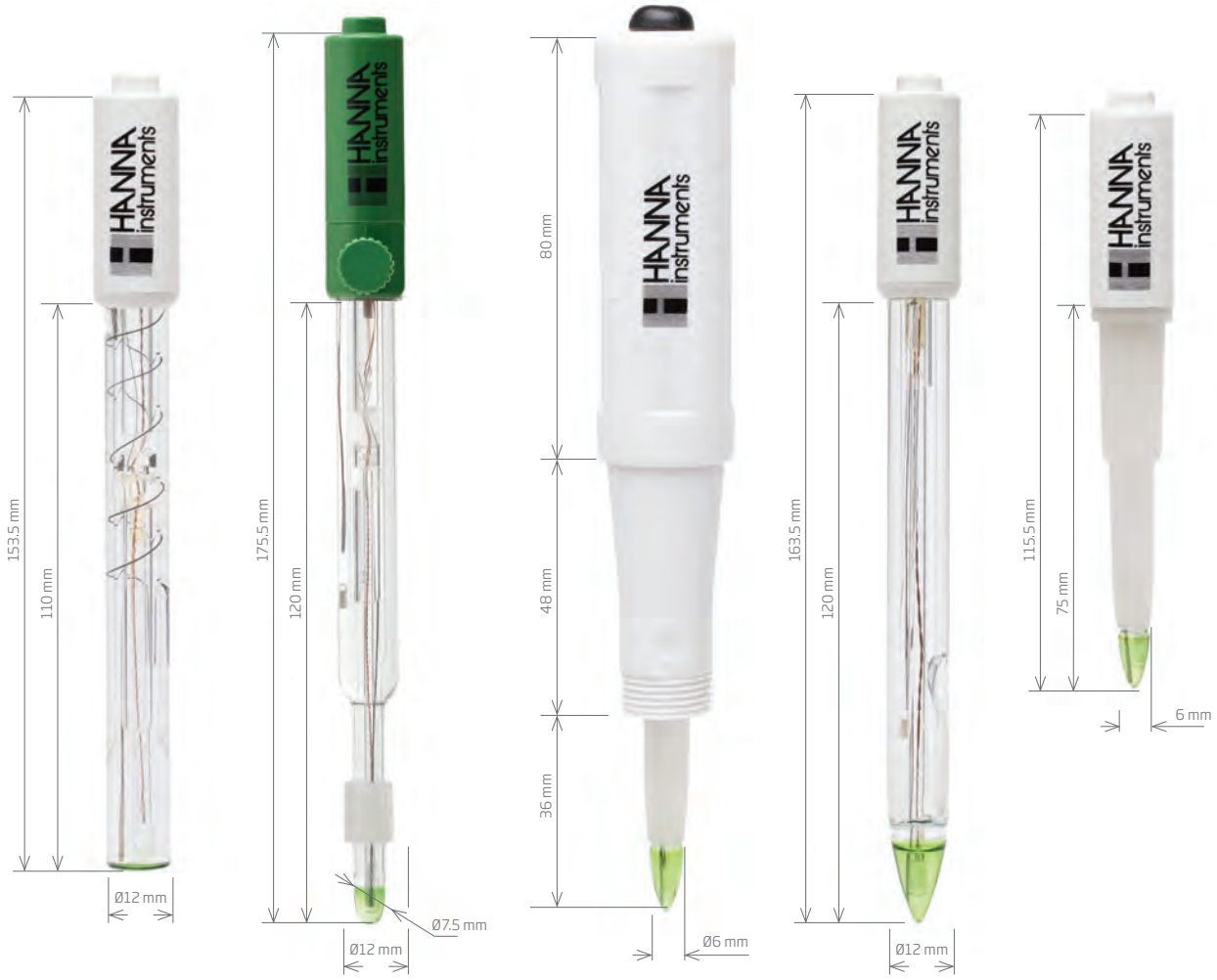
* For pH meters with CAL Check™ system

# Digital Electrodes



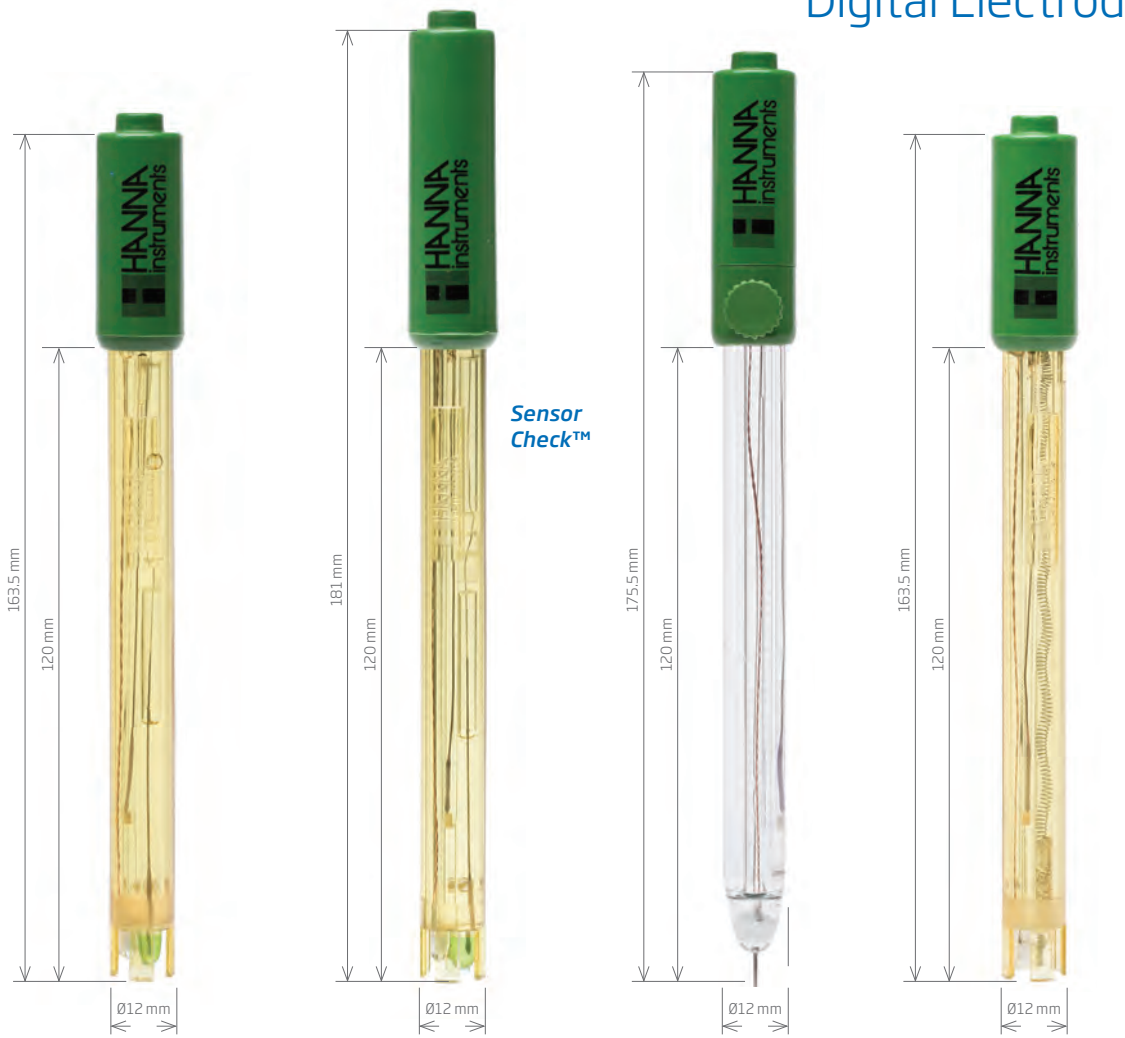

| Code | HI11310 | HI11311 | HI10530 | HI10430 |
|---|---|---|---|---|
| Description | refillable, combination, digital pH electrode | refillable, combination, digital pH electrode w/ Sensor Check™ | refillable, combination, digital pH electrode with conical tip | refillable, combination, digital pH electrode with double junction |
| Reference | double, Ag/AgCl | double, Ag/AgCl | double, Ag/AgCl | double, Ag/AgCl |
| Junction | ceramic, single / 15-20 µL/h | ceramic, single / 15-20 µL/h | ceramic, triple / 40-50 µL/h | ceramic, triple / 40-50 µL/h |
| Electrolyte | KCl 3.5M | KCl 3.5M | KCl 3.5M | KCl 3.5M |
| Max Pressure | 0.1 bar | 0.1 bar | 0.1 bar | 0.1 bar |
| Range | pH: 0 to 14 | pH: 0 to 14 | pH: 0 to 12 | pH: 0 to 13 |
| Recommended Operating Temp. | 0 to 100°C (32 to 212°F) | 0 to 100°C (32 to 212°F) | -5 to 70°C (23 to 158°F) | 0 to 100°C (32 to 212°F) |
| Glass Type | HT (high temperature) | HT (high temperature) | LT (low temperature) | HT (high temperature) |
| Tip /Shape | spheric (dia: 9.5 mm) | spheric (dia: 9.5 mm) | conic (12 x 12 mm) | spheric (dia: 9.5 mm) |
| Temperature Sensor | yes | yes | yes | yes |
| Matching Pin | no | yes | no | no |
| Amplifier | yes | yes | yes | yes |
| Body Material | glass | glass | glass | glass |
| Cable | 1 m (3.3') | 1 m (3.3') | 1 m (3.3') | 1 m (3.3') |
| Recommended Use | laboratory general purpose, beer | laboratory general purpose, beer | fats and creams, high purity water, soil samples, potable water, semi-solid products, low conductivity solutions, emulsions | hydrocarbons, paints, solvents, sea water, strong acids and bases, high conductivity samples, tris buffer |
| Connection | **HI11310** 3.5 mm connector | **HI11311** 3.5 mm connector | **HI10530** 3.5 mm connector | **HI10430** 3.5 mm connector |

# Digital Electrodes



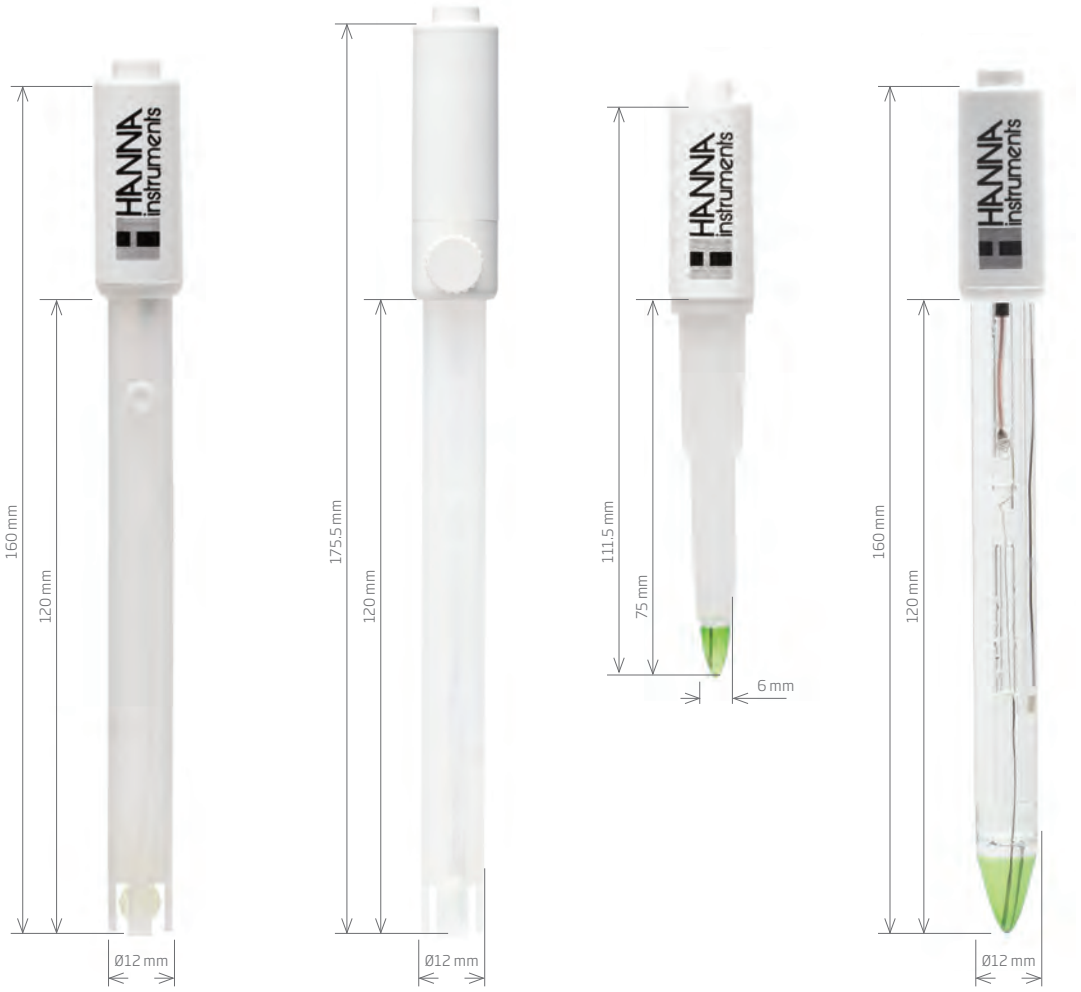

| Code | HI14140 | HI10480 | FC2320 | FC2100 | FC2020 |
|---|---|---|---|---|---|
| Description | digital pH electrode | refillable, digital pH electrode w/ CPS™ (clogging prevention system) | digital pH electrode | digital pH electrode | digital pH Electrode |
| Reference | single, Ag/AgCl | double, Ag/AgCl | double, Ag/AgCl | double, Ag/AgCl | double, Ag/AgCl |
| Junction | open | CPS™ | open | open | open |
| Electrolyte | viscolene | KCl 3.5M | viscolene | viscolene | viscolene |
| Max Pressure | 0.1 bar | 0.1 bar | 0.1 bar | 0.1 bar | 0.1 bar |
| Range | pH: 0 to 12 | pH: 0 to 12 | pH: 0 to 12 | pH: 0 to 12 | pH: 0 to 12 |
| Recommended Operating Temp. | 0 to 50°C (32 to 122°F) | -5 to 60°C (23 to 140°F) | 0 to 60°C (32 to 140°F) | 0 to 60°C (32 to 140°F) | 0 to 60°C (32 to 140°F) |
| Glass Type | LT (low temperature) | LT (low temperature) | LT (low temperature) | LT (low temperature) | LT (low temperature) |
| Tip /Shape | flat | dome (dia: 8 mm) | conic (6 x 10 mm) | conic (12 x 12 mm) | conic (6 x 10 mm) |
| Temperature Sensor | yes | yes | yes | yes | yes |
| Matching Pin | no | no | no | no | no |
| Amplifier | yes | yes | yes | yes | yes |
| Body Material | glass | glass | PVDF | glass | PVDF |
| Cable | 1 m (3.3') | 1 m (3.3') | 1 m (3.3') | 1 m (3.3') | 1 m (3.3') |
| Recommended Use | surfaces | application specific purpose, must in winemaking | application specific purpose, meat | application specific purpose, yogurt | application specific purpose, yogurt, cheese |
| Connection | **HI14140** 3.5 mm connector | **HI10480** 3.5 mm connector | **FC2320** 3.5 mm connector | **FC2100** 3.5 mm connector | **FC2020** 3.5 mm connector |

# Digital Electrodes




| Code | HI12300 | HI12301 | HI36180 | HI36200 |
|---|---|---|---|---|
| Description | combination, digital pH electrode | combination, digital pH electrode | refillable, ORP digital probe | ORP digital probe |
| Reference | double, Ag/AgCl | double, Ag/AgCl | double, Ag/AgCl | single, Ag/AgCl |
| Junction / Flow Rate | ceramic, single / 15-20 µL/h | ceramic, single / 15-20 µL/h | ceramic, single / 15-20 µL/h | ceramic, single |
| Electrolyte | gel | gel | KCl 3.5M + AgCl | gel |
| Max Pressure | 2 bar | 2 bar | 0.1 bar | 2 bar |
| Range | pH: 0 to 12 | pH: 0 to 12 | ORP: ±2000 mV | ORP: ±2000 mV |
| Recommended Operating Temp. | -5 to 70°C (23 to 158°F) | -5 to 70°C (23 to 158°F) | -5 to 100°C (23 to 212°F) | -5 to 70°C (23 to 158°F) |
| Glass Type | LT (low temperature) | LT (low temperature) | – | – |
| Tip /Shape | spheric (dia: 7.5 mm) | spheric (dia: 7.5 mm) | platinum pin | platinum pin |
| Temperature Sensor | yes | yes | yes | yes |
| Matching Pin | no | yes | no | no |
| Amplifier | yes | yes | yes | yes |
| Body Material | PEI | PEI | glass | PEI |
| Cable | 1 m (3.3') | 1 m (3.3') | 1 m (3.3') | 1 m (3.3') |
| Recommended Use | field applications | field applications | laboratory general purpose | field applications |
| Connection | **HI12300** 3.5 mm connector | **HI12301** 3.5 mm connector | **HI36180** 3.5 mm connector | **HI36200** 3.5 mm connector |

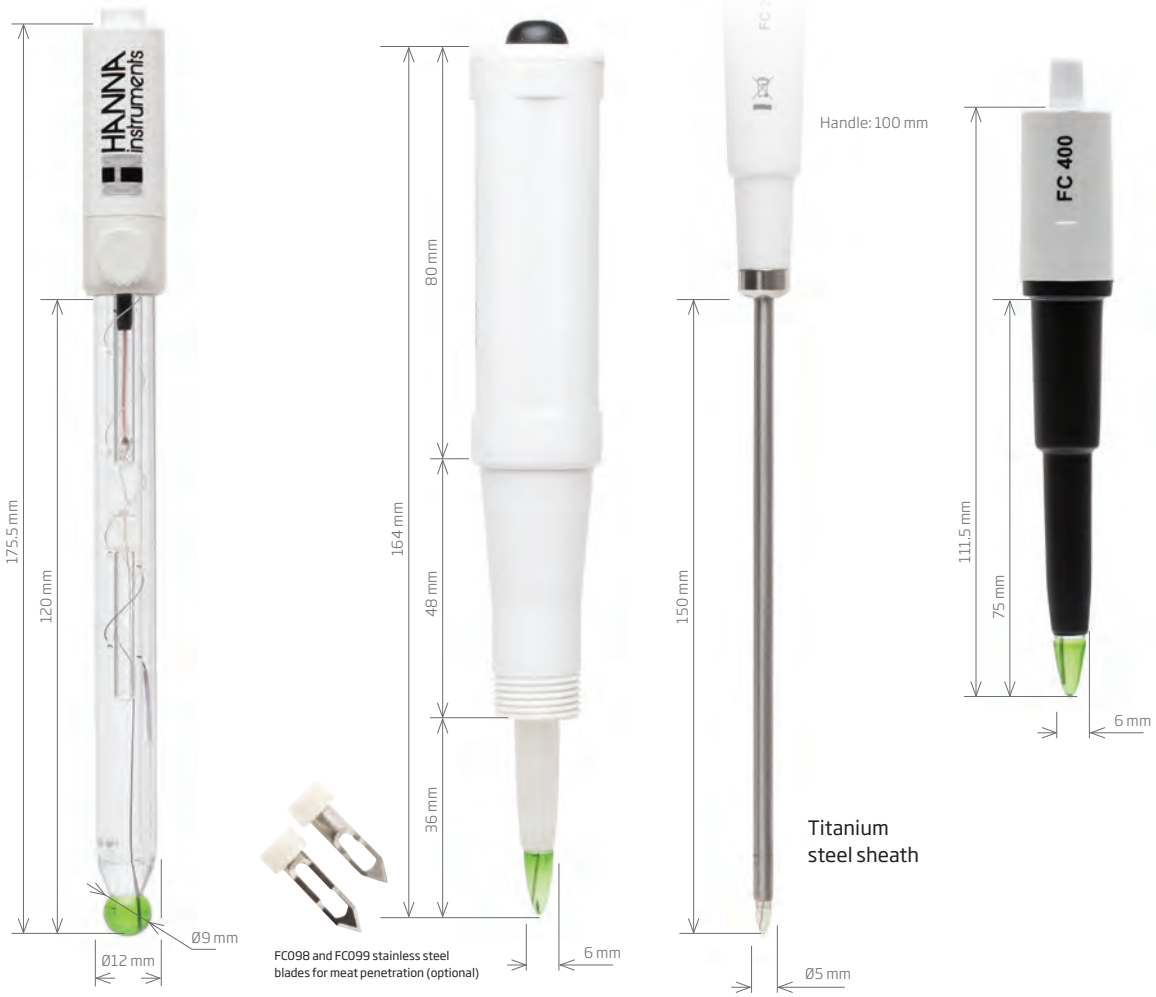
# Electrodes for the Food Industry




| Code | FC100B | FC1013 | FC200[ ] | FC210B |
|---|---|---|---|---|
| Description | pH electrode | preamplified pH/ temperature probe | pH electrode | pH electrode |
| Reference | double, Ag/AgCl | double, Ag/AgCl | single, Ag/AgCl | double, Ag/AgCl |
| Junction / Flow Rate | ceramic, single / 15-20 µL/h | ceramic, single / 15-20 µL/h | open | open |
| Electrolyte | KCl 3.5M | KCl 3.5M | viscolene | viscolene |
| Max Pressure | 0.1 bar | 0.1 bar | 0.1 bar | 0.1 bar |
| Range | pH: 0 to 13 | pH: 0 to 13 | pH: 0 to 12 | pH: 0 to 12 |
| Recommended Operating Temp. | 0 to 70°C (32 to 158°F) | 0 to 70°C (32 to 158°F) | 0 to 50°C (32 to 122°F) | 0 to 60°C (32 to 140°F) |
| Glass Type | GP (general purpose) | GP (general purpose) | LT (low temperature) | LT (low temperature) |
| Tip /Shape | spheric (dia: 7.5 mm) | spheric (dia: 7.5 mm) | conic (6 x 10 mm) | conic (12 x 12 mm) |
| Temperature Sensor | no | yes | no | no |
| Amplifier | no | yes | no | no |
| Body Material | PVDF | PVDF | PVDF | glass |
| Cable | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') |
| Recommended Use | food industry (general use), milk | food industry (general use), milk | penetration, yogurt, cheese, semi-solid foods, fruits, ham and sausages | yogurt, creams |
| Connection | **FC100B** BNC | **FC1013** Quick Connect DIN* | **FC200B** BNC<br>**FC200D** DIN | **FC210B** BNC |

