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# President's Message

January 2018

Dear Valued Customer:

2018 celebrates our 40th year in providing customers with exceptional instruments and the highest level of personal service and technical support. Our growth over the years only made us closer to you, our customer. We believe that expanding into new markets and understanding your instrumentation needs is the only path to success. A company is only as strong as its people. We could not have grown for 40 years without the dedication of our highly skilled employees.

Hanna dedicates itself to be a worldwide leader in quality, value, service and selection. We can assure you that these principles will be evident throughout your Hanna experience.

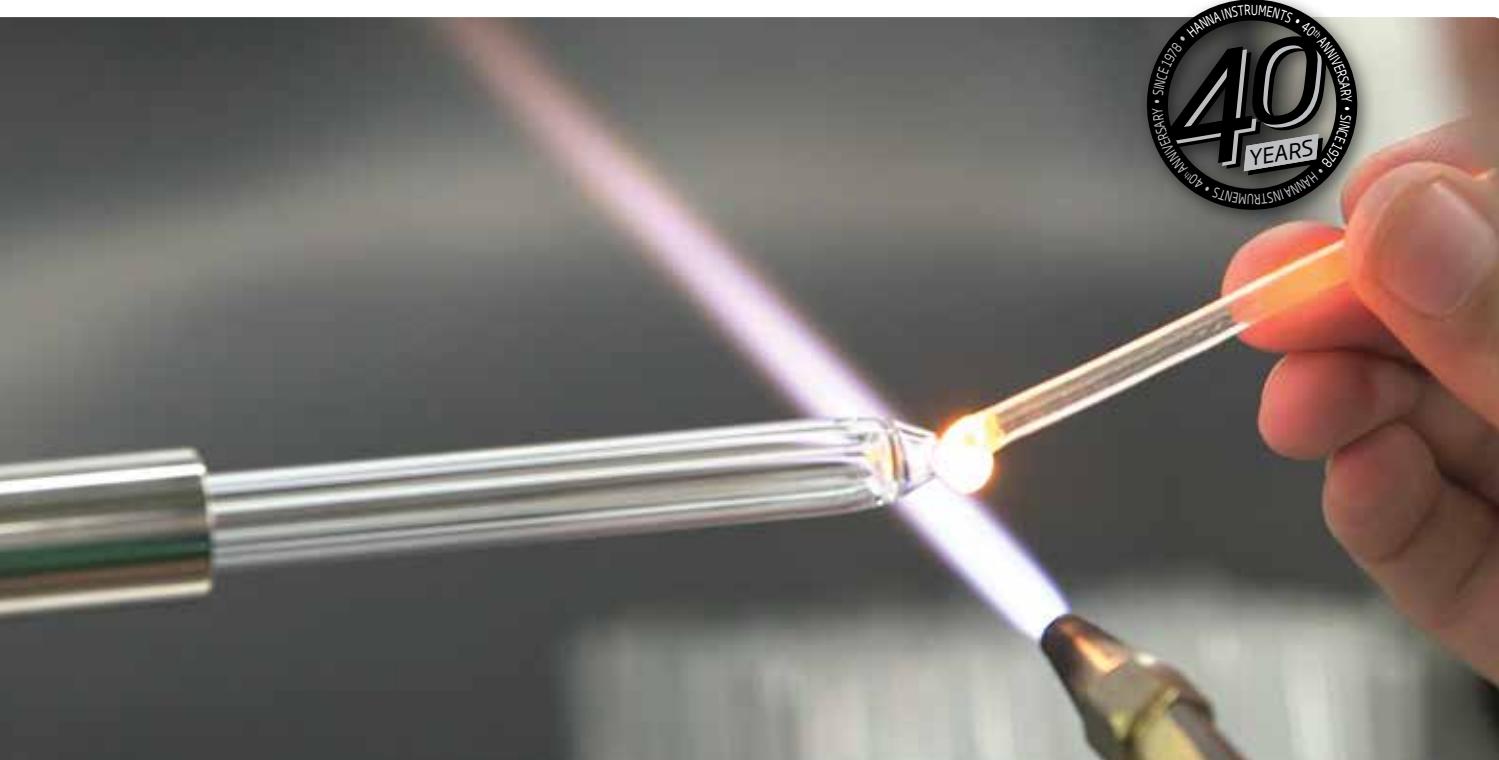
On behalf of Hanna worldwide, thank you for your continued and loyal support.

Martino Nardo  
President, Hanna Instruments



This year, Hanna Instruments® celebrates 40 years of history. From our first HI7910 pH controller (built in 1978, courtesy of Sergio D'Achille) our philosophy was clear: build the best solution for our customers by creating durable products with sensible features that perform beyond expectations.

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about Hanna

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## Hanna Design and Manufacturing

In a short time, Hanna has reached its target to produce all of its instrumentation in-house. Since the introduction of its industrial science park located in Romania, the facility is equipped to support all phases of production such as product research and design, plastic injection molding, electronic assembly, glass blowing for electrodes, standards production and final assembly of product. Hanna oversees all aspects of its products from conception to the final quality check and packaging. Hanna is an ISO 9001:2008 certified company.

Our Woonsocket and Smithfield, RI facilities house our primary research and development centers and assemble select products such as titrators, ISEs, HI921 autosampler and HALO®.

In-house production affords Hanna the freedom to efficiently bring new and innovative products to market while continuously improving the quality and features of existing products.



## History

In 1978 Hanna Instruments was founded in Limena, Italy by Oscar and Anna Nardo. Since that time, Hanna Instruments has grown to be a worldwide leader in the development of electro-analytical instrumentation. The development of novel instrumentation for customers that would not have normally used instrumentation is what has led to the success of the company.

In the 80's the company had a mission to provide a pH meter that was affordable, accurate and easy to use. The result was the pHep (pH electronic paper). This meter used an integrated circuit to measure the voltage response of a pH electrode packaged into a pocket-sized meter. The calibration of the meter was performed manually and the price was less than \$50.00. Having a simple operation and very affordable price point brought the advantages of an electro-analytical measurement of pH to the masses. Whether it be a farmer looking to measure the pH of soil to the printing press operator that needs to measure the pH of a fountain solution. Hanna Instruments provided the user with an accurate electronic alternative to litmus paper and chemical indicators.

Hanna Instruments has a history of developing innovative products that make analytical measurements easier to perform at an affordable price. Many innovations introduced by Hanna are now the norm for the instrumentation industry.

Hanna Instruments is currently headed by Martino Nardo, son of Oscar and Anna Nardo. Under the direction of Martino Nardo, Hanna Instruments® continues to develop innovative and unique products. The most recent innovations include both the thinnest multiparameter meter in the market and pH sensors that incorporate Bluetooth Smart technology. edge® pH/EC/DO meter was launched in 2014 and is only 0.5" thick. edge uses digital sensors with a 3.5mm connector and to change from one parameter to the next all the user has to do is unplug and plug in a different sensor. Also in 2014, the HALO® pH electrode was released. This electrode is the first Bluetooth pH/temperature electrode. The HALO transmitted measurement data wirelessly to an ipad that was running the Hanna Lab App. In 2015, edge blu was released and it brought the Bluetooth connectivity to a pH meter. Now the HALO can be used with a tablet style computer or a traditional pH meter. The HALO line of pH electrodes continues to be expanded to accommodate the diversity of applications. These Bluetooth enabled sensors are setting a new standard and it is safe to say that they will become commonplace in the future.

Being a leader in innovation is only part of our story. We are not only an instrumentation designer but also a vertically integrated manufacturer. From an original idea for a product to the finished good we are in control of the entire process. We employ our own engineers that design the circuits and program the firmware for the meters. We use surface mounted technology machines (SMT) to populate the circuit boards, injection molding machines to make the meter cases and other plastics, chemical manufacturing for solutions and reagents, glass blowers for the manufacture of pH and ORP electrodes, and even the printing of the packaging materials. Everything is done in-house. This ensures a high quality product while reducing the cost by not outsourcing to third parties. Even more importantly, it allows



Today, Hanna manufactures over 3,000 products in production facilities located in USA, Romania, Italy and Mauritius. We are proud to offer unique solutions for our customers. We continue to strive to understand the challenges that our customers are faced with in performing analytical measurements so that we can develop a solution that will provide a simplified and accurate way to measure.

for flexibility to produce short runs of products. Meaning that if the market demand for a particular product is very limited we will still produce it because we know that there is a customer that requires a unique solution and not a general one size fits all type of product.

## Philosophy

The philosophy of the Nardo family has always been to supply customers around the world with practical, cost-effective solutions for their testing needs.

When Hanna introduced the pHep®pH (pH Electronic Paper) tester in 1986 it revolutionized the world of testing. Millions of people from various industries were now capable of testing pH simply, accurately and affordably. This is the basis for the winning philosophy strongly embedded in Hanna. When Hanna introduced the world's first single parameter series of automatic titrators dedicated to food analysis in 2005, thousands of users from around the world were put in the position to improve the quality of their product by performing their own in-house analytical tests.

The driving philosophy that has been a Hanna trademark for over three decades has enabled the company to provide the right instrumentation to their customers with world class service and support.



## We Design, Manufacture, Supply and Support All of Our Products.

### A Worldwide Leader

With 60 offices in over 40 countries, Hanna dedicates itself to be a worldwide leader in service and selection.

Offering research grade quality at competitive prices, every Hanna office strives to work with each customer to develop a solution tailored to their needs, on their budget.

### Hanna 360° Value

When you buy a Hanna product, you're not only buying the best value for your money, but you're also receiving the benefit of Hanna's unsurpassed customer service and post-sale technical support.

### Quality

Our products are designed and manufactured under strict ISO 9001:2008 standards. Every instrument undergoes stringent quality control tests at different stages of manufacturing including 100% quality control checks just prior to shipment.



### Close to You

It is our policy to regularly participate in local trade shows and advertise our latest innovations in market specific magazines.

### Local Support

After you have made your investment, you should never feel uncertain about the support or technical service you will receive. Hanna develops relationships with its customers built on quality products with personal service and support.

### 24/7 Access

Visit us on the web at [www.Hannainst.com](http://www.Hannainst.com). There you can search for products, look up local office contacts, read the latest news from Certification

All Hanna products are in compliance with CE directives and our production facilities are ISO 9001:2008 certified. Hanna and download instruction manuals, MSDS and brochures.



## Casing, injection, and rubber molding

Hanna designs and manufactures all of our instrument casings, custom cases and inserts, solution and reagent bottles and rubberized shockproof boots.

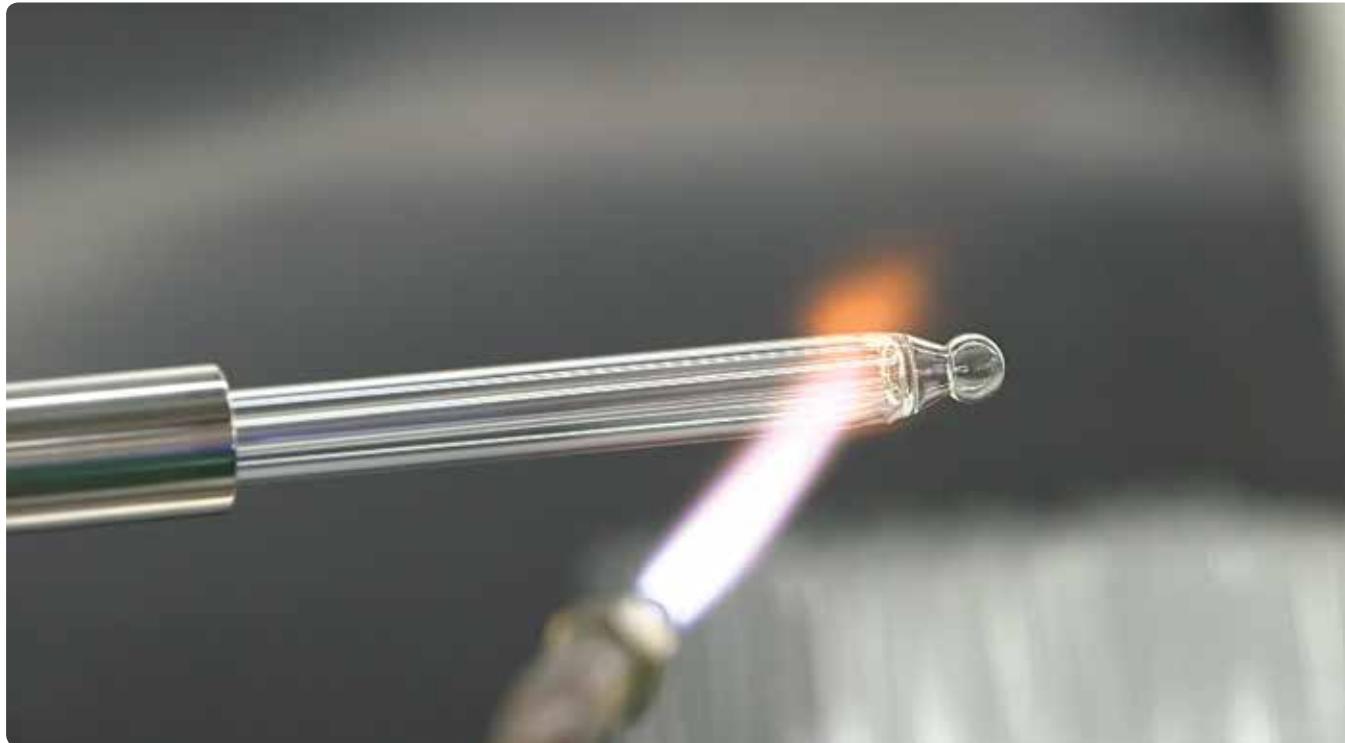




## Electronics

Our electronics department mounts and connects the electronic components onto our custom circuit boards. The boards are then tested and installed into our instruments.





## Glass Blowing

Our glass blowing department combines artistry and science to create our electrodes. Glass is heated and shaped within strict tolerances by hand in both of our facilities in Nusfalau, Romania and Rhode Island, USA.



## Electrode assembly

Our glass blowing, injection molding and electronics department work together to supply our electrode assembly department with the materials they need to build Hanna electrodes.



### Labels and keypads

All of the masks, labels and pad printing for our instruments and solution bottles is designed, printed, and die-cut in-house..





## Solutions

Our solutions are formulated and mixed on premises and are prepared to precise formulas and standardized with a pH electrode and meter calibrated to NIST standards.



## Reagents

Powder and liquid reagents are carefully formulated and filled to ensure maximum precision.



# 360° Value



## Packaging

Hanna produces the packaging for all product lines. Each package is carefully designed for safety and practicality. The in-house control of all research, design and production steps provides continual quality control at all phases to assure the highest level of quality.



## Manuals and literature

Our manuals and quick start guides are printed on our Heidelberg press as well as much of our leaflets, flyers and catalogs.



## Quality control

After continuous validation and testing, Hanna products undergo a final quality check before they are packaged and released to consumers.



# Hanna Milestones

## Introduction

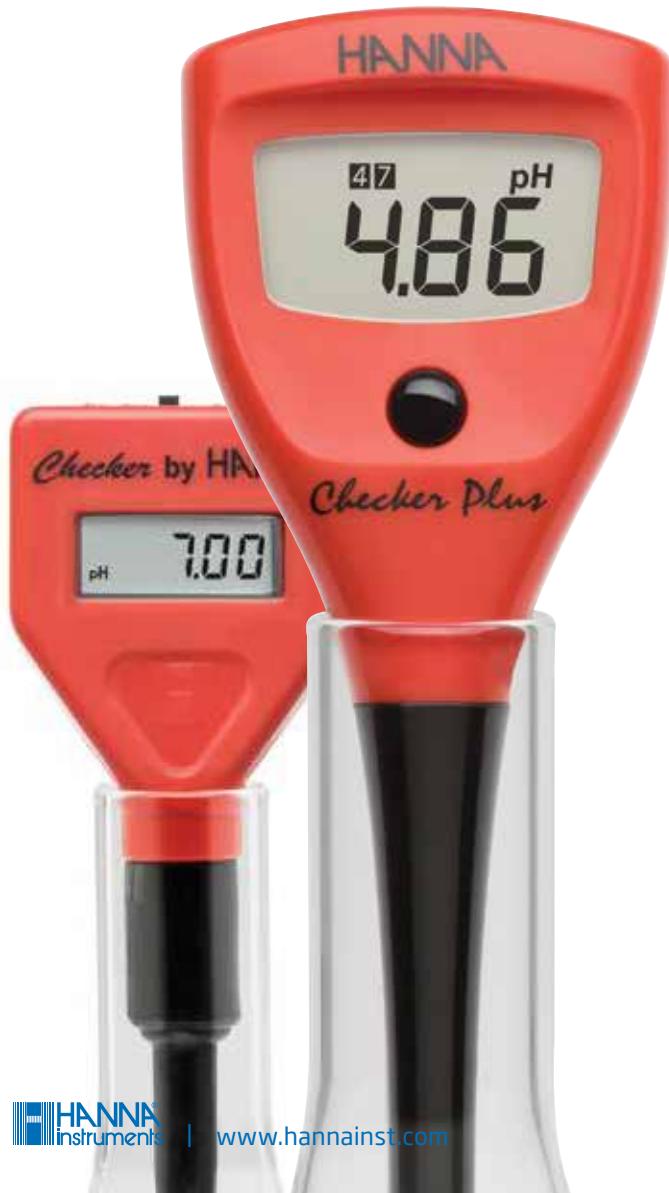
### Hanna is Technology and Innovation

For 40 years, Hanna has prided itself in being a world leader in innovation of analytical instrumentation. Headed by our team at the home office, Hanna's research and development department constantly challenge themselves to invent new testing techniques and to advance existing technology. The minds at Hanna work to achieve the common goal of simplifying analytical testing through improving instrumentation, sensor development, reagents and chemicals.

1978

### Hanna Opens in Italy

Hanna was founded in Limena, Italy. Limena is a province of Padua (AKA Padova) and is located in Northern Italy. It is approximately 40 km west of Venice. Padua is well known for the University of Padua. Many great scholars of our time have spent time at the university. Most notable scholars include Galileo Galilei and Nicolaus Copernicus.



1980

### World's first single-probe portable conductivity meter

The HI8033 is a four pole conductivity portable meter. Having a four pole design allowed the meter to measure a variety of different solutions with different conductivity values. The same meter can be used to measure both deionized water and fertilizer solution.



1982

### World's first pH controlled chemical dosing pump

The DP7916 combined a pH meter with a chemical dosing pump in order to maintain a desired set point of a process applications. The BL7916 is the second-generation design and is still widely used by many customers including plating, wastewater treatment, water treatment and swimming pools.

1984

### World's first microprocessor-based hand held pH meter

The HI8424 was the first portable microprocessor pH meter. The microprocessor allowed for automatic calibration as compared to manual calibration with trimmers or potentiometers. The calibration information was stored in the meter even when it was powered off.

1985

### World's first pH electrode with built-in temperature sensor

The HI8414 pH meter was the first meter to use a pH electrode (HI1213S) with a built in temperature sensor. The temperature sensor allowed for the automatic correction for changes in pH with changes in temperature as calculated by the Nernst equation. This advancement is now commonplace in the industry.



1986

## World's first electronic pocket sized pH tester

The pHep® or pH electronic paper revolutionized the way pH can be measured. This tester brought the electronic pH measurement to the masses. It allowed farmers, students, and many other users access to a pH meter that was simple to use and very accurate. The meter was also very affordable with a price point less than \$50.00.

1988

## World's first pre-amplified pH electrode

The 1910 and 1912 were the first pH electrodes to have a built in amplifier within the probe. The pH electrode produces a high impedance signal. Due to the low current signal the measurement is susceptible to electrical noise, humidity, and a bad connection. Utilizing an amplifier allowed for signal with a higher current, which overcame the measurement issues. We continue to use amplifiers in many electrodes including some of those with built in temperature sensors.

1990

## World's first waterproof portable pH meter

The HI9023 was the first waterproof portable pH meter. A pH measurement is usual for many industrial and environmental applications. In these situations it is common that a pH meter can get wet. If water or chemical solutions get inside the meter then it is possible that the sensitive electronics can be damaged. For this reason Hanna Instruments designed a meter that would be completely waterproof. The HI9023 and successive portables including the HI9024, HI9025 and HI9026 have been the work horse meter for many customers that need a rugged waterproof meter.

1991

## World's first replaceable electrode pH pocket tester

The Checker® 1 (HI98103) was the first pocket pH meter that had a replaceable electrode. The HI1270 pH electrode has a screw cap threaded end that was simple to replace extending the life of the pH meter. The Checker is by far the most popular and recognizable tester in the market with over 1 million meters used. The Checker is still in production and continues to be one of the most popular meters.

1992

## World's first portable pH meter with plain-paper printer

The HI9224 was the first portable pH meter with a built in printer. The addition of the printer to a meter was for the customers that required unalterable documentation. This is a great value for many industries including in the pharmaceutical and food industries.

1995

## World's first pocket thermometer with CAL Check™

The Checktemp series of pocket thermometers were the first thermometers that incorporated a unique calibration check feature for determining any drift of the internal electronics. A switch is used to place the thermometer in CAL Check mode. If the reading was inside  $\pm 0.3^{\circ}\text{C}$  from  $0.0^{\circ}\text{C}$  reference point that is simulated then the internal electronics are within an acceptable tolerance.

1997

## World's first pH tester with double junction electrode

The pHel pH testers were the first pocket size meters with a double junction. Many industries have metals or other compounds that react and form a precipitate with silver ions from the silver chloride found in a single junction reference design. With a double junction electrode the silver chloride is located in an inner compartment while an outer compartment is silver free. This design extended the life of an electrode and was useful for customers that preferred the convenience of a tester with features of a traditional laboratory electrode.



## Hanna Milestones

1999

### World's first pH/temperature tester with dual-level LCD

The pHep®4 and 5 were the second generation of the original pHep. These meters used a large dual-level LCD that allowed many advance features that would only be found on more expensive portable and benchtop instrumentation. The Dual level LCD was able to display both pH and Temperature simultaneously along with a battery and stability indicators. The meters also feature automatic temperature compensation, automatic calibration, battery percent level at start up, waterproof, and a replaceable electrode. pHep 4 and 5 set the standard for all instrumentation manufacturers that offer handheld testers.



2000

### World's first multiparameter (pH/conductivity/ temperature) pocket tester

The Combo pH/EC/TDS/Temperature meters were the first testers to combine pH and conductivity sensors into a single meter. They offered all the features of the redesigned pHep handheld testers with the addition of a graphite amperometric sensor for the measurement of EC and TDS. The Combo meters also had a exposed temperature sensor that allowed for a quick and accurate temperature compensation for both pH and conductivity measurements.