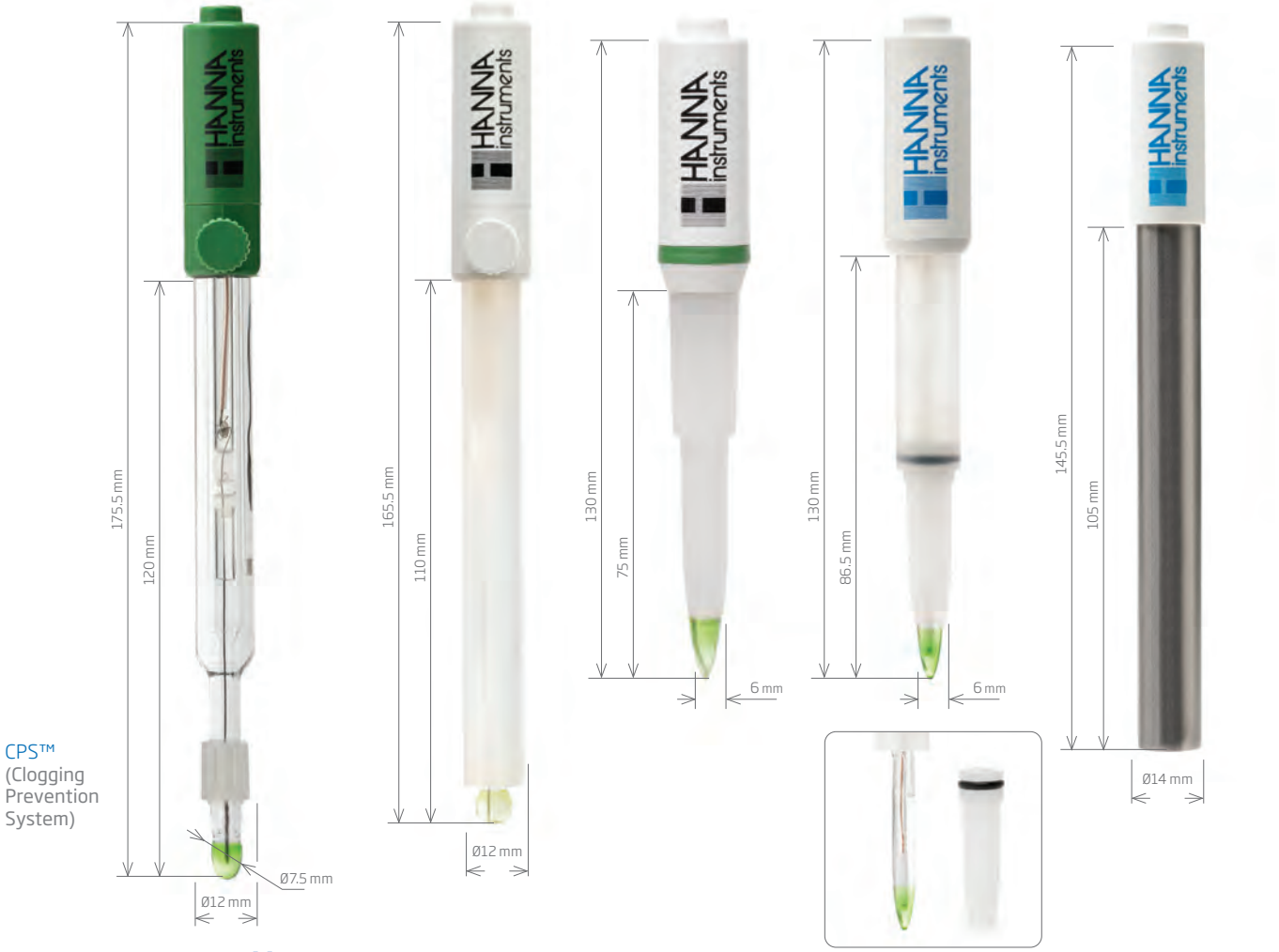
* Recommended for use with HI98162 and HI99162 pH meters

# Electrodes for the Food Industry




| Code | FC220B | FC230B | FC240B | FC400B |
|---|---|---|---|---|
| Description | pH electrode | combination pH electrode with PVDF outer body | combination pH electrode with stainless steel sheath | pH electrode |
| Reference | single, Ag/AgCl | single, Ag/AgCl | single, Ag/AgCl | double, Ag/AgCl |
| Junction / Flow Rate | ceramic, triple / 40-50 µL/h | open | open | open |
| Electrolyte | KCl 3.5M + AgCl | viscolene | gel | viscolene |
| Max Pressure | 0.1 bar | 0.1 bar | 0.1 bar | 0.1 bar |
| Range | pH: 0 to 12 | pH: 0 to 12 | pH: 0 to 13 | pH: 0 to 12 |
| Recommended Operating Temp. | -5 to 70°C (23 to 158°F) | 0 to 50°C (32 to 122°F) | 0 to 50°C (32 to 122°F) | 0 to 60°C (32 to 140°F) |
| Glass Type | LT (low temperature) | LT (low temperature) | GP (general purpose) | LT (low temperature) |
| Tip /Shape | spheric (dia: 9.5 mm) | conic (6 x 10 mm) | conic (3 x 5 mm) | conic (6 x 10 mm) |
| Temperature Sensor | no | no | no | no |
| Amplifier | no | no | no | no |
| Body Material | glass | PVDF | titanium | PVDF |
| Cable | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') |
| Recommended Use | creams, fruit juices, sauces | meat, semi frozen products | penetration, cheese, quality control | penetration, meat |
| Connection | **FC220B** BNC | **FC230B** BNC | **FC240B** BNC | **FC400B** BNC |

# Electrodes for the Food Industry




CPS™ (Clogging Prevention System)

| Code | HI1048[ ] • FC10483 | FC911 | FC2023 | FC2053 | FC2143 |
|---|---|---|---|---|---|
| Description | pH electrode with CPS™ (Clogging Prevention System) | pH electrode | pH electrode | pH electrode | pH electrode |
| Reference | double, Ag/AgCl | double, Ag/AgCl | double, Ag/AgCl | double, Ag/AgCl | single, Ag/AgCl |
| Junction / Flow Rate | CPS™ | ceramic, single / 15-20 µL/H | open | open | cloth |
| Electrolyte | KCl 3.5M | KCl 3.5M | viscolene | gel | gel |
| Max Pressure | 0.1 bar | 0.1 bar | 0.1 bar | 0.1 bar | 3 bar |
| Range | pH: 0 to 12 | pH: 0 to 13 | pH: 0 to 12 | pH: 0 to 12 | pH: 0 to 12 |
| Recommended Operating Temp. | -5 to 60°C (23 to 140°F) | 0 to 70°C (32 to 158°F) | 0 to 60°C (32 to 140°F) | 0 to 60°C (32 to 140°F) | 0 to 80°C (32 to 176°F) |
| Glass Type | LT (low temperature) | GP (general purpose) | LT (low temperature) | LT (low temperature) | LT (low temperature) |
| Tip /Shape | dome (dia: 8 mm) | spheric (dia: 7.5 mm) | conic (6 x 10 mm) | conic (6 x 10 mm) | flat |
| Temperature Sensor | DIN model only | no | yes | yes | yes |
| Amplifier | DIN model only | yes | yes | yes | yes |
| Body Material | glass | PVDF | PVDF | PVDF | titanium with HT glass sensor |
| Cable | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') | 7-pole; 1 m (3.3') | 7-pole; 1 m (3.3') | 7-pole; 1 m (3.3') |
| Recommended Use | must in winemaking | creams, fruit juices, sauces, high humidity | yogurt, cheese, meat, semi-solid foods, fruits, ham and sausages | yogurt, cheese, meat, semi-solid foods, fruits, ham and sausages | beer |
| Connection | **HI1048B** BNC<br>**HI1048B/50** BNC (.4 m (1.3') cable)<br>**HI1048P** BNC + pin*<br>**FC10483** Quick Connect DIN** | **FC911B** BNC | **FC2023** Quick Connect DIN * | **FC2053** Quick Connect DIN * | **FC2143** Quick Connect DIN * |

* For pH meters with CAL Check™ system
** Recommended for use with HI99111 pH meter

* Recommended for use with HI98161 and HI99161 pH meters

* Recommended for use with HI98161 pH meter

* Recommended for use with HI98151 pH meter

# Electrodes for the Food Industry

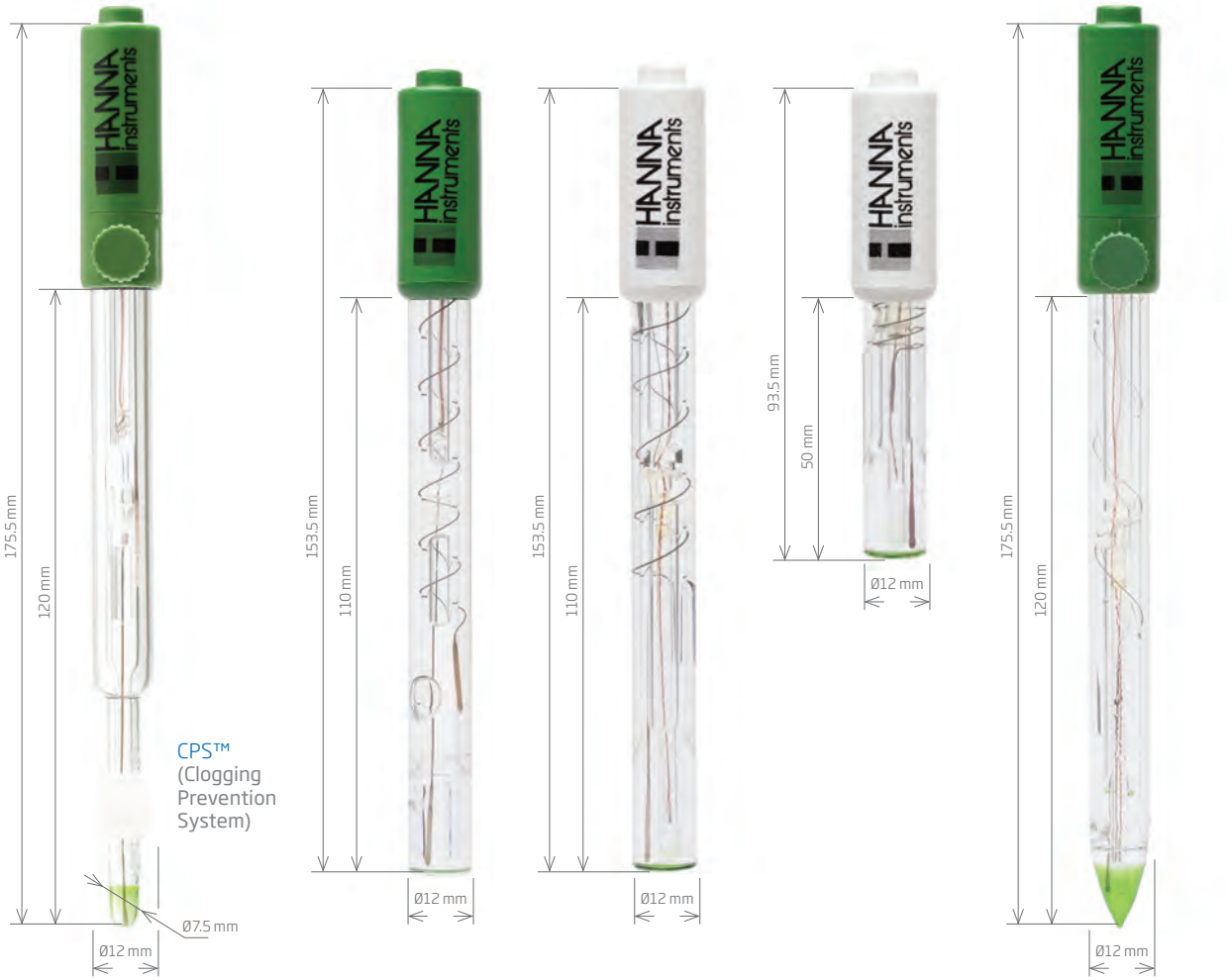

| Code | FC2323 | HI3148B | FC2133 | FC2423 | FC2423-1 |
|---|---|---|---|---|---|
| Description | pH electrode | ORP electrode | pre-amplified pH / temperature probe | pre-amplified pH / temperature probe | pre-amplified pH / temperature probe |
| Reference | single, Ag/AgCl | double, Ag/AgCl | double | single | single |
| Junction | open | CPS™ | open | open | open |
| Electrolyte | viscolene | KCl 3.5M | viscolene | viscolene | viscolene |
| Max Pressure | 0.1 bar | 0.1 bar | 0.1 bar | 0.1 bar | 0.1 bar |
| Range | pH: 0 to 12 | ORP: ±2000 mV | pH: 0 to 12 | pH: 0 to 12 | pH: 0 to 12 |
| Recommended Operating Temp. | 0 to 50°C (32 to 122°F) - LT | -5 to 60°C (23 to 140°F) | 0 to 60°C (32 to 140°F) | 0 to 50°C (32 to 122°F) | 0 to 50°C (32 to 122°F) |
| Glass type | LT (low temperature) | – | LT (low temperature) | LT (low temperature) | LT (low temperature) |
| Tip /Shape | conic (6 x 10 mm) | platinum ring | conic | conic (6 x8 mm) | conic |
| Temperature Sensor | yes | no | yes | yes | yes |
| Amplifier | yes | no | yes | yes | yes |
| Body Material | PVDF | glass | glass | titanium | titanium |
| Cable | 7-pole; 1 m (3.3') | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') |
| Recommended Use | meat | must in winemaking | yogurt | penetration, cheese | penetration, cheese |
| Connection | **FC2323** Quick Connect DIN* | **HI3148B** BNC<br>**HI3148B/50** BNC (.4 m (1.3') cable) | **FC2133** Quick Connect DIN* | **FC2423** Quick Connect DIN* | **FC2423** Quick Connect DIN* |

* Recommended for use with HI98163 and HI99163 pH meters

* Recommended for use with HI98164 and HI99164 pH meter

* Recommended for use with HI98165 and HI99165 pH meter

# Electrodes for Specific Analysis

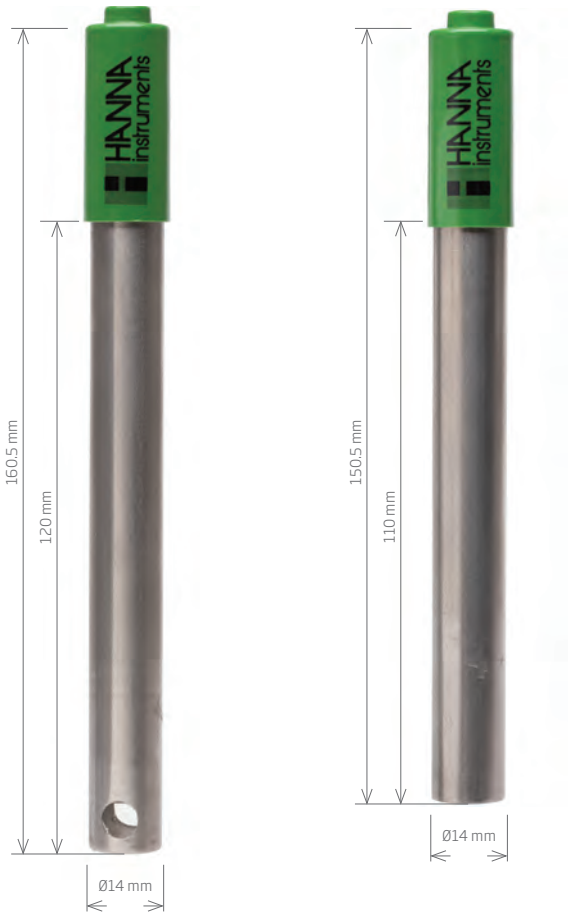



| Code | HI1049B | HI1413B | HI14143 | HI14143/50 | HI12923 |
|---|---|---|---|---|---|
| Description | pH electrode with CPS™ (Clogging Prevention System) | pH electrode | pH electrode | pH electrode | pH electrode |
| Reference | double, Ag/AgCl | single, Ag/AgCl | single, Ag/AgCl | single, Ag/AgCl | single, Ag/AgCl |
| Junction | CPS™ | open | open | open | ceramic, triple / 40-50 µL/h |
| Electrolyte | KCl 3.5M | viscolene | viscolene | viscolene | KCl 3.5M + AgCl |
| Max Pressure | 0.1 bar | 0.1 bar | 0.1 bar | 0.1 bar | 0.1 bar |
| Range | pH: 0 to 12 | pH: 0 to 12 | pH: 0 to 12 | pH: 0 to 12 | pH: 0 to 12 |
| Recommended Operating Temp. | 0 to 60°C (32 to 140°F) | 0 to 50°C (32 to 122°F) | 0 to 50°C (32 to 122°F) | 0 to 50°C (32 to 122°F) | -5 to 70°C (23 to 158°F) |
| Glass Type | LT (low temperature) | LT (low temperature) | LT (low temperature) | LT (low temperature) | LT (low temperature) |
| Tip /Shape | dome (dia: 8 mm) | flat | flat | flat | conic (12 x 12 mm) |
| Temperature Sensor | no | no | yes | yes | yes |
| Amplifier | no | no | yes | yes | yes |
| Body Material | glass | glass | glass | glass | glass |
| Cable | coaxial; 1 m (3.3') | coaxial; 1 m (3.3') | 7-pole; 1 m (3.3') | 7-pole; 1 m (3.3') | 7-pole; 1 m (3.3') |
| Recommended Use | non-aqueous titrations | surface, skin, leather, paper, emulsions | surface, leather, paper, emulsions | skin, scalp | direct soil pH measurement, soil solution |
| Connection | **HI1049B** BNC | **HI1413B** BNC | **HI14143** Quick Connect DIN* | **HI14143/50** Quick Connect DIN* | **HI12923** Quick Connect DIN* |
| | | | * Recommended for use with HI99171 pH meter | * Recommended for use with HI99181 pH meter | * Recommended for use with HI99121 pH meter |

# Electrodes for Specific Analysis


| Code | HI12943 | FC2153 | HI12963 | HI12973 |
|---|---|---|---|---|
| Description | pH electrode | pH electrode | pH electrode | pH/ORP electrode |
| Reference | single, Ag/AgCl | single, Ag/AgCl | single, Ag/AgCl | single, Ag/AgCl |
| Junction | ceramic, triple / 40-50 µL/h | ceramic, triple | cloth | cloth |
| Electrolyte | KCl 3.5M + AgCl | KCl 3.5M + AgCl | gel | gel |
| Max Pressure | 0.1 bar | 0.1 bar | 3 bar | 3 bar |
| Range | pH: 0 to 12 | pH: 0 to 12 | pH: 0 to 13 | pH: 0 to 13; ORP |
| Recommended Operating Temp. | -5 to 70°C (23 to 158°F) | -5 to 70°C (23 to 158°F) | 0 to 70°C (32 to 158°F) | 0 to 70°C (32 to 158°F) |
| Glass Type | LT (low temperature) | LT (low temperature) | GP (general purpose) | GP (general purpose) |
| Tip /Shape | conic (12 x 12 mm) | spheric (dia: 9.5 mm) | spheric (dia: 5 mm) | pH: conic (3 mm); ORP: platinum sensor |
| Temperature Sensor | yes | yes | yes | yes |
| Amplifier | yes | yes | yes | yes |
| Body Material | glass | glass | titanium | titanium |
| Cable | 7-pole; 1 m (3.3') | coaxial; 1 m (3.3') | 7-pole; 1 m (3.3') | 7-pole; 1 m (3.3') |
| Recommended Use | direct soil, soilless media, soil solution | drinking water | wastewater | wastewater, municipal water, water treatment, swimming pools |
| Connection | **HI12943** Quick Connect DIN* | **FC2153** DIN* | **HI12963** Quick Connect DIN* | **HI12973** Quick Connect DIN* |
| | * Only for use with HI9814 GroLine multiparameter meter | * Recommended for use with HI99192 pH meter | * Recommended for use with HI98190 and HI991001 pH meter | * Recommended for use with HI991003 pH meter |

# Electrodes for Specific Analysis



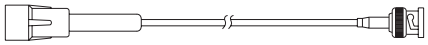

| Code | HI629113 | HI72911[ ] |
|---|---|---|
| Description | pH electrode | pH electrode |
| Reference | double, Ag/AgCl | double, Ag/AgCl |
| Junction | PTFE | PTFE |
| Electrolyte | polymer | polymer |
| Max Pressure | 3 bar | 3 bar |
| Range | pH: 0 to 13 | pH: 0 to 13 |
| Recommended Operating Temp. | 0 to 80°C (32 to 176°F) | 0 to 80°C (32 to 176°F) |
| Glass Type | GP (general purpose) | GP (general purpose) |
| Tip /Shape | flat | flat |
| Temperature Sensor | yes | yes |
| Amplifier | yes | yes |
| Body Material | titanium body working as matching pin | |
| Cable | 7-pole; 1 m (3.3') | 7-pole; 1 m (3.3') |
| Recommended Use | plating baths | cooling towers, boilers |
| Connection | **HI629113** Quick Connect DIN* | **HI729113** Quick Connect DIN**<br>**HI72911B** BNC + phono† |

* Recommended for use with HI99131 pH meter

** Recommended for use with HI99141 pH meter
† Recommended for use with HI98191 pH meter

## Electrode Extension Cables

### Screw Type to BNC Cables / Connectors

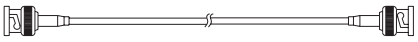


**Description**

3.0 mm (0.12") cable with screw type and BNC connectors

| Part # | Cable Length |
|---|---|
| **HI7855/1** | 1 m (3.3') |
| **HI7855/3** | 3 m (9.9') |
| **HI7855/5** | 5 m (16.5') |
| **HI7855/10** | 10 m (33') |
| **HI7855/15** | 15 m (49.5') |

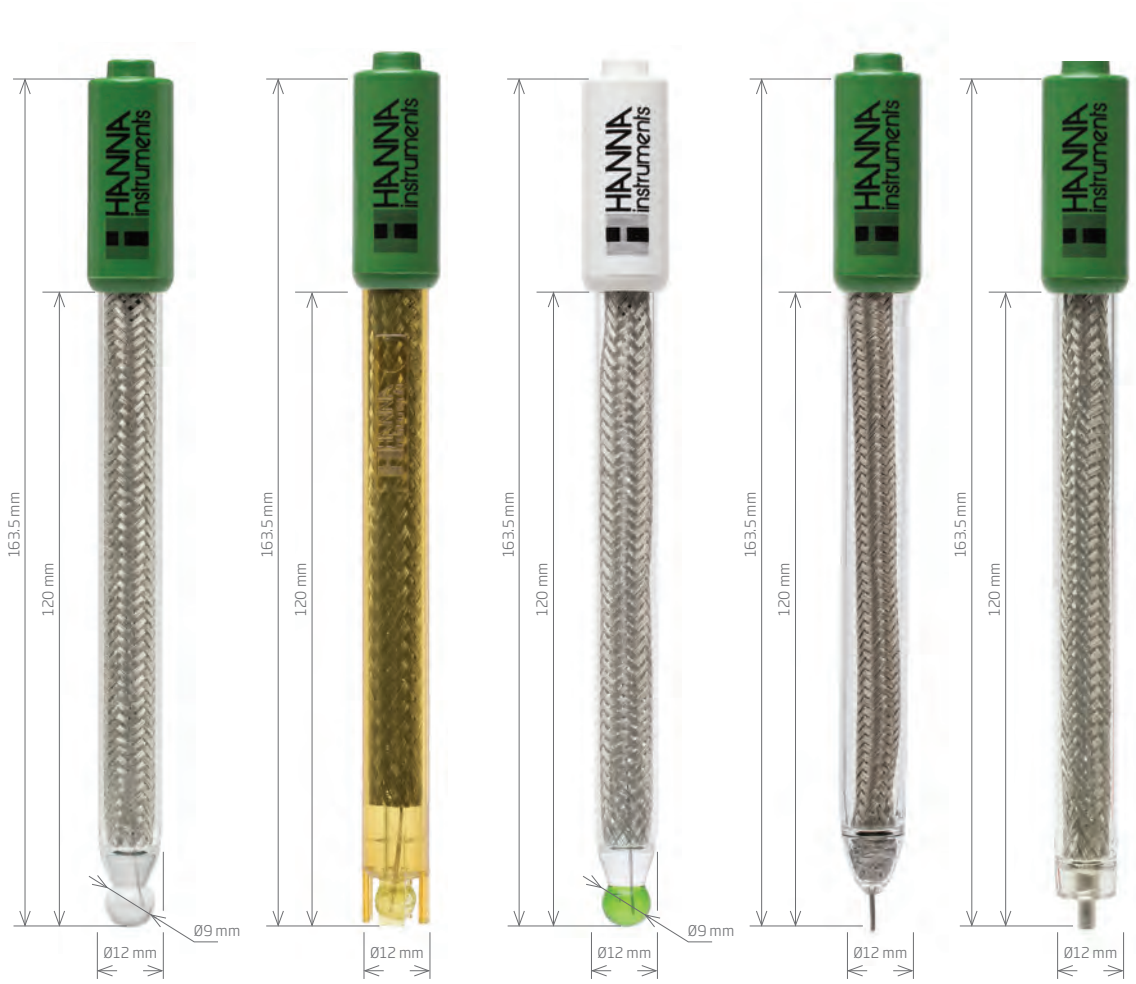
### BNC to BNC Cables / Connectors



**Description**

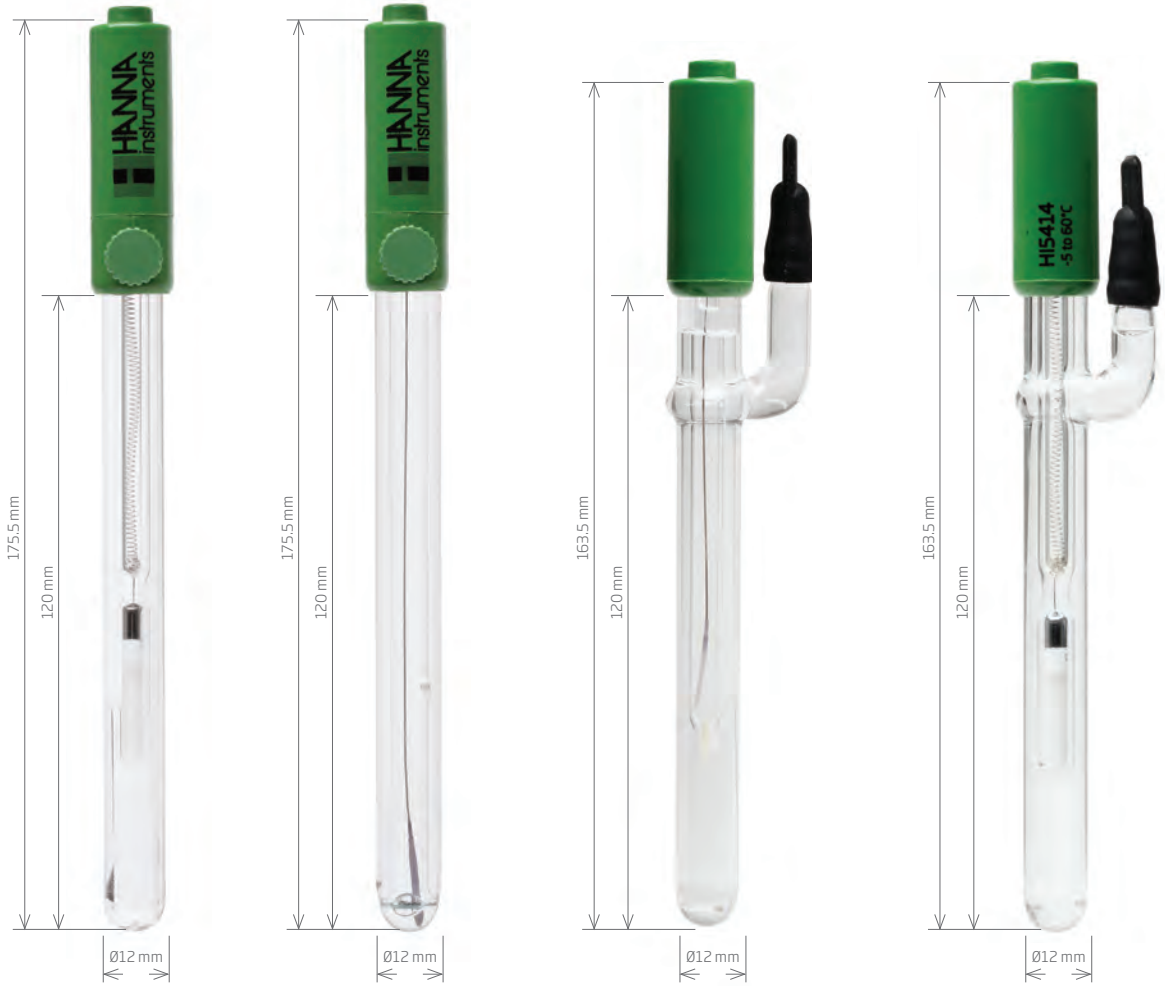
3.0 mm (0.12") cable with BNC connectors