2002

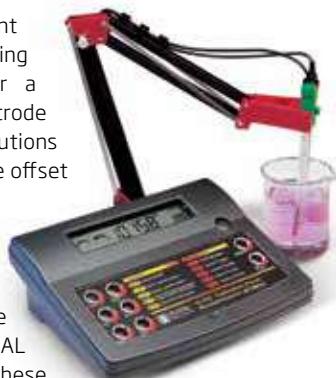
### World's first colorimeter with CAL Check™ feature

The HI95 series of portable photometers were the second generation of our single parameter photometers. The HI93 series first generation meters used an LED at a specific wavelength as a light source. The HI95 series optical system was improved to use a tungsten lamp and narrow band interference filter for a much narrower spectral bandwidth. Hanna Instruments also incorporated a unique CAL Check function in which a traceable secondary standard is used to check the pre-programmed curve. If readings are outside a specified tolerance then the unit could be calibrated with the standards and an offset to the curve applied.

2003

### World's first pH meter with CAL Check

Many problems in pH measurement result from a lack of understanding of the Nernstian response for a pH electrode. Every pH electrode generates a mV response in solutions at a specific pH. By monitoring the offset and slope characteristics of a pH electrode during the calibration process it is possible to determine potential problems. The pH221 and pH222 were the first pH meters to offer a unique CAL Check feature. During calibration these meters would alert the user if the probe needs to be cleaned or the buffer is contaminated. After calibration the probe condition (based on offset and slope) and the probe response were displayed with a five bar indicator. The greater the number of bars the better the condition and response.



2004

### World's first process pH meter with integrated cellular communication

The ability for remote data acquisition is becoming of increasing importance. Many times it is convenient to monitor a process parameter remotely. With the HI504900 GSM module it is possible to use a SIM card from cellular provider to transmit measurement data over a cellular connection. The HI504 process pH/mV controller allows for the digital transmission of data by using an RS485 serial connection. The HI504 allows for programming responses based on measurement criteria. These responses include the use of sending a text (SMS) messages over the cellular connection.

2004

## World's first pH/ORP combo tester

The measurement of pH and ORP is very common for industries that rely upon oxidizers for sanitization or to promote an oxidation reaction such as with the oxidation of cyanide to cyanate for the treatment of plating wastewater. Both pH and ORP measurements are also made for chemical reactions that use a reducing agent. The ORP generated by oxidizers and reductants are dependent on the pH of the solution. Many times there is enough oxidizer or reductant present but the pH is not at the optimum. With the HI98121 it is possible to monitor both pH and ORP at the same time. The HI98121 is commonly used to monitor pH and chlorine for many applications including swimming, food sanitization, plating wastewater treatment, and cooling tower water treatment.

2005

## World's first single parameter line of auto titrators for wine testing

Total titratable acidity and sulfur dioxide are two important parameters that are measured during the wine making process. To measure these parameters either a pH/mV meter would be used with a volumetric burette or a very expensive and complex titration system is used. Hanna Instruments developed the HI84100 (sulfur dioxide) and HI84102 (acidity) titrators for the wine industry. Both meters were inexpensive and simple to operate. All the chemistry used is premixed and the end point criteria pre-programmed. These meters allowed for the winemaker to perform analytical measurements without the need for sending samples to a lab.

2010

## World's first handheld colorimeters (Checker®HC) to offer ease of use and high accuracy in a palm sized design

The Checker HC handheld colorimeter series are the first single parameter colorimeters available in a convenient palm size design. Before the Checker HC colorimeters the user either used a expensive \$200-300 portable photometer or they used an inexpensive chemical test kit. The chemical test kits offer the advantage of being inexpensive but they do not provide the high degree of resolution or the non-subjective nature of a photometer. The Checker HC's provide the benefits of a colorimeter at a price point of a chemical test kit. The Checker HC's, like the pHep, are another prime example of Hanna Instruments bringing technology to people that would not normally think of using.



2013

## World's most innovative pH, EC and DO handheld/portable/wall-mount meter...edge®

edge is the thinnest multiparameter meter available. At just 0.5" thick the edge is loaded with many of the features found in expensive benchtop instrumentation. Features include data logging, USB ports, CAL Check™, auto ranging EC/TDS ranges, and GLP data review. edge uses digital pH, ORP, EC and DO probes with a small 3.5 mm connector. The edge is extremely versatile in that it can be used as a portable, benchtop or even as a wall mount indicator.



2014

## "World's first pH electrode with Bluetooth Smart technology (HALO®)

The HI11312 HALO is the world's first professional pH probe with Bluetooth Smart technology (Bluetooth 4.0). It is a high quality, double junction, refillable glass pH probe with a built-in temperature sensor that can be used virtually anywhere: in the field, laboratory or classroom. HALO transmits measurement data wirelessly to a compatible smart phone or tablet running the Hanna Lab App. Since the introduction of HALO in 2014 the family has grown to include other specialized electrodes including the FC2022 pH electrode for the measurement of pH in food products. HALO has set the new standard in technology for pH measurement that will be commonplace in the future.

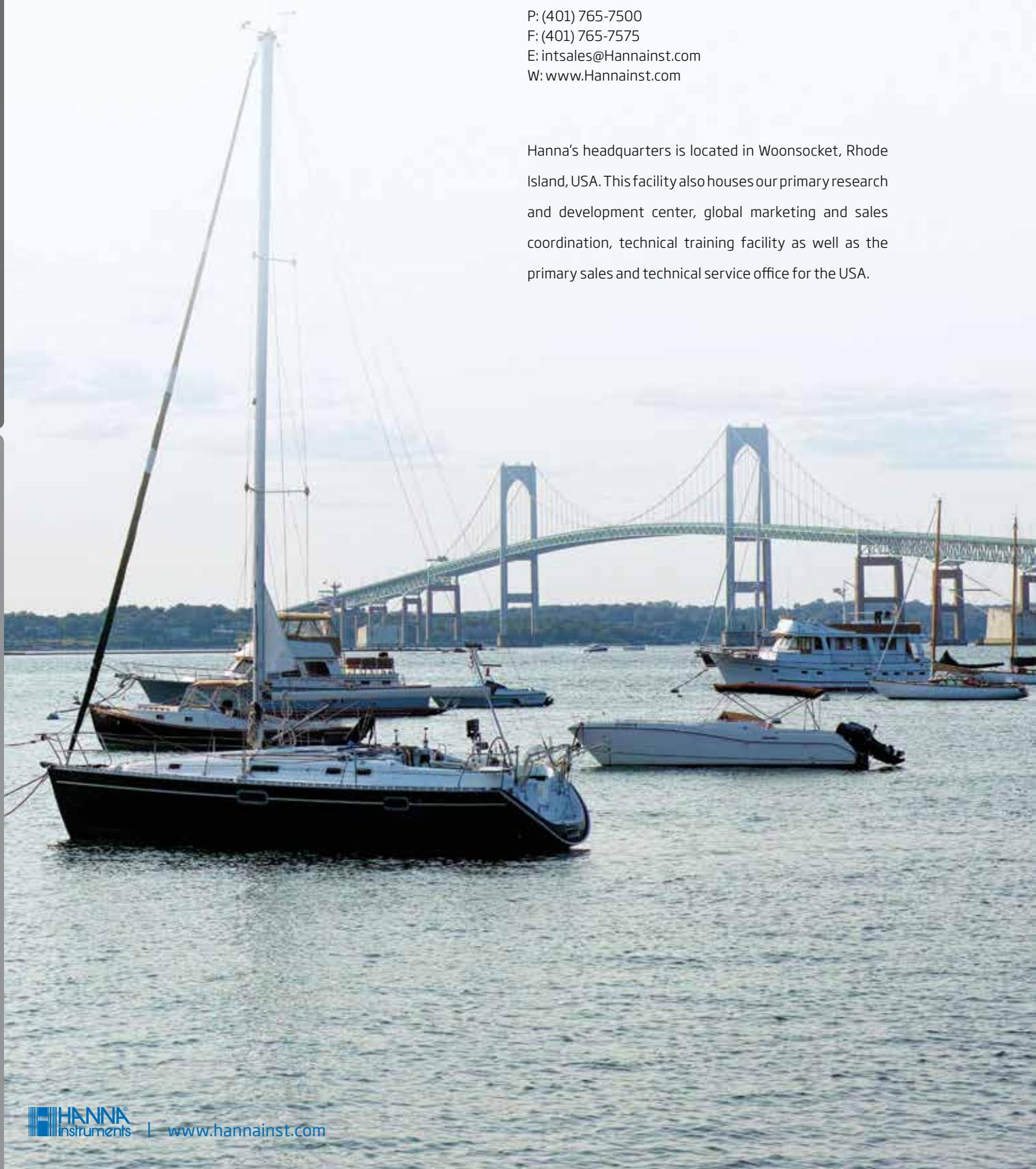
2015

## World's first pH electrode and meter with Bluetooth Smart technology (HALO and edge blu)

The edge blu is the first Bluetooth enabled pH meter for the use with HALO Bluetooth pH electrodes. The edge blu receives measurement data wirelessly from the HALO pH electrode. The logging of data by the meter is performed by touching the HALO pH electrode button. The type of logging mode used is based on the setup configuration of edge blu. Data is logged at interval, on demand or by stability.



# Hanna Instruments® World Headquarters



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Hanna's headquarters is located in Woonsocket, Rhode Island, USA. This facility also houses our primary research and development center, global marketing and sales coordination, technical training facility as well as the primary sales and technical service office for the USA.

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HI981420

## GroLine Hydroponics Monitor

The HI981420 GroLine Monitor provides 24 hour continuous monitoring of pH, conductivity (EC or TDS), and temperature in hydroponic nutrients. Quick to setup and simple to use, this monitor was designed with Hydroponics, Aquaponics, and Greenhouses in mind. Make your nutrient solution easy to manage with the GroLine Monitor and combined pH/EC/Temperature probe.

See page 1.34



# HALO®

Wireless pH Meters

Introduction

new products





HI13302

## HALO® Wireless pH Meter for Vials and Test Tubes

Our HALO Wireless pH Meter for Vials and Test Tubes has a tapered glass body and a spheric glass sensing bulb made with low temperature glass making it ideal for vials, test tubes, and smaller vessel applications. All readings are transmitted directly to your Apple or Android device or the edge blu.

[See page 2.18](#)

HI10832

## HALO Wireless pH Meter with Micro-bulb

Our HALO Wireless pH Meter with Microbulb has a bulb tip that is only 3 mm in diameter and can be used to measure pH in samples as little as 100  $\mu$ L. This meter is ideal for 96 well plates, microcentrifuge tubes, and for expensive samples that offer little volume to work with. All readings are transmitted directly to your Apple or Android device or the edge blu.

[See page 2.19](#)



FC2142

## HALO Wireless pH Meter for Beer

Our HALO for home and craft beer makers has durable titanium body, high temperature glass sensor, and an extendable cloth type junction for renewable electrode life. All readings are transmitted directly to your Apple or Android device or the edge blu.

[See page 2.25](#)



HI12922

## HALO Wireless Soil pH Meter

Our HALO Wireless Soil pH Meter has a triple ceramic junction in the outer reference cell, built-in temperature sensor, and the conic pH sensing tip making it ideal for pH measurements in soil samples. All readings are transmitted directly to your Apple or Android device or the edge blu.

[See page 2.26](#)



HI14142

## HALO Wireless pH Meter for Flat Surfaces

Our HALO Wireless pH Meter for Flat Surfaces has a flat tipped glass sensor and an open junction design to measure pH on flat surfaces or small volume samples. All readings are transmitted directly to your Apple or Android device or the edge blu.

[See page 2.27](#)



## Foodcare Thermometers

Professional, rugged, and waterproof thermometers designed to be used on a daily basis in industrial kitchens and catering as well as warehouses, loading docks and transportation vehicles.

Standard features include waterproof casing (rated IP65) and stainless steel penetration probe designed for continuous contact with foodstuffs in accordance with regulation (EC) number 1935/2004. These thermometers also include CAL Check™, low battery detection, auto-off capability, and long battery life.



HI93501

## Thermistor Thermometer

- Interchangeable thermistor probe

HI93501 is a thermistor style thermometer that includes a stainless steel replaceable style penetration probe (FC762PW). It measures temperatures from -50 to 150°C (-58 to 302.0°F).

[See page 14.28](#)



HI935001

## K-Type Thermocouple Thermometer

- Interchangeable K-type thermocouple probe

HI935001 is a thermometer that includes a K-type thermocouple stainless steel replaceable style penetration probe (FC766PW). This thermometer offers a large range of temperature measurement; from -50 to 300°C (-58.0 to 572°F).

[See page 14.29](#)



HI935007

## K-Type Thermocouple Thermometer

- Fixed K-type thermocouple probe

HI935007 is a thermometer that incorporates a fixed K-type thermocouple stainless steel penetration probe to provide the greatest accuracy. This thermometer offers a large range of temperature measurement; from -50 to 300°C (-58.0 to 572°F).

[See page 14.30](#)



HI935004

## T-Type Thermocouple Thermometer

- Interchangeable T-type thermocouple probe

HI935004 is a thermometer that includes a T-type thermocouple stainless steel replaceable style penetration probe (FC767PW). This thermometer offers temperature measurement from -50 to 300°C (-58.0 to 572°F).

[See page 14.31](#)



HI935008

## T-Type Thermocouple Thermometer

- Fixed T-type thermocouple probe

HI935008 is a thermometer that incorporates a fixed T-type thermocouple stainless steel penetration probe to provide the greatest accuracy. This thermometer offers temperature measurement from -50 to 300°C (-58.0 to 572°F).

[See page 14.32](#)



## Groline Sachets

we have expanded our Groline sachet offerings to include pH 4, pH 7, pH 10, 5000  $\mu\text{S}/\text{cm}$ , 1.41  $\text{mS}/\text{cm}$ , cleaning and storage.

# Table of Contents

## Testers and Monitors



### Introduction ..... 1.2

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# Introduction



## Laboratory Accuracy in the Field

In the past, measuring and monitoring important parameters was limited to the laboratory. Now, these parameters are being tested right in the field for applications such as environmental study, agriculture, the food industry, horticulture, wastewater management, fish farming, water quality maintenance and anywhere quality and accuracy is important. Hanna has developed a large variety of testers and monitors designed to fulfill the requirements of virtually any application.

Hanna offers a vast selection of single and multiparameter testers which cover a multitude of the most important parameters: pH, ORP, conductivity (EC), total dissolved solids (TDS), temperature, sodium, salt and relative humidity.

Testers can perform on the spot measurements quickly, accurately and inexpensively. They allow users with different backgrounds and technical training to make readings without the need of a laboratory or having to purchase expensive and complex analytical equipment.

Hanna provides high accuracy in a single parameter tester for pH, EC, TDS, temperature and more. Multiparameter testers are also available, eliminating the hassle of carrying multiple testers.

Hanna testers have easy to read LCDs and durable outer casings. They are able to measure in places with a high percentage of humidity, and low power demand allows a long battery life, eliminating the need for frequent battery replacement.

## pH Testers

All Hanna pH testers come with a replaceable pH probe, which is a unique advantage over most pH testers found on the market today. Clogged electrode junctions are a problem of the past with extendable cloth junctions. When the cloth is dirty from routine testing, readings can become slow and unstable. This can be fixed by simply pulling out 3 mm of cloth, and cutting off the dirty junction.

Testers feature Automatic Temperature Compensation (ATC) and calibration at one or two points. Designed to be pocket sized with a narrow tip, they are ideal for measurements in smaller samples.

## Conductivity Testers

Conductivity (EC) testers are widely used for monitoring EC/TDS with water conditioning, reverse osmosis, cooling towers, drinking water, wastewater, laboratories, agriculture, aquaculture and aquariums, hydroponics and the printing industry.

With selectable or fixed conversion factors to relate to EC and TDS, readings can be more accurate. Hanna conductivity testers feature an amperometric graphite probe that provides greater accuracy and repeatability in measurements because it cannot be contaminated by salt deposits in solutions. Calibration of conductivity testers is simple and can be done manually or automatically with a single point.

Measurements are automatically temperature compensated to ensure correct readings.

## Salt and Water Purity Testers

The SALINTEST can help you monitor the concentration of sodium chloride in live fish storage tanks, tropical fish aquariums and oceanographic investigations. Measurements are performed with a sodium ion selective electrode, with one point check in a standard salt solution.

Water purity testers enable users to check the purity of distilled or demineralized water in environments such as printed circuit board washing, laundry, steam cleaning, and all areas where pure water is used. The measurement for salt and water purity is conductometric.

## Thermometers

Hanna's thermometers feature a unique CAL Check™ function to ensure accurate measurements every time. Hanna temperature sensors allow users to take measurements with extremely high accuracy in a short amount of time. The sharp tip of the probes can easily penetrate semi-solid products, making routine controls simple and quick. These testers are ideal meters for measuring temperature according to HACCP requirements.

## Hanna Monitors

Hanna monitors are an ideal economical solution in applications where constant monitoring of a stationary sample is required. Hanna offers a large selection of wall-mountable monitors that cover a multitude of parameters, allowing the user to choose the meter and probe that best fits their application. Multiparameter models allow the user to monitor up to three different parameters with one indicator.

Each monitor is designed for specific application requirements such as in hydroponics, greenhouses, horticulture, water treatment and food preparation and processing.

At startup, monitors perform a self-check diagnostic to assure proper working condition. Stability indicators let the user know when to take readings while the HOLD function freezes readings on the display for easy and accurate recording. Selected instruments in this line provide a visual alarm so the user can easily recognize if the monitored solution is out of specification for the application.

Hanna offers monitors that feature large backlit LCDs for easy visual reading of multiple parameters as well as automatic calibration, automatic buffer selection and automatic temperature compensation (ATC).

Hanna's wall-mounted monitors are very easy to install and work with a 12V power supply. Many models feature interchangeable probes so an application specific probe can easily be plugged in to the meter. All monitors have durable outer casings protecting them from high humidity environments and rain.

### pH Monitors

Ideal for growers, pH monitors are supplied with advanced, non-clogging double junction pH electrodes that will withstand the most aggressive environments. Measurements are highly accurate and can be verified with one or two-point manual or automatic calibration.

Should the pH exceed a user-selected limit, an incorporated LED will alert the user with a flashing light. This feature allows even inexperienced users to successfully monitor parameters. The LED alarm and pH value can be set through trimmers on the instrument.

### Conductivity Monitors

Conductivity monitors with different measurement ranges are available with a host of features suited for aggressive environments.

Calibration and temperature compensation can be automatic or manual, while the EC/TDS conversion factor and temperature coefficient factor ( $\beta$ ) are user-adjustable. If desired, the most common TDS conversion factor of 0.5 can be used for agriculture measurements on application specific measurements. Both the direct two pin probes and graphite probes assure great accuracy and minimal maintenance.

### ORP Monitors

Hanna has developed oxidation-reduction (ORP) monitors specially for swimming pool and spa facilities where monitoring is crucial. Casings incorporate a large, bright LED indicator that will flash if measurements fall below the user-selected value.

## Temperature Monitors

Few manufacturers have given any thought to providing users with a convenient way of monitoring temperature conditions in catering, refrigerators, and other places that need quick monitoring. Hanna's precision thermometers can be mounted right over the samples to be measured or placed in refrigerators for continuous readings of cold storage products.

Temperature monitors come with Hanna's exclusive CAL Check™ feature. With CAL Check, users can ensure the accuracy of the meter without the need for external calibration equipment.

Food grade stainless steel probes and quick response times assure the safety and preservation of the goods monitored.



# Product Spotlights

HI98131

## GroLine pH/EC/TDS Combo Tester

The HI98131 GroLine Combo offers high accuracy pH, EC (conductivity), TDS (total dissolved solids), and temperature measurements in a rugged, waterproof casing that floats.

See page 1.10



HI98107 pHep® · HI98108 pHep®+

## pHep pH Testers

The pHep® is used by millions of people around the world to monitor pH in laboratories and industrial applications as well as in agriculture, fish farming, food manufacturing and quality control, swimming pools and the printing industry.

See page 1.14



HI98118

## GroLine pH Tester

The GroLine HI98118 pH/temperature tester is our latest pocket meter for measuring the pH of a hydroponic nutrient solution.

See page 1.15



HI98115

## GroLine pH Tester

Our HI98115 GroLine pH tester is designed with many advanced features for growers of all types. This pH tester offers automatic calibration to one or two points, automatic buffer recognition, calibrated buffer tags, stability indicator, low battery indicator, and selectable automatic shut-off. With its compact size, one-button operation, and ease of calibration, the HI98115 is the optimal tool for pH measurement in nutrient solutions and soil slurries.

See page 1.18



HI98331 Soil Test™

## Soil Test

*Direct Soil EC and Temperature Meter with Built-in Stainless Steel EC Probe*

The GroLine Soil Test EC (conductivity) and temperature tester offers many advanced features for growers of all types. The Soil Test offers automatic one-point calibration, stability indicator, hold functions to freeze readings on screen, low battery indicator, and selectable automatic shut-off.

With its compact size, single-button operation, and ease of calibration, Soil Test is the optimal tool for EC measurements made directly in soil.

See page 1.23



HI98318

## GroLine EC/TDS Tester

The GroLine waterproof EC/TDS tester is ideal for hydroponics, greenhouses, or anywhere you need quick and accurate conductivity measurements.

See page 1.25



HI981420

## GroLine Hydroponics Monitor

The HI981420 GroLine Monitor provides 24 hour continuous monitoring of pH, conductivity (EC or TDS), and temperature in hydroponic nutrients. Quick to setup and simple to use, this monitor was designed with Hydroponics, Aquaponics, and Greenhouses in mind. Make your nutrient solution easy to manage with the GroLine Monitor and combined pH/EC/Temperature probe.

See page 1.36



## Comparison Guides

Code	pH Range	EC Range	TDS Range	ORP Range	Salinity Range	Temperature Range(s)	0.01 pH Resolution	Automatic Calibration	Automatic EC Calibration	pH Calibration Points	EC/TDS Calibration Points	Quick Cal Calibration Solution Compatible	pH Buffer Sets	ATC	Waterproof	Replaceable Electrode/Probe	Cloth/Extendable Junction	HOLD Function	BEPs	Auto-off	Page	
<b>Multiparameter</b>																						
HI98129	•	•	•			°C/°F	•	•	•	2	1	2	•	•	•	•	•	•	•	•	1.8	
HI98130	•	•	•			°C/°F	•	•	•	2	1	2	•	•	•	•	•	•	•	•	1.8	
HI98131	•	•	•			°C/°F	•	•	•	2	1	•	2	•	•	•	•	•	•	•	1.10	
<b>pH/ORP</b>																						
HI98127	•					°C/°F		•		2		2	•	•	•	•	•	•	•	•	1.12	
HI98128	•					°C/°F	•	•		2		2	•	•	•	•	•	•	•	•	1.12	
HI98111	•									2			•	•							1.13	
HI98112	•									2			•	•							1.13	
HI98113	•					°C	•			2			•	•							1.13	
HI98107	•					°C/°F		•		2				•						•	1.14	
HI98108	•					°C/°F	•	•		2			•	•						•	1.14	
HI98118	•					°C/°F	•	•		2			•	•						•	1.15	
HI98100	•							•		2					•					•	1.16	
HI98103	•									2					•					•	1.16	
HI98115	•									2					•					•	1.18	
HI98120		•				°C/°F								•	•			•	•	•	1.20	
HI98121	•	•				°C/°F	•			2		2	•	•	•	•	•	•	•	•	1.20	
HI98201		•																			1.21	
<b>EC/TDS</b>																						
HI98203				•								1									1.21	
HI98311	•	•				°C/°F		•		1			•	•	•	•	•	•	•	•	1.22	
HI98312	•	•				°C/°F		•		1			•	•	•	•	•	•	•	•	1.22	
HI98331	•					°C/°F		•		1			•	•	•					•	1.23	
HI98301	•					°C/°F		•		1			•	•	•					•	1.24	
HI98302	•					°C/°F		•		1			•	•	•					•	1.24	
HI98303	•					°C/°F		•		1			•	•	•					•	1.24	
HI98304	•					°C/°F		•		1			•	•	•					•	1.24	
HI98318	•	•				°C/°F		•		1	•		•	•	•					•	1.25	
Primo		•						•				1		•						•	1.26	
Primo 5	•							•			1		•							•	1.26	
Primo 4	•							•			1		•							•	1.26	
HI98308	•										1					•					1.27	
HI98309	•																				1.27	

Code	pH Range	EC Range	TDS Range	ORP Range	Temperature Range(s)	pH Calibration Points	pH Buffer Sets	Automatic Calibration	pH Temperature Compensation	EC Temperature Compensation	TDS Temperature Compensation	CAL Check™	Waterproof	HOLD Function	Backlit LCD	12VDC Power Supply	Battery Power	Visual Alarm	Auto-off	Page	
<b>Temperature</b>																					
HI98501					°C/°F								•					•	1.28		
HI98509					°C/°F								•					•	1.30		
HI98539					°C/°F								•					•	1.31		
HI151-00					°C								•					•	1.32		
HI151-01					°F								•					•	1.32		
HI145-00					°C								•					•	1.33		
HI145-01					°F								•					•	1.33		
HI145-20					°C								•					•	1.33		
HI145-30					°F								•					•	1.33		
HI98517					°C														1.34		
<b>Monitors</b>																					
HI991404	•	•	•		°C/°F	2	2	•	•	•	•	•	•	•	•	•	•	•	1.35		
HI981420	•	•	•		°C/°F	2		•	•	•	•	•	•	•	•	•	•	•	•	1.36	
HI991405	•	•	•		°C/°F	2	2	•	•	•	•	•	•	•	•	•	•	•	1.39		
HI981504/5	•		•		°C/°F	2					•						•	•		1.40	
HI981504/7	•		•		°C/°F	2					•						•	•		1.40	
HI981404N	•		•			2					•							•		1.41	
HI981405N	•		•			2					•							•		1.41	
HI991401	•				°C/°F	2	2	•	•				•	•	•	•				1.42	
HI981401N	•					2											•			1.43	
HI981402	•					2											•	•		1.44	
HI993301	•	•			°C/°F			•		•	•		•	•	•	•	•			1.45	
HI993302	•	•			°C/°F			•		•	•		•	•	•	•	•			1.45	
HI983302N	•									•							•			1.46	
HI983307	•									•							•	•		1.47	
HI983304	•									•							•	•		1.48	
HI146-00					°C												•			1.49	
HI147-00					°C												•			1.50	
HI147-01					°F												•			1.50	

# pH/EC/TDS Testers

- **Waterproof**
  - Designed to float if accidentally dropped in a tank
- **Automatic Temperature Compensation**
  - All readings are compensated for variations in temperature
  - Temperature displayed in °C or °F along with pH reading
- **Stability indicator**
  - Meter displays a clock tag that will disappear when the reading has achieved stability
- **HOLD button**
  - Freezes reading on the display to allow recording of measurement
- **BEPS (Battery Error Prevention System)**
  - Meter will automatically shuts off if there is not enough power to get an accurate measurement
- **Battery % level at startup**
- **Low Battery Indicator**
- **Auto-off**
  - Automatically shuts off after 8 minutes of non-use to maximize battery life

The HI98129 and HI98130 are waterproof testers that offer high accuracy pH, EC/TDS and temperature measurements in a single tester; no more switching between meters for your routine measurements. These floating, waterproof combination testers have an easy-to-read LCD and an automatic shut-off. pH and EC/TDS readings are automatically temperature-compensated.

These testers feature a replaceable pH electrode cartridge with an extendable cloth junction, as well as an EC/TDS graphite electrode. The renewable cloth junction provides an extended electrode life and the replaceable pH cartridge means that this tester does not need to be thrown away when the pH sensor is exhausted.

The EC/TDS conversion factor is user-selectable, as well as the temperature compensation coefficient ( $\beta$ ).

Fast, efficient, accurate and portable, the Combo pH, EC/TDS and temperature testers combine all the features users have requested and more!



## High accuracy EC/TDS graphite probe

The graphite conductivity probe provides greater accuracy because it cannot be contaminated by salt deposits in the solution. The exposed temperature sensor provides fast response times and guarantees highly accurate temperature compensated readings.



## Replaceable pH electrode cartridge

The Combo features an easy-to-replace pH electrode. The sturdy, snap-in connector means there are no pins to bend or break.

## Extendable cloth junction

Simply pull out 3 mm (1/8") and cut when the cloth junction becomes dirty to improve response time and stability.



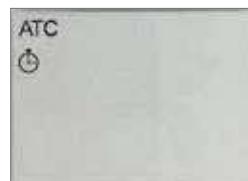
### On-screen battery life

LCD indicates the percentage of battery power remaining upon startup.



### HOLD function

The HOLD function “freezes” the LCD display temporarily.



### Instability & ATC indicators

Ensures reliable EC and TDS measurements. ATC symbol is shown when active.



### Standard or N.I.S.T buffer calibration

Automatic calibration is performed with two sets of memorized buffers for greater accuracy.



### Adjustable temperature coefficient factor

Users can choose between different factors ( $\beta$ ) for precise temperature compensated measurements.



### Adjustable TDS conversion factor

For measurement accuracy, users can choose between a range of conductivity to TDS conversion factors.

### Specifications

	HI98129	HI98130
pH	Range	0.00 to 14.00 pH
	Resolution	0.01 pH
	Accuracy	$\pm 0.05$ pH
Conductivity	Range	0 to 3999 $\mu$ S/cm
	Resolution	1 $\mu$ S/cm
	Accuracy	$\pm 2\%$ F.S.
TDS	Range	0 to 2000 mg/L (ppm)
	Resolution	1 ppm (mg/L)
	Accuracy	$\pm 2\%$ F.S.
Temperature	Range	0.0 to 60.0°C / 32.0 to 140.0°F
	Resolution	0.1°C / 0.1°F
	Accuracy	$\pm 0.5\text{°C} / \pm 1\text{°F}$
Additional Specifications	EC/TDS Calibration	automatic, one point at 1413 $\mu$ S/cm or 1382 ppm (mg/L)
	pH Calibration	automatic, one or two-point with two sets of standard buffers (pH 4.01 / 7.01 / 10.01 or 4.01 / 6.86 / 9.18)
	Temperature Compensation	pH: automatic; EC/TDS: automatic with $\beta$ adjustable from 0.0 to 2.4% / °C
	TDS Conversion Factor	0.45 to 1.00
	pH Electrode	HI73127 (replaceable; included)
	Environment	0 to 50°C (32 to 122°F); RH max 100%
	Battery Type / Life	1.5V (4) / approx. 100 hours of continuous use; auto-off after 8 minutes of non-use
	Dimensions / Weight	163 x 40 x 26 mm (6.4 x 1.6 x 1.0") / 100 g (3.5 oz.)
Ordering Information	HI98129 (Combo) and HI98130 (Combo) are supplied with HI73127 pH electrode and HI73128 electrode removal tool, batteries and instructions.	



### Calibrate directly in buffer solution sachets

An easy calibration can be performed right in our buffer solution sachets for the most accurate readings.

HI98131

# GroLine pH/EC/TDS Combo Tester

- **Waterproof**
  - Designed to withstand the humidity of a growing environment
- **Automatic one-point calibration** using our Quick Cal solution
- **Automatic Temperature Compensation**
  - All readings are compensated for variations in temperature
  - Temperature displayed in °C or °F along with pH reading
- **Measurement instability indicator**
  - Meter displays a clock tag that will disappear when the reading has achieved stability
- **HOLD button**
  - Freezes reading on the display to allow recording of measurement
- **BEPS (Battery Error Prevention System)**
  - Meter will automatically shuts off if there is not enough power to get an accurate measurement
- **Battery % level at startup**
- **Low Battery Indicator**
- **Auto-off**
  - Automatically shuts off after 8 or 60 minutes of non-use to maximize battery life

The HI98131 GroLine Combo offers high accuracy pH, EC (conductivity), TDS (total dissolved solids), and temperature measurements in a rugged, waterproof casing that floats.

The GroLine Combo features a replaceable pH electrode with extendable cloth junction as well as an EC/TDS graphite electrode. The renewable cloth junction provides an extended electrode life and the replaceable pH cartridge means that this tester does not need to be thrown away when the pH sensor is exhausted.

The EC/TDS conversion factor is user-selectable, as well as the temperature compensation coefficient ( $\beta$ ).



## GroLine



### Pocket Clip

A pocket clip is featured on the back of the the GroLine Combo



### Supplied complete

Supplied with all the tools necessary to start performing tests



### High accuracy EC/TDS graphite probe

The graphite conductivity probe provides greater accuracy because it cannot be contaminated by salt deposits in the solution. The exposed temperature sensor provides fast response times and guarantees highly accurate temperature compensated readings.



### Replaceable pH electrode cartridge

The Combo features an easy-to-replace pH electrode. The sturdy, snap-in connector means there are no pins to bend or break.



### Extendable cloth junction

Simply pull out 3 mm (1/8") and cut when the cloth junction becomes dirty to improve response time and stability.

### Specifications

#### HI98131

pH	Range	0.00 to 14.00 pH
	Resolution	0.01 pH
	Accuracy	±0.1 pH
	Calibration	automatic, one or two-point calibration (using pH 4.01, 7.01, 10.01 buffers); one-point calibration using HI5036 or HI50036 Quick Cal calibration solution
	Temperature Compensation	automatic
EC	Range	0.00 to 6.00 mS/cm
	Resolution	0.01 mS/cm
	Accuracy	±2% F.S.
	Calibration	automatic, one-point at 1.41 mS/cm or 5.00 mS/cm; one-point calibration using Quick Cal calibration solution
	Temperature Compensation	automatic, with $\beta = 1.9\%/\text{°C}$
TDS	Range	0 to 3000 ppm (500 CF); 0 to 3999 ppm (700 CF)
	Resolution	10 ppm (mg/L)
	Accuracy	±2% F.S.
	Conversion Factor**	0.5 (500 ppm) or 0.7 (700 ppm)
Temperature	Range*	0.0 to 60.0°C / 32.0 to 140.0°F
	Resolution	0.1°C / 0.1°F
	Accuracy	±0.5°C / ±1°F
Additional Specifications	pH Electrode	HI73127 (replaceable; included)
	Environment	0 to 50°C (32 to 122°F); RH max 100%
	Battery Type / Life	1.5V (4) / approx. 100 hours of continuous use; auto-off after 8 min or 60 min of non-use; can be disabled
	Dimensions / Weight	163 x 40 x 26 mm (6.4 x 1.6 x 1.0") / 100 g (3.5 oz.)
Ordering Information	HI98131 (GroLine Combo) is supplied with HI73127 pH electrode, electrode removal tool, Quick Cal calibration solution sachets (4), electrode cleaning solution sachet, batteries, storage cap, quality certificate and instruction manual.	



### Calibrate pH and EC with one solution

Calibration of both pH and EC can be performed using our Quick Cal calibration solution

HI98127 (pHep®4) · HI98128 (pHep®5)

# pH and Temperature Testers

- **Waterproof**
  - Designed to float if accidentally dropped in a tank
- **Automatic Temperature Compensation**
  - All readings are compensated for variations in temperature
  - Temperature displayed in °C or °F along with pH reading
- **Stability indicator**
  - Meter displays a clock tag that will disappear when the reading has achieved stability
- **HOLD button**
  - Freezes reading on the display to allow recording of measurement
- **BEPS (Battery Error Prevention System)**
  - Meter will automatically shuts off if there is not enough power to get an accurate measurement
- **Battery % level at startup**
- **Low Battery Indicator**
- **Automatic Shut-Off**
  - The meter can be set to automatically turn off after 8 minutes or 60 minutes to conserve battery life in the event that the meter is left on. The auto off feature can be disabled.

The pHep®4 and pHep®5 are waterproof pH testers that have many advanced features found in more expensive portable instrumentation. These ergonomic meters feature automatic one or two point calibration to a known buffer, automatic temperature compensation, battery percent level indicator at start up, and a stability indicator to alert the user when a stable reading has been obtained. The large multi level LCD display shows both pH and temperature simultaneously.



These meters also feature the HI73127 replaceable electrode with a stainless steel round connector and extendable cloth junction. This cartridge design has no pins to line up or that can break.



Specifications		HI98127 (pHep®4)	HI98128 (pHep®5)
pH	Range	-2.0 to 16.0 pH	-2.00 to 16.00 pH
	Resolution	0.1 pH	0.01 pH
	Accuracy	±0.1 pH	±0.05 pH
Temperature	Range	-5.0 to 60.0°C / 23.0 to 140.0°F	-5.0 to 60.0°C / 23.0 to 140.0°F
	Resolution	0.1°C / 0.1°F	0.1°C / 0.1°F
	Accuracy	±0.5°C / ±1°F	±0.5°C / ±1°F
Additional Specifications	pH Calibration	automatic, one or two-point with two sets of standard buffers (pH 4.01 / 7.01 / 10.01 or pH 4.01 / 6.86 / 9.18)	
	Temperature Compensation	automatic	
	Battery Type / Life	1.5V (4) / approx. 300 hours of continuous use; auto-off after 8 minutes of non-use	
	Environment	-5 to 50°C (23 to 122°F); RH max 100%	
	Dimensions	163 x 40 x 26 mm (6.4 x 1.6 x 1.0")	
	Weight	100 g (3.5 oz.)	
Ordering Information	HI98127 (pHep®4) and HI98128 (pHep®5) are supplied with HI73127 pH electrode, HI73128 electrode removal tool, batteries and instructions.		



HI98111 PICCOLO® · HI98112 PICCOLO® 2

HI98113 PICCOLO® plus

## Stick pH Tester

- Pre-amplified electrode
- Narrow, replaceable probe
- Easy to hold and operate

PICCOLO® is a revolutionary pH meter with a 4-in-1 amplified electrode.

Conventional pH meters are susceptible to the weak, high impedance signal which makes the electrode, connector, cable and meter vulnerable to noise, humidity and dirty environments. PICCOLO® has overcome these problems with a pre-amplified electrode that delivers a strong signal to the meter. The interchangeable electrode is inexpensive, rugged and houses the pH sensor, reference system, temperature sensor and the amplifier module.

**PICCOLO®** with a 9 cm (3.5") electrode (HI1280).

**PICCOLO® 2** with a 16 cm (6.3") electrode (HI1290).

**PICCOLO® plus** with a 16 cm (6.3") electrode (HI1295) and temperature readout on LCD.

Specifications	HI98111 (PICCOLO®)	HI98112 (PICCOLO®2)	HI98113 (PICCOLO® plus)
pH	Range	1.00 to 13.00 pH	1.00 to 13.00 pH
	Resolution	0.01 pH	0.01 pH
	Accuracy (@25°C/77°F)	±0.01 pH	±0.01 pH; ±1°C
Additional Specifications	Electrode	HI1280	HI1290
	Calibration	manual, two-point	manual, two-point
	Temperature Compensation	automatic, 0 to 70°C (32 to 158°F)	
	Battery Type / Life	1.5V (3) / approximately 100 hours of continuous use	
	Environment	0 to 50°C (32 to 122°F); RH max 95%	
	Dimensions (with electrode)	194 x 29 x 15 mm (7.6 x 1.1 x 0.6")	265 x 29 x 15 mm (10.4 x 1.1 x 0.6")
	Weight	70 g (2.5 oz.)	265 x 29 x 15 mm (10.4 x 1.1 x 0.6")
	All PICCOLO® models are supplied complete with pH electrode, pH 4.01 and pH 7.01 buffer solution sachets, calibration screwdriver, batteries, rugged carrying case and instructions.		
Ordering Information	HI98111 (PICCOLO®) is supplied with 90 mm (3.5") HI1280 amplified pH electrode.	HI98112 (PICCOLO®2) is supplied with 160 mm (6.3") HI1290 amplified pH electrode.	HI98113 (PICCOLO® plus) is supplied with HI1295 amplified electrode with temperature sensor.

HI98107 pHep® · HI98108 pHep+

## pHep pH Testers

- Waterproof
- Extractable cloth junction to extend pH electrode life
- Built in temperature sensor for Automatic Temperature Compensated measurements.
- Automatic one or two-point calibration
- Stability indicator
- Low battery indicator
- Two-Button operation

The pHep is used by millions of people around the world to monitor pH in laboratories and industrial applications as well as in agriculture, fish farming, food manufacturing and quality control, swimming pools and the printing industry.

With a renewable cloth junction, the pHep has an extended life over typical pH testers. A normal junction will clog with use over time and a typical tester would normally have to be thrown away once the junction becomes contaminated. The junction is 2 cm long and when dirty, can be pulled out to expose a fresh section to effectively renew the pHep's life.



### Exposed temperature sensor

HI98108 features an exposed temperature sensor for faster response times.



### Watertight seal

An easily removable cover provides access to the battery compartment.



	Specifications	HI98107 (pHep®)	HI98108 (pHep®+)
pH	Range	0.0 to 14.0 pH	0.00 to 14.00 pH
	Resolution	0.1 pH	0.01 pH
	Accuracy (@25°C/77°F)	±0.1 pH	±0.10 pH
	Calibration	automatic, one or two-points (pH 4.01, 7.01, 10.01)	
Temperature	Range	0.0 to 50.0 °C (32.0 to 122.0 °F)	0.0 to 50.0 °C (32.0 to 122.0 °F)
	Resolution	0.1°C / 0.1°F	0.1°C / 0.1°F
	Accuracy (@25°C/77°F)	±0.5°C / ±1.0°F	±0.5°C / ±1.0°F
Additional Specifications	Temperature Compensation	automatic, 0 to 50°C (32 to 122°F)	
	Battery Type / Life	CR2032 3V Li-ion / approximately 800 hours of continuous use	
	Auto-off	8 minutes, 60 minutes, or can be disabled	
	Environment	0 to 50°C (32 to 122°F); RH 100% max	
	Dimensions	160 x 40 x 17 mm (6.3 x 1.6 x 0.7")	
	Weight	75 g (2.6 oz.)	
Ordering Information	HI98107 (pHep) is supplied with CR2032 battery, electrode cleaning solution sachet, pH 4.01 buffer solution sachet, pH 7.01 buffer solution sachet (2), storage/protection sleeve, instruction manual and quality certificate.		
	HI98108 (pHep+) is supplied with CR2032 battery, electrode cleaning solution sachet, pH 4.01 buffer solution sachet, pH 7.01 buffer solution sachet (2), storage/protection sleeve, instruction manual and quality certificate.		



GroLine



HI98118

## GroLine pH Tester

- Waterproof
- Extractable cloth junction to extend pH electrode life
- Quick calibration mode using Hanna Quick Cal pH/EC calibration solution
- Two-button operation

The GroLine HI98118 pH/temperature tester is our latest pocket meter for measuring the pH of a hydroponic nutrient solution. The HI98118 has a very large easy to read LCD display that shows both pH and temperature along with calibration, stability, and low battery indicators. All operations are simplified to two buttons.



### Exposed temperature sensor

HI98118 features an exposed temperature sensor for faster response times.



### Watertight seal

An easily removable cover provides access to the battery compartment.



Supplied in a carrying case with buffer and cleaning solutions.

### Specifications

#### HI98118

pH	Range	0.00 to 14.00 pH
	Resolution	0.01 pH
	Accuracy (@25°C/77°F)	±0.10 pH
	Calibration	automatic, one or two-points (pH 4.01, 7.01, 10.01)
	Quick Calibration	one-point calibration using HI5036 or HI50036P Quick Cal calibration solution
Temperature	Range	0.0 to 50.0 °C (32.0 to 122.0 °F)
	Resolution	0.1°C/0.1°F
	Accuracy (@25°C/77°F)	±0.5°C/±1.0°F
Additional Specifications	Temperature Compensation	automatic, 0 to 50°C (32 to 122°F)
	Battery Type / Life	CR2032 3V Li-ion / approximately 1000 hours of continuous use
	Auto-off	8 minutes, 60 minutes, or can be disabled
	Environment	0 to 50°C (32 to 122°F); RH 100% max
	Dimensions	160 x 40 x 17 mm (6.3 x 1.6 x 0.7")
	Weight	75 g (2.6 oz.)
Ordering Information	HI98118 GroLine pH tester, Quick Cal calibration sachets (3), electrode cleaning solution sachet, battery, instruction manual and quality certificate.	

HI98100 · HI98103

# Checker® pH Testers

The latest HI98103 Checker and HI98100 Checker Plus are the next generation of the original Hanna Checker pH tester. The Checker is by far one of the most popular pH meters in the world with over 1 million meters used since its introduction in 1991. From students to researchers, the Checker has been helping people with their pH measurements as a meter that is simple to use and operate.

These Checker pH testers have been designed with many advanced features while maintaining the look and feel of the original Checker. The HI98100 Checker Plus and HI98103 Checker now offer automatic calibration to one or two points, automatic buffer recognition, calibrated buffer tags, stability indicator, low battery indicator, and selectable automatic shut off. Both the Checker and Checker Plus maintain the iconic pentagon design with a probe measuring 103 mm in length that is tapered to an 8 mm diameter, making it ideal for measurements in test tubes and vials.



Over 1 million users  
since its introduction

testers

## Replaceable pH Electrode

The supplied HI1271 pH electrode is 103 mm long and tapers to an 8 mm diameter at the sensing end to easily fit into test tubes, vials, and other containers with a small opening.

## Economical

The Checker and Checker Plus are full-featured pH testers at an affordable price.

## High accuracy

The HI98100 Checker Plus features  $\pm 0.2$  pH accuracy with 0.01 resolution while the HI98103 features 0.1 resolution.

## Large LCD

Enhanced LCD that displays reading, stability indicator, low battery indicator, and calibration tags.

## Automatic Calibration

These meters are calibrated automatically to one or two points. The calibration buffers are automatically recognized and after calibration the buffer values used are shown on the display as a tag.

## Stability Indicator

An hourglass indicator is displayed on the LCD until a stable reading is obtained. Once a reading stabilizes, the indicator disappears and a reading can be recorded.