| Part # | Cable Length |
|---|---|
| **HI7858/1** | 1 m (3.3') |
| **HI7858/5** | 5 m (16.5') |
| **HI7858/10** | 10 m (33') |




| Code | HI2111B | HI2112B | FC260B | HI3133B | HI5110B |
|---|---|---|---|---|---|
| Description | pH half-cell | pH half-cell | pH half-cell | ORP half-cell | ORP half-cell |
| Half Cell | – | – | – | platinum | Ag |
| Range | pH: 0 to 14 | pH: 0 to 13 | pH: 0 to 12 | mV | mV |
| Recommended Operating Temp. | 0 to 100°C (32 to 212°F) | 0 to 70°C (32 to 158°F) | -5 to 80°C (23 to 176°F) | -5 to 100°C (23 to 212°F) | 0 to 70°C (32 to 158°F) |
| Glass Type | HT (high temperature) | GP (general purpose) | LT (low temperature) | | |
| Tip /Shape | spheric (dia: 9.5 mm) | spheric (dia: 7.5 mm) | spheric (dia: 9.5 mm) | platinum pin | cylindric (dia: 3 mm) |
| Body Material | glass | PEI | glass | glass | glass |
| Cable | coaxial | coaxial | coaxial | coaxial | coaxial |
| Recommended Use | general purpose, strong alkaline solutions | general purpose | milk | general purpose, potentiometric titration | argentometric titration |
| Connection | **HI2111B** BNC | **HI2112B** BNC | **FC260B** BNC | **HI3133B** BNC | **HI5110B** BNC |

# Reference Electrodes

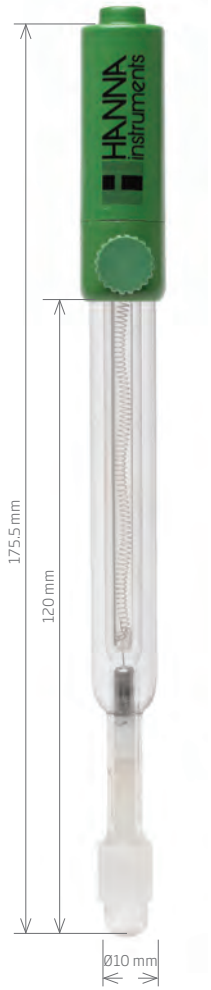



| Code | HI5412 | HI5311 | HI5314 | HI5414 |
|---|---|---|---|---|
| Description | reference electrode | reference electrode | reference electrode | reference electrode |
| Reference | single, $Hg/Hg_2Cl_2$ | double, Ag/AgCl | double, Ag/AgCl | single, $Hg/Hg_2Cl_2$ |
| Junction / Flow Rate | ceramic, single / 15-20 µL/h | ceramic, single / 15-20 µL/h | ceramic, double | ceramic, double |
| Electrolyte | KCl 3.5M | KCl 3.5M | KCl 3.5M | KCl 3.5M |
| Max Pressure | 0.1 bar | 0.1 bar | 3 bar with back pressure | 3 bar with back pressure |
| Recommended Operating Temp. | -5 to 60°C (23 to 140°F) | -5 to 100°C (23 to 212°F) | -5 to 100°C (23 to 212°F) | -5 to 60°C (23 to 140°F) |
| Body Material | glass | glass | glass | glass |
| Cable | 1 m (3.3') | 1 m (3.3') | 1 m (3.3') | 1 m (3.3') |
| Recommended Use | general purpose, titrations | general purpose, titrations | measurements with remote filling | measurements with remote filling |
| Connection | **HI5412** 4 mm banana | **HI5311** 4 mm banana | **HI5314** 4 mm banana | **HI5414** 4 mm banana |

## 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.

# Reference Electrodes






| Code | HI5413 | HI5312 | HI5313 |
|---|---|---|---|
| Description | reference electrode | reference electrode | reference electrode |
| Reference | single, $Hg/Hg_2Cl_2$ | double, Ag/AgCl | single, Ag/AgCl |
| Junction / Flow Rate | PE sleeve | PE sleeve | ceramic |
| Electrolyte | KCl 3.5M | KCl 3.5M | gel (KCl 1M + AgCl) |
| Max Pressure | 0.1 bar | 0.1 bar | 0.1 bar |
| Recommended Operating Temp. | -5 to 60°C (23 to 140°F) | 0 to 60°C (32 to 140°F) | -5 to 60°C (23 to 140°F) |
| Body Material | glass | glass | PEI |
| Cable | 1 m (3.3') | 1 m (3.3') | 1 m (3.3') |
| Recommended Use | samples with suspended solids | titrations, samples with suspended solids | titrations, samples with suspended solids |
| Connection | **HI5413** 4 mm banana | **HI5312** 4 mm banana | **HI5313** 4 mm banana |

# pH and ORP Solutions

## Hanna seal of freshness

Our air-tight bottle with tamper-proof seal of freshness ensures quality.


## Table of Reference Temperatures

All calibration solution bottles are provided with a label presenting a reference table of the relationship between pH or conductivity values and temperature.

## Ready-made Solutions

Buffer solutions that can be prepared in small batches from capsules, tablets or powders, are called "fresh" because they are prepared at the time of use. They are considered to be, but are not very precise. The quality of buffer solutions produced depends on many factors including the quantity and quality of the chemicals and distilled water used in production. Other important factors are the temperature and the instruments used to prepare them.

**Hanna buffer solutions are checked carefully, in an aseptic environment with the highest precision reference instruments, and are calibrated to NIST Standards.**

Hanna solutions are more convenient than the so-called "fresh" solutions. The main standard buffer solutions produced by Hanna are available in bottles or in sealed sachets, complete with or without a certificate of analysis.

The following pages show the series of calibration solutions in the various types of packages that will satisfy every application need, while always guaranteeing a highly accurate buffer.


## Certified Solutions

For those operators who request it, we provide standard solutions complete with certificate of analysis. These certificates are prepared in accordance with NIST standards to avoid any possible error in determining the actual pH value. The certificate shows the date of production, batch number and expiration date.

## Safety Data Sheets

Download Safety Data Sheets (SDS) from our website at: **www.hannainst.com**.

## Calibration and Cleaning Solutions

The fundamental use of calibration and cleaning solutions is to correctly maintain electrode operation to assure accurate and reproducible readings. Often, readings are not correct because the sensors have not been properly handled. Using Hanna's wide range of solutions will help guarantee proper cleaning and calibration of electrodes and probes for maximum performance.



## Sachets are Practical, Safe and Ready-to-Use

Single-use sachets are quick and easy to use. Each sealed, opaque sachet holds just the right amount of solution. Every time your instrument and probe is maintained using Hanna sachets, it is like using a newly opened bottle of solution.

A wide range of pH, conductivity, TDS, and cleaning solutions are available.

## Table of Reference Temperatures

A label presenting a reference table of the relationship between pH or conductivity values and temperature is printed on all calibration solution sachets.

# Electrode Cleaning, Calibration and Maintenance

## Step 1: Cleaning

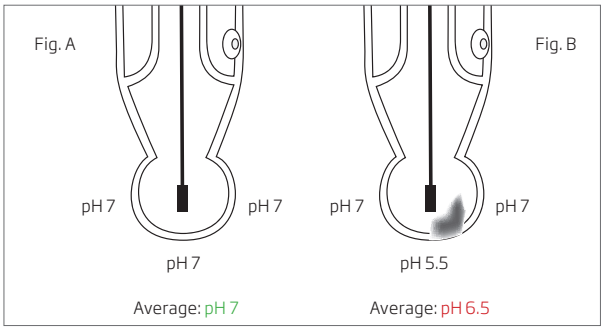



Fig. A: pH reading from a properly cleaned electrode in pH 7 solution.

Fig. B: pH reading from a dirty electrode in pH 7 solution.

### Just because you can't see contamination doesn't mean it isn't there.

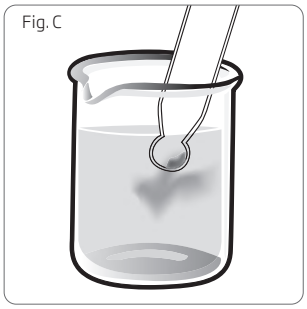
An electrode generates a voltage of the average hydrogen ion concentration from the surface area outside the pH bulb tip. Fig. A above shows that the clean electrode is submersed in pH 7 from all areas of the bulb surface.

When an electrode becomes dirty from use or neglect, the contaminated surface contributes to a voltage offset based on the surface area exposed to buffer as seen in Fig. B. Now the pH meter is mistakenly reading pH 6.5 instead of the actual pH 7.

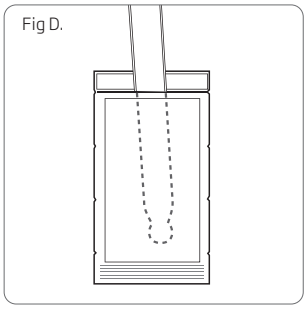
Always clean your electrode before calibration. If a dirty electrode is used for calibration, all subsequent measurements will be in error.

### A dirty electrode can contaminate solutions.

Always use fresh solutions with each calibration. Buffer solutions can be contaminated by dirty electrodes as in Fig. C. Always clean your electrode before each calibration and measurement, and always use fresh solutions.




Contamination can take time to work its way around the beaker. If you notice fluctuations in your readings, it may be time to calibrate with fresh solutions.

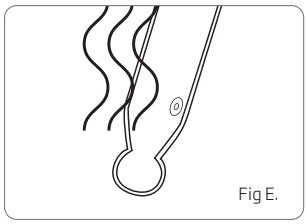


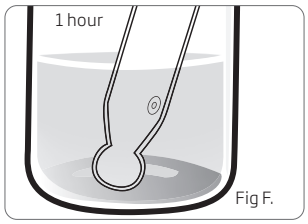

### Fresh Every Time

Hanna single-use sachets are a great way to ensure your solution is always fresh. Fig. D shows just how easy it is to tear open the packet and insert the electrode. These opaque sachets are also the ideal size for testers.

### pH Cleaning Procedure

Hanna manufactures a full complement of cleaning solutions formulated to address general and specific cleaning needs.




*IMPORTANT: After performing any of the cleaning procedures, rinse the electrode thoroughly with purified water (Fig. E) and soak the electrode in HI70300 or HI80300 Storage Solution for at least 1 hour before taking measurements (Fig. F).*

### General Cleaning

Soak in Hanna HI7061 or HI8061 General Cleaning Solution for approximately 30 minutes to dissolve mineral deposits and other general coatings.

### Protein Coating

Soak in Hanna HI7073 or HI8073 Protein Cleaning Solution for 15 minutes to enzymatically dissolve deposits from protein sources.

### Inorganic Soak

Soak in Hanna HI7074 Inorganic Cleaning Solution for 15 minutes. This cleaner is especially effective at removal of precipitates caused by reaction with the silver in the filling solution that may form in a ceramic junction.

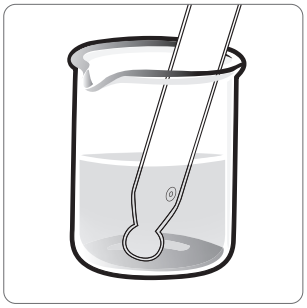
### Oil and Grease Rinse

Oil and grease removal require the correct chemicals to solubilize the coating, but mild enough to leave the electrode unaffected. Use Hanna HI7077 or HI8077 Oil and Fat Cleaning Solution.

## Step 2: Calibration

### Calibration only counts when using fresh solutions and properly cleaned electrodes.

A pH electrode that is properly manufactured and kept clean will retain its measuring integrity for a long time. As a result of many factors such as age, use, poor maintenance, or improper handling, any electrode will lose its integrity in time.



Routine maintenance will ensure accurate readings while extending the life of your electrode.

# pH and ORP Solutions

A proper calibration restores the ability of an electrode to take accurate measurements. The most common cause for pH measurement inaccuracies is an unclean or improperly cleaned electrode. This is very important to note because during calibration, the instrument assumes that the electrode is clean and that the standardization curve created during the calibration process will remain a valid reference until the next calibration. pH meters on the market today will allow an offset of approximately ±60 mV while Hanna only allows an offset of approximately ±30 mV. An offset voltage is the mV at 7.00 pH. The deviation from 0 mV is not unusual, in fact it represents the true characteristics of a normal pH electrode.

An offset can be compensated for by calibrating a pH meter with a properly cleaned electrode. Calibrating a meter with a dirty electrode will only compound the problem. An mV offset that continues to deviate with a properly cleaned electrode is a good indication that the electrode may need to be replaced.

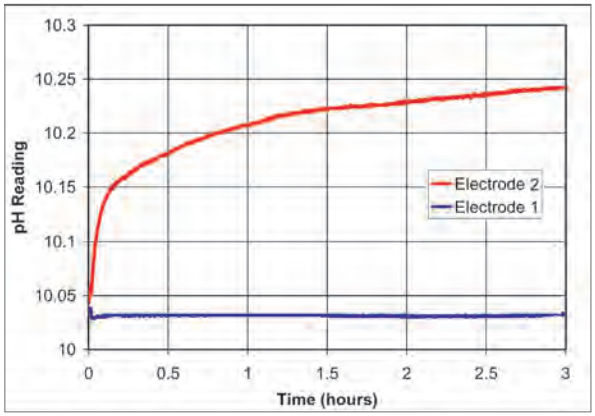



Fig G.

Electrode 1 has been properly cleaned before calibration.
Electrode 2 has not been properly cleaned.

## Electrode readings may vary with insufficient cleanings.

Fig. G (above) shows that the pH measured by a dirty electrode changes over a short period of time, resulting from the residue on the pH electrode bulb. The resulting pH measurements, based upon the calibration of a coated electrode, will then be incorrect.

Conventional pH meters do not warn the user when a pH electrode is dirty or when a solution may be contaminated. A common example of this occurs just after calibrating the instrument; the pH electrode is immersed into the pH 7 buffer and the reading is lower than expected (pH 6.8 or 6.9 instead of pH 7). Hanna meters that feature our exclusive CAL Check™ electrode diagnostics automatically alert the user of any potential electrode or solution problems during calibration.

## Precision Solutions

Hanna's wide range of solutions will help guarantee correct cleaning and calibration of electrodes and probes for maximum performance. Our solutions have been manufactured with your application in mind.

# Step 3: Maintenance

## Measurement

Always calibrate the electrode and pH meter together before making measurements. Rinse the pH electrode sensor tip with deionized or distilled water. For a faster response, and to avoid cross-contamination of the samples, rinse the electrode tip with a few drops of the solution to be tested. Before taking measurements submerse the pH sensor tip and reference junction (~3 cm /1¼") in the stirred sample.

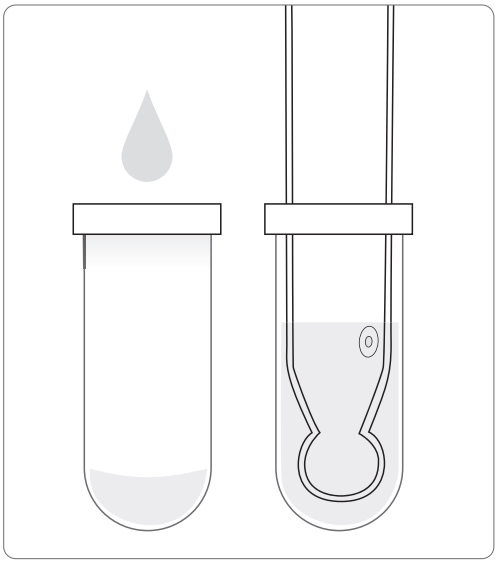


Fig H

## Storage

To ensure an optimum response time, the glass sensor tip and the reference junction of the pH electrode should be kept moist and not be allowed to dry out.

Replace the solution in the protective cap with a few drops of HI70300 or HI80300 Storage Solution or, in its absence, with pH 4 or pH 7 buffer (Fig H).

*NOTE: Never store the electrode in distilled or deionized water.*

## Inspect

Inspect and clean the electrode on a regular schedule to ensure the electrode will be ready when you need it. Coatings and reactions from samples result in decreased efficiency and longer response times.


HI5000 Series

# pH Technical Calibration Solutions

- Supplied with Certificate of Analysis
- Accuracy of ±0.01 pH @ 25°C
- Safety Data Sheets
  - Safety data sheets for all Hanna solutions are available at hannainst.com or upon request.
- Expiration date
  - The production batch number, expiration date, and temperature correlation table are reported on all Hanna calibration solutions.
- NIST traceability
  - Standardized using a meter and specially designed multi-reference probe. Reported values are traceable to NIST Standard Reference Materials (SRMs).
- Air-tight bottles
  - Air-tight bottle with tamper-proof seal of freshness to ensure quality.
- Single use sachets
  - opaque packaging prevents oxidation from UV light that could alter the value. Every sachet is as fresh as the day it was packaged.

## Technical Solutions (±0.01 pH) for Each Point of the pH Scale

To obtain precise and valid pH measurements, the pH meter and electrode must be calibrated at a minimum of two different points, close to the value of the sample to be tested. For this type of calibration, Hanna offers technical solutions for each point of the pH scale.

This complete scale of buffer solutions offers a higher degree of accuracy for pH measurements in specific areas of application, as in monitoring the pH of must and wine. This line includes twenty solutions starting from a value of pH 1.00 up to pH 13.00 with an accuracy of ±0.01 pH, thus covering every point of the pH scale.

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

Also available are solution bottles that are colored according to a given standard calibration value: HI5004-R (Red), HI5007-G (Green) and HI5010-V (Violet).


## Table of Reference Temperatures

HI5000 calibration solutions are provided with a label presenting a reference table of the relationship between pH or conductivity values and temperature.


## Bottles

| pH Value @25°C | Code | Package | Certificate of Analysis |
|---|---|---|---|
| 1.00 | **HI5001** | 500 mL | • |
| 1.68 | **HI5016** | 500 mL | • |
| 2.00 | **HI5002** | 500 mL | • |
| 2.00 | **HI5002-01** | 1 L | • |
| 3.00 | **HI5003** | 500 mL | • |
| 4.01 | **HI5004** | 500 mL | • |
| 4.01 | **HI5004-01** | 1 L | • |
| 4.01 | **HI5004-R** | 500 mL (color coded solution) | • |
| 4.01 | **HI5004-R08** | 1 G (3.78 L) (2) (color coded solution) | • |
| 5.00 | **HI5005** | 500 mL | • |
| 5.00 | **HI5005-01** | 1 L | • |
| 6.00 | **HI5006** | 500 mL | • |
| 6.86 | **HI5068** | 500 mL | • |
| 7.01 | **HI5007** | 500 mL | • |
| 7.01 | **HI5007-01** | 1 L | • |
| 7.01 | **HI5007-G** | 500 mL (color coded solution) | • |
| 7.01 | **HI5007-G08** | 1 G (3.78 L) (2) (color coded solution) | • |
| 7.41 | **HI5074** | 500 mL | • |
| 8.00 | **HI5008** | 500 mL | • |
| 8.00 | **HI5008-01** | 1 L | • |
| 9.00 | **HI5009** | 500 mL | • |
| 9.18 | **HI5091** | 500 mL | • |
| 10.01 | **HI5010** | 500 mL | • |
| 10.01 | **HI5010-01** | 1 L | • |
| 10.01 | **HI5010-V** | 500 mL (color coded solution) | • |
| 10.01 | **HI5010-V08** | 1 G (3.78 L) (2) (color coded solution) | • |
| 11.00 | **HI5011** | 500 mL | • |
| 12.00 | **HI5012** | 500 mL | • |
| 12.45 | **HI5124** | 500 mL | • |
| 13.00 | **HI5013** | 500 mL | • |

## Sachets

| pH Value @25°C | Code | Package | Certificate of Analysis |
|---|---|---|---|
| 1.00 | **HI50001-02** | 20 mL (25) | • |
| 1.68 | **HI50016-02** | 20 mL (25) | • |
| 2.00 | **HI50002-02** | 20 mL (25) | • |
| 3.00 | **HI50003-02** | 20 mL (25) | • |
| 4.01 | **HI50004-02** | 20 mL (25) | • |
| 5.00 | **HI50005-02** | 20 mL (25) | • |
| 6.86 | **HI50068-02** | 20 mL (25) | • |
| 7.01 | **HI50007-02** | 20 mL (25) | • |
| 9.00 | **HI50009-02** | 20 mL (25) | • |
| 9.18 | **HI50091-02** | 20 mL (25) | • |
| 10.01 | **HI50010-02** | 20 mL (25) | • |
| 11.00 | **HI50011-02** | 20 mL (25) | • |
| 12.00 | **HI50012-02** | 20 mL (25) | • |
| 12.45 | **HI50124-02** | 20 mL (25) | • |
| 13.00 | **HI50013-02** | 20 mL (25) | • |

## Hanna Combination Kits in Bottles

Use our combination kits for easy ordering and reordering.

| Code | Solutions (pH Value @25°C) | Bottle | Certificate of Analysis |
|---|---|---|---|
| **HI54710** | pH 4.01, pH 7.01, pH 10.01 | 500 mL (3) | • |
| **HI54710-10** | pH 4.01, pH 7.01, pH 10.01, HI70300L | 500 mL (4) | • |
| **HI54710-11** | pH 4.01, pH 7.01, pH 10.01, HI70300L, HI7061L | 500 mL (5) | • |

HI6000 Series

# ±0.002 pH Millesimal Calibration Solutions

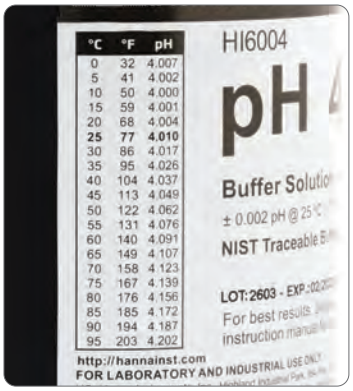
- Supplied with Certificate of Analysis
- Accuracy of ±0.002 pH @ 25°C
- Safety Data Sheets
  - Safety data sheets for all Hanna solutions are available at hannainst.com or upon request.
- Expiration date
  - The production batch number, expiration date, and temperature correlation table are reported on all Hanna calibration solutions.
- NIST traceability
  - Standardized using a meter and specially designed multi-reference probe. Reported values are traceable to NIST Standard Reference Materials (SRMs).
- Air-tight bottles
  - Air-tight bottle with tamper-proof seal of freshness to ensure quality.
- Single use sachets
  - Opaque packaging prevents oxidation from UV light that could alter the value. Every sachet is as fresh as the day it was packaged.
- Opaque bottles
  - Prevents any oxidation from UV light that could alter the buffer value.


## Bottles

| pH Value @25°C | Code | Package | Certificate of Analysis |
|---|---|---|---|
| 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 | • |
| 11.000 | **HI6011** | 500 mL | • |
| 12.000 | **HI6012** | 500 mL | • |
| 12.450 | **HI6124** | 500 mL | • |
| 13.000 | **HI6013** | 500 mL | • |

## Sachets

| pH Value @25°C | Code | Package | Certificate of Analysis |
|---|---|---|---|
| 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) | • |




## Table of Reference Temperatures

H6000 calibration solutions are provided with a label presenting a reference table of the relationship between pH or conductivity values and temperature.

GroLine

# Quick Cal

## pH/EC Quick Cal Calibration Solution

Quick Cal is for use with Hanna's GroLine pH and/or EC/TDS meters. Using the Quick Cal function found in compatible meters allows for single-point calibration for pH and/or conductivity sensors.

- Calibration solution for GroLine pH and EC/TDS meters
- pH calibration buffer value of pH 6.86
- EC calibration standard value of 5,000 µS/cm (5.00 mS/cm)
- Safety Data Sheets
  - Safety data sheets for all Hanna solutions are available at hannainst.com or upon request.
- Expiration date
  - The production batch number, expiration date, and temperature correlation table are reported on all Hanna calibration solutions.
- NIST traceability
  - Standardized using a pH meter calibrated by means of two standard solutions prepared from NIST standard reference materials. A conductivity meter and probe calibrated against NIST primary standard solutions or primary standard solutions prepared following NIST guidelines.




- Air-tight bottles
  - Air-tight bottle with tamper-proof seal of freshness to ensure quality.
- Single use sachets
  - Opaque packaging prevents oxidation from UV light that could alter the value. Every sachet is as fresh as the day it was packaged.

### Quick Cal pH/EC Bottles

| Code | Size | Certificate of Analysis |
|---|---|---|
| **HI5036-050** | 500 mL (GroLine) | • |
| **HI5036-023** | 230 mL (GroLine) | • |
| **HI5036-012** | 120 mL (GroLine) | • |

### Quick Cal pH/EC Sachets

| Code | Size | Certificate of Analysis |
|---|---|---|
| **HI50036P** | 20 mL sachets, 25 pcs. (GroLine) | • |

# pH Buffer Solutions

- Safety Data Sheets
  - Safety data sheets for all Hanna solutions are available at hannainst.com or upon request.
- Expiration date
  - The production batch number, expiration date, and temperature correlation table are reported on all Hanna calibration solutions.
- NIST traceability
  - Standardized using a pH meter calibrated by means of two standard solutions prepared from NIST standard reference materials.


- Air-tight bottles
  - Air-tight bottle with tamper-proof seal of freshness to ensure quality.
- Single use sachets
  - Opaque packaging prevents oxidation from UV light that could alter the value. Every sachet is as fresh as the day it was packaged.
- FDA compliant bottles (HI80xx)
  - Hanna solutions are offered in opaque bottles that meet FDA requirements.

## 4.01 pH Buffer Solution

This buffer value is widely used in water purification plants, in the food industry, and wherever the pH is expected to be slightly acidic.


## 4.01 pH @ 25°C - Bottles

| Code | Size | FDA Bottle | Certificate of Analysis |
|---|---|---|---|
| **HI7004/1G** | 1 G (3.78 L) (color coded solution) | | on request |
| **HI7004/1L** | 1 L (color coded solution) | | on request |
| **HI7004L** | 500 mL | | on request |
| **HI7004L/C** | 500 mL | | • |
| **HI7004C** | 500 mL (color coded solution) | | on request |
| **HI7004M** | 230 mL | | on request |
| **HI7004-050** | 500 mL (GroLine) | | • |
| **HI7004-023** | 230 mL (GroLine) | | • |
| **HI7004-012** | 120 mL (GroLine) | | • |
| **HI8004L** | 500 mL | • | • |
| **HI8004L/C** | 500 mL | • | • |

## 4.01 pH @ 25°C - Sachets

| Code | Size | Package | Certificate of Analysis |
|---|---|---|---|
| **HI70004C** | 20 mL | 25 pcs. | • |
| **HI70004G** | 20 mL (GroLIne) | 25 pcs. | • |
| **HI70004P** | 20 mL | 25 pcs. | |

## 4.01 and 7.01 pH @ 25°C - Sachets

| Code | Size | Package | Certificate of Analysis |
|---|---|---|---|
| **HI77400C** | 20 mL | 10 pcs., 5 ea | • |
| **HI77400P** | 20 mL | 10 pcs., 5 ea | |

# pH Buffer Solutions

- Safety Data Sheets
  - Safety data sheets for all Hanna solutions are available at hannainst.com or upon request.
- Expiration date
  - The production batch number, expiration date, and temperature correlation table are reported on all Hanna calibration solutions.
- NIST traceability
  - Standardized using a pH meter calibrated by means of two standard solutions prepared from NIST standard reference materials.

- Air-tight bottles
  - Air-tight bottle with tamper-proof seal of freshness to ensure quality.
- Single use sachets
  - Opaque packaging prevents oxidation from UV light that could alter the value. Every sachet is as fresh as the day it was packaged.
- FDA compliant bottles (HI80xx)
  - Hanna solutions are offered in opaque, bottles that meet FDA requirements.


## 7.01 pH @ 25°C - Bottles

| Code | Size | FDA Bottle | Certificate of Analysis |
|---|---|---|---|
| **HI7007/1G** | 1 G (3.78 L) (color coded solution) | | on request |
| **HI7007/1L** | 1 L (color coded solution) | | on request |
| **HI7007C** | 500 mL (color coded solution) | | on request |
| **HI7007L** | 500 mL | | on request |
| **HI7007L/C** | 500 mL | | • |
| **HI7007M** | 230 mL | | on request |
| **HI7007-050** | 500 mL (GroLine) | | • |
| **HI7007-023** | 230 mL (GroLine) | | • |
| **HI7007-012** | 120 mL (GroLine) | | • |
| **HI8007L** | 500 mL | • | • |
| **HI8007L/C** | 500 mL | • | • |

## 7.01 pH @ 25°C, and Combination Packs - Sachets

| Code | Value | Size | Package | Certificate of Analysis |
|---|---|---|---|---|
| **HI70007C** | 7.01 pH | 20 mL | 25 pcs. | • |
| **HI70007G** | 7.01 pH (GroLine) | 20 mL | 25 pcs. | • |
| **HI70007P** | 7.01 pH | 20 mL | 25 pcs. | |
| **HI77700P** | 7.01 pH | 20 mL | 10 pcs. | |
| **HI770710C** | 10.01 & 7.01 pH | 20 mL | 10 pcs., 5 ea | • |
| **HI770710P** | 10.01 & 7.01 pH | 20 mL | 10 pcs., 5 ea | |
| **HI77100C** | 1413 µS/cm & 7.01 pH | 20 mL | 20 pcs., 10 ea | • |
| **HI77100P** | 1413 µS/cm & 7.01 pH | 20 mL | 20 pcs., 10 ea | |
| **HI77200P** | 1500 mg/L (ppm) & 7.01 pH | 20 mL | 20 pcs., 10 ea | |
| **HI77400P** | 4.01 & 7.01 pH | 20 mL | 10 pcs., 5 ea | |

## 7.01 pH Buffer Solution

pH 7.01 is the most widely used among all buffer solutions. For this reason we have prepared it in a wider variety of sizes to meet application demand.

# pH Buffer Solutions

- Safety Data Sheets
  - Safety data sheets for all Hanna solutions are available at hannainst.com or upon request.
- Expiration date
  - The production batch number, expiration date, and temperature correlation table are reported on all Hanna calibration solutions.
- NIST traceability
  - Standardized using a pH meter calibrated by means of two standard solutions prepared from NIST standard reference materials.


- Air-tight bottles
  - Air-tight bottle with tamper-proof seal of freshness to ensure quality.
- Single use sachets
  - Opaque packaging prevents oxidation from UV light that could alter the value. Every sachet is as fresh as the day it was packaged.
- FDA compliant bottles (HI80xx)
  - Hanna solutions are offered in opaque bottles that meet FDA requirements.

## 10.01 pH Buffer Solution

pH 10.01 solution is commonly used to calibrate equipment used for analyzing basic samples. pH 10.01 buffer solution is available in various sizes to best fit your needs.


## 10.01 pH @ 25°C - Bottles

| Code | Size | FDA Bottle | Certificate of Analysis |
|---|---|---|---|
| **HI7010/1G** | 1 G (3.78 L) (color coded bottle) | | on request |
| **HI7010/1L** | 1 L (color coded bottle) | | on request |
| **HI7010L** | 500 mL | | on request |
| **HI7010C** | 500 mL (color coded solution) | | on request |
| **HI7010L/C** | 500 mL | | • |
| **HI7010M** | 230 mL | | on request |
| **HI7010-050** | 500 mL (GroLine) | | • |
| **HI7010-023** | 230 mL (GroLine) | | • |
| **HI7010-012** | 120 mL (GroLine) | | • |
| **HI8010L** | 500 mL | • | • |
| **HI8010L/C** | 500 mL | • | • |

## 10.01 pH @ 25°C, and Combination Packs - Sachets

| Code | pH Value | Size | Package | Certificate of Analysis |
|---|---|---|---|---|
| **HI70010C** | 10.01 | 20 mL | 25 pcs. | • |
| **HI70010P** | 10.01 | 20 mL | 25 pcs. | |
| **HI770710C** | 10.01 & 7.01 | 20 mL | 10 pcs., 5 ea | • |
| **HI770710P** | 10.01 & 7.01 | 20 mL | 10 pcs., 5 ea | |

## 1.68 pH @ 25°C - Bottles

| Code | Size | Certificate of Analysis |
|---|---|---|
| **HI7001L** | 500 mL | on request |
| **HI7001M** | 230 mL | on request |

## 6.00 pH @ 25°C - Bottle

| Code | Size | Package |
|---|---|---|
| **HI70060M** | 230 mL | bottle |

## 6.86 pH @ 25°C - Bottles

| Code | Size | FDA Bottle | Certificate of Analysis |
|---|---|---|---|
| **HI7006/1G** | 1 G (3.78 L) | | on request |
| **HI7006/1L** | 1 L | | on request |
| **HI7006L** | 500 mL | | on request |
| **HI7006L/C** | 500 mL | | • |
| **HI7006M** | 230 mL | | on request |
| **HI8006L** | 500 mL | • | • |
| **HI8006L/C** | 500 mL | • | • |

## 6.86 pH @ 25°C - Sachets

| Code | Size | Package | Certificate of Analysis |
|---|---|---|---|
| **HI70006C** | 20 mL | 25 pcs. | • |
| **HI70006P** | 20 mL | 25 pcs. | |

## 8.20 pH @ 25°C - Bottle

| Code | Size | Package |
|---|---|---|
| **HI70082M** | 230 mL | bottle |

## 8.30 pH @ 25°C - Bottle

| Code | Size | Package |
|---|---|---|
| **HI70083M** | 230 mL | bottle |

## 9.18 pH @ 25°C - Bottles

| Code | Size | FDA Bottle | Certificate of Analysis |
|---|---|---|---|
| **HI7009/1G** | 1 G (3.78 L) | | on request |
| **HI7009/1L** | 1 L | | on request |
| **HI7009L** | 500 mL | | on request |
| **HI7009L/C** | 500 mL | | • |
| **HI7009M** | 230 mL | | on request |
| **HI8009L/C** | 500 mL | • | • |
| **HI8009L** | 500 mL | • | • |

## 9.18 pH @ 25°C - Sachets

| Code | Size | Package | Certificate of Analysis |
|---|---|---|---|
| **HI70009C** | 20 mL | 25 pcs. | • |
| **HI70009P** | 20 mL | 25 pcs. | |

# pH Buffer Solutions

- Safety Data Sheets
  - Safety data sheets for all Hanna solutions are available at hannainst.com or upon request.
- Expiration date
  - The production batch number, expiration date, and temperature correlation table are reported on all Hanna calibration solutions.
- NIST traceability
  - Standardized using a pH meter calibrated by means of two standard solutions prepared from NIST standard reference materials.
- Air-tight bottles
  - Air-tight bottle with tamper-proof seal of freshness to ensure quality.
- Single use sachets
  - Opaque packaging prevents oxidation from UV light that could alter the value. Every sachet is as fresh as the day it was packaged.
- FDA compliant bottles (HI80xx)
  - Hanna solutions are offered in opaque bottles that meet FDA requirements.

## 1.68 pH Buffer Solution

Plating bath samples, food samples, and waste samples are often acidic in nature. To increase accuracy of your measurement at lower pH values, it is important to calibrate your electrode and meter at the appropriate pH. pH 1.68 buffer solution allows you to calibrate your measurement system in the acidic pH range and bracket your samples by using a second value at 4.01 pH or near 7.01 pH.

## 6.86 pH Buffer Solution

Many of our portable and benchtop instruments may now be calibrated with both pH 6.86 or pH 7.01 buffers.

## 8.20 and 8.30 pH Buffer Solution

To increase accuracy of your measurement, 8.20 and 8.30 pH buffer solution are available.

## 9.18 pH Buffer Solution

To increase measurement accuracy in an alkaline environment, it is important to calibrate your electrode and meter in that pH range and to preferably bracket your sample values. Hanna offers both pH 9.18 buffer and pH 10.01 buffer to fufill this requirement.

# ORP and Sample Preparation Solutions

- Safety Data Sheets
  - Safety data sheets for all Hanna solutions are available at hannainst.com or upon request.
- Expiration date
  - The production batch number and expiration date are reported on all Hanna calibration solutions.
- Air-tight bottles
  - Air-tight bottle with tamper-proof seal of freshness to ensure quality.

## ORP Test and Pretreatment Solutions

ORP standard solutions allows users to test the precision of ORP electrodes. For example, by immersing the electrode in HI7021 solution, the reading should be at 240 mV (@25°C/77°F).

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

Use HI7092 for oxidizing or HI7091 for reducing pretreatment.

## Soil Sample Preparation Solution

HI7051 Soil Sample Preparation Solution is an electrolyte solution used in the measurement of soil pH. The pH of soil is most commonly measured as either a water slurry or electrolyte slurry, where a set ratio of soil:solvent (solvent is water or electrolyte solution) is chosen; common ratios used for soil pH are 1:1, 1:2, or 1:5, where more solvent than soil is used when soils-to-be-analyzed contain high amounts of organic matter or clay. Use of an electrolyte solution is usually preferred as it is less affected by soil electrolyte concentration and provides a more consistent measurement for soils whose salt content may fluctuate as a result of seasonal conditions or crop residues.

Using the HI7051 solution prior to taking a measurement provides for a more accurate pH reading of soil samples.


### ORP Test and Pretreatment Solution Bottles

| Code | Description | Size | Certificate of Analysis |
|---|---|---|---|
| **HI7021L** | 240 mV ORP solution for platinum and gold electrodes | 500 mL | on request |
| **HI7021M** | 240 mV ORP solution for platinum and gold electrodes | 230 mL | on request |
| **HI7022L** | 470 mV ORP solution for platinum and gold electrodes | 500 mL | on request |
| **HI7022M** | 470 mV ORP solution for platinum and gold electrodes | 230 mL | on request |
| **HI7091L** | reducing pretreatment solution (2 components) | 500 mL + 14g (set) | |
| **HI7092L** | oxidizing pretreatment solution for ORP electrodes | 500 mL | |
| **HI7092M** | oxidizing pretreatment solution for ORP electrodes | 230 mL | |

### ORP Test and Pretreatment Solution Sachets

| Code | Description | Size | Package | Certificate of Analysis |
|---|---|---|---|---|
| **HI70022P** | 470 mV ORP solution for platinum and gold electrodes | 20 mL | 25 pcs. | • |

### Sample Preparation Solution Bottles

| Code | Description | Size |
|---|---|---|
| **HI7051M** | soil sample preparation solution | 230 mL |
| **HI7051L** | soil sample preparation solution | 500 mL |
| **HI70960** | preparation solution for solid or semi-solid samples | 30 mL |


# Electrode Storage Solutions

- Designed for storing any pH or ORP electrode
- Special formulation
  - Special formulation to minimize microbial growth and osmotic/ diffusion effects between the solution and inner reference electrolyte
- Expiration date
  - The production batch number and expiration date are reported on all Hanna calibration solutions.

- Air-tight bottles
  - Air-tight bottle with tamper-proof seal of freshness to ensure quality.
- Single use sachets
  - Opaque packaging prevents oxidation from UV light that could alter the value. Every sachet is as fresh as the day it was packaged.
- FDA compliant bottles (HI803xx)
  - Hanna solutions are offered in opaque bottles that meet FDA requirements.


HI70300 is a storage solution prepared with reagent grade chemicals that can be used to ensure optimum performance of your pH and ORP electrodes.

To ensure an optimum response time, the glass sensor tip and the reference junction of the pH electrode should be kept moist and not be allowed to dry out when not in use.

Placing the pH electrode in a small glass filled with storage solution or replacing the solution in the protective cap is a suitable way to store the electrode. Storage solution should also be used to rehydrate the electrode after a cleaning procedure by soaking for at least one hour before taking measurements.

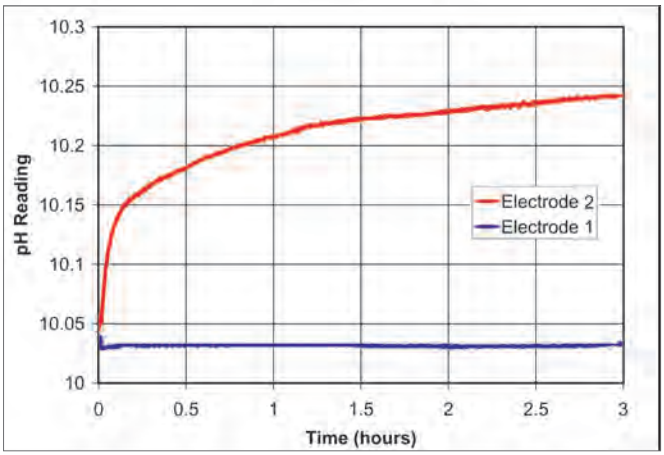
## Electrode Storage Solutions

| Code | Description | Package |
|---|---|---|
| **HI70300L** | storage solution for pH and ORP electrodes | 500 mL bottle |
| **HI70300M** | storage solution for pH and ORP electrodes | 230 mL bottle |
| **HI70300S** | storage solution for pH and ORP electrodes | 30 mL bottle |
| **HI70300G** (GroLine) | storage solution for pH and ORP electrodes | 20 mL sachet (25) |
| **HI70300-050** | storage solution for pH and ORP electrodes (GroLine) | 500 mL bottle |
| **HI70300-023** | storage solution for pH and ORP electrodes (GroLine) | 230 mL bottle |
| **HI70300-012** | storage solution for pH and ORP electrodes (GroLine) | 120 mL bottle |
| **HI80300L** | storage solution for pH and ORP electrodes | 500 mL FDA bottle |
| **HI80300M** | storage solution for pH and ORP electrodes | 230 mL FDA bottle |
| **HI5300-12** | storage solution for pH and ORP electrodes | 120 mL bottle |


# Electrode Cleaning Solutions for a Top Performing Sensor

- Expiration date
  - The production batch number and expiration date are reported on all Hanna calibration solutions.
- Air-tight bottles
  - Air-tight bottle with tamper-proof seal of freshness to ensure quality.
- Single use sachets
  - Opaque packaging prevents oxidation from UV light that could alter the value. Every sachet is as fresh as the day it was packaged.
- FDA compliant bottles (HI80xx)
  - Hanna solutions are offered in opaque bottles that meet FDA requirements.

Electrodes can become dirty from use and will produce inaccurate results even as they read correctly in a pH buffer. Hanna's cleaning solutions eliminate impurities and residues that are left on electrode surfaces when immersed in samples during measurement and stored incorrectly. Hanna suggests cleaning the bulb and junction of your electrode on a regular basis to ensure that the probe is always clean and prevent any clogging of the junction.




Electrode 1 has been properly cleaned before calibration."
Electrode 2 has not been properly cleaned.

## General Use Electrode Cleaning Solutions - Bottles

| Code | Application | Package |
|---|---|---|
| **HI7061M** | general purpose | 230 mL bottle |
| **HI7061L** | general purpose | 500 mL 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 |
| **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 |
| **HI8061L** | general purpose | 500 mL FDA bottle |
| **HI8073L** | proteins | 500 mL FDA bottle |
| **HI8077L** | oil and fats | 500 mL FDA bottle |


## Specific Electrode Cleaning Solutions - Bottles

| Code | Description | Size |
|---|---|---|
| **HI70621L** | cleaning Solution for skin grease and sebum (Cosmetic Industry) | 500 mL |
| **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 | 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 deposits (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 | 500 mL |
| **HI70682L** | cleaning solution for brewing deposits | 500 mL |


## General Use Electrode Cleaning Solutions - Sachets

| Code | Application | Package |
|---|---|---|
| **HI70000P** | rinsing | 20 mL sachet (25) |
| **HI700601P** | general purpose | 20 mL sachet (25) |
| **HI70061G** | general purpose (GroLine) | 20 mL sachet (25) |

## Specific Electrode Cleaning Solutions - Sachets

| Code | Description | Qty/Size |
|---|---|---|
| **HI700620P** | cleaning Solution for skin residuals | 20 mL (25) |
| **HI700621P** | cleaning Solution for skin grease and sebum (Cosmetic Industry) | 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 deposits (food industry) | 20 mL (25) |
| **HI700643P** | cleaning and disinfection solution for yogurt products (food industry) | 20 mL (25) |
| **HI700661P** | general purpose cleaning solution for 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) |
| **HI700671P** | cleaning and disinfection solution for algae, fungi and bacteria (industrial processes) | 20 mL (25) |
| **HI700680P** | cleaning solution for cellulose deposits | 20 mL (25) |
| **HI700681P** | cleaning solution for ink stains | 20 mL (25) |
| **HI700682P** | cleaning solution for beer and wort (beermaking) | 20 mL (25) |
| **HI700683P** | cleaning solution for sushi rice deposits | 20 mL (25) |
| **HI700684P** | cleaning solution for bread and dough deposits | 20 mL (25) |
| **HI700685P** | cleaning solution for chocolate deposits | 20 mL (25) |

# Electrode Fill Solutions

- Expiration date
  - The production batch number and expiration date are reported on all Hanna calibration solutions.

- Air-tight bottles
  - Air-tight bottle with tamper-proof seal of freshness to ensure quality.
- FDA compliant bottles (HI80xx)
  - Hanna solutions are offered in opaque bottles that meet FDA requirements.