## Automatic Shut-off

These meters can be set to automatically turn off after 8 minutes or 60 minutes to conserve battery life in the event that the meter is left on. The auto-off feature can also be disabled.

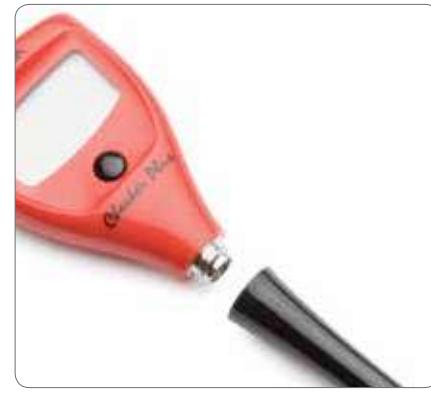
## Long Battery Life

These Checkers have a long battery life of approximately 1000 hours. When the battery power is running low a battery indicator is displayed.

## Plastic Carrying Case

The HI98100 and HI98103 are supplied complete with meter, probe, calibration solutions, and cleaning solutions packaged in a durable plastic carrying case.





The HI1271 pH electrode can be easily replaced. Just unscrew the electrode from the meter body and screw on a new one.



Calibration can be performed directly in our solution sachets.



An easily removable cover provides access to the replaceable battery.



Supplied in a carrying case with buffer and cleaning solutions.

HI98115

## GroLine pH Tester

The HI98115 GroLine pH tester has been designed with many advanced features for growers of all types. This pH tester offers automatic calibration to one or two points, automatic buffer recognition, calibrated buffer tags, stability indicator, low battery indicator, and selectable automatic shut-off. With its compact size, one-button operation, and ease of calibration, the HI98115 is the optimal tool for pH measurement in nutrient solutions and soil slurries.

*GroLine*



### Replaceable pH Electrode

The HI1271 supplied gel filled pH electrode is 103 mm long and tapers to an 8 mm diameter at the sensing end. This narrow electrode easily fits into test tubes, vials, and other containers with small opening.

### Economical

The HI98115 is a full-featured pH tester at a price that anyone that needs to measure pH can afford.

### High accuracy

The HI98115 GroLine pH tester features  $\pm 0.2$  pH accuracy with 0.01 resolution.

### Large LCD

Enhanced LCD that displays reading, stability indicator, low battery indicator and calibration tags.

### Automatic Calibration

HI98115 is calibrated automatically to one or two points. The calibration buffers are automatically recognized and after calibration the buffer values used are shown on the display as a tag.

### Stability Indicator

An hourglass indicator is displayed on the LCD until a stable reading is obtained. Once a reading stabilized the indicator disappears and a reading can be recorded.

### Automatic Shut-Off

The meter can be set to automatically turn off after 8 minutes or 60 minutes to conserve battery life in the event that the meter is left on. The auto off feature can be disabled.

### Long Battery Life

HI98115 has an exceptional long battery life of approximately 1000 hours. When the battery power is running low a low battery indicator is displayed.

### Plastic Carrying Case

HI98115 is supplied complete with meter, probe, calibration solutions and cleaning solutions packaged in a durable plastic carrying case.





The HI1271 pH electrode can be easily replaced. Just unscrew the electrode from the meter body and screw on a new one.



An easily removable cover provides access to the replaceable battery.



pH calibration can be performed directly in our solution sachets.



### Plastic Carrying Case

HI98115 is supplied complete with meter, probe, calibration solutions and cleaning solutions packaged in a durable plastic carrying case

### Specifications

### HI98115

pH	Range	0.00 to 14.00 pH
	Resolution	0.01 pH
	Accuracy (@25°C/77°F)	±0.2 pH
	Calibration	automatic, one or two-point
	Electrode	HI1271 (included)
	Battery Type / Life	CR2032 Li-ion / approximately 1000 hours of continuous use
	Auto-off	8 minutes, 60 minutes, or can be disabled
	Environment	0 to 50°C (32 to 122°F); RH 95% max
	Dimensions	50 x 174 x 21 mm (2 x 6.8 x 0.9")
	Weight	50 g (1.8 oz)
	HI98115 is supplied with HI1271 pH electrode, pH 4.01 buffer solution sachet (2), pH 7.01 buffer solution sachet (2), electrode cleaning solution sachet (2), battery, quality certificate, and instruction manual in a carrying case.	
	Ordering Information	

# ORP and pH/ORP Testers

- Automatic one or two-point pH calibration (HI98121)
- Waterproof
  - Waterproof and designed to float
- ATC
  - Automatic Temperature Compensation (HI98121)
- HOLD** feature
  - HOLD button to freeze readings on the display
- Battery indicator**
  - Battery life indicator at startup

The HI98120 is a waterproof ORP and temperature meter, while the HI98121 measures pH, ORP and temperature. The housing of these testers has been completely sealed against humidity and is designed to float.

Electrode replacement with the stainless steel round connector means there are no pins to bend or break during replacement.

When the cloth junction becomes clogged and response time is sluggish, simply pull out 3 mm (1/8") to clear the clogging which will improve response time and stability.



Replaceable pH (HI98121) or ORP (HI98120) electrode cartridge



Exposed temperature sensor

The exposed stainless steel temperature sensor facilitates faster and more accurate temperature measurement.



HI98121

HI98120

Specifications	HI98120	HI98121
pH	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.05 pH
ORP	Range	± 1000 mV
	Resolution	1 mV
	Accuracy	±2 mV
Temperature	Range	-5.0 to 60.0°C / 23.0 to 140.0°F
	Resolution	0.1°C / 0.1°F
	Accuracy	±0.5°C / ±1°F
Additional Specifications	ORP Calibration	factory calibrated
	pH Calibration	- automatic, one or two-point with two sets of standard buffers (pH 4.01 / 7.01 / 10.01 or 4.01 / 6.86 / 9.18)
	Temperature Compensation	- automatic for pH readings
	Electrodes	HI73120 replaceable ORP electrode (included)
	Battery Type / Life	1.5V (4) / approximately 250 hours of continuous use; auto-off after 8 minutes of non-use
Ordering Information	Environment	-5 to 50°C (23 to 122°F); RH max 100%
	Dimensions / Weight	163 x 40 x 26 mm (6.4 x 1.6 x 1.0") / 100 g (3.5 oz.)
	HI98120	(ORP) is supplied with HI73120 ORP electrode, HI73128 electrode removal tool, batteries and instructions.
Ordering Information	HI98121	(ORP/pH) is supplied with HI73127 pH electrode, HI73128 electrode removal tool, batteries and instructions.



HI98201

## ORP Tester

- Extractable junction
- 700-Hour battery life

The HI98201 is an ORP tester ideal for use in swimming pools and spas, as it can provide a valuable indication of water quality. This tester utilizes a platinum electrode and Hanna unique renewable cloth junction, that can be pulled out when clogging occurs, reactivating the reference and restoring the electrode.

Oxidation reduction is a process by which a molecule or ion loses or gains electrons. This occurs most readily in water treatment and in pool and spa maintenance where an oxidizer, such as chlorine, is added to the water to destroy contaminants. The higher the ORP value, the greater the sanitizing power of your water.

### Specifications

### HI98201

ORP	Range	±999 mV
	Resolution	1 mV
	Accuracy (@25°C/77°F)	±5 mV
Additional Specifications	Battery Type / Life	1.5V (4) / approximately 700 hours of continuous use
	Environment	0 to 50°C (32 to 122°F); RH max 95%
	Dimensions	175 x 41 x 23 mm (6.9 x 1.6 x 0.9")
	Weight	95 g (3.4 oz.)
Ordering Information	HI98201 (ORP) is supplied with protective cap, batteries and instructions	

ORP solutions begin on page 2.154

HI98203 SALINTEST

## Salt Content Meter

- Sodium ISE for NaCl readings
- Extractable junction

Worldwide, fish farming has made great strides in the past two decades, with aquaculture becoming the prime source for quality seafood. As the methods and products keep changing, one crucial factor remains the same: the necessity for salinity testing. The main component of salt in seawater is sodium chloride.

The SALINTEST can help you accurately monitor the concentration of sodium chloride in aquaculture systems. Besides applications in aquaculture, SALINTEST is also ideal for checking salt concentrations in live fish storage tanks, tropical fish aquariums, refrigerated storage and oceanographic investigations. The SALINTEST is easy to maintain and to assure accuracy, it has one-point calibration through a trimmer on the side.

### Specifications

### HI98203 (SALINTEST)

NaCl	Range	0.00 to 1.00 pNaCl (58.4 to 5.84 g/L (ppt) NaCl)
	Resolution	0.01 pNaCl
	Accuracy (@25°C/77°F)	±0.02 pNaCl
Additional Specifications	Calibration	manual, one-point
	Battery Type / Life	1.5V (4) / approximately 500 hours of continuous use
	Environment	0 to 50°C (32 to 122°F); RH max 95%
	Dimensions	175 x 41 x 23 mm (6.9 x 1.6 x 0.9")
	Weight	95 g (3.4 oz.)
Ordering Information	HI98203 (SALINTEST) is supplied with protective cap, calibration screwdriver, batteries and instructions. SALINTEST is also supplied with a handy chart that converts readings into g/L of sodium chloride.	



# EC/TDS and Temperature Testers

- **Waterproof**
  - Waterproof and designed to float
- **ATC**
  - Automatic Temperature Compensation
- **HOLD feature**
  - HOLD button to freeze readings on the display
- **BEPS**
  - Alerts the user of low battery power that could adversely affect readings

When the original DiST® (Dissolved Solids Tester) was first introduced, conductivity (EC) and total dissolved solids (TDS) measurements became easy and affordable. The DiST's ease of use, in combination with its affordability, made it the standard in EC and TDS measurement. Hanna continues the standard in EC and TDS testing with the DiST®5 and DiST®6.

These testers include features such as: a replaceable graphite electrode, adjustable TDS ratio, °C or °F measurement, Automatic Temperature Compensation (ATC) with adjustable  $\beta$ , battery level indicator, stability indicator, automatic shut-off and automatic calibration.

The graphite conductivity electrode offers greater accuracy by resisting contamination by salt deposits in the sample.

All of these features are packed in a floating, waterproof casing. These 3-in-1 testers are unmatched in EC/TDS and temperature measurements.



## Replaceable graphite electrode

An easy-to-replace graphite electrode with a sturdy, snap-in connector means there are no pins to bend or break.



Specifications		HI98311 (DiST®5)	HI98312 (DiST®6)
EC	Range	0 to 3999 $\mu$ S/cm	0.00 to 20.00 mS/cm
	Resolution	1 $\mu$ S/cm	0.01 mS/cm
	Accuracy	±2% F.S.	±2% F.S.
TDS	Range	0 to 2000 ppm (mg/L)	0.00 to 10.00 ppt (g/L)
	Resolution	1 ppm (mg/L)	0.01 ppt (g/L)
	Accuracy	±2% F.S.	±2% F.S.
Temperature	Range	0.0 to 60.0°C / 32.0 to 140.0°F	0.0 to 60.0°C / 32.0 to 140.0°F
	Resolution	0.1°C / 0.1°F	0.1°C / 0.1°F
	Accuracy	±0.5°C / ±1°F	±0.5°C / ±1°F
Additional Specifications	Calibration	automatic, one point at 1413 $\mu$ S/cm or 1382 ppm (mg/L)	automatic, one point at 12.88 mS/cm or 6.44 ppt (g/L)
	TDS Conversion Factor	adjustable from 0.45 to 1.00	
	Temperature Compensation	automatic, with $\beta$ adjustable from 0.0 to 2.4% / °C	
	Probe	HI73311 replaceable EC/TDS graphite electrode (included)	
	Environment	0 to 50°C (32 to 122°F); RH max 100%	
	Battery Type / Life	1.5V (4) / approx. 100 hours of continuous use; auto-off after 8 minutes of non-use	
	Dimensions	163 x 40 x 26 mm (6.4 x 1.6 x 1.0")	
	Weight	100 g (3.5 oz.)	
Ordering Information	HI98311 (DiST®5) and HI98312 (DiST®6) are supplied with HI73311 EC/TDS probe, HI73128 probe removal tool, batteries and instructions.		

# GroLine

114 mm (4.5") stainless steel penetration probe



HI98331 Soil Test™

## GroLine Soil Test

Direct Soil EC and Temperature Meter with Built-in Stainless Steel EC Probe

- One-point calibration
- Automatic calibration to 1413  $\mu\text{S}/\text{cm}$  conductivity standard
- Automatic Temperature Compensation (ATC)
- Samples automatically compensated for temperature variations
- Uses a fixed 2%/ $^{\circ}\text{C}$  temperature correction coefficient
- Stainless steel penetration electrode
- Allows for direct measurement in soil

The Soil Test™ Direct Soil EC Tester is a rugged and reliable pocket-sized tester that offers quick and accurate readings. The Soil Test™ features a stainless steel penetration probe for direct measurement of conductivity in soils. With a compact size, single button operation, and automatic calibration, Soil Test is an excellent choice for taking direct conductivity measurements in soil.



### Battery compartment

An easily removable cover provides access to the battery compartment.



Supplied in a carrying case with probe sleeve

### Specifications

### HI98331 Soil Test™

EC	Range	0 to 4000 $\mu\text{S}/\text{cm}$ 0.00 to 4.00 mS/cm (dS/m)
	Resolution	1 $\mu\text{S}/\text{cm}$ 0.01 mS/cm (dS/m)
	Accuracy (@25°C/77°F)	±50 $\mu\text{S}/\text{cm}$ (0 to 2000 $\mu\text{S}/\text{cm}$ ) ±300 $\mu\text{S}/\text{cm}$ (2000 to 4000 $\mu\text{S}/\text{cm}$ ) ±0.05 mS/cm (0.00 to 2.00 mS/cm) ±0.30 mS/cm (2.00 to 4.00 mS/cm)
	Calibration	automatic, one-point (1.41 mS/cm)
Temperature	Range	0.0 to 50.0°C (32.0 to 122.0°F)
	Resolution	0.1°C (0.1°F)
	Accuracy (@25°C/77°F)	±1°C (±1.5°F)
Additional Specifications	Temperature Compensation	Automatic, with coefficient ( $\beta$ ) fixed @ 2%/ $^{\circ}\text{C}$
	Probe	114 mm (4.5") stainless steel penetration (fixed)
	Battery Type / Life	CR2032 Li-ion (included) / approx. 100 hours of continuous use
	Auto-off	8 minutes, 60 minutes, or can be disabled
	Environment	0 to 50°C (32 to 122°F); RH 95% max
	Dimensions	50 x 196 x 21 mm (2.0 x 7.7 x 0.9")
	Weight	74 g (2.4 oz.)
Ordering Information	HI98331 (Soil Test) is supplied with HI73331 penetration conductivity probe, calibration screwdriver, batteries and instructions.	

DiST®: HI98301 · HI98302 · HI98303

HI98304

## EC and TDS Testers

- Waterproof
- Automatic temperature compensation (ATC)
- Automatic one-point calibration
- Measurement stability indicator
- Temperature measurement

The DiST® family of testers is widely used for monitoring EC/TDS in drinking water, water conditioning, reverse osmosis, cooling towers, wastewater, laboratories, agriculture, aquaculture and aquariums, hydroponics and the printing industry.

These testers feature an amperometric graphite electrode that provides improved repeatability in measurements, since they do not oxidize. An amperometric measurement of EC/TDS is based on Ohm's Law,  $I = V/R$ , where  $R$  depends on the distance between two pins and their surface. Oxidation changes both the distance and surface, which will directly affect accuracy. DiST® non-oxidizing graphite pins are able to provide an optimal surface for accurate, dependable results.

When calibration is needed, simply submerge the electrode tip into calibration solution and the meter will auto calibrate.



### Exposed temperature sensor

These testers feature exposed temperature sensors for faster response times.



### Watertight seal

An easily removable cover provides access to the battery compartment.



Specifications		HI98301 (DiST®1)	HI98302 (DiST®2)	HI98303 (DiST®3)	HI98304 (DiST®4)
TDS	Range	0 to 2000 ppm (mg/L)	0.00 to 10.00 ppt (g/L)	–	–
	Resolution	1 ppm (mg/L)	0.01 ppt (g/L)	–	–
	Accuracy (@25°C/77°F)	±2% F.S.	–	–	–
	TDS Factor	0.5	0.5	–	–
EC	Range	–	–	0 to 2000 µS/cm	0.00 to 20.00 mS/cm
	Resolution	–	–	1 µS/cm	0.01 mS/cm
	Accuracy (@25°C/77°F)	–	–	±2% F.S.	–
	–	–	–	–	–
Temperature	Range	0.0 to 50.0°C/32.0 to 122.0°F	–	–	–
	Resolution	0.1°C / 0.1°F	–	–	–
	Accuracy (@25°C/77°F)	±0.5°C / ±1.0°F	–	–	–
	–	–	–	–	–
Additional Specifications	Calibration Solution	HI70032: 1382 ppm	HI70038: 6.44 ppt	HI70031: 1413 mS/cm	HI70030: 12.88 mS/cm
	Calibration	automatic, one-point	–	–	–
	Temperature Compensation	automatic from 0 to 50°C (32 to 122°F)	–	–	–
	Battery Type / Life	CR2032 3V Li-ion / approx. 250 hours of continuous use	–	–	–
	Environment	0 to 50°C (32 to 122°F); RH 100% max	–	–	–
	Dimensions	160 x 40 x 17 mm (6.3 x 1.6 x 0.7")	–	–	–
	Weight	75 g (2.6 oz)	–	–	–
HI98301 (DiST 1) is supplied with CR2032 battery, 1382 ppm calibration solution sachet (4), storage/protection sleeve, instruction manual and quality certificate.					
HI98302 (DiST 2) is supplied with CR2032 battery, 6.44 ppt calibration solution sachet (4), storage/protection sleeve, instruction manual and quality certificate.					
HI98303 (DiST 3) is supplied with CR2032 battery, 1413 µS/cm calibration solution sachet (4), storage/protection sleeve, instruction manual and quality certificate.					
HI98304 (DiST 4) is supplied with CR2032 battery, 12.88 mS/cm calibration solution sachet (4), storage/protection sleeve, instruction manual and quality certificate.					
Ordering Information					



GroLine



HI98318

## GroLine EC/TDS Tester

- Waterproof
- Automatic temperature compensation (ATC)
- Automatic one-point EC calibration
- Measurement stability indicator

The GroLine waterproof EC/TDS tester is ideal for hydroponics, greenhouses, or anywhere you need quick and accurate conductivity measurements.



### Exposed temperature sensor

HI98318 features an exposed temperature sensor for faster response times.



### Watertight seal

An easily removable cover provides access to the battery compartment.



Supplied in a carrying case with calibration solutions.

### Specifications

	HI98318
EC/TDS	Range 0.00 to 6.00 mS/cm; 0 to 3000 ppm (0.5); 0 to 4000 ppm (0.7)
	Resolution 0.01 mS/cm; 10 ppm (0.5); 10 ppm (0.7)
	Accuracy (@25°C/77°F) $\pm 2\%$ F.S.
	Calibration automatic, one-point (1.41 mS)
	Quick Calibration one-point calibration using HI5036 or HI50036P Quick Cal calibration solution
	TDS Conversion Factor (CF)* 0.5 (500 ppm) or 0.7 (700 ppm)
Temperature	Range 0.0 to 50.0°C/32.0 to 122.0°F
	Resolution 0.1°C/0.1°F
	Accuracy (@25°C/77°F) $\pm 0.5\%$ F.S.
Additional Specifications	Temperature Compensation automatic, 0.0 to 50.0°C (32 to 122°F)
	Battery Type / Life CR2032 Li-ion (Included) / approx. 250 hours of continuous use
	Auto-off 8 minutes, 60 minutes, or can be disabled
	Environment 0 to 50°C (32 to 122°F); RH 100% max
	Dimensions 160 x 40 x 17 mm (6.3 x 1.6 x 0.7")
	Weight 75 g (2.6 oz)
Ordering Information	HI98318 GroLine EC/TDS tester is supplied with Quick Cal calibration sachets (4), battery, storage cap, instruction manual and quality certificate.

# EC/TDS Testers

- Single point automatic calibration
- Automatic temperature compensation (ATC)

The Primo series of testers provide a fast and dependable way to measure the total dissolved solids or conductivity in your water samples. It is ideally suited for the rigorous demands of water quality professionals. These meters feature Automatic Temperature Compensation (ATC) and automatic single point calibration.

Primo TDS tester is a rugged and reliable pocket-sized tester that offers quick and accurate readings. Primo is used for testing total dissolved solids (TDS) in applications such as hydroponics, drinking water, reverse osmosis systems, and aquariums.

Primo 5 EC tester is a rugged and reliable pocket-sized tester that offers quick and accurate readings. Primo 5 is used for testing low range conductivity (EC) in applications such as hydroponics, drinking water, reverse osmosis systems, boilers and cooling towers, and aquariums.

Primo 4 EC tester is a rugged and reliable pocket-sized tester with a 1 m (3.3') cable probe connection that offers quick and accurate conductivity reading (EC) in the 0.00 to 10.00 mS/cm range. Perfect for applications such as hydroponics, drinking water and aquariums.



	Specifications	Primo	Primo 5	Primo 4
TDS	Range	0 to 1999 ppm (mg/L)	-	-
	Resolution	1 ppm (mg/L)	-	-
	Accuracy (@25°C/77°F)	±2% F.S.	-	-
EC	Range	-	0 to 1999 µS/cm	0.00 to 10.00 mS/cm
	Resolution	-	1 µS/cm	0.01 mS/cm
	Accuracy (@25°C/77°F)	-	±2% F.S.	±2% F.S.
Additional Specifications	Calibration	automatic, at 1382 ppm (mg/L)	automatic, at 1413 µS/cm	automatic, at 5.00 mS/cm
	Probe Connection	direct	direct	1 m (3.3') cable
	Dimensions	180 x 50 x 25 mm (7.1 x 2.0 x 1.0")	180 x 50 x 25 mm (7.1 x 2.0 x 1.0")	66 x 50 x 25 mm (2.6 x 2.0 x 1.0")
	Weight	50 g (1.8 oz.)	50 g (1.8 oz.)	115 g (4.1 oz.)
	Temperature Compensation	automatic from 0 to 60°C (32 to 140°F), $\beta=2\%/\text{°C}$		
	Battery Type / Life	1.5V (2) / approximately 200 hours of continuous use; auto-off after 5 minutes of non-use		
	Environment	0 to 50°C (32 to 122°F); RH max 95%		
	Ordering Information	Primo and Primo 5 are supplied with batteries and instructions. Primo 4 with 1 m (3.3') cable probe connection are supplied with batteries and instructions.		



HI98308 · HI98309

## Water Purity Testers

The HI98308 and HI98309 use a conductometric measurement to determine the purity of water.

The HI98308 Pure Water Test (PWT) enables users to check the purity of distilled or demineralized water in laboratory or industrial environments.

The HI98309 Ultra Pure Water (UPW) is an ideal tester for high purity water, which has less conductivity.