The electrolyte level in refillable electrodes should be checked before performing any measurements. If the level is low, refill with the proper electrolyte solution to ensure optimum performance. This simple maintenance helps guarantee adequate head pressure to promote the flow of reference electrolyte into the sample being measured.



## Electrode Fill Solutions

| Code | Description | Package |
|---|---|---|
| **HI7071** | 3.5M KCl with AgCl reference electrolyte | 30 mL bottle (4) |
| **HI7071M** | 3.5M KCl with AgCl reference electrolyte | 230 mL bottle |
| **HI7071L** | 3.5M KCl with AgCl reference electrolyte | 500 mL bottle |
| **HI7072** | 1M potassium nitrate electrode fill solution | 30 mL bottle (4) |
| **HI7072L** | 1M potassium nitrate electrode fill solution | 500 mL bottle |
| **HI7075** | 1.7M potassium nitrate, 0.7M potassium chloride electrode fill solution | 30 mL bottle (4) |
| **HI7076** | 1M sodium chloride electrode fill solution | 30 mL bottle (4) |
| **HI7078** | 0.5M ammonium sulfate electrode fill solution | 30 mL bottle (4) |
| **HI7082** | 3.5M KCl reference electrolyte for double junction electrodes | 30 mL bottle (4) |
| **HI7082M** | 3.5M KCl reference electrolyte for double junction electrodes | 230 mL bottle |
| **HI7082L** | 3.5M KCl reference electrolyte for double junction electrodes | 460 mL bottle |
| **HI8071** | 3.5M KCl with AgCl reference electrolyte | 30 mL FDA bottle (4) |
| **HI8082** | 3.5M KCl reference electrolyte for double junction | 30 mL FDA bottle (4) |
| **HI8093** | 1M KCl with AgCl reference electrolyte | 30 mL FDA bottle (4) |
| **HI9071** | gelled bridge electrolyte for FC2053 pH electrode and HI981030 GroLine pH tester | 30 mL bottle |

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# Introduction to ISE

## Three Methods of Analysis

Potentiometric ion analyses with ion-selective electrodes (ISEs) are performed by use of one of three methods, each entailing its own advantages: direct potentiometry, incremental methods, and potentiometric titration. Hanna offers a solution for each of these methods.

### Direct Potentiometry

Direct potentiometry is a widely used method of performing ion analysis with ISEs. This method is highly effective when the user must quickly measure large batches of samples at varying concentrations. Our direct reading meters, such as the HI98191, display concentration of the unknown sample by a direct reading after calibration of the instrument with two or more standards; ionic strength adjustments are made to both samples and standards. In some applications, quick and reliable measurements can be made on-site without taking samples back to the laboratory.

### Incremental Methods

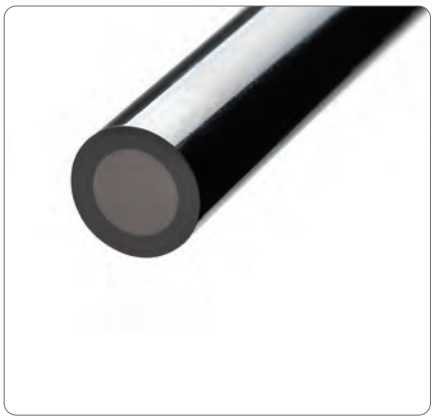
Incremental methods are useful techniques used to determine ion concentration in samples whose constituents are variable or concentrated. Incremental methods have some inherent advantages over direct potentiometry. The techniques can reduce errors from variables such as temperature, viscosity, pH or ionic strength. The electrodes remain immersed throughout the process, thus reducing sample carry over and possible liquid junction changes in the reference. Known addition, known subtraction, analyte addition, and analyte subtraction methods are four of these incremental techniques. All four techniques involve adding a standard to the sample, or sample to the standard; the meter then calculates the ion concentration of the sample.

### Potentiometric Titration

A potentiometric titration can increase the precision of ISE measurements and also the number of ionic species that can be determined. ISEs are commonly used as indicators for the titrant or sample species to follow the progress of a precipitation or complexometric titration. A small change in reactant addition corresponds to a large change in electrode potential at the stoichiometric endpoint. An example of a precipitation titration is the determination of chloride using silver nitrate. A silver ISE can be used to follow this titration. A complexometric titration is used for the determination of calcium. A calcium solution is titrated with the complexing agent, EDTA. During the titration there is a gradual decrease in the free $Ca^{2+}$ ion concentration as more EDTA is added. The endpoint corresponds to the point at which all of the $Ca^{2+}$ is complexed. The progress of this titration can be monitored using a calcium ISE.

## Ion Selective Electrode Types

Hanna's ISEs can be grouped into three general categories based upon construction.



### Solid-state

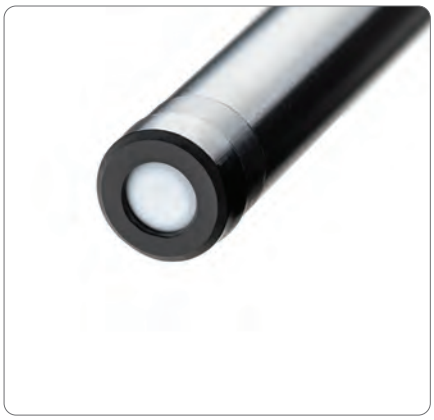
Solid-state electrodes are available as both single half-cells or as combination electrodes complete with reference electrode. These electrodes incorporate a solid sensing surface made of compressed silver halides or solid crystalline material. Hanna's offering includes sensors for the determination of bromide, cadmium, chloride, cupric, cyanide, fluoride, iodide, lead and silver ions. Rugged, solid body construction ensures a long life.

Theory: A solid-state electrode develops a voltage due to ion-exchange occurring between the sample and the inorganic membrane. An equilibrium mechanism occurs due to the very limited solubility of the membrane material in the sample.

### Liquid Membrane

Liquid membrane electrodes are available as single half-cells or as combination electrodes complete with reference electrode. The sensing surfaces of these electrodes are comprised of a homogeneous polymer matrix containing organic ion exchangers that are selective for the determined ion. These sensors incorporate easily replaceable membrane modules and are available for measurements of nitrate, potassium and calcium.

Theory: The potassium electrode was one of the earliest liquid membrane sensors developed. The membrane is usually in the form of a thin disc of PVC impregnated with the antibiotic valinomycin. The exchanger, also known as an ionophore, is a ring structure that fits potassium ions inside, functioning as a lock and key mechanism. This type of membrane is not as rugged as the solid-state type so they are designed for easy replacement of the sensing module.



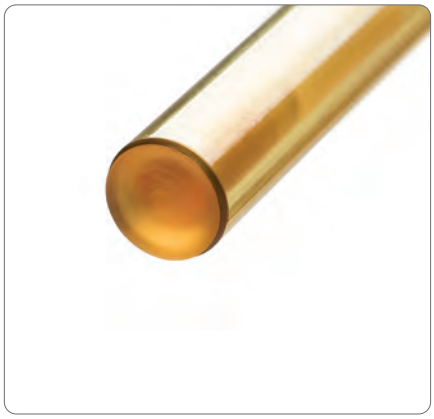
## Gas Membrane

Gas sensors are combination electrodes that detect dissolved gases in a solution. No external reference is required for these electrodes. The sensing element is separated from the sample solution by a gas permeable membrane. Hanna's offering of gas membrane ISEs include ammonia and carbon dioxide.

Theory: A gas sensor works due to the partial pressure of the measured gas in solution. The dissolved gas in the sample diffuses into the membrane and changes the pH in a thin film of unbuffered electrolyte on the surface of the internal pH sensor. Diffusion continues until the partial pressure of the sample and the thin film of electrolyte are the same. The pH change is proportional to the dissolved gas in the sample.

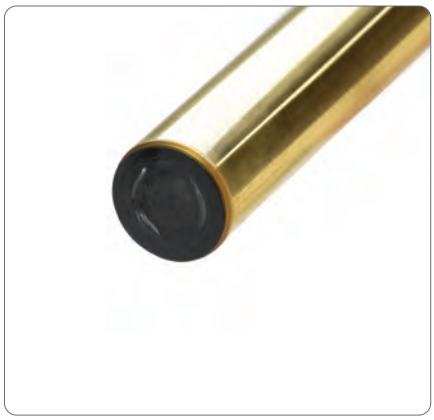
# Reference and Combination Electrodes

Hanna's reference electrode is used with our half-cell ISE sensors to provide accurate and repeatable measurements. Hanna's combination electrodes incorporate the measuring electrode with the reference, making them ideal for field measurements.



## Reference

Reference electrodes are used to provide a stable voltage and electrolytic contact to measure a voltage gradient across a measurement membrane. Hanna has designed an easy to use, durable, double junction, quick-fill, sleeve-style reference electrode with a cone style junction to work with the ISE family of sensors. The design forms the liquid junction with the test solution at the tip of the junction cone, producing a highly stable reference electrode with reasonable, low flow rates. The model HI5315 is a silver/silver chloride half-cell with a permanent gel-filled internal cell. The outer fill solution is easily replaceable and serves as a buffer zone between the internal chloride ion-containing gel and the sample solution. Hanna offers a complete line of silver-free fill solutions to optimize your ion measurement. A fast responding liquid junction, excellent reproducibility, and ease of use will mark this reference as your "best" in the lab.



## Combination

Combination electrodes include a sensor and reference electrode within one electrode body. Our combination ISEs provide the same selectivity and response as our ISE half-cells, but include our superior double junction reference in the same electrode body. Combination solid-state electrodes have a built-in solid-state sensor and quick refillable reference electrode. Our liquid membrane and fluoride combination electrodes have replaceable module construction and the Hanna double junction reference stability.

# Comparison Guides

## Benchtop Meters

| | pH Range | ISE Range | ORP Range/Relative mV | EC/TDS/Salinity Range | Resistivity Range | Temperature Range | (D)irect /(I)ncremental Measurement | ISE Calibration Points | ISE Buffers: Standard/Custom | pH CAL Check™ | Temperature Compensation: (A)utomatic or (M)anual | GLP | (A)uto, (L)og on demand and Auto(E)nd Data Logging | HOLD | Predefined ISE electrode | PC Connection | On-screen Help, Tutorial and Multi-language | Application Designed | Page |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HI5522 | • | • | • | • | • | °C/°F | D,I | 5 | 8/5 | • | A/M | • | A, L, E | • | • | USB | • | research | 3.6 |
| HI5222 | • | • | • | | | °C/°F | D,I | 5 | 8/5 | • | A/M | • | A, L, E | • | • | USB | • | research | 3.12 |

## Portable Meters

| | pH Range | ISE Range | ORP Range/Relative mV | EC/TDS/Salinity Range | Resistivity Range | Temperature Range | (D)irect /(I)ncremental Measurement | ISE Calibration Points | ISE: Standard/Custom | pH CAL Check | Temperature Compensation: (A)utomatic or (M)anual | GLP | (A)uto, (L)og on demand and Auto(E)nd Data Logging | HOLD | Predefined ISE electrode | PC Connection | On-screen Help, Tutorial and Multi-language | Application Designed | Page |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HI98191 | • | • | • | | | °C/°F | D | 5 | 7/5 | • | A/M | • | A, L, E | • | | USB | • | universal | 3.16 |
| HI98402 | | • | | | | °C/°F | D | 2 | 5/0 | | A/M | | | | • | | | fluoride | 3.19 |
| HI931100 | | • | | | | °C/°F | D | 2 | 3/0 | | A/M | | | | • | | | NaCl sodium chloride | 3.20 |
| HI931101 | | • | | | | °C/°F | D | 2 | 3/0 | | A/M | | | | • | | | Na sodium | 3.20 |
| HI931102 | | • | | | | °C/°F | D | 2 | 3/0 | | A/M | | | | • | | | NaCl | 3.21 |

# Ion Selective Sensors and Accessories Reference Chart

| Electrode | Type | Half-Cell | Combination | Ionic Strength Adjusters (ISA) 500 mL bottle | Silver Free Reference Fill Solutions (4) 30 mL bottles | ISE Standards 1, 500 mL bottle | ISE Standards 2, 500 mL bottle | ISE Standards 3, 500 mL bottle | Other |
|---|---|---|---|---|---|---|---|---|---|
| Ammonia | gas | – | HI4101 | **HI4001-00** | **HI4001-40** | **HI4001-01** 0.1 M | **HI4001-02** 100 mg/L (ppm) | **HI4001-03** 1000 mg/L (ppm) | **HI4000-52** replacement cap<br>**HI4001-51** membrane kit<br>**HI4000-51** replacement pH internal and cap for ammonia<br>**HI4001-45** conditioning solution<br>**HI4000-47** 4 and 7 pH buffers with chloride ions background<br>**HI740159** plastic tweezers |
| Bromide | solid | HI4002 | HI4102 | **HI4000-00** | **HI7072**, 1 M $KNO_3$ | **HI4002-01**, 0.1 M | | | **HI4000-70** polishing strip |
| Cadmium | solid | HI4003 | HI4103 | **HI4000-00** | **HI7072**, 1 M $KNO_3$ | **HI4003-01** 0.1 M | | | **HI4000-70** polishing strip |
| Calcium | polymer membrane | HI4004 | HI4104 | **HI4004-00** | **HI7082**, 3.5 M KCl | **HI4004-01**, 0.1 M | | | **HI4004-51** module<br>**HI4104-51** module for combination<br>**HI4004-45** conditioning solution |
| Carbon Dioxide | gas | – | HI4105 | **HI4005-00** | **HI4005-40** | **HI4005-01**, 0.1 M | **HI4005-03**, 1000 mg/L (ppm) $CO_2$ as $CaCO_3$ | | **HI4000-54** replacement pH internal and cap for $CO_2$<br>**HI4005-53** $CO_2$ membrane kit (3 pack)<br>**HI4000-47** 4 and 7 pH buffers with chloride background<br>**HI4005-45** conditioning solution<br>**HI740159** plastic tweezers |
| Chloride | solid | HI4007 | HI4107 | **HI4000-00** | **HI7072**, 1 M $KNO_3$ | **HI4007-01**, 0.1 M | **HI4007-02**, 100 mg/L (ppm) | **HI4007-03**, 1000 mg/L (ppm) | **HI4000-70** polishing strip |
| Cupric | solid | HI4008 | HI4108 | **HI4000-00** | **HI7072**, 1 M $KNO_3$ | **HI4008-01**, 0.1 M | | | **HI4000-70** polishing strip |
| Cyanide | solid | HI4009 | HI4109 | **HI4001-00** | **HI7072**, 1 M $KNO_3$ | | | | **HI4000-70** polishing strip |
| Fluoride | solid | HI4010 | HI4110 | **HI4010-00**<br>**HI4010-05**<br>**HI4010-06**<br>**HI4010-30,** TISAB II, 1 ppm TISAB II, 10 ppm TISAB II | **HI7075**, 1 M $KNO_3$ , 0.7 M KCl | **HI4010-01**, 0.1M | **HI4010-02**, 100 mg/L (ppm) | **HI4010-03**, 1000 mg/L (ppm) | **HI4010-11** 1 ppm with TISAB II<br>**HI4010-12** 2 ppm with TISAB II<br>**HI4010-10** 10 ppm with TISAB II<br>**HI4110-51** module for combination<br>**HI4010-30** fluoride measurement kit |
| Iodide | solid | HI4011 | HI4111 | **HI4000-00** | **HI7072**, 1 M $KNO_3$ | **HI4011-01**, 0.1 M | | | **HI4000-70** polishing strip |
| Lead/ Sulfate | solid | HI4012 | HI4112 | **HI4012-00** | **HI7072**, 1 M $KNO_3$ | **HI4012-01**, lead, 0.1 M<br>**HI4012-21** sulfate, 0.1 M | | | **HI4000-70** polishing strip |
| Nitrate | polymer membrane | HI4013 | HI4113 | **HI4013-00** | **HI7078**, $(NH_4)_2SO_4$ 0.5M | **HI4013-01**, 0.1 M | **HI4013-02**, 100 mg/L (ppm) nitrate-nitrogen | **HI4013-03**, 1000 mg/L (ppm) nitrate-nitrogen | **HI4013-51** module<br>**HI4013-53** module (3 pack)<br>**HI4113-51** module for combination<br>**HI4113-53** module for combination (3 pack)<br>**HI4013-06** interferent suppressant ISA |
| Potassium | polymer membrane | HI4014 | HI4114 | **HI4014-00** | **HI7076**, 1 M NaCl | **HI4014-01**, 0.1 M | | | **HI4014-51** module<br>**HI4114-51** module for combination |
| Silver/ Sulfide | solid | HI4015 | HI4115 | **HI4000-00** ($Ag^-$)<br>**HI4015-00** ($S^{2-}$) | **HI7072**, 1 M $KNO_3$ | **HI4015-01**, 0.1 M $Ag^+$ | | | **HI4000-70** polishing strip |
| Sodium | | – | FC300 | **HI4016-00** | **HI7079**, 2 M $NH_4Cl$ + AgCl | **HI4016-01**, 0.1 M | **HI4016-02**, 100 mg/L (ppm) | **HI4016-03**, 1000 mg/L (ppm) | **HI4016-10**, 10 mg/L (ppm)<br>**HI4016-45** storage solution<br>**HI4016-46** conditioning solution |
| Reference | | HI5315 | | | **HI7072**, 1 M $KNO_3$<br>**HI7076**, 1 M NaCl<br>**HI7078**, $(NH_4)_2SO_4$<br>**HI7082**, 3.5 M KCl<br>**HI7075**, 1.7M $KNO_3$, 0.7M KCl | | | | |

HI5522

# Research Grade Meter

*pH/ORP/ISE and EC/TDS/Resistivity/Salinity and Temperature*


The HI5522 is an advanced research grade benchtop pH/ORP/ISE and EC/TDS/Salinity/Resistivity meter that is completely customizable with a large color LCD, capacitive touch keys, and USB port for computer connectivity.

The HI5522 is a two-channel meter that allows for simultaneous measure of pH, ORP, or ISE on one channel and EC, TDS, Salinity, or Resistivity on the other. Channel one has a BNC connection for use with the expansive line of pH, ORP, and ISE electrodes that Hanna Instruments offers. The meter is supplied with the HI1131B glass body, double junction, combination pH electrode that operates over a wide temperature range from 0 to 100°C. All readings are automatically compensated for temperature variations with the separate HI7662-T temperature probe or from the built-in temperature sensor of the conductivity probe on Channel two. The HI5522 is supplied with the HI76312 four-ring conductivity probe that operates over a wide range from 0.000 µS/cm to 1000.0 mS/cm*. The meter can be set to auto-ranging in which the meter chooses the appropriate conductivity range from seven ranges or fixed range in which the meter will only display reading in µS/cm or mS/cm. All readings are automatically compensated for temperature variations with a built in temperature sensor. The temperature correction coefficient is adjustable from 0.00 to 10.00 %/°C.

As a pH meter the HI5522 can be calibrated up to five points with a choice of eight pre-programmed buffers or five custom buffers. The HI5522 features Hanna's exclusive CAL Check™ to alert the user of potential problems during the pH calibration process. Indicators displayed during calibration include "Electrode Dirty/Broken" and "Buffer Contaminated." The overall probe condition based on the offset and slope characteristic of the electrode is displayed as a percentage after calibration is complete.

In ISE mode the HI5522 can be calibrated up to five points with a choice of five fixed standards or five user defined in any concentration unit. The calibration data including date, time, standards used and slope can be viewed at any time along with the current measurement by selecting the Good Laboratory Practice (GLP) display option.

As an EC/TDS/Salinity/Resistivity meter the HI5522 can be calibrated up to four points with a choice of six pre-programmed conductivity standards or user defined custom standards. Resistivity, TDS, Practical Salinity (PSU) and Natural Seawater Scale are calibrated through conductivity. The % NaCl is calibrated to single point with the HI7037 salinity standard. The calibration data including date, time, and standards used, offset and cell factor can be accessed at any time along with the current measurement by selecting the Good Laboratory Practice (GLP) display option.

For the measurement of high purity water used in pharmaceutical manufacturing, the HI5522 is programmed with the three stages of the USP <645> method. Once a stage is met a report is generated and can be saved. Up to 200 reports can be stored and transferred to a Windows® compatible computer using the supplied USB cable and software.

Three selectable logging modes are available: automatic, manual and AutoHold logging. Up to 100,000 data points can be recorded in 100 lots with 50,000 records max/lot on each channel and exported to a computer for data review and storage.

## Customizable User Interface

The user interface of the HI5522 allows the user to show measurements in various modes: basic measurement with or without GLP information, real-time graphing, and logging data. Calibration stability criteria can be adjusted from fast, moderate, and accurate. Programmable alarm limits can be set to inside or outside allowable limits.

## Color Graphic LCD

The HI5522 features a color graphic LCD with on-screen help, graphic, and custom color configurations. The display allows for real-time graphing and the use of virtual keys provide for an intuitive user interface.

## Capacitive Touch

The HI5522 features sensitive capacitive touch buttons for accurate keystrokes when navigating menus and screens. There are four dedicated keys that are used for routine operations including calibration and switching measurement modes and four virtual keys that change based upon use. The capacitive touch technology ensures the buttons never get clogged with sample residue.

## Four Ring Conductivity Probe

All readings are performed with the HI76312 four-ring conductivity probe that has a built in temperature sensor for automatic temperature correction. The four rings are made with platinum and the body of the electrode is made of Polyetherimide (PEI) plastic that is resistant to many harsh chemicals. The four-ring design allows for this probe to be used over a wide range of measurements.

## Choice of Calibration

Automatic buffer recognition, semiautomatic, and direct manual entry pH calibration options are available for calibrating up to five points, from a selection of eight standard buffers and up to five custom buffers. For the conductivity channel the calibration can be set to automatic standard recognition or user entry along with a choice of single or multi-point. Calibration can be performed up to four points when multi-point is selected.

## CAL Check™

CAL Check alerts users to potential problems during the calibration of the pH electrode. Indicators include "Electrode Dirty/Broken," "Buffer Contaminated," electrode response time and the overall probe condition as a percentage that is based on the offset and slope characteristics.

## GLP Data

HI5522 includes a GLP feature that allows users to view calibration data and calibration expiration information at the touch of a key. Calibration data include date, time, standards used for calibration.

## ISE Measurement with Choice of Concentration Units

The HI5522 allows for calibration and readings in choice of concentration units. The choices of concentration units include ppt, g/L, mg/mL, ppm, mg/L, µg/L, ppb, µg/L, mg/mL, M, mol/L, mmol/L, %w/v and a user-defined unit.

## ISE Measurement with Incremental Methods

The known addition, known subtraction, analyte addition, and analyte subtraction incremental methods are pre-programmed into the HI5522. Simply follow the on screen guided procedure and the meter will perform the calculation automatically allowing for a higher level of accuracy to be obtained as compared to a direct ISE measurement.

## Data Logging

Three selectable logging modes are available on the HI5522: automatic, manual, and AutoHold logging. Automatic and manual logs up to 100 lots with 50,000 records max/lot, with up to 100,000 total data points. Automatic logging features the option to save data according to sampling period and interval.

## Data Transfer

Data can be transferred to a PC with USB cable and HI92000 software (both sold separately).

## Contextual Help

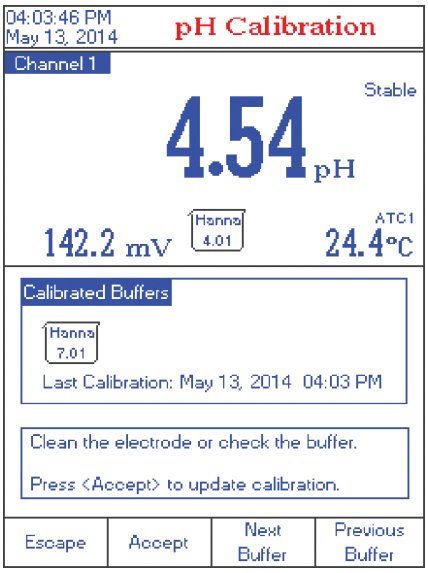
Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.

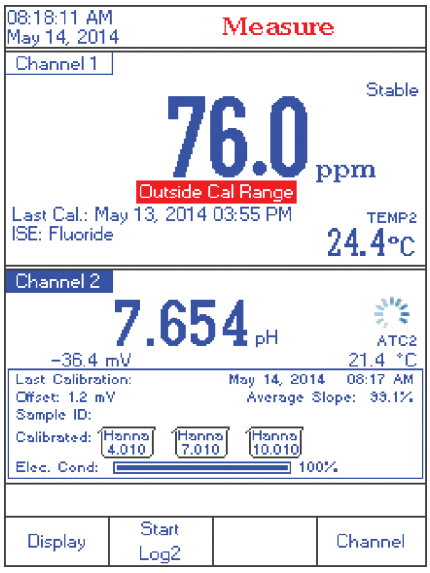
# pH and EC Features

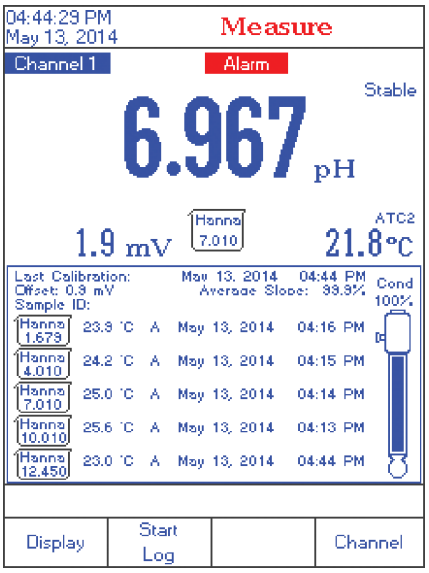
## pH CAL Check™

Proper calibration of the pH electrode system is critical in order to achieve reliable results. Hanna's exclusive CAL Check system includes several features to help users reach that goal.

- Each time a pH calibration is performed, the instrument compares the new calibration with the previous one. When this comparison indicates a significant difference, the message alerts the user to either clean the electrode, check the buffer or both.
- When measurements are taken too far from the calibration points, the instrument will warn the user with a message on the LCD.
- The condition of the pH electrode after calibration is shown on the display, as well as the date and time.
- To avoid taking readings with old calibrations, the instrument automatically reminds the user when the calibration has expired.




## EC USP Mode

Hanna's HI5522 and HI5521 together with EC probes can be used for conductivity measurements required to prepare water for injection (WFI) according to USP <645>.

The instruments give clear instructions on how to perform each stage and automatically check that the temperature, conductivity and stability are within USP limits.

Comprehensive results are shown on a single screen at the end of the test. Up to 200 reports can be saved for future recall.




# ISE Features

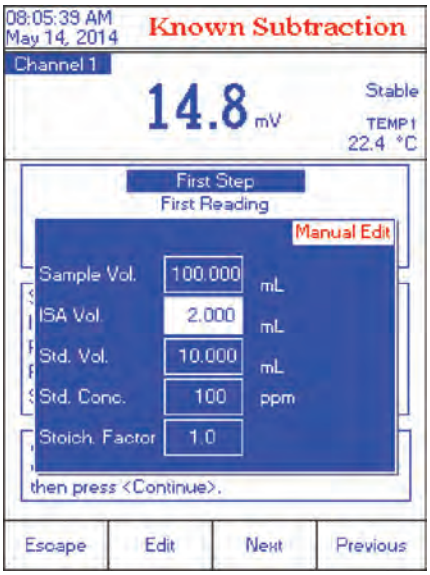
## ISE Incremental Methods

Ion concentration determinations with ISEs can be made faster and easier using the streamlined incremental methods.

Incremental methods involve adding a standard to a sample or sample to a standard and detecting the mV change that occurs due to the addition, and this difference determines the concentration. Historically the user would use mathematical equations to determine the ion concentration of the sample; the HI5522, sample concentrations are calculated automatically and then logged into an ISE method report; up to 200 reports can be saved for future recall. The entire process can be repeated on multiple samples without reentering sets of parameters. Reports can be printed using HI92000 PC software.

Incremental method techniques can reduce errors from variables such as temperature, viscosity, pH or ionic strength. The electrodes remain immersed throughout the process, thus reducing measurement time as well as eliminating sample carry over and its associated errors.

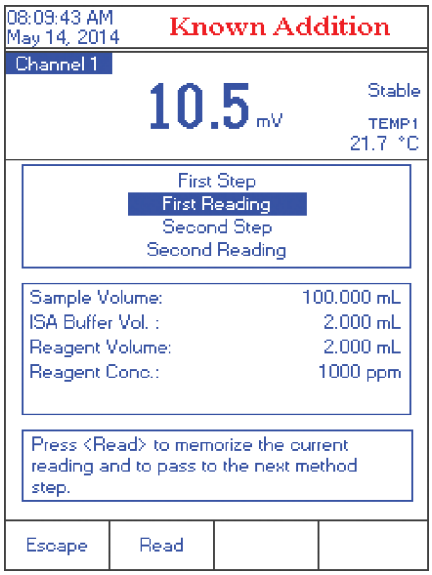
Known Addition, Known Subtraction, Analyte Addition, and Analyte Subtraction methods are standard method choices provided by the HI5522.




### *First Step*

The first step in performing an incremental method analysis is to enter the required parameters including sample, ISA and standard volumes, as well as standard concentration and stoichiometric factor.

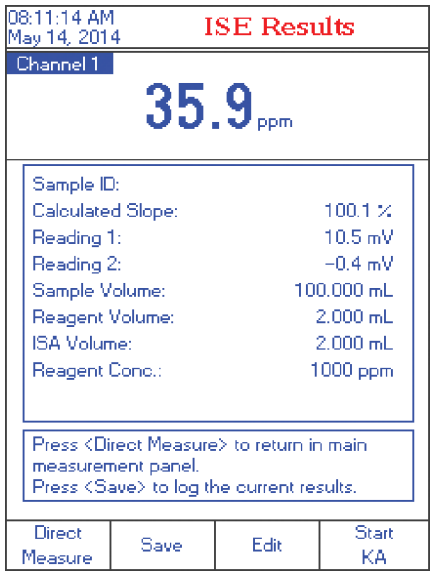
When repeating the analysis on another sample, the parameters do not need to be reentered.




### *Sequence of Readings*

Once the variables are entered, the user is guided step-by-step through the measurement process.

The initial mV measurement is made before the addition; next is the addition, followed by the second mV measurement.



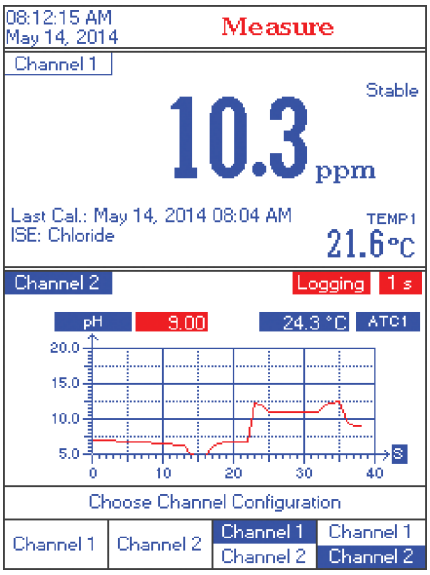

### *Results*

The results are automatically calculated and shown together with all the parameters used.

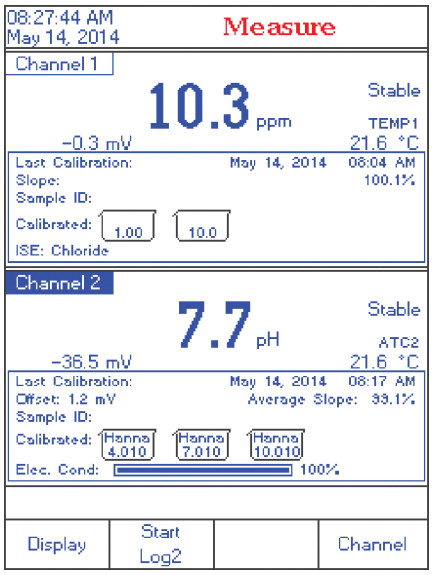
At this time, results can be saved into an ISE Methods Report and printed using the HI92000 PC software.

- Low Profile
  - HI5522 features a low profile with an ideal viewing angle

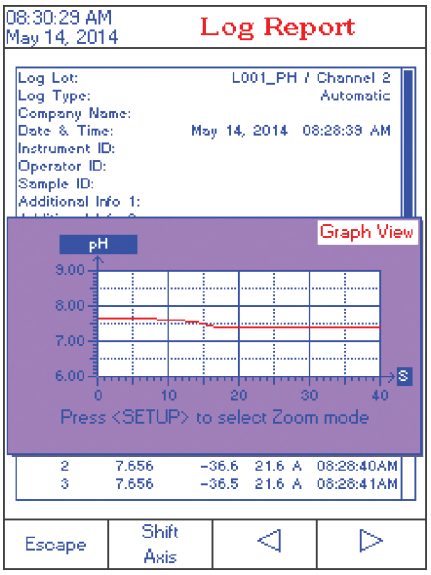
# Additional Features by Screen



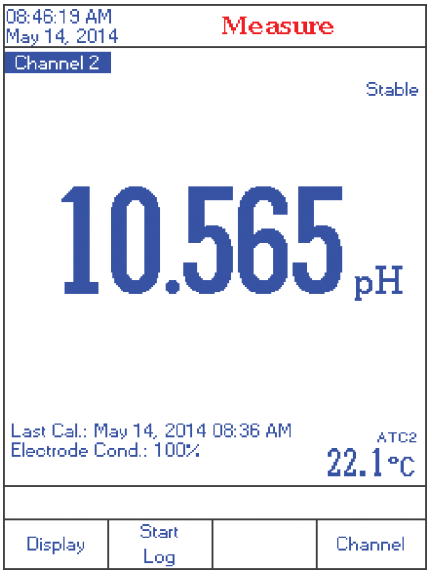

Channel Configuration



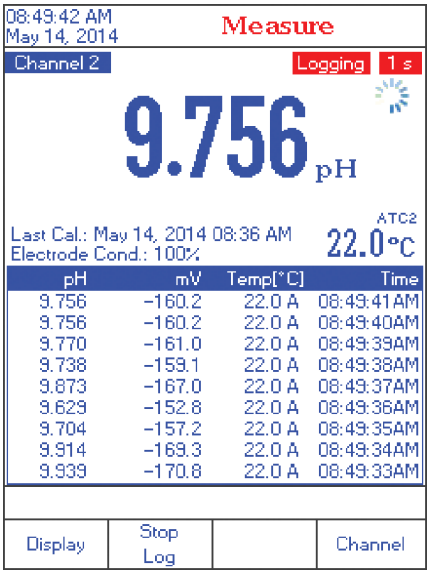

Good Laboratory Practices



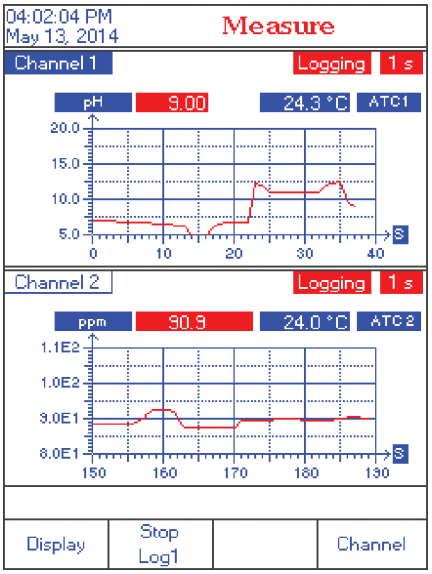

Log Recall




Basic Display




Real-Time Logging




Simultaneous Dual Channel Graphing


## Dual Channels

The two measurement channels of the HI5522 are galvanically isolated to eliminate noise and instability.

In ISE mode, this instrument provides a choice of several incremental methods. Communication is via opto-isolated USB.

| Specifications | | HI5522 |
|---|---|---|
| pH | Range | -2.0 to 20.0 pH; -2.00 to 20.00; -2.000 to 20.000 pH |
| | Resolution | 0.1 pH; 0.01 pH; 0.001 pH |
| | Accuracy | ±0.1 pH; ±0.01 pH; ±0.002 pH ±1 LSD |
| | Calibration | automatic, up to five-point calibration, eight standard buffers available (1.68, 3.00, 4.01, 6.86, 7.01, 9.18, 10.01,12.45), and five custom buffers |
| | Temperature Compensation | automatic or manual from -20.0 to 120.0°C/-4.0 to 248.0°F/253.15 to 393.15K |
| mV | Range | ±2000 mV |
| | Resolution | 0.1 mV |
| | Accuracy | ±0.2 mV ±1 LSD |
| ISE | Range | $1 \times 10^{-6}$ to $9.99 \times 10^{10}$ concentration |
| | Resolution | 1; 0.1; 0.01; 0.001 concentration |
| | Accuracy | ±0.5% (monovalent ions); ±1% (divalent ions) |
| | Calibration | automatic, up to five-point calibration, five fixed standard solutions available for each measurement unit, and five user defined standards |
| Temperature** | Range | -20.0 to 120°C; -4.0 to 248.0°F; 253.15 to 393.15K |
| | Resolution | 0.1°C; 0.1°F; 0.1K |
| | Accuracy | ±0.2°C ; ±0.4°F; ±0.2K (without probe) |
| EC | Range | 0.000 to 9.999 µS/cm; 10.00 to 99.99 µS/cm; 100.0 to 999.9 µS/cm; 1.000 to 9.999 mS/cm; 10.00 to 99.99 mS/cm; 100.0 to 1000.0 mS/cm absolute EC* |
| | Resolution | 0.001 µS/cm; 0.01 µS/cm; 0.1 µS/cm; 0.001 mS/cm; 0.01 mS/cm; 0.1 mS/cm |
| | Accuracy | ±1% of reading (±0.01 µS/cm) |
| | Cell Constant | 0.0500 to 200.00 |
| | Cell Type | 4-pole cell |
| | Calibration | automatic standard recognition, user standard single point / multi-point calibration |
| | Calibration Reminder | yes |
| | Temperature Coefficient | 0.00 to 10.00 %/°C |
| | Temperature Compensation | disabled, linear and non-linear (natural water) |
| | Reference Temperature | 5.0 to 30.0°C |
| | Profiles | up to 10, 5 each channel |
| | USP Compliant | yes |
| TDS | Range | 0.000 to 9.999 ppm; 10.00 to 99.99 ppm; 100.0 to 999.9 ppm; 1.000 to 9.999 ppt; 10.00 to 99.99 ppt; 100.0 to 400.0 ppt actual TDS* (with 1.00 factor) |
| | Resolution | 0.001 ppm; 0.01 ppm; 0.1 ppm; 0.001 ppt; 0.01 ppt; 0.1 ppt |
| | Accuracy | ±1% of reading (±0.01 ppm) |
| Resistivity | Range | 1.0 to 99.9 Ω•cm; 100 to 999 Ω•cm; 1.00 to 9.99 kΩ•cm; 10.0 to 99.9 kΩ•cm; 100 to 999 kΩ•cm; 1.00 to 9.99 MΩ•cm; 10.0 to 100.0 MΩ•cm |
| | Resolution | 0.1 Ω•cm; 1 Ω•cm; 0.01 kΩ•cm; 0.1 kΩ•cm; 1 kΩ•cm; 0.01 MΩ•cm; 0.1 MΩ•cm |
| | Accuracy | ±2% of reading (±1 Ω•cm) |
| Salinity | Range | practical scale: 0.00 to 42.00 psu; natural sea water scale: 0.00 to 80.00 ppt; percent scale: 0.0 to 400.0% |
| | Resolution | 0.01 for practical scale/natural sea water scale; 0.1% for percent scale |
| | Accuracy | ±1% of reading |
| | Calibration | percent scale–one-point (with HI7037 standard); all others through EC |
| Additional Specifications | pH Electrode | HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included) |
| | EC Probe | HI76312 platinum, four-ring EC/TDS probe with and 1 m (3.3') cable (included) |
| | Temperature Probe | HI7662-W stainless steel temperature probe with 1 m (3.3') cable (included) |
| | Input Channel(s) | 1 pH/ORP/ISE + 1 EC |
| | GLP | cell constant, reference temperature/coefficient, calibration points, cal time stamp, probe offset for conductivity |
| | Logging | **record :** Up to 100 lots, 50,000 records max/lot / maximum 100,000 data points/channel; **interval:** 14 selectable between 1 second and 180 minutes; **type:** automatic, manual, AutoHOLD; **additional:** 200 records USP; 200 records incremental methods |
| | PC Connection | USB |
| | Power Supply | 12 VDC adapter (included) |
| | Environment | 0 to 50°C (32 to 122°F; 273 to 323K) RH max 95% non-condensing |
| | Dimensions / Weight | 160 x 231 x 94 mm (6.3 x 9.1 x 3.7") / 1.2 kg (2.64 lbs.) |
| Ordering Information | | **HI5522-01** (115V) and **HI5522-02** (230V) are supplied with HI1131B pH electrode, HI76312 EC/TDS probe, HI7662-W temperature probe, pH 4.01 buffer solution sachet (2), pH 7.01 buffer solution sachet (2), pH 10.01 buffer solution sachet (2), 1413 µS/cm conductivity standard sachet (2), 12880 µS/cm conductivity standard sachet (2), HI700601 electrode cleaning solution sachet (2), HI7082 3.5M KCl electrolyte solution (30 mL), HI76404W electrode holder, 12 VDC adapter, capillary dropper pipette, quality certificate, quick start guide and instruction manual. |

(*) Uncompensated conductivity (or TDS) is the conductivity (or TDS) value without temperature compensation.
(**) Reduced to actual probe limits

pH and ORP electrodes begin on page 2.124; pH and ORP solutions begin on page 2.144;
ISE electrodes and solutions begin on page 3.22; EC, TDS and salinity solutions begin on page 5.34

HI5222

# Research Grade Meter

*pH/ORP/ISE and Temperature*


The HI5222 is an advanced research grade benchtop pH/mV/ISE dual channel meter that is completely customizable with a large color LCD, capacitive touch keys, and USB port for computer connectivity.

The HI5222 features two galvanically isolated BNC connections for use with the expansive line of pH, ISE and ORP electrodes that Hanna Instruments offers. The meter is supplied with the HI1131B glass body, double junction, combination pH electrode that operates over a wide range of temperature from 0 to 100°C. All readings are automatically compensated for temperature variations with the separate HI7662-T temperature probe that is included.

As a pH meter the HI5222 can be calibrated up to five points with eight pre-programmed buffers or five custom buffers. The HI5222 features Hanna's exclusive CAL Check™ to alert the user of potential problems during the pH calibration process. Indicators displayed during calibration include "Electrode Dirty/Broken" and "Buffer Contaminated." The overall probe condition based on the offset and slope characteristic of the electrode is displayed as a percentage after calibration is complete.

As an ISE meter the HI5222 can be calibrated up to five points with a choice of seven fixed standards or five user defined in any concentration unit. The calibration data including date, time, standards used and slope can be viewed at any time along with the current measurement by selecting the Good Laboratory Practice (GLP) display option.

Three selectable logging modes are available: automatic, manual and AutoHold logging. Up to 100,000 data points per channel can be recorded in 100 lots, 50,000 records max/lot and exported to a computer for data review and storage.

## Customizable User Interface

The user interface of the HI5222 allows the user to show measurements in various modes: basic measurement with or without GLP information, real-time graphing, and logging data. Calibration stability criteria can be adjusted from fast, moderate, and accurate. Programmable alarm limits can be set to inside or outside allowable limits.

## Color Graphic LCD

The HI5222 features a color graphic LCD with on-screen help, graphic, and custom color configurations. The display allows for real-time graphing and the use of virtual keys provide for an intuitive user interface.

## Capacitive Touch

The HI5222 features sensitive capacitive touch buttons for accurate keystrokes when navigating menus and screens. There are four dedicated keys that are used for routine operations including calibration and switching measurement modes and four virtual keys that change based upon use. The capacitive touch technology ensures the buttons never get clogged with sample residue.

## Two Galvanically Isolated pH/ORP/ISE Channels

The HI5222 has two input channels that can be used for pH, ORP and ISE electrodes. Each input channel has connectors for BNC probes, reference probes and a temperature sensor. Each channel is galvanically isolated which means that two measurement probes can be in the same solution at the same time and the voltages produced will not interfere with each other.

## Choice of Calibration

Automatic buffer recognition, semi automatic, and direct manual entry pH calibration options are available for calibrating up to five points, from a selection of eight standard buffers and up to five custom buffers.

## GLP Data

HI5222 includes a GLP Feature that allows users to view calibration data and calibration expiration information at the touch of a key. Calibration data include date, time, buffers used for calibration, and electrode offset and slope characteristics.

## CAL Check™

CAL Check alerts users to potential problems during the calibration of the pH electrode. Indicators include "Electrode Dirty/Broken," "Buffer Contaminated," electrode response time and the overall probe condition as a percentage that is based on the offset and slope characteristics.

## ISE Measurement with Choice of Concentration Units

The HI5222 allows for calibration and readings in choice of concentration units. The choices of concentration units include ppt, g/L, mg/mL, ppm, mg/L, µg/mL, ppb, µg/L, mg/mL, M, mol/L, mmol/L, %w/v and a user-defined unit.

## ISE Measurement with Incremental Methods

The known addition, known subtraction, analyte addition, and analyte subtraction incremental methods are pre-programmed into the HI5222. Simply follow the on screen guided procedure and the meter will perform the calculation automatically allowing for a higher level of accuracy to be obtained as compared to a direct ISE measurement.

## Data Logging

Three selectable logging modes are available on the HI5222: automatic, manual, and AutoHold logging. Automatic and manual logs up to 100 lots with 50,000 records max/lot with up to 100,000 total data points per channel. Automatic logging features the option to save data according to sampling period and interval.

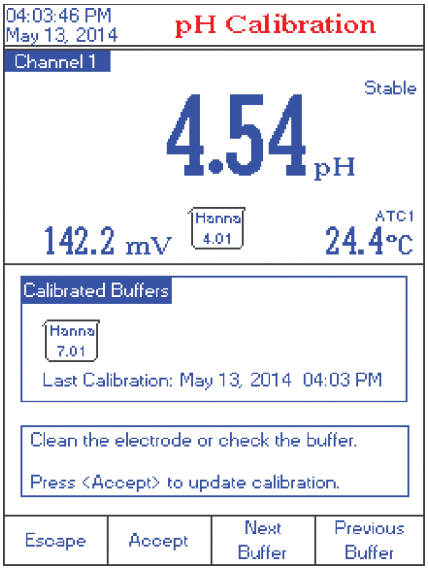
## Data Transfer

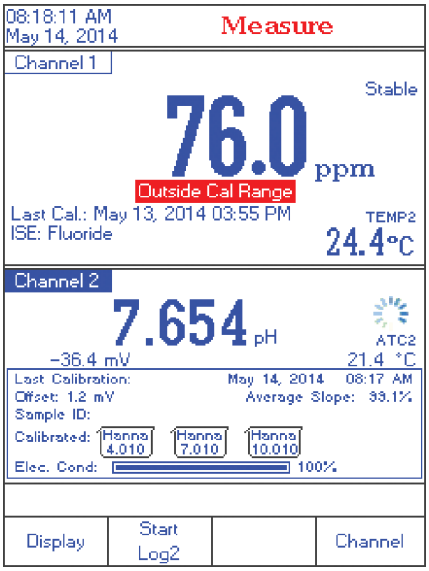
Data can be transferred to a PC with USB cable and HI92000 software (both sold separately).

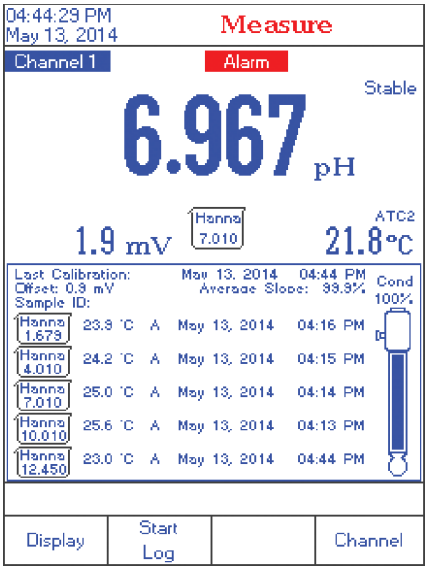
## Contextual Help

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.