PWT is suited for fields such as printed circuit board washing, laundry, steam cleaning, checking car battery water and all areas where distilled, demineralized or pure water is used.

UPW is the first pure water tester to measure in 1/1000ths of micro-Siemens ( $\mu$ S) and provides fast spot checks for minute traces of water contamination.

These testers are housed in durable casing that provides excellent protection against harsh industrial environments.

Specifications	HI98308 (PWT)	HI98309 (UPW)
EC	Range	0.0 to 99.9 $\mu$ S/cm
	Resolution	0.1 $\mu$ S/cm
	Accuracy	$\pm 2\%$ F.S.
Additional Specifications	Calibration	manual, one point
	Temperature Compensation	automatic from 0 to 50°C (32 to 122°F) with $\beta=2\%/\text{°C}$ typical
	Battery Type / Life	1.5V (4) / approximately 250 hours of continuous use
	Environment	0 to 50°C (32 to 122°F); RH max 95% non condensing
	Dimensions	175 x 41 x 23 mm (6.9 x 1.6 x 0.9")
	Weight	95 g (3.4 oz.)
Ordering Information	HI98308 (PWT) and HI98309 (UPW) are supplied with protective cap, calibration screwdriver (HI98308 only), batteries and instructions.	

# Digital Thermometer

with Stainless Steel Penetration Probe

- **Large display**
  - The large display features a wide temperature range and optimal viewing angle.
- **IP65 water resistant protection**
- **HACCP**
  - Use as a tool for control in HACCP analysis
- **AISI 316 stainless steel penetration probe**

The Checktemp delivers high accuracy temperature measurements over a wide range without concern for breakage or condensation.

The Checktemp offers no breakage, no waste, no injuries and no difficulty in reading; the digital display prevents a parallax error (observing the wrong measurement due to the angle of view) and is optimized for a wide range of environmental temperatures.

Checktemp is provided with Hanna's unique CAL Check™ function for accurate measurements every time. The Checktemp® implements a CAL Check upon startup and reports the status as "-0-" or "Err".

The sharp-tip probe of the Checktemp® easily penetrates semi-solid products making routine temperature checks simple and quick for both incoming and outgoing goods. Checktemp is the ideal instrument for measuring temperature according to HACCP requirements.



Select between °C or °F measurement in one tester



Specifications	°C	°F
Range	-50.0 to 150.0°C	-58.0 to 302°F
Resolution	0.1°C (-50.0 to 150.0°C)	0.1°F (-58.0 to 199.9°F); 1°F (above 200°F)
Accuracy	±0.2°C (-30 to 120°C) ±0.3°C (outside: -50.0 to -30.0°C and 120.0 to 150.0°C)	±0.5°F (-22 to 199.9°F) ±1°F (outside: -58.0 to -22.0°F and 200 to 302°F)
Probe	fixed, stainless steel probe; 106 x Ø 3.6 mm (penetration)	
Battery Type / Life	CR2032 Li-ion / approximately 2000 hours of continuous use	
Auto Off	8 min (default), 60 min or OFF	
Environment	-30 to 50°C (-22 to 122°F); IP65	
Dimensions	50 x 185 x 21 mm (2 x 7.3 x 0.9")	
Weight	50 g (1.8 oz.)	
Ordering Information	<b>HI98501</b> (Checktemp®) is supplied with penetration probe, protective cap, battery and instructions.	



### CAL Check™

Automatically verifies calibration at startup and alerts the user of the calibration status.



### Save battery life with auto-off feature

With the auto-off feature, select from 8 min., 60 min., or disable the feature.

### Easy battery change

Easily replace the battery with a twist-off cover.



### Protective probe sleeve included

Protects the probe when not in use.

HI98509 Checktemp®1

# Digital Thermometer

with Stainless Steel Probe Attached to  
a 3.3' Silicone Cable

- Battery life up to two years
  - With the Auto-Off feature, select from 8 min., 60 min., or disable the feature
- HACCP
  - Use as a tool for control in HACCP analysis
- Large display
  - The large display features a wide temperature range and viewing angle
- IP65 water resistant protection
- Silicone probe cable
  - 3.3' silicone cable maintains flexibility and performance in applications where temperatures are widely variable
- AISI 316 stainless steel penetration probe

Checktemp 1 is a high-accuracy thermometer with a 1 m (3.3') flexible, silicone cable connecting the meter and the AISI 316 stainless steel probe. This probe is in compliance with food regulations, making it an ideal instrument for measuring temperature according to HACCP requirements. The sharp-tip penetration probe easily lances semi-solid products such as fruits, vegetables, and cheeses. This probe can also handle measurements in liquid, air and frozen materials. The probe incorporates an NTC thermistor sensor to measure the temperature. Thermistors make it possible to obtain extremely high accuracy in a very short period of time.

The Hanna CAL Check feature has been incorporated into the Checktemp 1 for reliable and accurate measurements. CAL Check automatically runs a self-check diagnostic upon startup and reports status back to the user.



Select between °C or °F  
measurement in one tester



## CAL Check™

Automatically verifies calibration at startup and alerts the user of the calibration status.

Specifications	°C	°F
Range	-50.0 to 150.0°C	-58.0 to 302°F
Resolution	0.1°C (-50.0 to 150°C)	0.1°F (-58.0 to 199.9°F); 1°F (above 200°F)
Accuracy	±0.2°C (-30 to 120.0°C) ±0.3°C (outside: -50.0 to -30.0°C and 120.0 to 150.0°C)	±0.5°F (-22.0 to 199.9°F) ±1°F (outside: -58.0 to -22.0°F and 200 to 302°F)
Probe	stainless steel probe with 1 m (3.3') silicone cable; 97.3 x dia 3.5 mm (3.8 x dia 0.14")	
Battery Type / Life	3 x 1.5V AAA / approximately 2 years of use	
Auto Off	8 min (default), 60 min or OFF	
Environment	-30 to 50°C (-4 to 122°F); IP65	
Dimensions	107 x 59 x 17 mm (4.2 x 5.3 x .65")	
Weight	130 g (4.6 oz.)	
Ordering Information	HI98509 (Checktemp 1) is supplied with penetration probe, batteries, stand and instructions.	

HI98539 Checktemp®Dip

# Digital Thermometer

with Weighted Stainless Steel Probe  
Attached to a 9.9' Silicone Cable



- **Battery life up to two years**

- With the Auto-Off feature, select from 8 min., 60 min., or disable the feature

- **HACCP**

- Use as a tool for control in HACCP analysis

- **Large display**

- The large display features a wide temperature range and viewing angle

- **IP65 water resistant protection**

- **Silicone probe cable**

- 3.3' silicone cable maintains flexibility and performance in applications where temperatures are widely variable

- **AISI 316 stainless steel weighted probe**

Checktemp Dip is a high-accuracy thermometer with a 3 m (9.9') flexible, silicone cable connecting the meter and the AISI 316 stainless steel weighted probe. This probe is in compliance with food regulations, making it an ideal instrument for measuring temperature in food applications such as wine casks and milk tanks. The probe incorporates an NTC thermistor sensor to measure the temperature. Thermistors make it possible to obtain extremely high accuracy in a very short period of time.

Checktemp Dip can also be used for applications such as fish farms, water reservoirs and pools where the operator can simply stand on the edge of the water and dip the probe in.

The Hanna CAL Check feature has been incorporated into the Checktemp Dip for reliable and accurate measurements. CAL Check automatically runs a self-check diagnostic upon startup and reports status back to the user.



## CAL Check™

Automatically verifies calibration at startup and alerts the user of the calibration status.

Specifications	°C	°F
Range	-20.0 to 80.0°C	-4.0 to 176.0°F
Resolution	0.1°C	0.1°F
Accuracy	±0.3°C	±0.5°F
Probe	weighted stainless steel probe with 3 m (9.9') silicone cable	
Battery Type / Life	3 x 1.5V AAA / approximately 2 years of use	
Auto Off	8 min (default), 60 min or OFF	
Environment	-30 to 50°C (-22 to 122°F); IP65	
Dimensions	107 x 59 x 17 mm (4.2 x 2.3 x 0.7")	
Weight	109 g (3.8 oz.)	
Ordering Information	HI98539 (Checktemp®Dip) is supplied with stainless steel weighted probe, stand, batteries and instructions.	



Select between °C or °F measurement in one tester

# Folding Pocket Thermometer

- CAL Check™
  - Alerts users of calibration status

The folding Checktemp®4 provides practical temperature measurement for the food service industry.

Special attention was given to the ergonomic form of Checktemp 4. This thermometer fits comfortably and securely in your hand while the LCD on the side of the handle remains easy to see and read. The fast-responding, fold-away probe is made of high quality stainless steel and can penetrate semi-frozen and semi-solid foods such as meats, ice cream and cheeses. When you are finished using your Checktemp 4, wipe the probe clean and fold it away. Checktemp 4 automatically turns off so you can safely carry it in your pocket.



## CAL Check

As you unfold the stainless steel probe, the Checktemp 4 automatically turns on and immediately performs a calibration test. This unique Hanna feature, CAL Check, provides the security of knowing you have accurate measurements. CAL Check also lets you know if your battery level is low or if your meter requires recalibration.



Turns on and off by opening and closing the probe

Specifications	HI151-00 (Checktemp 4C)	HI151-01 (Checktemp 4F)
Range	-50.0 to 220°C	-58.0 to 428°F
Resolution	0.1°C (-50.0 to 199.9°C); 1°C (200 to 220°C)	0.1°F (-58.0 to 199.9°F); 1°F (200 to 428°F)
Accuracy	±0.3°C ±1 digit (-20.0 to 90.0°C); ±1% F.S. ±1 digit (outside)	±0.5°F ±1 digit (-4.0 to 194.0°F); ±1% F.S. ±1 digit (outside)
CAL Check	automatic, at start-up	
Probe	stainless steel probe with penetration tip; 117 x dia 3.5 mm (4.6 x dia 0.14")	
Battery Type / Life	1.5V AA / approx. 25,000 hours of continuous use; auto-off after 8 minutes of non-use	
Environment	0 to 50°C (32 to 122°F); RH max 95%	
Dimensions	165 x 50 x 20 mm (6.5 x 2.0 x 0.8")	
Weight	100 g (3.5 oz.)	
Ordering Information	HI151-00 (Checktemp 4 C) is supplied complete with battery and instructions HI151-01 (Checktemp 4 F) is supplied complete with battery and instructions	

HI145

## T-Shaped Thermometer

- **CAL Check™**
  - Alerts users of calibration status
- **HOLD Feature**
  - HOLD button to freeze readings on the display

HI145 thermometers were developed for HACCP programs that require high standards of performance with simplicity of use. The durable T-shaped handle fits comfortably in hand and is ideal for applications where applied force is necessary for insertion, such as with incoming meat inspection and semi-frozen foods. The LCD positioned on top of the meter allows for easy reading in cooking applications.

The HI145-00 and HI145-01 thermometers are equipped with a 125 mm (5") long AISI 316 stainless steel probe. The sharp conical tip provides fast response and improved accuracy over the entire range.

The HI145-20 and HI145-30 thermometers are supplied with a 300 mm (12") long stainless steel probe, ideal for monitoring hot liquids, such as in deep frying and soup preparation.

With an automatic CAL Check feature, the HI145 series performs a self-check of its calibration status and displays it on the LCD. This feature ensures accuracy, repeatability and confidence in readings.



Specifications	HI145-00	HI145-01	HI145-20	HI145-30
Range	-50.0 to 220°C	-58.0 to 428.0°F	-50.0 to 220°C	-58.0 to 428.0°F
Resolution	0.1°C (-50.0 to 199.9°C); 1°C (200 to 220°C)	0.1°F (-58.0 to 199.9°F); 1°F (200 to 428°F)	0.1°C (-50.0 to 199.9°C); 1°C (200 to 220°C)	0.1°F (-58.0 to 199.9°F); 1°F (200 to 428°F)
Accuracy	±0.3°C (-20 to 90°C); ±0.4% F.S. (outside)	±0.6°F (-4 to 194°F); ±0.4% F.S. (outside)	±0.3°C (-20 to 90°C) ±0.4% F.S. (outside)	±0.6°F (-4 to 194°F); ±0.4% F.S. (outside)
Probe	stainless steel probe; 125 mm x dia 5 mm (4.9 x dia 0.2")		stainless steel probe; 300 mm x dia 5 mm (11.8 x dia 0.2")	
Battery Type / Life	1.5V AAA / approximately 10,000 hours of continuous use; auto-off after 8 minutes of non-use			
Environment	-10 to 50°C (14 to 122°F); RH max 95%		-10 to 50°C (14 to 122°F); RH max 95%	
Dimensions	92 x 165 x 38 mm (3.6 x 6.5 x 1.5")		92 x 340 x 38 mm (3.6 x 13.4 x 1.5")	
Weight	65 g (2.3 oz.)		80 g (2.8 oz.)	
Ordering Information	All models of the HI145 series are supplied complete with battery and instructions. <b>HI145-00</b> with 125 mm probe, <b>HI145-01</b> with 125 mm probe, <b>HI145-20</b> with 300 mm probe; <b>HI145-30</b> with 300 mm probe			

HI98517 KEY °C

## KEY® Pocket Thermometer

- Ideal for spot measurements
- Four interchangeable stainless steel probes available

The KEY is a pocket thermometer with an interchangeable probe for quick spot measurements. With a response time of less than 20 seconds in water, KEY is ideal for quality control and industrial temperature monitoring.

Four interchangeable temperature probes are available to meet specific requirements. Each probe is constructed out of rugged AISI 316 stainless steel, which resists the harmful effects of chemicals and humidity.

The HI98517-13 probe is for penetration and is included with the meter, providing a fast response typical of a thermocouple probe. The HI98517-15 and HI98517-30 probes are for general liquid monitoring, while the HI98517-12 is a surface probe made for machine shops, molding facilities and welding surfaces.

### 4 probes available:

**HI98517-13**

*penetration/general purpose*

K-type thermocouple probe supplied with KEY®. Application: liquid, air/gas, penetration of semi-solids.



**HI98517-15 and HI98517-30**

*liquid/general purpose*

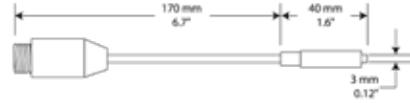
K-type thermocouple probe for KEY®. Application: liquids, air/gas.



**HI98517-12**

*surface*

K-type thermocouple probe for KEY®. Application: solids, plates, furnaces, molds.



### Specifications

### HI98517 (KEY C)

Range	-40 to 550°C
Resolution	1°C
Accuracy	±2°C
Response Time	approximately 20 seconds in water with HI98517-13 probe (included)
Battery Type / Life	1.5V (4) / approximately 700 hours of continuous use
Environment	0 to 50°C (32 to 122°F); RH max 95%
Dimensions (meter only)	175 x 41 x 23 mm (6.2 x 1.4 x 0.8")
Weight	78 g (3.0 oz.)
<b>Ordering Information</b>	<b>HI98517</b> (KEY C) is supplied with HI 98517-13 probe, batteries and instructions.



HI991404 · HI991405

## pH/EC/TDS and Temperature Monitors

- HOLD button to freeze readings on the display
- Waterproof
- Automatic temperature compensation (ATC)

These monitors continuously monitor the three most crucial nutrient parameters in hydroponic, greenhouse and horticultural applications: pH, EC/TDS and temperature.

At startup, these indicators perform a self-check to assure proper working condition. The stability indicator and HOLD function lets the user know when to take readings and freezes the reading on display for easy and accurate recording.

These instruments are supplied with a non-clogging double junction pH electrode, as well as a rugged conductivity probe that will withstand even the most aggressive environments. The 12 VDC adapter makes these instruments ideal for all continuous monitoring applications.



### Specifications

	HI991404	HI991405
pH	Range	0.0 to 14.0 pH
	Resolution	0.1 pH
	Accuracy	±0.1 pH
EC	Range	0 to 3999 µS/cm
	Resolution	1 µS/cm
	Accuracy	±2% F.S.
TDS	Range	0 to 2000 mg/L (ppm)
	Resolution	1 mg/L (ppm)
	Accuracy	±2% F.S.
Temperature	Range	0.0 to 60.0°C / 32.0 to 122.0°F
	Resolution	0.1°C (0.1°F)
	Accuracy	±0.5°C (±1°F)
Additional Specifications	Temperature Compensation	pH: automatic; EC/TDS: automatic with β adjustable from 0.0 to 2.4%/°C
	pH Calibration	pH: automatic, one or two-point with auto-buffer recognition
	EC/TDS Calibration	automatic, one-point at 1413 µS/cm or 1382 ppm
	pH Electrode	HI1293 PEI body, pre-amplified pH electrode with 1/2" NPT pipe thread, DIN connector and 2 m (6.6') cable (included);
	EC/TDS Probe	HI7630 conductivity probe with 1/2" NPT pipe thread and 2 m (6.6') cable (fixed)
	TDS Conversion Factor	adjustable from 0.45 to 1.00
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Input Impedance	10 <sup>12</sup> Ohm
	Power Supply	12 VDC adapter (included)
	Dimensions / Weight (meter only)	160 x 105 x 31 mm (6.2 x 4.1 x 1.2) / 190 g (6.7 oz.)
Ordering Information	<b>HI991404-01</b> (Combo Gro'Chek) (115V) and <b>HI991404-02</b> (Combo Gro'Chek) (230V) is supplied with HI1293D pH electrode, HI7630 EC probe (fixed), HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI70031 1413 µS/cm calibration solution sachet, 12 VDC adapter and instructions.	
	<b>HI991405-01</b> (Combo Gro'Chek) (115V) and <b>HI991405-02</b> (Combo Gro'Chek) (230V) is supplied with HI1293D pH electrode, HI7630 EC probe (fixed), HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI70030 1288 mS/cm calibration solution sachet, 12 VDC adapter and instructions.	

pH solutions begin on page 2.142; EC and TDS solutions begin on page 5.34;  
see pH electrode specifications on page 1.52

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# GroLine Hydroponics Monitor



## GroLine

### 24/7 Monitoring.

The HI981420 GroLine Monitor provides 24 hour continuous monitoring of pH, conductivity (EC or TDS), and temperature in hydroponic nutrients. Quick to setup and simple to use, this monitor was designed with Hydroponics, Aquaponics, and Greenhouses in mind. Make your nutrient solution easy to manage with the GroLine Monitor and combined pH/EC/Temperature probe.

### Instantly See All Measurements.

The versatile display of the GroLine Monitor allows for three screen modes. The LCD can display all three essential hydroponic nutrients measurements at one time, a 3-second cycle of single measurements, or a real-time graph screen with options for measurement selection and log recall.

### Monitor Changes Over Time.

Fluctuations in your hydroponic nutrient solution can have lasting effects on your plants. The GroLine Monitor automatically logs every 15 minutes for the last 30 days, and stores min, max, and average values so you can recognize when patterns arise and help prevent future problems. For review and storage, use the USB-C to easily transfer data to a flash drive or PC using a cable. Files are exported as .csv.

### Grow With Confidence.

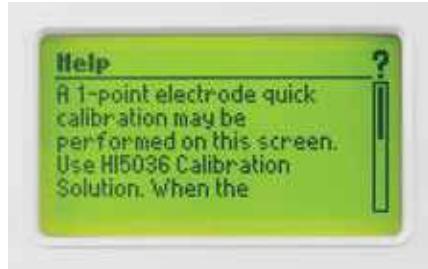
The GroLine Monitor frees up your time by doing the testing for you. Simply set high and low alarm levels - if your hydroponic nutrient solution moves out of range a measurement error will display. A quick look at the large display will let you know if your nutrient solution needs adjusting.

## Features

- 3 sensors combined in a single rugged probe body
- pH electrode with renewable cloth junction, amperometric EC/TDS sensor, and an internal temperature sensor for temperature compensated readings
- IP65 rated enclosure designed to withstand harsh growing environments

- Selectable EC to TDS conversion factor: choice of either a 0.5 or 0.7 conversion factor
- Automatic Temperature Compensation
  - All readings are compensated for variations in temperature.
  - Temperature displayed in °C or °F along with pH, EC or TDS reading
- Large LCD with plant-friendly green backlighting
- Ambient light sensor for automatic LCD dimming
- Calibration reminder
- Data logging for 30 days
  - Logs every 15 minutes for last 30 days, stores min, max, and average values

## On-Screen Features



### On-screen Help

Context sensitive help is available at the push of a button.

### High and Low Alarms

High and Low alarms for pH, EC/TDS and Temperature. Warns when process is out of desired range by flashing display and message

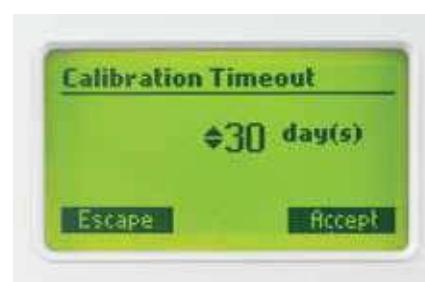


### Menu

Easy to navigate menu system to access calibration, GLP, and meter setup.

### Data Viewing

30 day and 24 hour summary screens can be viewed in plot or detail views. Real-time data can be viewed in plot view.



### Data Transfer

Data transfer: USB-C port for easy data transfer to memory stick or PC

### Calibration Timeout

Set a reminder to calibrate your probe. Reminder can be set from 1 to 30 days

### GLP

The HI981420 can store calibration info from the last 5 pH and EC calibrations.



## Quick Cal

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.



### Simpler with a combination probe

The HI1285-8 is a 3-in-1 pre-amplified combination probe. This probe is built to be durable, with an extendable cloth pH junction and two graphite sensors for reliable conductivity readings. A built-in temperature sensor ensures fast, accurately compensated readings even during sudden temperature fluctuations.



## Supplied Complete

HI981420 GroLine Monitor is supplied with all the tools necessary so you can start monitoring right away.