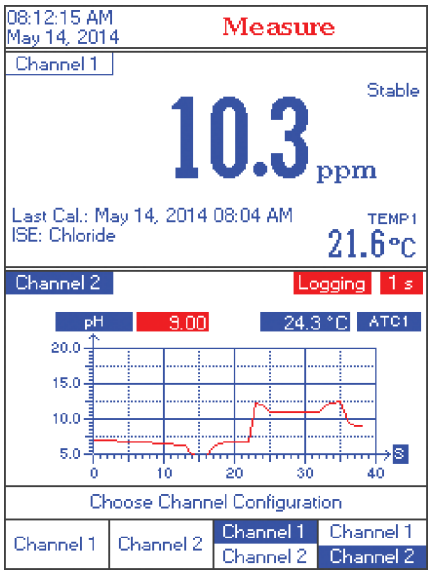
# CAL Check Screens



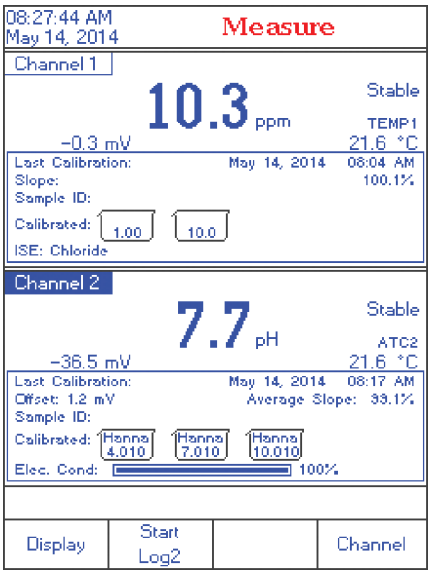



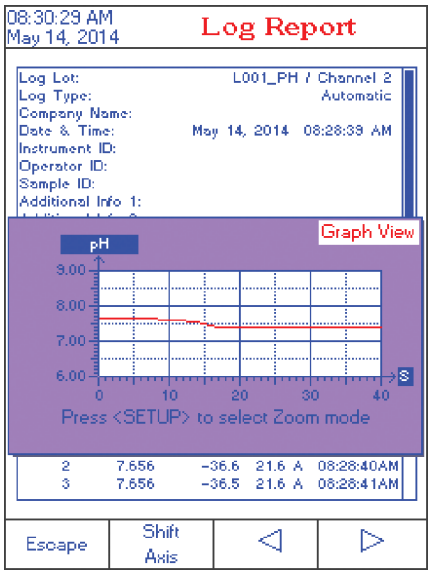
# Additional Features by Screen



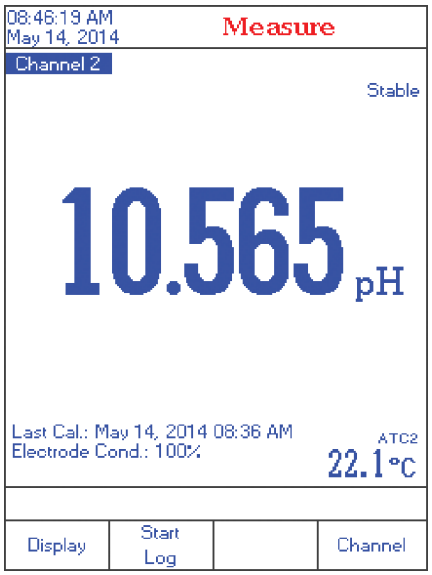

Channel Configuration



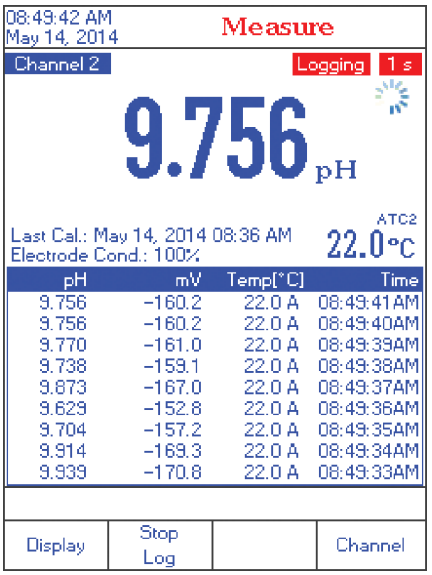

Good Laboratory Practices



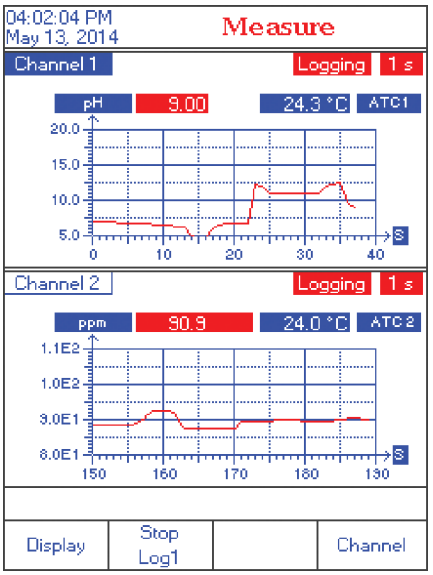

Log Recall




Basic Display




Real-Time Logging




Simultaneous Dual Channel Graphing


## Dual Channels

The two measurement channels of the HI5222 are galvanically isolated to eliminate noise and instability.

In ISE mode, this instrument provides a choice of several incremental methods. Communication is via opto-isolated USB.

| Specifications | | HI5222 |
|---|---|---|
| pH | Range | -2.0 to 20.0 pH; -2.00 to 20.00; -2.000 to 20.000 pH |
| | Resolution | 0.1 pH; 0.01 pH; 0.001 pH |
| | Accuracy | ±0.1 pH; ±0.01 pH; ±0.002 pH ±1 LSD |
| | Calibration | automatic, up to five point calibration, eight standard buffers available (1.68, 3.00, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45), and five custom buffers |
| | Temperature Compensation | automatic or manual from -20.0 to 120.0°C/-4.0 to 248.0°/253.15 to 393.15K |
| mV | Range | ±2000 mV |
| | Resolution | 0.1 mV |
| | Accuracy | ±0.2 mV ±1 LSD |
| | Relative mV Offset Range | ±2000 mV |
| ISE | Range | $1 \times 10^{-6}$ to $9.99 \times 10^{10}$ concentration |
| | Resolution | 1; 0.1; 0.01; 0.001 concentration |
| | Accuracy | ±0.5% (monovalent ions); ±1% (divalent ions) |
| | Calibration | automatic, up to five-point calibration, seven fixed standard solutions available for each measurement unit, and five user defined standards |
| Temperature* | Range | -20.0 to 120°C; -4.0 to 248.0°F; 253.15 to 393.15K |
| | Resolution | 0.1°C; 0.1°F; 0.1K |
| | Accuracy | ±0.2°C; ±0.4°F; ±0.2K |
| Additional Specifications | pH Electrode | HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included) |
| | Temperature Probe | HI7662-W stainless steel temperature probe with 1 m (3.3') cable (included) |
| | Input Channel(s) | 2 pH/ORP/ISE |
| | GLP | calibration points, calibration time stamp, probe offset, slope, date, time and buffers/standards used |
| | Logging | **record :** Up to 100 lots, 50,000 records max/lot / maximum 100,000 data points/channel; **interval:** 14 selectable between 1 second and 180 minutes; **type:** automatic, manual, AutoHOLD; |
| | Display | color graphic LCD 240x340 pixels |
| | PC Connection | USB |
| | Power Supply | 12 VDC adapter (included) |
| | Environment | 0 to 50°C (32 to 122°F; 273 to 323K) RH max 95% non-condensing |
| | Dimensions | 160 x 231 x 94 mm (6.3 x 9.1 x 3.7") |
| | Weight | 1.2 kg (2.64 lbs.) |
| Ordering Information | | **HI5222-01** (115V) and **HI5222-02** (230V) are supplied with HI1131B pH electrode, HI7662-W temperature probe, pH 4.01 buffer solution sachet (2), pH 7.01 buffer solution sachet (2), HI700601 electrode cleaning solution sachet (2), HI7082 3.5M KCl electrolyte solution (30 mL), HI76404W electrode holder, 12 VDC adapter, capillary dropper pipette, quality certificate, quick start guide and instruction manual.<br>**HI5222-03** includes the above without electrode. |

(*) Reduced to actual probe limits

pH and ORP electrodes begin on page 2.124; pH and ORP solutions begin on page 2.144;
ISE electrodes and solutions begin on page 3.22

HI98191

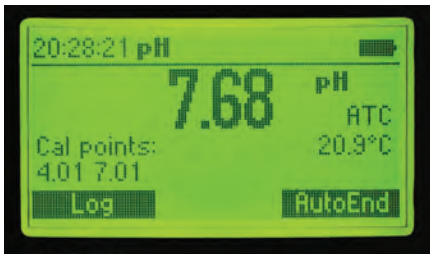
# Professional Waterproof Meters

*pH/ORP/ISE*

- ISE measurement units
  - Extensive choice of units to display readings (ppm, ppt, g/L, µg/L, mg/L, M, mol/L, mmol/L, %, w/v, user)
- Waterproof
  - IP67 rated waterproof, rugged enclosure
- CAL Check™
  - Alerts users to problems during pH calibration including dirty/broken electrode, contaminated buffer and overall probe condition
- Automatic or manual temperature compensation
  - pH sensors incorporate a built-in temperature sensor
- Calibration
  - Up to a five-point pH calibration with seven standard buffers and five custom buffers available
- Approximately 200 hour battery life
  - Powered by (4) 1.5V AA batteries
- Clear display
  - Dot matrix display with multifunction virtual keys
- AutoHold
  - Automatically holds the first stable reading on the display
- Calibration timeout
  - Alerts when calibration is due at a specified interval
- Connectivity
  - PC connectivity via opto-isolated micro-USB with HI92000 software
- GLP
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- Intuitive keypad
  - Most of the available options such as GLP information, help, range, calibration and backlight have a dedicated button
- Supplied complete
  - Each meter is supplied complete with sensor, calibration solution, beakers, PC software and connection cable, instruction manual, quick start guide and batteries in a rugged, custom carrying case.


## Designed for professionals

The HI98191 is a rugged, portable pH/ORP/ISE meter with the performance and features of a benchtop meter. Exchange out the pH probe for an ORP probe to obtain mV readings in the ±2000 mV range. This professional, waterproof meter can easily be operated with one hand and complies with IP67 standards. The HI98191 is supplied with all necessary accessories to perform a pH/temperature measurement packaged into a durable carrying case.

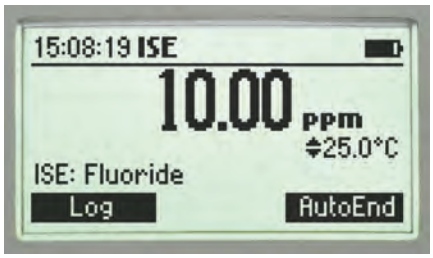



## Backlit Graphic LCD Display

The HI98191 features a backlit graphic LCD with on-screen help. The graphic display allows for the use of virtual keys to provide for an intuitive user interface.

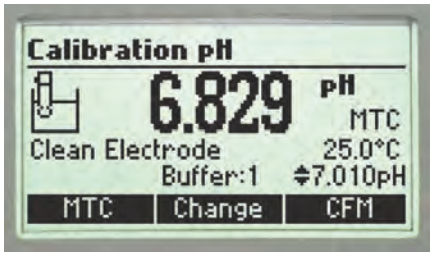
## Waterproof Protection

The meter is enclosed in an IP67 rated waterproof casing and can withstand immersion in water at a depth of 1 m for up to 30 minutes. The probe features an IP68 rating for continuous immersion in water.




## ISE Sensors and Calibration

HI98191 has 17 different standard ISE sensors pre-programmed in the meter. Selecting the appropriate sensor will automatically update the ion charge for slope calibration and can be calibrated up to five points with the choice of seven standards and five custom standards (choice of units). This meter allows an extensive choice of measurement units (ppm, ppt, g/L, ppb, µg/L, mg/mL, M, mol/L, mmol/L, % w/v, user) and has an expanded measuring range of $1.00 \times 10^{-7}$ to $9.99 \times 10^{10}$.




## pH Calibration

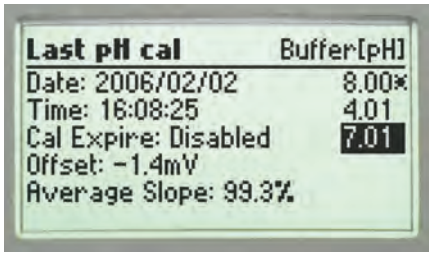
Choose from seven standard pH buffers and five custom pH buffers to obtain up to five point calibration and achieve high precision readings with a pH accuracy of ±0.002 and up to ±0.001 pH resolution.

## Enhanced Calibration

An "Out of Calibration Range" warning can be engaged to keep the user informed of the current calibration and help to avoid performing measurements that are out of range.

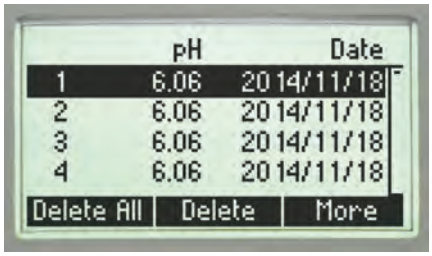
## CAL Check™

Hanna's CAL Check maintains a history of past calibrations and monitors the pH electrode and buffers during subsequent calibrations for any signs of wide variances due to a dirty or broken electrode or contaminated pH buffers. During calibration, users are alerted to problems should they occur. After calibration, the electrode's overall condition is displayed as a percentage.




## GLP

Comprehensive GLP functions are directly accessible by pressing the GLP key. Calibration data, including date, time and calibration values are stored for retrieval at a later time.




## Data Logging

The log-on-demand feature allows users to store up to 300 samples that can be later transferred to a PC with the HI920015 USB cable and HI92000 software.

## Intuitive Keypad

The fitted rubber keypad has dedicated keys for power, backlight, up/down arrows, help and alphanumeric characters. The meter also features two virtual soft keys that navigate the user through the configuration of each parameter, meter setup, and logging of data. The interface is intuitive for any user's level of experience.

## AutoHold

Pressing AutoHold during measurement will automatically hold the first stable reading on the display.

## Dedicated Help Key

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.


## Setup screen

Our extensive setup screen features a host of configurable options such as time, date, temperature units and language for help screens and guides.

## PC Connectivity

Logged data can be transferred to a Windows compatible PC with the included HI920015 micro USB cable and HI92000 software.

## Long Battery Life

The display of the meter has a battery icon indicator to show the remaining power. The meter uses four 1.5V AA batteries that provide up to 200 hours of battery life.

## Rugged Custom Carrying Case

The HI98191 meter, probe, and all accessories are supplied in the HI720191 rugged carrying case designed to provide years of use. The inside compartment of the carrying case is thermoformed to securely hold and protect all of the components.


## HI72911B pH Electrode

- Titanium body
  - Titanium construction provides an unbreakable structure and allows the transfer of heat to the internal temperature sensor for rapid temperature compensation
- Maintenance free, gel-filled electrode
  - No fill solution required


## Calibrate right in the case with custom beaker holders

- Optional shockproof silicon rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710034** Orange

| Specifications | | HI98191 |
|---|---|---|
| pH* | Range | -2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH |
| | Resolution | 0.1 pH; 0.01 pH; 0.001 pH |
| | Accuracy | ±0.1 pH; ±0.01 pH; ±0.002 pH |
| | Calibration | up to five-point calibration, seven standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and five custom buffers |
| | Temperature Compensation | automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F) |
| mV* | Range | ±2000 mV |
| | Resolution | 0.1 mV |
| | Accuracy | ±0.2 mV |
| | Relative mV Offset Range | ±2000 mV |
| ISE | Range | from 1.00 $E^{-7}$ to 9.99 $E^{10}$ concentration |
| | Resolution | 3 digits 0.01; 0.1; 1; 10 concentration |
| | Accuracy | ±0.5% of reading (monovalent ions), ±1% of reading (divalent ions) |
| | Calibration | up to five point calibration, six standard solutions available (0.1, 1, 10, 100, 1000, 10000 ppm) |
| Temperature* | Range | -20.0 to 120.0 °C (-4.0 to 248.0°F) |
| | Resolution | 0.1°C (0.1°F) |
| | Accuracy | ±0.4°C (±0.8°F) (excluding probe error) |
| Additional Specifications | pH Probe | HI72911B titanium body, pH electrode with internal temperature sensor, BNC connector and 1 m (3.3' cable) |
| | Slope Calibration | from 80 to 110% |
| | Log-on-demand | 300 samples (100 each pH/mV/ISE range) |
| | PC Connection | opto-isolated USB with HI92000 software and micro USB cable |
| | Input Impedance | $10^{12}$ Ω |
| | Battery Type / Life | 1.5V AA batteries (4) / approximately 200 hours of continuous use without backlight (50 hours with backlight) |
| | Auto-off | user selectable: 5, 10, 30, 60 min, disabled |
| | Environment | 0 to 50°C (32 to 122°F); RH 100% IP67 |
| | Dimensions / Weight | 185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.) |
| Ordering Information | **HI98191** is supplied with HI72911B pH electrode, HI7004M pH 4.01 buffer solution (230 mL), HI7007M pH 7.01 buffer solution (230 mL), electrode cleaning solution sachet (2), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), quick start guide, quality certificate and instruction manual in an HI720191 rugged carrying case with custom insert.<br>**HI98191-03** includes the above without electrode. | |

* Will be reduced to actual sensor limits



pH and ORP electrodes begin on page 2.124; pH and ORP solutions begin on page 2.144;
ISE electrodes and solutions begin on page 3.22


HI98402

# Fluoride Meter

- ATC
  - Automatic Temperature Compensation
- Waterproof
  - Waterproof, rugged housing for both indoor and outdoor applications
- Help features
  - Tutorial messages on LCD display

The HI98402 measures fluoride from 0.05 mg/L to 1.9 g/L in five distinct ranges. The HI98402 utilizes an auto-ranging feature which automatically selects the range that provides the best resolution.

The HI98402 automatically compensates for temperature from -5 to 55°C using the optional HI7662 stainless steel temperature probe. Both the temperature and fluoride concentrations are displayed on the large LCD.

Calibration is automatic at one or two points. The calibration points can be chosen among 1 mg/L, 2 mg/L, 10 mg/L, 100 mg/L and 1000 mg/L.

The HI98402 is supplied in a rugged carrying case complete with batteries that provide up to 200 hours of continuous operation.

| Specifications | | HI98402 |
|---|---|---|
| Fluoride | Range | 0.050 to 0.500 mg/L (ppm); 0.50 to 5.00 mg/L (ppt)<br>5.0 to 50.0 mg/L; 50 to 500 mg/L; 0.50 to 1.90 g/L (ppt) |
| | Resolution | 0.001 mg/L (ppm); 0.01 mg/L; 0.1 mg/L; 1 mg/L; 0.01 g/L |
| | Accuracy | ±5% of reading or ±0.02 mg/L (ppm) fluoride<br>(with ±3°C from calibration temperature) |
| Temperature | Range* | -20.0 to 120.0°C (-4.0 to 248.0°F) |
| | Resolution | 0.1°C (0.1°F) |
| | Accuracy | ±0.2°C (±0.4°F) excluding probe error |
| Additional Specifications | Calibration | automatic from one or two point at 1 mg/L, 2 mg/L, 10 mg/L, 100 mg/L and 1000 mg/L |
| | Temperature Compensation | automatic, -5 to 55°C (with temperature probe) |
| | Electrodes | HI4010 fluoride electrode with BNC connector and 1 m (3.3') cable (not included)<br>HI5313 reference electrode with 1 m (3.3') cable (not included) |
| | Temperature Probe | HI7662 stainless steel temperature probe with 1 m (3.3') cable (not included) |
| | Input Impedance | $10^{12}$ ohm |
| | Battery Type / Life | 1.5V AAA (3) / approximately 200 hours of continuous use |
| | Environment | 0 to 50°C (32 to 122°F); RH max 100% |
| | Dimensions | 185 x 72 x 36 mm (7.3 x 2.8 x 1.4") |
| | Weight | 300 g (10.6 oz.) |
| Ordering Information | **HI98402** is supplied with batteries, rugged carrying case and instructions. | |

* Will be reduced to actual sensor limits.

ISE electrodes and solutions begin on page 3.22

HI931100 · HI931101

# Sodium Chloride and Sodium Content Meters

- Help features
  - Tutorial messages on LCD
- Backlight
  - Dual-level LCD

HI931100 is an ion-selective sodium chloride meter that uses a sodium ion-selective electrode to measure the salinity (NaCl) content of a solution. This powerful instrument has four ranges, capable of measuring concentrations from 0.150 g/L to 300 g/L NaCl. HI931100 auto ranges from sample to sample over an extremely broad range without the need for recalibration.

The HI931101 measures sodium from ions 15.0 mg/L to 60 g/L.

Both the HI931100 and the HI931101 use the FC300B combination sodium electrode (not included). The calibration process is automatic at two points, the first at 2.3 g/L while the second can be either at 0.23 g/L (low range) or at 23.0 g/L (high range).

A separate temperature probe, HI7662 provides temperature readings from -20 to 120°C.


| Specifications | | HI931100 | HI931101 |
|---|---|---|---|
| NaCl | Range | 0.150 to 1.500 g/L NaCl; 1.50 to 15.00 g/L NaCl;15.0 to 150.0 g/L NaCl; 150 to 300 g/L NaCl | 0.00 to 3.00 pNa; 15.0 to 150.0 mg/L (ppm) Na;0.150 to 1.500 g/L Na; 1.50 to 15.00 g/L Na; 15.0 to 60.0 g/L Na |
| | Resolution | 0.001 g/L NaCl; 0.01 g/L NaCl; 0.1 g/L NaCl; 1 g/L NaCl | 0.01 pNa; 0.1 mg/L Na; 0.001 g/L Na; 0.01 g/L Na; 0.1 g/L Na |
| | Accuracy (@25°C/77°F) | ±5% of reading (NaCl) | ±0.05 pNa; ±5% of reading (Na) |
| Temperature | Range | -20.0 to 120.0°C (-4.0 to 248.0°F) | -20.0 to 120.0°C (-4.0 to 248.0°F) |
| | Resolution | 0.1°C (0.1°F) | 0.1°C (0.1°F) |
| | Accuracy (@25°C/77°F) | ±0.2°C (±0.4°F) (excluding probe error) | ±0.2°C (±0.4°F) (excluding probe error) |
| Additional Specifications | Calibration | automatic, one or two point at 0.30 g/L (ppt)(HI7085); 3.00 g/L (HI7083); 30.0 g/L (HI7081) | automatic, one or two point at 0.23 g/L (HI7087/HI8087) 2.3 g/L (HI7080/HI8080) 23.0 g/L (HI7086/HI8086) |
| | Temperature Compensation | fixed at 25°C (77°F) | |
| | Electrode | FC300B glass body sodium ion selective electrode with BNC connector and 1 m (3.3') cable (not included) | |
| | Temperature Probe | HI7662 stainless steel temperature probe with 1 m (3.3') cable (not included) | |
| | Input Impedance | $10^{12}$ ohm | |
| | Battery Type / Life | 1.5V AAA (3) / approx. 200 hours of continuous use | |
| | Environment | 0 to 50°C (32 to 122°F); RH max 100% | |
| | Dimensions | 185 x 72 x 36 mm (7.3 x 2.8 x 1.4") | |
| | Weight | 300 g (10.6 oz.) | |
| Ordering Information | | **HI931100** and **HI931101** and are supplied with batteries, instructions and hard carrying case. | |


ISE electrodes and solutions begin on page 3.22

HI931102

# HACCP Compliant Salinity Foodcare Meter

- Help features
  - Tutorial messages on LCD
- Backlight
  - Dual-level LCD


Hanna has designed this waterproof salinity meter for use in food production.

The HI931102 is an ion selective meter that uses a sodium ion selective electrode to measure the sodium content of a solution and report it as g/L NaCl or percent NaCl. This powerful instrument has four ranges, capable of measuring concentrations from 0.150 g/L to 300 g/L. This meter is able to auto-range from sample to sample over an extremely broad range without the need for recalibration.

The HI931102 uses the FC300B combination sodium ISE to measure sodium readings from 0.150 g/L to 300 g/L. The calibration process is automatic at two points, the first is at 3.00 g/L while the second can be either at 0.30 g/L (low range) or at 30.0 g/L (high range).