Specifications	HI981420
pH	Range* 0.0 to 14.00 pH; 0.0 to 14.0 pH
	Resolution 0.01 pH; 0.1 pH
	Accuracy $\pm 0.05$ pH, $\pm 0.1$ pH
	Calibration one or two-point calibration (using pH 4.01, 7.01, 10.01 buffers) (using auto buffer recognition); one-point calibration using quick calibration solution
	Temperature Compensation automatic from 0.0 to 60.0°C (32.0 to 140.0°F)
EC	Range 0.0 to 10.00 mS/cm
	Resolution 0.01 mS/cm
	Accuracy $\pm 0.1$ mS/cm from 0.00 to 5.00 mS; $\pm 0.2$ mS/cm from 5.00 to 10.00 mS/cm)
	Calibration one-point at 1.41 mS/cm or 5.00 mS/cm (using auto standard recognition); one-point calibration using quick calibration solution
	Temperature Compensation automatic with $\beta$ set at 1.9%/°C
TDS	Range 0 to 5000 ppm (0.5 CF); 0 to 7000 ppm (0.7 CF)
	Resolution 10 ppm (mg/L)
	Accuracy $\pm 2\%$ FS
	Calibration via EC calibration
	Conversion Factor (CF)** 0.5 (500 ppm) or 0.7 (700 ppm)
Temperature	Range 0.0 to 60.0°C/32.0 to 140.0°F
	Resolution 0.1°C/0.1°F
	Accuracy $\pm 0.5$ °C/ $\pm 1$ °F
Additional Specifications	Probe HI1285-8 pH/EC/TDS/temperature polypropylene body, pre-amplified multiparameter probe with internal temperature sensor, DIN connector and 2 m (6.6') cable.
	Connectivity USB Type-C
	Data logging automatic Logging for 30 days with 15 minute intervals; min/max/average
	Data export .CSV format; via USB-C drive or PC using USB-C connection
	Display 128 x 64 pixel B/W LCD with green backlight, Automatic backlight dimming using ambient light sensor.
	Alarms high and low with enable/disable option for all parameters.
	Power Supply 12VDC adapter (included)
	Environment 0 to 50 °C (32 to 122 °F), RH max 95% non-condensing, IP65
	Dimensions 125 x 185 x 38 mm (4.92 x 7.28 x 1.49")
	Weight 333g (11.7oz.)
Ordering Information	HI981420 is supplied with HI1285-8 multiparameter probe, Quick Cal buffer solution sachets (2), pH electrode cleaning solution sachet for agriculture (2), 12VDC power adapter, quality certificates and instruction manual.

\* The sensor is rated 0 to 13 pH and 0 to 50°

\*\*1000  $\mu$ S/cm = 500 ppm with 0.5 CF

pH solutions begin on page 2.142; Quick Cal solutions begin on page 2.149;  
EC and TDS solutions begin on page 5.34; see pH electrode specifications on page 1.52

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# pH/TDS and Temperature Monitor

- Backlit, graphic LCD display
- Automatic temperature compensation (ATC)

Set-up for the HI981504 is simple; install the HI981504 near the sample to be tested, plug the indicator in, and immerse the probes. pH, TDS and temperature measurements will be simultaneously displayed on three backlit LCDs.

Users can easily select the temperature unit (°C or °F) on the back panel.

The HI1286 gel-filled pH electrode is provided with a waterproof sleeve to protect the BNC connector. The unique design of the electrode provides longer life in aggressive solutions. The HI7634 TDS probe is easy to clean and requires little maintenance. Measurements are accurate and the meter can be calibrated at one or two points for pH and at a single point for TDS. Temperature is factory-calibrated.



**HI981504/5 · HI981504/7**

Specifications	
pH	Range 0.0 to 14.0
	Resolution 0.1
	Accuracy $\pm 0.2$
TDS	Range 0 to 1990 ppm
	Resolution 10 ppm
	Accuracy $\pm 2\%$ F.S
Temperature	Range -10.0 to 60.0°C or -14.0 to 140.0°F
	Resolution 0.1°C or 0.1°F
	Accuracy $\pm 0.3^\circ\text{C}$ or $\pm 0.5^\circ\text{F}$
Additional Specifications	pH Calibration manual, two-point through trimmers
	TDS Calibration manual, one-point through trimmer
	TDS Factor HI981504/5: 0.5; HI981504/7: 0.7
	Probes pH: HI1286 PEI body pH electrode with 2 m (6.6') cable (included); TDS: HI7634 TDS probe (fixed); temperature: stainless steel with 2 m cable (fixed)
	Temperature Compensation automatic from 5 to 50°C (41 to 122°F), for TDS readings only
	Power Supply 12 VDC adapter (included)
	Environment 0 to 50°C (32 to 122°F); 95% RH
	Dimensions/Weight 160 x 110 x 35 mm (6.3 x 4.3 x 1.4")/560 g (1.2 lbs.)
HI981504/5-1 (115V) and HI981504/5-2 (230V) are supplied with HI1286 pH electrode, HI7634 TDS probe (fixed), temperature probe (fixed), HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI70032 1382 ppm calibration solution sachet, HI700661 electrode cleaning solution sachet (2), screwdriver, 12 VDC adapter and instructions.	
HI981504/7-1 (115V) and HI981504/7-2 (230V) are supplied with HI1286 pH electrode, HI7634 TDS probe (fixed), temperature probe (fixed), HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI70442 1500 ppm calibration solution sachet, HI700661 electrode cleaning solution sachet (2), screwdriver, 12 VDC adapter and instructions.	
Ordering Information	



HI981404N · HI981405N

## pH/TDS or pH/EC Continuous Indicators

- Two parameters with a single instrument
- Advanced electrode technology
- Simple operation and maintenance
- Supplied complete and ready to use

The HI981404N and HI981405N are ideal for agricultural, horticultural and hydroponics applications where pH and TDS (HI981404N) or pH and EC (HI981405N) levels need to be monitored for optimal plant growth. These instruments continuously monitor and display the values of a solution on an easy-to-read set of LCDs.

The HI1286 gel filled pH electrode is replaceable and the BNC connector is protected behind a waterproof sleeve. The unique design of the electrode guarantees greater clogging resistance in fertilizer solutions with high concentrations of nutrients. TDS measurements are performed using the 4-4-2 conversion factor of 0.7 so you do not need to convert the readings.

Both models are equipped with a grounding bar to ensure highly accurate pH readings and longer electrode life.

The HI981404N and HI981405N are compact and easy to install, making them ideal for all continuous monitoring applications.

Specifications		HI981404N	HI981405N
pH	Range	0.0 to 14.0 pH	0.0 to 14.0 pH
	Resolution	0.1 pH	0.1 pH
	Accuracy (@25°C/77°F)	±0.2 pH	±0.2 pH
EC	Range	–	0.00 to 9.99 mS/cm
	Resolution	–	0.01 mS/cm
	Accuracy (@25°C/77°F)	–	±2% F.S.
TDS	Range	0 to 1990 mg/L (ppm)	–
	Resolution	10 mg/L (ppm)	–
	Accuracy (@25°C/77°F)	±2% F.S.	–
Calibration	Calibration	manual, one or two-point (pH); manual, one-point (TDS)	manual, one or two-point (pH); manual, one-point (EC)
Temperature Compensation	Temperature Compensation	automatic from 5 to 50°C (41 to 122°F) (TDS only)	automatic from 5 to 50°C (41 to 122°F) (EC only)
TDS Conversion Factor	TDS Conversion Factor	0.7 ppm = 1 µS/cm	–
Probes	Probes	HI1286 interchangeable pH electrode (included), HI7634 TDS probe (fixed), HI1283 grounding bar with 2 m (6.6') cable (included)	HI1286 interchangeable pH electrode (included), HI7632 EC probe (fixed), HI1283 grounding bar with 2 m (6.6') cable (included)
Power Supply	Power Supply	12 VDC adapter (included)	
Environment	Environment	0 to 50°C (32 to 122°F), RH 95%	
Dimensions	Dimensions	160 x 110 x 35 mm (6.5 x 4.3 x 1.4")	
Weight	Weight	300 g (10.6 oz.)	
Ordering Information	<b>HI981404N-01</b> (Gro'Chek Combo) (115V) and <b>HI981404N-02</b> (Gro'Chek Combo) (230V) are supplied complete with HI1286 pH electrode, HI7634 TDS probe, HI1283 grounding bar, calibration solutions, screwdriver for calibration, 12 VDC adapter and instructions.		
	<b>HI981405N-01</b> (Gro'Chek Combo) (115V) and <b>HI981405N-02</b> (Gro'Chek Combo) (230V) are supplied complete with HI1286 pH electrode, HI7632 EC probe, HI1283 grounding bar, calibration solutions, screwdriver for calibration, 12 VDC adapter and instructions.		

pH solutions begin on page 2.142; EC and TDS solutions begin on page 5.34;  
see pH electrode specifications on page 1.52

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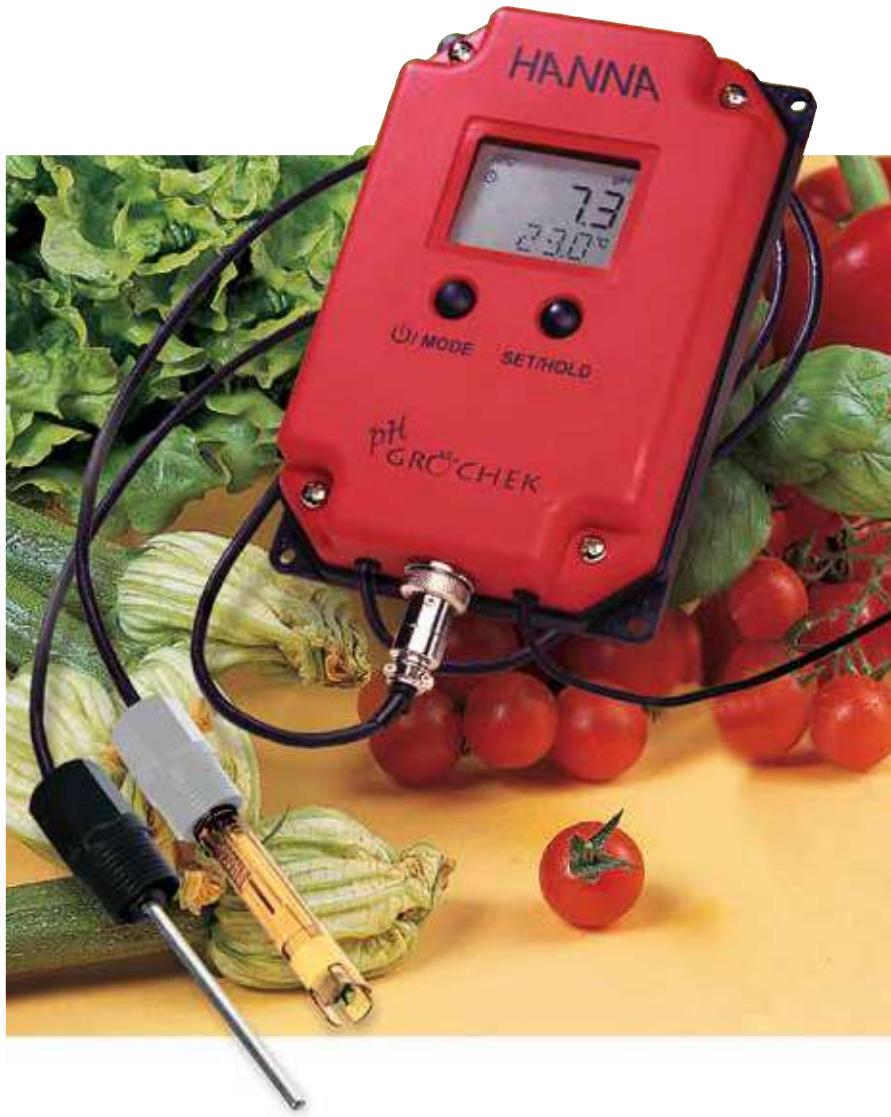
# pH and Temperature Monitor

- Automatic Temperature Compensation (ATC)
- HOLD button to freeze readings on the display
- Waterproof
- Backlit, graphic LCD display

This monitor from Hanna has a large backlit LCD to give users instantaneous readings of both pH and temperature that can be easily read in dim light. The HI991401 provides automatic calibration, automatic buffer selection and automatic temperature compensation.

The HI991401's waterproof housing has been designed to meet the grower's need for a monitor that is well-suited to the environments found in agricultural and hydroponics applications. Measurements are highly accurate and can be verified with one- or two-point calibrations. With a 12 VDC power supply included with the meter, low battery failures are never an issue.

The HI1293 pH electrode has been specially designed to address the needs of growers. Its design guarantees greater clogging resistance in fertilizer solutions with high concentrations of nutrients to ensure longer electrode life.



Specifications		HI991401 (pH Gro'Chek)
pH	Range	0.0 to 14.0 pH
	Resolution	0.1 pH
	Accuracy	±0.1 pH
Temperature	Range	0.0 to 60.0°C (32.0 to 140.0°F)
	Resolution	0.1°C (0.1°F)
	Accuracy	±0.5°C (±1°F)
Additional Specifications	Probes	HI1293 PEI body, pre-amplified pH electrode with 1/2" NPT pipe thread, DIN connector and 2 m (6.6') cable (included); HI1294 temperature probe with 1.2" NPT pipe thread and 2 m (6.6') cable (fixed)
	pH Calibration	automatic, one or two points with two sets of memorized buffers (pH 4.01/ 7.01/10.01 or pH 4.01/6.86/9.18)
	Input Impedance	10 <sup>12</sup> Ohm
	Power Supply	12 VDC adapter (included)
	Environment	0 to 50°C (32 to 122°F); RH max 95%
	Dimensions	160 x 105 x 31 mm (6.2 x 4.1 x 1.2")
	Weight	190 g (6.7 oz.) - meter only
Ordering Information	HI991401-01 (pH Gro'Chek) (115V) and HI991401-02 (pH Gro'Chek) (230V) are supplied with HI1293D pH electrode, HI1294 temperature probe (fixed), HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, 12 VDC power adapter and instructions.	



HI981401N (Gro'Chek pH)

## pH Monitor

- **Water resistant housing**

- The meter housing is rated IP54 meaning it has a high level of protection against particles and a fair amount of protection against water

- **One-point calibration**

- Calibrate to pH 7.01 and pH 4.01 solutions using a screwdriver

Engineered to withstand the aggressive environments in agricultural and hydroponic application, the HI981401N is a simple way to measure pH. You can simply hang the meter right above the sample to be tested for continuous measurement and the unit will run without interruption on 12 VDC power supply or take it with you for spot checks. The meter housing is rated IP54 meaning they have a high level of protection against particles and a fair amount of protection against water. The integrated large LCD allows for an easy reading from a distance.

The meters are supplied with a HI1286 pH probe with a PEI body and BNC connector. This double junction, gel-filled combination pH electrode has a unique PTFE sleeve to prevent particulates within a sample from clogging the junction. In addition to the specialized junction, the polyethylenimine (PEI) protective body protects against most aggressive chemicals as seen in fertilizer solutions with high concentrations of phosphate and nitrate.

Specifications	HI981401N
Range	0.0 to 14.0 pH
Resolution	0.1 pH
Accuracy (@25°C/77°F)	±0.2 pH
Calibration	manual, two-point, at pH 4 and 7
pH Electrode	HI1286 PEI body pH electrode with 2 m (6.6') cable (included); HI1283 stainless steel grounding bar with 2 m (6.6') cable (included)
Input Impedance	10 <sup>12</sup> Ohm
Power Supply	12 VDC power adapter (included)
Environment	0 to 50°C; RH max 100%
Dimensions	86 x 110 x 43 mm (3.4 x 4.3 x 1.7")
Weight	150 g (5.3 oz.)
Ordering Information	<b>HI981401N-01</b> (Gro'Chek pH) (115V) and <b>HI981401N-02</b> (Gro'Chek pH) (230V) are supplied with HI1286 pH electrode, HI1283 stainless steel grounding bar, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, calibration screwdriver, 12 VDC adapter and instructions.

HI981402 (Pronto pH)

# pH Monitor

- Waterproof
- LED indicators

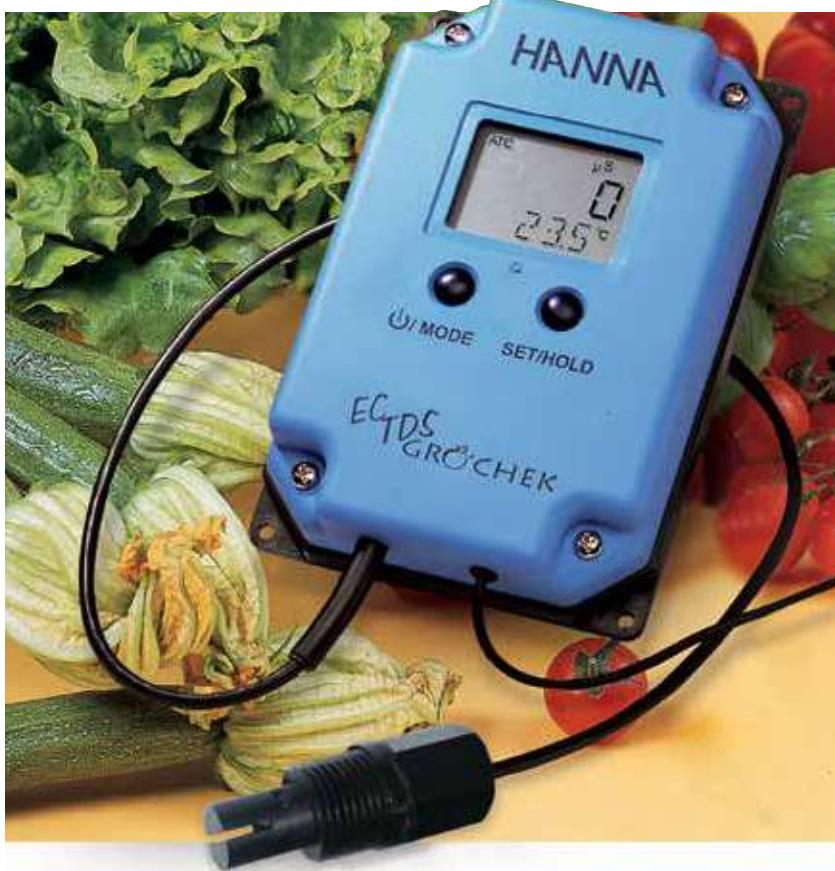
The HI981402 is a water-resistant pH meter with a built-in digital LCD. The meter is supplied with the HI1286 double junction, plastic bodied, gel-filled combination pH electrode with a flexible 2 m (6.6') cable. The electrode also has a unique clog-resistant PTFE junction that enhances both probe life and accuracy. The BNC connector is protected by a waterproof sleeve.

The alarm set point can be selected anywhere in the 3 to 11 pH range. A red LED warns the user in the event the reading is outside the setpoint by more than  $\pm 0.5$  pH. Calibration can be manually performed at two points through two easily accessible trimmers on the front of the unit.

The HI981402 is suited for outdoor installations and highly humid conditions. The molded eye allows the meter to be installed close to the sample and the 12 VDC power supply is ideal for continuous monitoring for extended periods of time.



Specifications	HI981402 (Pronto pH)
Range	0.0 to 14.0 pH
Resolution	0.1 pH
Accuracy (@25°C/77°F)	$\pm 0.2$ pH
Calibration	manual, one or two-point
Setpoint	adjustable from 3.0 to 11.0 pH
Alarm	red LED (blinks when pH reading differs from the setpoint more than $\pm 0.5$ pH)
pH Electrode	HI1286 PEI body pH electrode with 2 m (6.6') cable (included)
Input Impedance	$10^{12}$ Ohm
Power Supply	12 VDC adapter (included)
Environment	0 to 50°C (32 to 122°F); RH max 100%
Dimensions	86 x 110 x 43 mm (3.4 x 4.3 x 1.7")
Weight	150 g (5.3 oz.)
Ordering Information	HI981402-01 (Pronto pH) (115V) and HI981402-02 (Pronto pH) (230V) is supplied with HI1286 pH electrode, calibration screwdriver, 12 VDC power adapter and instructions.



HI993301 · HI993302

## EC/TDS and Temperature Monitors

- HOLD button to freeze readings on the display
- Waterproof
- Backlit, graphic LCD display

Waterproof and chemically resistant, the HI993301 and HI993302 monitors have been designed to meet the grower's need for equipment suited to the environments found in agricultural and hydroponics applications. At startup, the HI993301 and HI993302 perform a self-check to ensure proper working condition.

These indicators from Hanna have backlit LCDs and display instantaneous readings of both EC or TDS and temperature.

These instruments feature a stability indicator that prompts the user when to take the reading. For manual recording purposes, readings can be frozen on the LCD display by pressing the HOLD button.

Calibration and temperature compensation are automatic, while the EC/TDS conversion factor and temperature coefficient ( $\beta$ ) are user-adjustable for application-specific measurements.

Specifications		HI993301	HI993302
EC	Range	0 to 3999 $\mu$ S/cm	0.00 to 20.00 mS/cm
	Resolution	1 $\mu$ S/cm	0.01 mS/cm
	Accuracy	$\pm 2\%$ F.S.	$\pm 2\%$ F.S.
TDS	Range	0 to 2000 mg/L (ppm)	0.00 to 10.00 g/L (ppt)
	Resolution	1 mg/L (ppm)	0.01 g/L (ppt)
	Accuracy	$\pm 2\%$ F.S.	$\pm 2\%$ F.S.
Temperature	Range	0.0 to 60.0°C / 32.0 to 140.0°F	0.0 to 60.0°C / 32.0 to 140.0°F
	Resolution	0.1°C (0.1°F)	0.1°C (0.1°F)
	Accuracy	$\pm 0.5\text{°C}$ ( $\pm 1\text{°F}$ )	$\pm 0.5\text{°C}$ ( $\pm 1\text{°F}$ )
Additional Specifications	EC/TDS Calibration	automatic, one point at 1413 $\mu$ S/cm or 1382 mg/L (ppm)	automatic, one point at 12.88 mS/cm or 6.44 g/L (ppt)
	Probe	HI7630 conductivity probe with internal temperature sensor, 1/2" NPT pipe thread and 2 m (6.6') cable (fixed, included)	
	TDS Conversion Factor	adjustable from 0.45 to 1.00	
	Temperature Compensation	automatic with $\beta$ adjustable from 0.0 to 2.4%/ $^{\circ}$ C	
	Power Supply	12 VDC adapter (included)	
	Environment	0 to 50°C (32 to 122°F); RH max 95%	
	Dimensions	160 x 105 x 31 mm (6.2 x 4.1 x 1.2")	
	Weight	190 g (6.7 oz.) - meter only	
Ordering Information	<b>HI993301-01</b> (EC/TDS Gro'Chek) (115V) and <b>HI993301-02</b> (EC/TDS Gro'Chek) (230V) is supplied with HI7630 conductivity probe, HI70031 1413 $\mu$ S/cm calibration solution sachet, 12 VDC adapter and Instructions.		
	<b>HI993302-01</b> (EC/TDS Gro'Chek) (115V) and <b>HI993302-02</b> (EC/TDS Gro'Chek) (230V) is supplied with HI7630 conductivity probe, HI70030 12.88 mS/cm calibration solution sachet, 12 VDC adapter and Instructions.		

## EC Meter

- **Water resistant housing**
  - The meter housing is rated IP54 meaning it has a high level of protection against particles and a fair amount of protection against water
- **One-point calibration**
  - Calibrate with 1413  $\mu\text{S}/\text{cm}$  EC solutions using a screwdriver
- **Automatic Temperature Compensation (ATC)**
  - Samples automatically compensated for temperature variations

Engineered to withstand the aggressive environments in agricultural and hydroponic application, the HI983302N is a simple way to measure EC. You can simply hang the meter right above the sample to be tested for continuous measurement and the unit will run without interruption on 12 VDC power supply or take it with you for spot checks. The meter housing is rated IP54 meaning they have a high level of protection against particles and a fair amount of protection against water. The integrated large LCD allows for an easy reading from a distance.

The meters are supplied with a HI7632 probe that automatically compensates for any temperature variation. The HI7632 is a two-pole amperometric EC probe for panel mounted mini controllers that measure in the high range (mS/cm and ppt). This probe has a built-in temperature sensor for Automatic Temperature Compensation and a  $\frac{1}{2}$ " male NPT threaded connection for insertion mounting. The HI7632 probe provides a rapid response and high accuracy EC measurement.



Specifications	HI983302N (Gro'Chek EC)
Range	0.00 to 9.99 mS/cm
Resolution	0.01 mS/cm
Accuracy (@25°C/77°F)	2% F.S.
Calibration	manual, one-point through trimmer
Temperature Compensation	automatic from 5 to 50°C (41 to 122°F)
Probe	HI7632 EC probe with 2 m (6.6') cable (included)
Power supply	12 VDC adapter (included)
Environment	0 to 50°C (32 to 122°F); RH max 100%
Dimensions	86 x 110 x 43 mm (3.4 x 4.3 x 1.7")
Weight	215 g (7.6 oz.)
Ordering Information	<b>HI983302N-01</b> (Gro'Chek EC) (115V) and <b>HI983302N-02</b> (Gro'Chek EC) (230V) is supplied with HI7632 probe, 12 VDC adapter, 1413 mS/cm calibration solution (20 mL), calibration screwdriver and instructions.



HI983307

## EC Monitor

- Automatic Temperature Compensation (ATC)
- Water-resistant

This water-resistant EC monitor is the result of customer requests for accurate, affordable process monitoring with low maintenance.

HI983307 is supplied with a direct two-pin probe and 2 m (6.6') cable with a  $\frac{1}{2}$ " thread for flow-thru mounting. The probe has a temperature sensor to automatically compensate against temperature changes from 5 to 50°C (41 to 122°F) with a  $\beta$  of 2% per degree.

In the measurement mode, a red LED will warn the user in the event the reading is outside of the alarm interval. A front trimmer allows manual one-point calibration. The electrical circuitry is tightly sealed inside the water-resistant enclosure. This EC monitor can be installed anywhere quickly and easily with the casings molded eye. The 12 VDC power supply allows continuous monitoring over extended periods of time.

### Specifications

### HI983307

EC	Range	0.00 to 9.99 mS/cm
	Resolution	0.01 mS/cm
	Accuracy (@25°C/77°F)	$\pm 2\%$ F. S.
Additional Specifications	Calibration	manual, one-point, through trimmer
	Calibration Solution	HI70039
	Temperature Compensation	automatic, 5 to 50°C (41 to 122°F) with $\beta=2\%$
	Setpoint	0.70 to 3.50 mS/cm
	Alarm	red LED blinks when measured value differs from set point more than $\pm 0.20$ mS/cm
	Probe (included)	HI7632/2 with 2 m (6.6') cable and $\frac{1}{2}$ " thread for in-line installation
	Power supply	12 VDC adapter (included)
	Environment	0 to 50°C (32 to 122°F); RH max 100%
	Dimensions	86 x 110 x 43 mm (3.4 x 4.3 x 1.7")
	Weight	215 g (7.6 oz.)
Ordering Information	HI983307-01 (115V) and HI983307-02 (230V) are supplied with HI7632/2 EC/TDS probe, calibration screwdriver, 12 VDC adapter and instructions.	

# Conductivity Meter for Demineralized Water

- Automatic Temperature Compensation (ATC)
- Water-resistant
- Adjustable setpoint

The HI983304 is specifically designed for use in demineralized and deionized water, as these applications have low conductivity.

When placed at the output of any demineralization system, the visual alarm will be activated once the demineralizing equipment is exhausted. This exclusive feature will ensure maximum system efficiency with minimum investment.

The HI983304 has a built-in LCD display and measures from 0 to 19.99  $\mu\text{S}/\text{cm}$ .

This meter is supplied with an HI7631/2 direct two-pin probe with 2 m (6.6') cable and a  $\frac{1}{2}$ " thread for flow-thru mounting. This probe is also equipped with a temperature sensor to automatically compensate measurements against temperature changes from 5 to 50°C (41 to 122°F).

When operating in the measurement mode, the HI983304's red LED will alert the user as soon as the reading is 1  $\mu\text{S}/\text{cm}$  over the setpoint.



## Specifications HI983304

Range	0.00 to 19.99 $\mu\text{S}/\text{cm}$
Resolution	0.01 $\mu\text{S}/\text{cm}$
Accuracy (@25°C/77°F)	$\pm 2\%$ F. S.
Calibration	manual, one point, through trimmer
Temperature Compensation	automatic, 5 to 50°C (41 to 122°F) with $\beta=2.4\%/\text{°C}$
Setpoint	1.00 to 5.00 $\mu\text{S}/\text{cm}$
Alarm	red LED blinks when measured value differs from the setpoint more than 1.00 $\mu\text{S}/\text{cm}$
Probe (included)	HI7631/2 conductivity probe with 2 m (6.6') cable and 1/2" thread for flow-thru monitoring (included)
Power supply	12 VDC adapter (included)
Environment	0 to 50°C (32 to 122°F); RH max 100%
Dimensions	86 x 110 x 43 mm (3.4 x 4.3 x 1.7")
Weight	215 g (7.6 oz.)
Ordering Information	HI983304-01 (115V) and HI983304-02 (230V) are supplied with HI7631/2 EC/TDS probe, calibration screwdriver, 12 VDC adapter and instructions.

HI146-00

## Wall-Mounted Precision Thermometer

- CAL Check™
  - Alerts users of calibration status
- HACCP
  - Meets HAACP requirements
- Water resistant

The HI146-00 is a high accuracy thermometer with a professional grade probe attached to a flexible 2 m (6.6') cable. The CAL Check feature is incorporated into its function to allow you to confirm the accuracy of the meters any time.

You can monitor the exact temperature of any product continuously and easily observe it on the LCD display.

With its compact and simplified design, featuring a fixed stainless steel probe and optional probe holder, this thermometer is ideal for monitoring the temperatures of liquids, semi-solids and refrigerated foods.

The HI146-00 can be easily carried from station to station or installed in a fixed position using the molded eye and a wall mount probe holder.

In order to make sure that the meter is reporting the correct temperature, the HI146-00 has been designed with Hanna's exclusive CAL Check switch. By simply setting the switch from "READ" to "TEST" and without requiring any external equipment, users can ensure the accuracy of the meter. In the "TEST" mode, the HI146-00 shows 0.0 °C (32.0°F) with an accuracy of  $\pm 0.3^{\circ}\text{C}$  ( $\pm 0.5^{\circ}\text{F}$ ). With this Hanna innovation, the accuracy can be checked throughout the life of the thermometer without requiring any accessories or additional investments.



### Specifications HI146-00 (Pronto)

Range	-50.0 to 150.0°C
Resolution	0.1°C
Accuracy	$\pm 0.3^{\circ}\text{C}$ (-20 to 90°C) $\pm 0.5^{\circ}\text{C}$ (outside)
Temperature Probe	stainless steel probe (fixed) with 2 m (6.6') cable; 160 x dia 3 mm (6.3 x dia 0.1")
Battery Type / life	1.5V AA / approximately 5 years
Environment	0 to 50°C (32 to 122°F); RH max 95%
Dimensions	86 x 110 x 43 mm (3.4 x 4.3 x 1.7")
Weight	150 g (5.3 oz.)
Ordering Information	HI146-00 (Pronto) is supplied with stainless steel temperature probe, battery and instructions.

# Checkfridge® Remote Sensor Thermometer

- CAL Check™
  - Alerts users of calibration status
- BEPS
  - Alerts the user of low battery power that could adversely affect readings

Few manufacturers have given any thought to providing the user a convenient means to monitor internal temperature conditions of a refrigerator or freezer from the outside.

Water testing laboratories require constant monitoring of refrigerators and incubators for compliance to standard operations. The Hanna HI147 Checkfridge® is the ideal thermometer for accurate, reliable internal temperature readings.

How do you know when the reading on the thermometer is correct? An ice point or slurry could be made. Even then there could be several degrees difference between the real and theoretical temperatures. With the HI147, there is no need to waste time preparing an ice bath for making these tests; its unique CAL Check feature can simulate it. Conveniently located on the face of the thermometer is a TEST switch. Engage the switch and the HI147 performs an internal CAL Check. In only a few seconds, you see the results on the large LCD. Return the switch to the READ position and the HI147 returns to its normal measuring status.



Specifications	HI147-00 Checkfridge® C	HI147-01 Checkfridge® F
Range	-50.0 to 150.0°C	-58.0 to 302.0°F
Resolution	0.1°C	0.1°F (-58.0 to 199.9°F) 1°F (200 to 302°F)
Accuracy	±0.3°C (-20 to 90°C); ±0.5°C (outside)	±0.6°F (-4 to 194°F); ±1°F (outside)
CAL Check	manual, through switch	
Temperature Probe	stainless steel, general purpose with 1 m (3.3') cable (fixed); 40 x dia 5 mm (1.6 x dia 0.2")	
Battery Type / Life	1.5V AAA / approximately 3 years of continuous use	
Environment	0 to 50°C (32 to 122°F); RH max 95%	
Dimensions (meter only)	93 x 39 x 31 mm (3.7 x 1.5 x 1.2")	
Weight	60 g (2.1 oz.)	
Ordering Information	HI147-00 (Checkfridge® C) is supplied with battery and instructions. HI147-01 (Checkfridge® F) is supplied with battery and instructions.	

## Replacement Electrodes



CODE	HI73127	HI73120	HI73311	HI1270	HI1271
Description	pH electrode	ORP electrode	EC/TDS electrode	pH electrode	pH electrode
Reference	single, Ag/AgCl	single, Ag/AgCl		single, Ag/AgCl	single, Ag/AgCl
Junction / Flow Rate	cloth	cloth		open	open
Electrolyte	gel	gel		viscolene	viscolene
Max Pressure	0.1 bar	0.1 bar		0.1 bar	0.1 bar
Range	pH: 0 to 14	ORP: $\pm 2000$ mV		pH: 0 to 13	pH: 0 to 13
Recommended Operating Temp.	-5 to 50°C (23 to 122°F) - GP	-5 to 50°C (23 to 122°F) - GP	-5 to 50°C (23 to 122°F) - GP	0 to 50°C (32 to 122°F) - GP	0 to 50°C (32 to 122°F) - GP
Tip / Shape	spheric (dia: 5.0 mm)	platinum pin		spheric (dia: 3.0 mm)	spheric (dia: 3.0 mm)
Temperature Sensor	no	no	no	no	no
Amplifier	no	no	no	no	no
Body Material	polypropylene	polypropylene	polypropylene	polypropylene	polypropylene
Cable	no	no	no	no	no
Recommended Use	general purpose, field applications				
Connection	pin	pin	pin	screw cap	screw cap

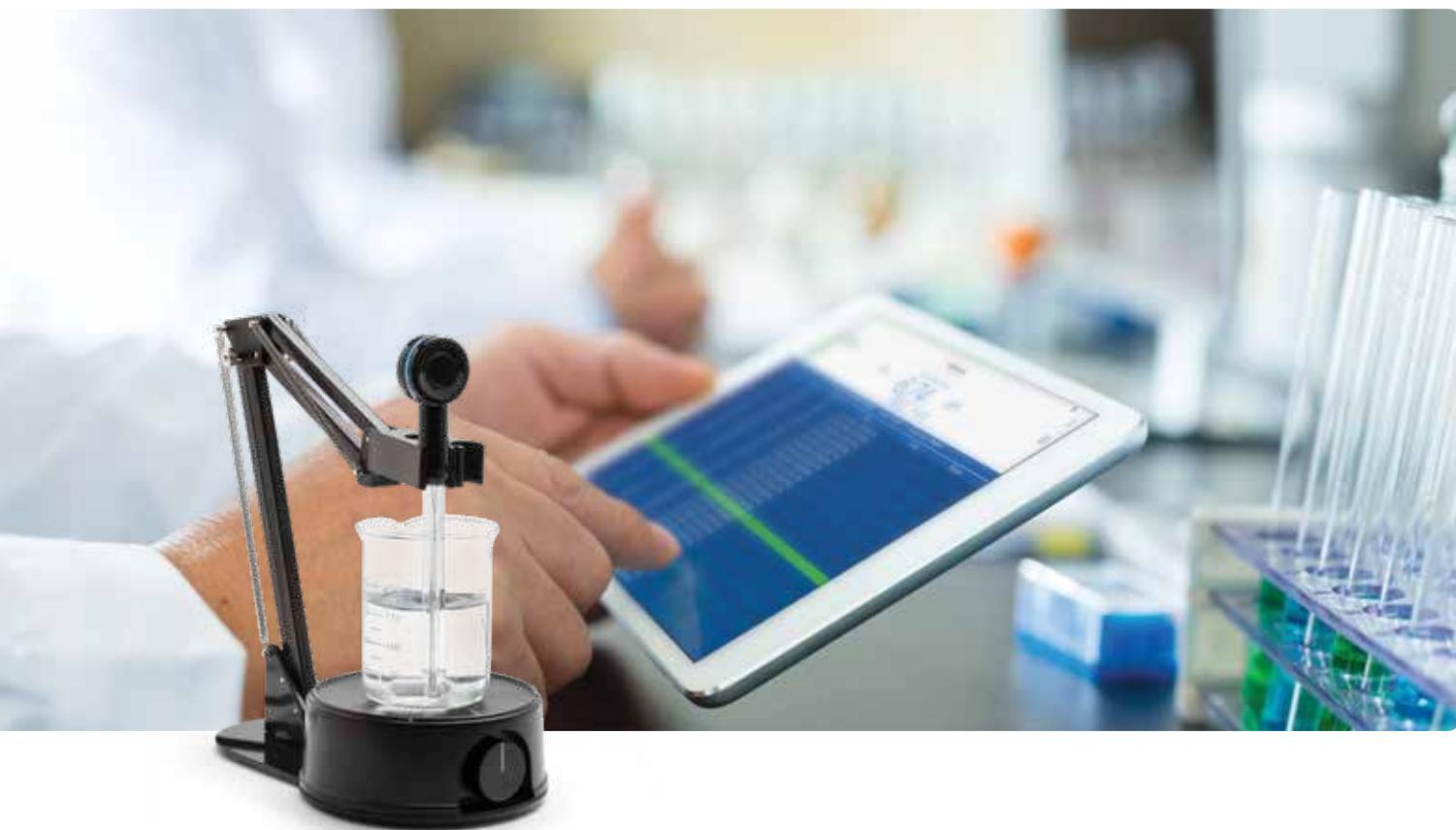
# Replacement Electrodes



CODE	HI1280	HI1290	HI1295	HI1285-8	HI1286	HI1293D
Description	pH electrode	pH electrode	pH electrode	pre-amplified pH and EC probe	pH electrode	pH electrode
Reference	single, Ag/AgCl	single, Ag/AgCl	single, Ag/AgCl	single, Ag/AgCl	double, 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	cloth	PTFE	PTFE
Electrolyte	gel	gel	gel	gel	polymer	polymer
Max Pressure	0.1 bar	0.1 bar	2 bar	.2 bar	3 bar	3 bar
Range	pH: 0 to 13	pH: 0 to 13	pH: 0 to 13	pH: 0 to 13 / EC	pH: 0 to 13	pH: 0 to 13
Recommended Operating Temp.	0 to 70°C (32 to 158°F) - GP	0 to 70°C (32 to 158°F) - GP	0 to 70°C (32 to 158°F) - GP	0 to 50°C (32 to 122°F) - LT	0 to 80°C (32 to 176°F) - GP	0 to 60°C (32 to 140°F)
Tip / Shape	spheric (dia: 5.0 mm)	spheric (dia: 5.0 mm)	spheric (dia: 5.0 mm)	spheric (dia: 8.5 mm)	spheric (dia: 7.5 mm)	spheric (dia: 7.5 mm)
Temperature Sensor	yes	yes	yes	yes	no	no
Amplifier	yes	yes	yes	yes	no	yes
Body Material	polypropylene	polypropylene	polypropylene	polypropylene	PEI	PEI
Cable	no	no	no	7-pole; 1 m cable (3.3')	coaxial; 2 m (6.6')	5-pole; 2 m (6.6')
Recommended Use	general purpose, field applications	general purpose, field applications	general purpose, field applications	hydroponics, aquaponics, greenhouses	general purpose, water treatment, agriculture	hydroponics, greenhouses
Connection	multi-pin	multi-pin	multi-pin	DIN*	BNC	DIN

\* To be used with HI981420 GroLine monitor

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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 focused testing 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 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 a rinse in buffer or standard.
4. Wait for a stable reading before the calibration point is confirmed.
5. Temperature compensation of pH reading and pH buffers.

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  $\pm 30$  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.



	pH Range	0.001pH 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	Page
HI11312	0.00-13.00	•	•	up to 7	•	•	•	yes (page 2.28)	•	glass	lab	500 hours	2.16	
HI11102	0.00-12.00	•	•	up to 7	•	•	•	yes (page 2.28)	•	glass	lab	500 hours	2.17	
HI13302	0.00-12.00	•	•	up to 7	•	•	•	yes (page 2.28)	•	glass	lab, test tube	500 hours	2.18	
HI10832	0.00-13.00	•	•	up to 7	•	•	•	yes (page 2.28)	•	glass	lab, small sample	500 hours	2.19	
HI12302	0.00-12.00	•	•	up to 7	•	•	•	yes (page 2.28)	•	PEI	field	500 hours	2.20	
FC2022	0.00-12.00	•	•	up to 7	•	•	•	yes (page 2.28)	•	PVDF	food	500 hours	2.21	
HI10482	0.00-12.00	•	•	up to 7	•	•	•	yes (page 2.28)	•	glass	wine, must and juice	•	500 hours	2.23
FC2142	0.00-13.00	•	•	up to 7	•	•	•	yes (page 2.28)	•	titanium	brewing	500 hours	2.25	
HI12922	0.00-12.00	•	•	up to 7	•	•	•	yes (page 2.28)	•	glass	direct soil	500 hours	2.26	
HI14142	0.00-12.00	•	•	up to 7	•	•	•	yes (page 2.28)	•	glass	flat surfaces	500 hours	2.27	



	Bluetooth® Wireless Technology	Hanna Lab App Compatible	pH Measurement	EC/TDS Measurement	DO Measurement	pH CAL Check™	0.001pH 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	•	•*	•*	•	•	•	•	•	•	•	•	•	•	•	•	•	2.32
edge pH	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2.36

\* with optional compatible edge electrode

## 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	RealTime Graphing	Data Logging	Incremental Methods	PC Connectivity	Fully Customizable	Page
HI5222	•	•		•	•	•	•	•	•	•	•	•	•	2.40
HI5221		•	•	•	•	•	•	•	•	•	•	•	•	2.44

## 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	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2.46
HI2221	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2.48
HI2211	•	•	•	•											2.49
HI2210		•	•												2.49
HI2209	•														2.50
HI22091	•														2.50
HI208		•	•												2.51

## Waterproof Portable pH Meters



	ISE Measurement	mV Measurement	Temperature Measurement	0.001pH Resolution	pHSensorCheck™	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
HI98190	•	•	•	•	•	•	•	•	300	•	•	•	•	•	•	•	•	2.52
HI9126	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2.76
HI9125	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2.77
HI9124	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2.77
HI991003	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2.78
HI991002	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2.78
HI991001	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2.78

## Application Specific 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	•																			2.56
HI98162	•	•	•	•	•															2.60
HI98163	•	•	•	•	•															2.64
HI98164	•	•	•	•	•															2.68
HI98165	•	•	•	•	•															2.72
HI99121	•	•	•	•	•	•														2.79
HI99131	•	•	•	•	•	•														2.80
HI99141	•	•	•	•	•	•														2.81
HI99171	•	•	•	•	•	•														2.82
HI99181	•	•	•	•	•	•														2.83
HI99162	•	•	•	•	•	•														2.84
HI99164	•	•	•	•	•	•														2.88
HI99165	•	•	•	•	•	•														2.92
HI99161	•	•	•	•	•	•														2.96
HI99163	•	•	•	•	•	•														2.97
HI99192	•	•	•	•	•	•														2.98
HI99151	•	•	•	•	•	•														2.100
HI99111	•	•	•	•	•	•														2.102



## 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	•	•	•	•	•	•	•	•	•	2.104
HI8314	•	•	•	•	•	•	•	•	•	2.105
HI83141	•	•	•	•	•	•	•	•	•	2.105
HI8014	•									2.106
HI8010										2.106
HI8427	•									2.107
HI931001	•									2.107



## 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<sup>®</sup>blu, a pH meter that uses HALO<sup>®</sup> pH electrodes with Bluetooth<sup>®</sup> Smart technology (Bluetooth 4.0). Bluetooth<sup>®</sup> 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 is in the plugged in benchtop or wall mount cradle. The battery can also be recharged through the micro USB port with either a USB port from a computer or directly to the power supply.



### Two USB ports

edge blu includes one standard USB for exporting data to a flash drive. edge blu also includes 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. Interval logging 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

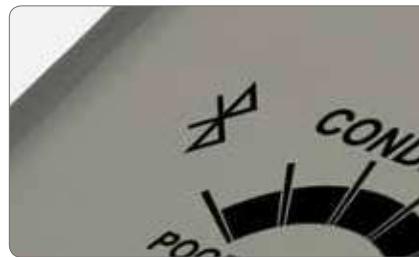
Data of the last calibration you perform is stored in the sensor including the date, time, and buffers used. When the sensor is connected to edge blu, GLP data is automatically transferred.

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



### 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 uses 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'). 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 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.

edge®blu



### 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.

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

HI181 magnetic  
stirrer and beaker  
not included.



4.0

Bluetooth®  
Smart

0

footprint

05

inch thick  
(12.7 mm)

88

oz. weight  
(250 g)

8

hours battery  
life

55

inch display  
(14 cm)

2

USB ports

## edge blu additional features

- Resolution selectable from 0.01 and 0.001 pH
- Range -2.000 to 16.000 pH
- Accuracy  $\pm 0.002$  pH for 0.001 pH resolution;  $\pm 0.01$  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
  - You can use edge® blu Basic Mode—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.