A separate temperature probe, HI7662 provides temperature readings from -20 to 120°C.

| Specifications | | HI931102 |
|---|---|---|
| NaCl | Range | 0.150 to 1.500 g/L NaCl; 1.50 to 15.00 g/L NaCl; 15.0 to 150.0 g/L NaCl; 150 to 300 g/L NaCl; 0.0 to 30.0 % NaCl |
| | Resolution | 0.001 g/L NaCl; 0.01 g/L NaCl; 0.1 g/L NaCl; 1 g/L NaCl; 0.1 % NaCl |
| | Accuracy (@25°C/77°F) | ±5% of reading |
| Temperature | Range | -20.0 to 120.0°C (-4.0 to 248.0°F) |
| | Resolution | 0.1°C (0.1°F) |
| | Accuracy (@25°C/77°F) | ±0.2°C (±0.4°F) (excluding probe error) |
| Additional Information | Calibration | automatic, one or two-points at 3.00 g/L (HI7083) and 0.30 g/L (HI7085) or 30.0 g/L (HI7081) |
| | Temperature Compensation | fixed at 25°C (77°F) |
| | Electrode | FC300B glass body sodium ion selective electrode with BNC connector and 1 m (3.3') cable (not included) |
| | Temperature Probe | HI7662 stainless steel temperature probe with 1 m (3.3') cable (not included) |
| | Input Impedance | $10^{12}$ ohm |
| | Battery Type / Life | 1.5V AAA (3) / approx. 200 hours of continuous use |
| | Environment | 0 to 50°C (32 to 122°F); RH max 100% |
| | Dimensions | 185 x 72 x 36 mm (7.3 x 2.8 x 1.4") |
| | Weight | 300 g (10.6 oz.) |
| Ordering Information | **HI931102** is supplied with batteries, instructions and hard carrying case. | |

See FC300 specifications on page 3.27

HI4101 · HI4002 · HI4102 · HI4003 · HI4103

# Ion Selective Electrodes

*Ammonia · Bromide · Cadmium*


| Parameter | Ammonia | Bromide | | Cadmium | |
|---|---|---|---|---|---|
| Code | **HI4101** | **HI4002** | **HI4102** | **HI4003** | **HI4103** |
| Type | gas-sensing; combination | solid-state; half-cell | solid-state; combination | solid-state; half-cell | solid-state; combination |
| Measurement Range | 1M to $1 \cdot 10^{-6}$M<br>17000 to 0.02 mg/L (ppm)<br>14000 to 0.016 mg/L as N | 1M to $1 \cdot 10^{-6}$M<br>79910 to 0.08 mg/L (ppm) | | 0.1M to $1 \cdot 10^{-7}$M<br>11200 to 0.01 mg/L (ppm) | |
| Optimum pH Range | >11 | 2 to 12.5 | 2 to 12.5 | 2 to 12 | 2 to 12 |
| Temperature Range | 0 to 40°C | 0 to 80°C | 0 to 80°C | 0 to 80°C | 0 to 80°C |
| Approximate Slope | -56 | -56 | -56 | +28 | +28 |
| Body O.D. | 12 mm | 12 mm | 12 mm | 12 mm | 12 mm |
| Insertion Length | 120 mm | 120 mm | 120 mm | 120 mm | 120 mm |
| Body Material | Delrin® | epoxy | PEI | epoxy | PEI |
| Cable | 1 m coaxial | 1 m coaxial | 1 m coaxial | 1 m coaxial | 1 m coaxial |
| Possible Applications | determination of ammonium, ammonia in wine, beer, water, waste water and soil | plants, soils, and as an indicator for titration | | electroplating, battery construction, laboratory and as an indicator for titrations | |
| Connection | BNC | BNC | BNC | BNC | BNC |

# Ion Selective Electrodes

*Calcium · Carbon Dioxide · Chloride*




| Parameter | Calcium | | Carbon Dioxide | Chloride | |
|---|---|---|---|---|---|
| Code | **HI4004** | **HI4104** | **HI4105** | **HI4007** | **HI4107** |
| Type | polymer membrane; half-cell | polymer membrane; combination | gas-sensing; combination | solid-state; half-cell | solid-state; combination |
| Measurement Range | 1M to $3•10^{-6}$M<br>40080 to 0.12 mg/L (ppm) | | $1•10^{-2}$M to $1•10^{-4}$M<br>440 to 4.4 mg/L (ppm) | 1M to $5•10^{-5}$M<br>35500 to 1.8 mg/L (ppm) | |
| Optimum pH Range | 4 to 10 | 4 to 10 | 4.2 to 5.2 | 2 to 11 | 2 to 11 |
| Temperature Range | 0 to 40°C | 0 to 40°C | 0 to 40°C | 0 to 80°C | 0 to 80°C |
| Approximate Slope | +28 | +28 | +54 | -56 | -56 |
| Body O.D. | 12 mm | 12 mm | 12 mm | 12 mm | 12 mm |
| Insertion Length | 120 mm | 120 mm | 120 mm | 120 mm | 120 mm |
| Body Material | epoxy/PVC | PEI/PVC | Delrin® | epoxy | PEI |
| Cable | 1 m coaxial | 1 m coaxial | 1 m coaxial | 1 m coaxial | 1 m coaxial |
| Possible Applications | determination of free calcium in beverages, water, and seawater | | determination of carbonates as $CO_2$ in water, soft drinks and wine samples | determination of free chloride ions in emulsified food products, beverages, plants, soils and as an indicator for titration | |
| Connection | BNC | BNC | BNC | BNC | BNC |

HI4008 · HI4108 · HI4009 · HI4109

# Ion Selective Electrodes

*Cupric · Cyanide*


| Parameter | Cupric | | Cyanide | |
|---|---|---|---|---|
| Code | **HI4008** | **HI4108** | **HI4009** | **HI4109** |
| Type | solid-state; half-cell | solid-state; combination | solid-state; half-cell | solid-state; combination |
| Measurement Range | 0.1M to $1 \cdot 10^{-6}$M<br>6355 to 0.06 mg/L (ppm) | | 0.01M to $1 \cdot 10^{-6}$M<br>260 to 0.02 mg/L (ppm) | |
| Optimum pH Range | 3 to 7 | 3 to 7 | >11 | >11 |
| Temperature Range | 0 to 80°C | 0 to 80°C | 0 to 80°C | 0 to 80°C |
| Approximate Slope | +27 | +27 | -56 | -56 |
| Body O.D. | 12 mm | 12 mm | 12 mm | 12 mm |
| Insertion Length | 120 mm | 120 mm | 120 mm | 120 mm |
| Body Material | epoxy | PEI | epoxy | PEI |
| Cable | 1 m coaxial | 1 m coaxial | 1 m coaxial | 1 m coaxial |
| Possible Applications | used as an indicator for titrations using chelates | | determination of free cyanide ions in plating baths, waste water and in plant and soil samples | |
| Connection | BNC | BNC | BNC | BNC |

# Ion Selective Electrodes

*Fluoride · Iodide*




| Parameter | Fluoride | | | Iodide | |
|---|---|---|---|---|---|
| Code | **HI4010** | **HI4110** | **FC301B** | **HI4011** | **HI4111** |
| Type | solid-state; half-cell | solid-state; combination | solid-state; half-cell | solid-state; half-cell | solid-state; combination |
| Measurement Range | 1M to $1 \cdot 10^{-6}$M Sat. to 0.02 mg/L (ppm) | | | 1M to $1 \cdot 10^{-7}$M 127000 to 0.01 mg/L (ppm) | |
| Optimum pH Range | 5 to 8 | 5 to 8 | 5 to 8 | 2 to 13 | 2 to 13 |
| Temperature Range | 0 to 80°C | 0 to 80°C | 0 to 80°C | 0 to 80°C | 0 to 80°C |
| Approximate Slope | -56 | -56 | -56 | -56 | -56 |
| Body O.D. | 12 mm | 12 mm | 12 mm | 12 mm | 12 mm |
| Insertion Length | 120 mm | 120 mm | 120 mm | 120 mm | 120 mm |
| Body Material | epoxy | PEI/epoxy | epoxy | epoxy | PEI |
| Cable | 1 m coaxial | 1 m coaxial | 1 m coaxial | 1 m coaxial | 1 m coaxial |
| Possible Applications | determination of free fluoride in potable water, soft drinks, wine, plants, emulsified food products, plating and pickling acids | | | determination of free iodide ions in emulsified food samples (iodized table salt), plants and for titration | |
| Connection | BNC | BNC | BNC | BNC | BNC |

HI4012 · HI4112 · HI4013 · HI4113 · HI4014 · HI4114

# Ion Selective Electrodes

*Lead/Sulfate · Nitrate · Potassium*


| Parameter | Lead/Sulfate | | Nitrate | | Potassium | |
|---|---|---|---|---|---|---|
| Code | **HI4012** | **HI4112** | **HI4013** | **HI4113** | **HI4014** | **HI4114** |
| Type | solid-state; half-cell | solid-state; combination | polymer membrane; half-cell | polymer membrane; combination | polymer membrane; half-cell | polymer membrane; combination |
| Measurement Range | 0.1M to $1 \cdot 10^{-6}$M<br>20700 to 0.21 mg/L (ppm) | | 1.0M to $1 \cdot 10^{-5}$M<br>6200 to 0.62 mg/L (ppm)<br>1400 to 0.4 mg/L (ppm) as N | | 1.0M to $1 \cdot 10^{-6}$M<br>39100 to 0.039 mg/L (ppm) | |
| Optimum pH Range | 4 to 7 | 4 to 7 | 3.0 to 8 | 3.0 to 8 | 1.5 to 12.0 | 1.5 to 12.0 |
| Temperature Range | 0 to 80°C | 0 to 80°C | 0 to 40°C | 0 to 40°C | 0 to 40°C | 0 to 40°C |
| Approximate Slope | +27 | +27 | -56 | -56 | +56 | +56 |
| Body O.D. | 12 mm | 12 mm | 12 mm | 12 mm | 12 mm | 12 mm |
| Insertion Length | 120 mm | 120 mm | 120 mm | 120 mm | 120 mm | 120 mm |
| Body Material | epoxy | PEI | epoxy/PVC | PEI/PVC | epoxy/PVC | PEI/PVC |
| Cable | 1 m coaxial | 1 m coaxial | 1 m coaxial | 1 m coaxial | 1 m coaxial | 1 m coaxial |
| Possible Applications | determination of lead ions in plating baths and as an indicator for titrations | | determination of free nitrate in natural waters (fresh and sea), and in emulsified food and plant samples | | determination of potassium ions in wine, waters, soils and biological samples | |
| Connection | BNC | BNC | BNC | BNC | BNC | BNC |

# Ion Selective Electrodes

*Silver/Sulfide · Sodium · Reference*




| Parameter | Silver/Sulfide | | Sodium | Reference |
|---|---|---|---|---|
| Code | **HI4015** | **HI4115** | **FC300B** | **HI5315** |
| Type | solid-state; half-cell | solid-state; combination | glass combination | N/A |
| Measurement Range | 1.0M to 1•10$^{-6}$M<br>107900 to 0.11ppm (Ag+)<br>1.0M to 1•10$^{-7}$M<br>32100 to 0.003 ppm ($S^{2-}$) | $Ag^+$ 1.0M to 1•10$^{-6}$M<br>107900 to 0.11ppm<br>$S^{2-}$ 1.0M to 1•10$^{-7}$M<br>32100 to 0.003 ppm | 1M to 1•10$^{-5}$M<br>22990 to 0.23 ppm | N/A |
| Optimum pH Range | 2 to 8 ($Ag^+$)<br>12 to 14 ($S^{2-}$) | $Ag^+$ 2 to 8<br>S= 12 to 14 | 9.75 to 14 pH | N/A |
| Temperature Range | 0 to 80°C | 0 to 80°C | 0 to 80°C | 0 to 85°C |
| Approximate Slope | +56 ($Ag^+$) / -28 ($S^{2-}$) | +56 $Ag^+$ / -28 $S^{2-}$ | +57 | N/A |
| Body O.D. | 12 mm | 12 mm | 12 mm | 12 mm |
| Insertion Length | 120 mm | 120 mm | 120 mm | 120 mm |
| Body Material | epoxy | PEI | glass | PEI |
| Cable | 1 m coaxial | 1 m coaxial | 1 m coaxial | 1 m coaxial |
| Possible Applications | used as an indicator for titrations using silver nitrate; for the determination of sulfide ions in waters, paper liquors, natural waters and soils. | | water, soil, food products, soup, dairy, brines, soft drinks, beer, wine and laboratory | used to complete electrical circuit and to provide stable reference voltage for ISE half-cells |
| Connection | BNC | BNC | BNC | BNC |

# Solutions

## ISE Standards

Our wide selection of Hanna ISE Standards are made and bottled in our own state-of-the-art solutions facility. ISE Standards are required for direct and incremental measurement techniques and are available with certificate of analysis.

| Code | Description | Size |
|---|---|---|
| **HI4001-01** | 0.10 M ammonia standard | 500 mL |
| **HI4001-02** | 100 mg/L (ppm) ammonia standard (as $NH_3^-N$) | 500 mL |
| **HI4001-03** | 1000 mg/L (ppm) ammonia standard (as $NH_3^-N$) | 500 mL |
| **HI4002-01** | 0.10 M bromide standard | 500 mL |
| **HI4003-01** | 0.10 M cadmium standard | 500 mL |
| **HI4004-01** | 0.10 M calcium standard | 500 mL |
| **HI4005-01** | 0.10 M carbon dioxide standard | 500 mL |
| **HI4005-03** | 1000 ppm as $CaCO_3$ carbon dioxide standard | 500 mL |
| **HI4007-01** | 0.10 M chloride standard | 500 mL |
| **HI4007-02** | 100 ppm chloride standard | 500 mL |
| **HI4007-03** | 1000 ppm chloride standard | 500 mL |
| **HI4008-01** | 0.1 M cupric standard | 500 mL |
| **HI4010-01** | 0.1 M fluoride standard | 500 mL |
| **HI4010-02** | 100 ppm fluoride standard | 500 mL |
| **HI4010-03** | 1000 ppm fluoride standard | 500 mL |
| **HI4010-10** | 10 ppm fluoride standard premixed with TISAB II | 500 mL |
| **HI4010-11** | 1 ppm fluoride standard premixed with TISAB II | 500 mL |
| **HI4010-12** | 2 ppm fluoride standard premixed with TISAB II | 500 mL |
| **HI4010-30** | kit containing 4 bottles each of : HI4010-10, HI4010-11 and HI4010-00 | 500 mL (3 x 4) |
| **HI4011-01** | 0.1 M iodide standard | 500 mL |
| **HI4012-01** | 0.1 M lead standard | 500 mL |
| **HI4012-21** | 0.1 M sulfate standard | 500 mL |
| **HI4013-01** | 0.1 M nitrate standard | 500 mL |
| **HI4013-02** | 100 ppm nitrate standard (as N) | 500 mL |
| **HI4013-03** | 1000 ppm nitrate standard (as N) | 500 mL |
| **HI4014-01** | 0.1 M potassium standard | 500 mL |
| **HI4015-01** | 0.1 M silver standard | 500 mL |
| **HI4016-01** | 0.1 M sodium standard | 500 mL |
| **HI4016-02** | 100 ppm sodium standard | 500 mL |
| **HI4016-03** | 1000 ppm sodium standard | 500 mL |
| **HI4016-10** | 10 ppm sodium standard | 500 mL |


## Gas Sensor Fill Solutions

| Code | Description | Size |
|---|---|---|
| **HI4001-40** | ammonia filling solution | 30 mL bottles (4) |
| **HI4005-40** | carbon dioxide filling solution | 30 mL bottles (4) |

## Specific Solutions for ISE Sensors

| Code | Description | Size |
|---|---|---|
| **HI4000-47** | pH 4 and pH 7 buffers with chloride ions background, used to check internal glass electrode of gas sensors | 10 packages each and 2 beakers |
| **HI4001-45** | conditioning and storage solution for HI4101 ammonia ISE | 500 mL |
| **HI4004-45** | conditioning and storage solution for HI4004 and HI4104 calcium ISEs | 500 mL |
| **HI4005-45** | conditioning and storage solution for HI4105 carbon dioxide ISE | 500 mL |
| **HI4016-45** | storage solution for sodium ISE | 500 mL |
| **HI4016-46** | conditioning solution for sodium ISE | 500 mL |


## Ionic Strength Adjusters (ISA)

Hanna Ionic Strength Adjusters (ISA) are formulated to provide a constant ionic strength in sample and standards alike, thus permitting concentration rather than activity measurements to be made. In some cases ISAs adjust pH and eliminate matrix effects.

| Code | Description | Size |
|---|---|---|
| **HI4000-00** | ISA for halide ISEs | 500 mL |
| **HI4001-00** | alkaline ISA for ammonia and cyanide ISEs | 500 mL |
| **HI4004-00** | ISA for calcium ISEs | 500 mL |
| **HI4005-00** | ISA for carbon dioxide ISEs | 500 mL |
| **HI4010-00** | TISAB II for fluoride ISEs | 500 mL |
| **HI4010-05** | TISAB II for fluoride ISEs | 1 gallon |
| **HI4010-06** | TISAB III concentrate for fluoride ISEs | 500 mL |
| **HI4012-00** | ISA for lead/sulfate ISEs | 100 mL (5) |
| **HI4013-00** | ISA for nitrate ISEs | 500 mL |
| **HI4013-06** | nitrate interferent suppressant ISA | 500 mL |
| **HI4014-00** | ISA for potassium ISEs | 500 mL |
| **HI4015-00** | SAOB (sulfide antioxidant buffer) | 500 mL + 18 g (2 components) |
| **HI4016-00** | ISA for sodium ISEs | 500 mL |

## Silver-free Reference Fill Solutions

Recommended for our combination ISE electrodes and the Hanna HI5315 reference electrode. Reference electrodes should be topped off daily with the correct filling solution for optimum measurement performance. These solutions are silver-free to eliminate silver precipitates found with standard electrolytes.

| Code | Description | Size |
|---|---|---|
| **HI7072** | electrolyte solution, 1 M $KNO_3$ | 30 mL bottles (4) |
| **HI7075** | electrolyte solution with $KNO_3$ and KCl | 30 mL bottles (4) |
| **HI7076** | electrolyte solution, 1 M NaCl | 30 mL bottles (4) |
| **HI7078** | electrolyte solution, $(NH_4)_2SO_4$ | 30 mL bottles (4) |
| **HI7082** | electrolyte solution, 3.5 M KCl | 30 mL bottles (4) |

## Reference Fill Solutions Containing Silver Chloride (AgCl)

| Code | Description | Size |
|---|---|---|
| **HI7079** | 2M $NH_4Cl$ sat. with AgCl electrolyte for sodium ISEs (contains AgCl) | 30 mL bottles (4) |

# Solutions

## Sodium ($Na^+$) ISE Standard Solutions

| Code | Description | Package |
|---|---|---|
| **HI7080L** | 2.3 g/L sodium standard solution | 500 mL bottle |
| **HI7080M** | 2.3 g/L sodium standard solution | 230 mL bottle |
| **HI7086L** | 23 g/L sodium standard solution | 500 mL bottle |
| **HI7086M** | 23 g/L sodium standard solution | 230 mL bottle |
| **HI7087L** | 0.23 g/L sodium standard solution | 500 mL bottle |
| **HI7087M** | 0.23 g/L sodium standard solution | 230 mL bottle |
| **HI8080L** | 2.3 g/L sodium standard solution | 500 mL FDA bottle |
| **HI8086L** | 23 g/L sodium standard solution | 500 mL FDA bottle |
| **HI8087L** | 0.23 g/L sodium standard solution | 500 mL FDA bottle |

## Sodium Chloride (NaCl) Standard Solutions

| Code | Description | Package |
|---|---|---|
| **HI7037L** | 100% NaCl Calibration Solution for Seawater Salinty (100% NaCl) | 500 mL bottle |
| **HI7037M** | 100% NaCl Calibration Solution for Seawater Salinty (100% NaCl) | 230 mL bottle |
| **HI7081/1L** | standard solution at 30 g/L sodium chloride | 1 L bottle |
| **HI7081L** | standard solution at 30 g/L sodium chloride | 500 mL bottle |
| **HI7081M** | standard solution at 30 g/L sodium chloride | 230 mL bottle |
| **HI7083L** | standard solution at 3.0 g/L sodium chloride | 500 mL bottle |
| **HI7083M** | standard solution at 3.0 g/L sodium chloride | 230 mL bottle |
| **HI7084L** | standard solution at 58.4 g/L sodium chloride | 500 mL bottle |
| **HI7084M** | standard solution at 58.4 g/L sodium chloride | 230 mL bottle |
| **HI7085L** | standard solution at 0.3 g/L sodium chloride | 500 mL bottle |
| **HI7085M** | standard solution at 0.3 g/L sodium chloride | 230 mL bottle |
| **HI7088L** | standard solution at 5.84 g/L sodium chloride | 500 mL bottle |
| **HI7088M** | standard solution at 5.84 g/L sodium chloride | 230 mL bottle |
| **HI7089L** | standard solution at 125 g/L sodium chloride | 500 mL bottle |
| **HI7089M** | standard solution at 125 g/L sodium chloride | 230 mL bottle |
| **HI7090L** | ISA solution for sodium ISE | 500 mL bottle |
| **HI7090M** | ISA solution for sodium ISE | 230 mL bottle |
| **HI8088L** | standard solution at 5.84 g/L sodium chloride | 500 mL FDA bottle |

The sodium and sodium chloride standard solutions are used for the calibration of pocket-sized, portable and bench salinity meters, as well as for the sodium ISE.

These solutions are available in 230 or 500 mL bottles, and also in opaque bottles that meet the FDA (Food & Drug Administration) specifications, in 230 or 500 mL volumes.

Fluoride standard solutions are used to calibrate all instruments that measure fluoride using a fluoride ISE. Additional fluoride standards are found on page 4.28

Both sodium/sodium chloride and fluoride solutions are available with a certificate of analysis on request.

## Fluoride Standard Solutions

| Code | Description | Bottle |
|---|---|---|
| **HI7023/1L** | TISAB Solution | 1 L |
| **HI7023L** | TISAB Solution | 500 mL |
| **HI7023M** | TISAB Solution | 230 mL |
| **HI70701/1L** | standard solution at 1 g/L $F^-$ | 1 L |
| **HI70701L** | standard solution at 1 g/L $F^-$ | 500 mL |
| **HI70701M** | standard solution at 1 g/L $F^-$ | 230 mL |
| **HI70702/1L** | standard solution at 10 mg/L $F^-$ | 1 L |
| **HI70702L** | standard solution at 10 mg/L $F^-$ | 500 mL |
| **HI70702M** | standard solution at 10 mg/L $F^-$ | 230 mL |
| **HI70703/1L** | standard solution at 100 mg/L $F^-$ | 1 L |
| **HI70703L** | standard solution at 100 mg/L $F^-$ | 500 mL |
| **HI70703M** | standard solution at 100 mg/L $F^-$ | 230 mL |

## Accessories

| | |
|---|---|
| **HI4000-50** | liquid membrane sensor handle |
| **HI4000-51** | gas sensor replacement pH for ammonia sensor |
| **HI4000-52** | gas sensor membrane cap for ammonia |
| **HI4000-54** | gas sensor replacement pH for carbon dioxide ISE |
| **HI4000-70** | halide polishing strips (24) |
| **HI4001-51** | ammonia membrane kit (20 loose) |
| **HI4004-51** | calcium module for HI4004 half-cell ISE |
| **HI4104-51** | calcium module for HI4104 combination ISE |
| **HI4005-53** | carbon dioxide membrane kit (3 caps) |
| **HI4110-51** | fluoride module for HI4110 combination ISE |
| **HI4013-51** | nitrate module for HI4013 half-cell ISE |
| **HI4013-53** | nitrate module for HI4013 half-cell ISE (3 pack) |
| **HI4113-51** | nitrate module for HI4113 combination ISE |
| **HI4113-53** | nitrate module for HI4113 combination ISE (3 pack) |
| **HI4014-51** | potassium module for HI 4014 half-cell ISE |
| **HI4114-51** | potassium module for combination ISE |
| **HI740159** | plastic tweezers |