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



## 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<sup>1</sup>.

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<sup>1</sup>. 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
  - Measurement 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

Specifications		edge®blu*
pH	Range <sup>2</sup>	-2.00 to 16.00 pH; -2.000 to 16.000 pH <sup>†</sup>
	Resolution	0.01 pH; 0.001 pH <sup>†</sup>
	Accuracy (@25°C/77°F)	±0.01 pH; ±0.002 pH <sup>†</sup>
	Calibration	Basic mode: Automatic, up to 3 points calibration 5 standard buffer 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 <sup>2</sup>	automatic, -5.0 to 100.0°C (23.0 to 212.0°F) (using integral 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 <sup>2</sup>	-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 <sup>†</sup> (400 for basic mode) records organized in: manual log-on-demand (max. 200 logs), manual log-on-stability (max. 200 logs), interval logging <sup>†</sup> (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 (115V) and HI2202-02 (230V) 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 ±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 <sup>2</sup>	-2.000 to 16.000 pH ±800 mV -20.0 to 120.0°C (-4.0 to 248.0°F)
Resolution	0.1; 0.01; 0.001 pH 1; 0.1 mV 0.1°C (0.1°F)
Accuracy (@25°C/77°F)	±0.005 pH ±0.3 mV ±0.5°C (±1.0°F)
Calibration Points	up to five-point calibration with seven standard buffers (1.68, 3.00 or 4.01, 6.86, 7.01, 9.18, 10.01, 12.45 pH)
Temperature Compensation <sup>2</sup>	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



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<sup>2</sup> Limits will be reduced to actual probe/sensor limits.

\* HALO required for measurement use.

† Standard mode only



# 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 will revolutionize the way pH is measured.

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



### One Press Connect

Connect to the Hanna Lab App at the press of a button via Bluetooth® wireless technology (10 m range (33')). Visible from a distance, the LED halo light indicates 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.



Ideal for lab applications

Compatible with:  
iOS  
Android™  
edge®blu

HI11312 HALO is an innovative, pH electrode with Bluetooth® Smart technology that allows the use of 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

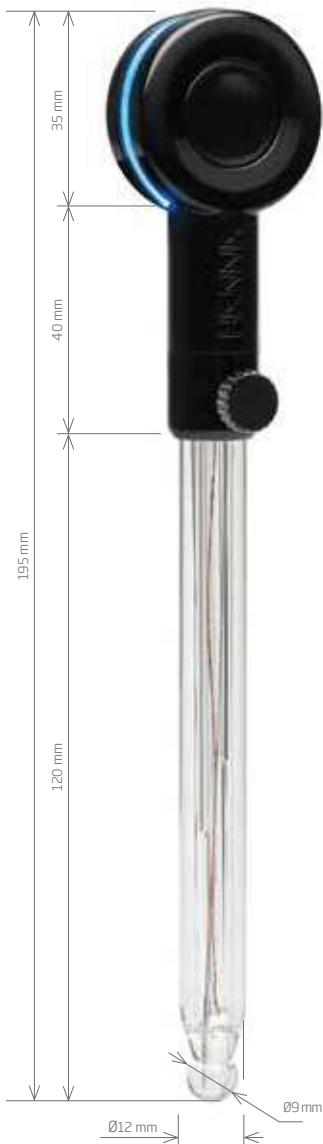
HI11312 is a double junction pH electrode in which the Ag/AgCl necessary for the reference cell is located behind an inner ceramic junction. The gel electrolyte between the inner and outer junction is silver free. This is important to prevent the precipitation of silver by Tris buffer, metals, and sulfides 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)
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 (23 to 122°F); electronic module is not waterproof

### Ordering Information

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

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HI11102

**HALO**®

Ideal for lab applications

Compatible with:  
iOS  
Android™  
edge®blu

2

pH

HALO

HI11102 HALO is an innovative, pH electrode with Bluetooth® Smart technology that allows the use of 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)
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 (23 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.

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pH solutions begin on page 2.142



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 the use of 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 customers.

- **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

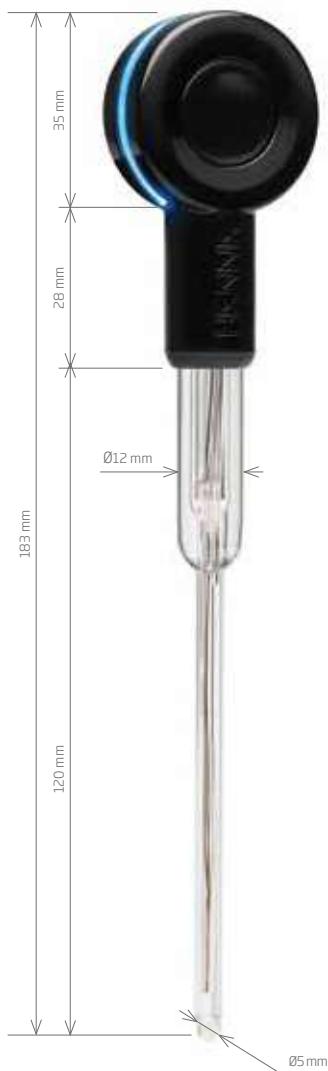
HI13302 has a thermistor temperature sensor built into the tip of the pH electrode. A thermistor based temperature sensor provides for a high accuracy temperature while being in the tip of the electrode allows for a rapid temperature compensated measurement.

### Open Junction Design

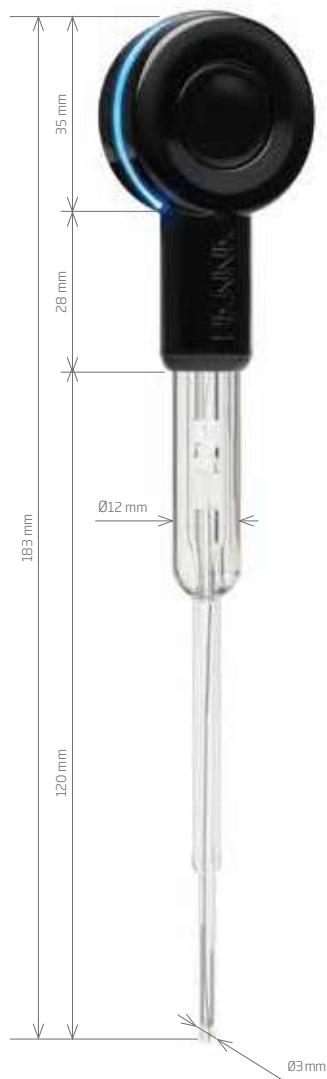
The reference half-cell has an open junction design in order to accommodate the 5 mm micro bulb and shaft. The open junction design is resistant to clogging from suspended solids and proteins found in biological samples. Any clogging that occurs will impede the measurement circuit between the indicating 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)
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 (23 to 122°F); electronic module is not waterproof
<b>Ordering Information</b>	<b>HI13302</b> (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, battery, quality certificate and instruction sheet.



HI10832

Ideal for small sample  
lab applications

Compatible with:  
iOS  
Android™  
edge®blu

HI10832 HALO is an innovative, application specific, pH electrode with Bluetooth® Smart technology that allows the use of 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)
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 (23 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.



Ideal for field applications

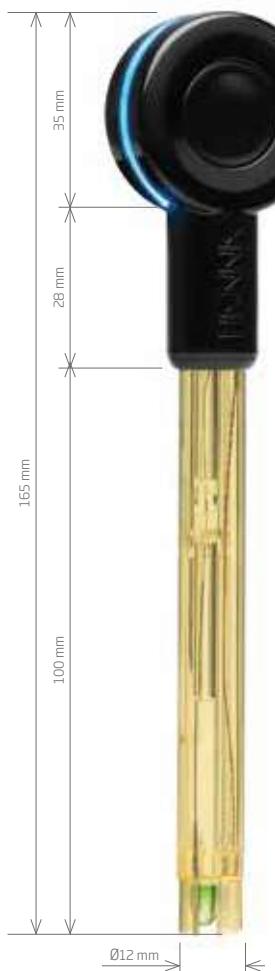
Compatible with:  
iOS  
Android™  
edge®blu

HI12302 HALO is an innovative, pH electrode with Bluetooth® Smart technology that allows the use of 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

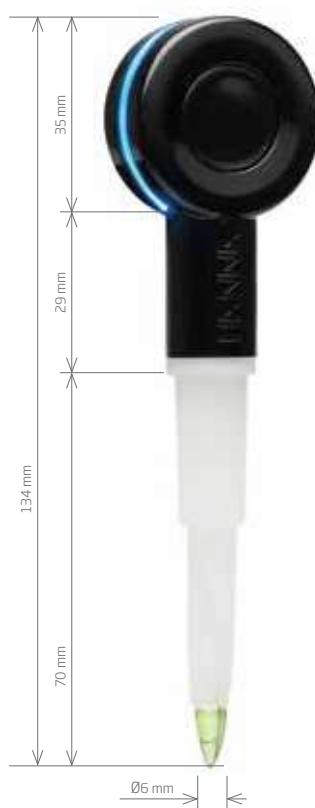
A thermistor temperature sensor built into the tip of the pH electrode. A thermistor based temperature sensor provides for a high accuracy temperature reading while being in the tip of the electrode allows for a rapid determination of the temperature as it impacts the effect on the glass membrane potential.

## 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)
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 (23 to 122°F); electronic module is not waterproof
<b>Ordering Information</b>	<b>HI12302</b> (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, battery, quality certificate and instruction sheet.

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FC2022

# HALO®

Ideal for food applications

Compatible with:  
iOS  
Android™  
edge®blu

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 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)
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 (23 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.

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pH solutions begin on page 2.142

## 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 bacteria growth and fermentation.



#### 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 80°C (32 to 176°F)
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 (23 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.

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pH solutions begin on page 2.142

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 (1/2") from the fill hole in order to maintain a good flow rate sustained by having adequate head pressure.

#### Built-in Temperature Sensor

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

#### Customized Calibration Buffer Value

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

## pH in Beer

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

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

Hop utilization during the wort boil is also affected by pH. As pH increases, the solubility of hop resins increases. Unfortunately for hop lovers, a high pH also increases the release of tannins resulting in a harsher taste. Higher pH also favors elevated microbial activity.

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



FC2142

Ideal for brewers

Compatible with:  
iOS  
Android™  
edge®blu

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

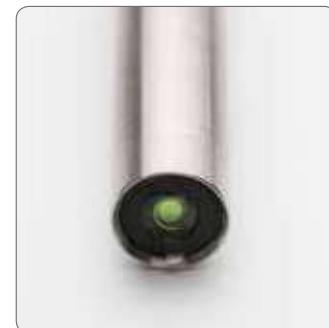
- **High temperature glass**
  - Extends probe life when used with samples at elevated temperatures
- **Extractable cloth junction**
  - Quickly renew the junction to increase stability and extend probe life
- **Built-in temperature sensor**
  - High accuracy temperature compensated measurements
- **Titanium body**
  - Provides protection even at high temperatures as well as stability of measurement

## High Temperature Glass

Standard pH glass deteriorates faster when used at high temperatures. FC2142 uses a special high temperature (HT) formulation glass that is suitable for measuring pH samples, such as with wort or mash, up to 80°C (176°F).

## Extractable Cloth Junction

The advantage of the cloth junction is that it can be extracted from the probe exposing a fresh surface. This is very important since one of the major contributors to unstable measurements is a clogged junction. This is likely to occur when measuring the pH of mash that has a high solids content. Pulling out a small portion of the junction exposes a clean, unclogged portion that increases response time and extends the life of the pH electrode.



## 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	spheric
Temperature Operating Range	0 to 80°C (32 to 176°F)
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 (23 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.



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 the use of 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

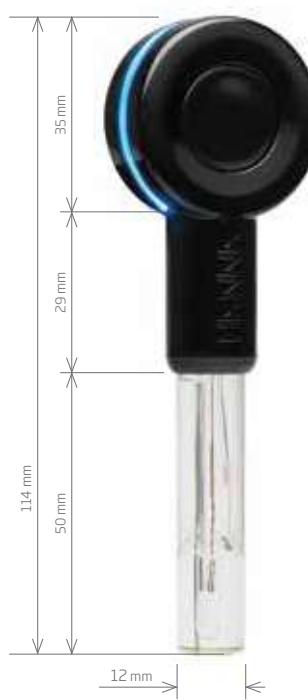
The HI12922 has a thermistor temperature sensor built into the tip of the pH electrode. A thermistor based temperature sensor provides for a high accuracy temperature while being in the tip of the electrode allows for a rapid temperature compensated measurement.

Includes soil auger



### 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)
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 (23 to 122°F); electronic module is not waterproof
Ordering Information	HI12922 (HALO) is supplied with soil auger, storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, fill solution, battery, quality certificate and instruction sheet.



HI14142

**HALO**<sup>®</sup>

Ideal for flat surfaces

 Compatible with:  
 iOS  
 Android™  
 edge®blu

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

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

### Flat Tip Bulb

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

### Low Temperature Glass

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

### Open Junction Design

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

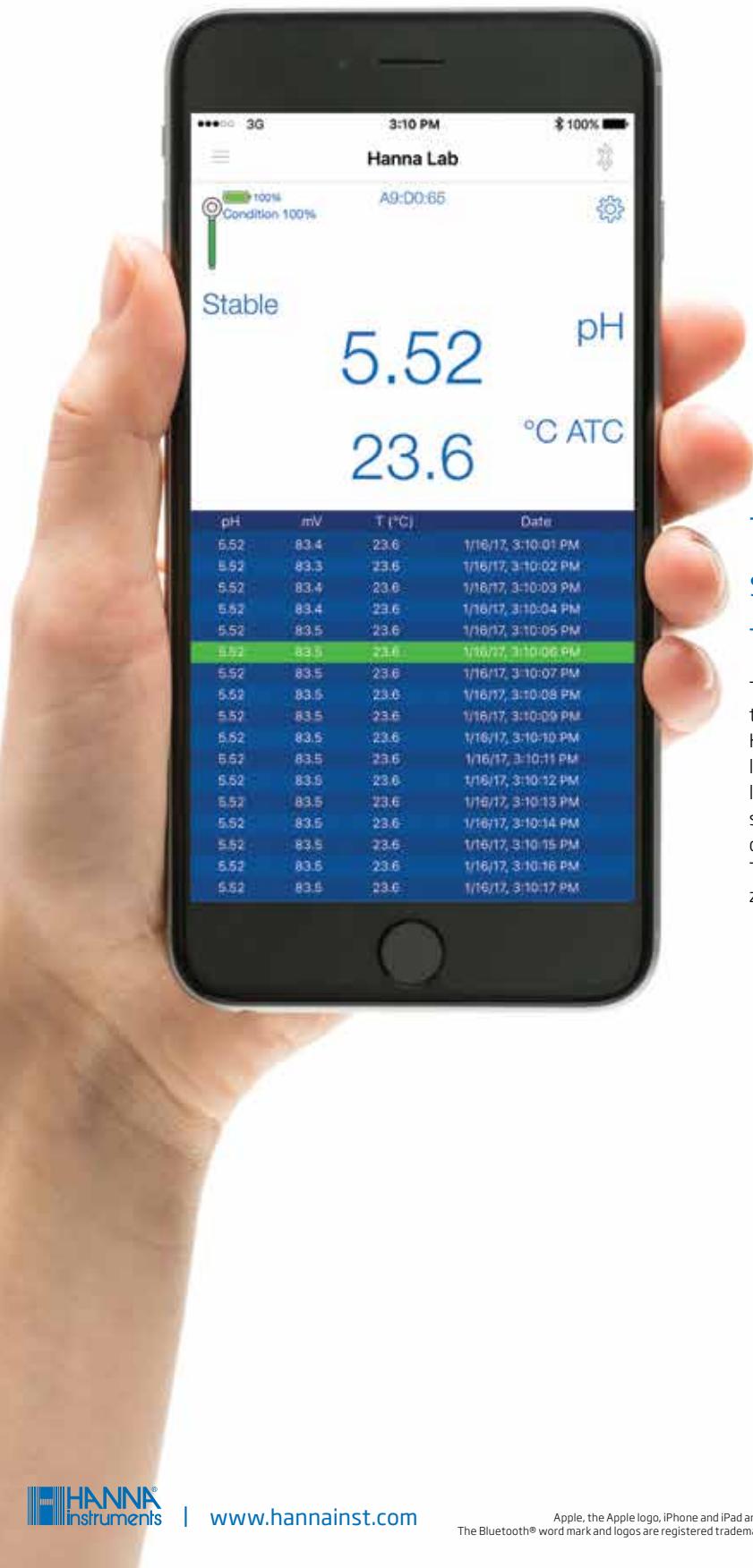
### Maintenance Free Gel-filled Reference

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

### Built-in Temperature Sensor

The thermistor temperature sensor built into the tip of the pH electrode. A thermistor based temperature sensor provides for a high accuracy temperature 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)
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 (23 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.



## 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.

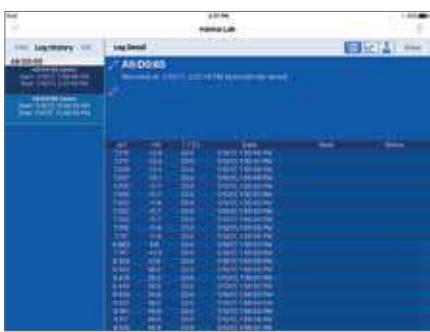


### Fluid, Dynamic Graphing

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.

## 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.



### Full GLP

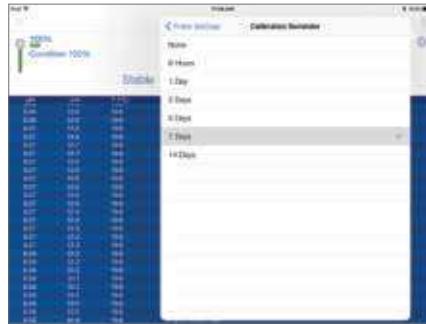
Displays date and time of current calibration, probe offset, and average slope along with calibrated buffers, mV values, temperature and slopes between each buffer. For tablet displays, full GLP can be also displayed in table and graph views.

## 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.



### Calibration Reminder

Alerts users when HALO needs calibration.



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

### Download Information





## 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 in the plugged in benchtop or wall mount cradle. The battery can also be recharged through the micro USB port with either a USB port from a computer or directly to the power supply.



### 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.

### Two USB ports

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



### 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.



### 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.

### 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.



## 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.

edge



### 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 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 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 3.5mm 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  $\pm 0.002$  pH for 0.001 pH resolution;  $\pm 0.01$  for 0.01 resolution
- Data logging
  - Manual log-on-demand
  - Manual log-on-stability
  - Interval logging
- Temperature readout ( $^{\circ}$ C or  $^{\circ}$ F)
- Automatic Temperature Compensation (ATC)
- CAL Check™ Indicators:
  - Probe condition
  - Response time
  - Check buffer
  - Clean electrode
- Sensor Check™ Indicators:
  - Broken electrode
  - Clogged junction



## 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 <sup>†</sup>
	Resolution	0.01 pH; 0.001 pH <sup>†</sup>
	Accuracy (@25°C/77°F)	$\pm 0.01$ pH; $\pm 0.002$ pH <sup>†</sup>
	Calibration	automatic, up to three points (five points <sup>†</sup> ) calibration, 5 standard (7 standard <sup>†</sup> ) buffers available (1.68 <sup>†</sup> , 4.01 or 3.00, 6.86, 7.01, 9.18, 10.01, 12.45 <sup>†</sup> ) and two custom buffers <sup>†</sup>
	Temperature Compensation*	automatic, -5.0 to 100.0°C (23.0 to 212.0°F) (using integral temperature sensor)
	Electrode Diagnostics	standard mode: probe condition, response time and out of calibration range
mV pH	Range	$\pm 1000$ mV
	Resolution	0.1 mV
	Accuracy (@25°C/77°F)	$\pm 0.2$ mV
Temperature	Range*	-20.0 to 120.0°C; -4.0 to 248.0°F
	Resolution	0.1°C; 0.1°F
	Accuracy	$\pm 0.5$ °C; $\pm 0.9$ °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 <sup>†</sup> (400 for basic mode) records organized in: manual log-on-demand (max. 200 logs), manual log-on-stability (max. 200 logs), interval logging <sup>†</sup> (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	<b>HI2020-01</b> (115V) and <b>HI2020-02</b> (230V) 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. 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—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  $\pm 0.002$  pH for 0.001 pH resolution;  $\pm 0.01$  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 in the plugged in benchtop or wall mount cradle. The battery can also be recharged through the micro USB port with either a USB port from a computer or directly to the power supply.



### Two USB ports

edge pH includes one standard USB for exporting data to a flash drive. edge blu also includes 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

edge pH	
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†
mV 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*
ORP	automatic, -5.0 to 100.0°C (23.0 to 212.0°F) (using integral temperature sensor)
	Electrode Diagnostics
	standard mode: probe condition, response time and out of calibration range
Temperature	Range
	±1000 mV
	Resolution
	0.1 mV
Additional Specifications	Accuracy (@25°C/77°F)
	±0.2 mV
	Range
	±2000 mV
ORP	Resolution
	0.1 mV
	Accuracy (@25°C/77°F)
Temperature	±0.2 mV (±999.9 mV); ±1 mV (±2000 mV)
	Calibration
	one-point calibration
Additional Specifications	Range*
	-20.0 to 120.0°C; -4.0 to 248.0°F
	Resolution
Temperature	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
Ordering Information	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.)
HI2002-01 (115V) and HI2002-02 (230V) 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.	

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

## Research Grade Meter

pH/ORP/ISE and Temperature

pH

benchtop



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 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.

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.

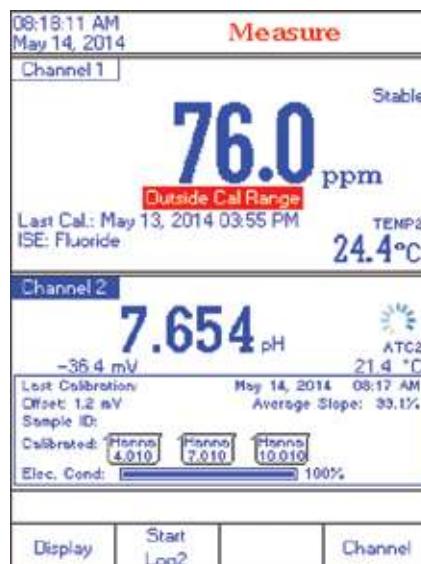
## ISE Measurement with Choice of Concentration Units

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

## CAL Check Screens



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

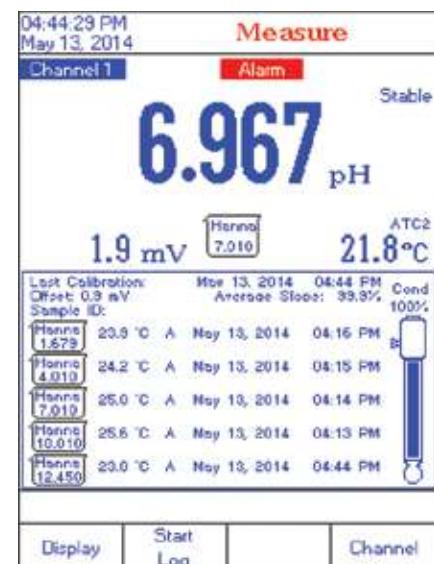
Three selectable logging modes are available on the HI5222: automatic, manual, and AutoHold logging. Automatic and manual logs up to 100 lots with 50,000 records max/lot with up to 100,000 total data points per channel. Automatic logging features the option to save data according to sampling period and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

## Data Transfer

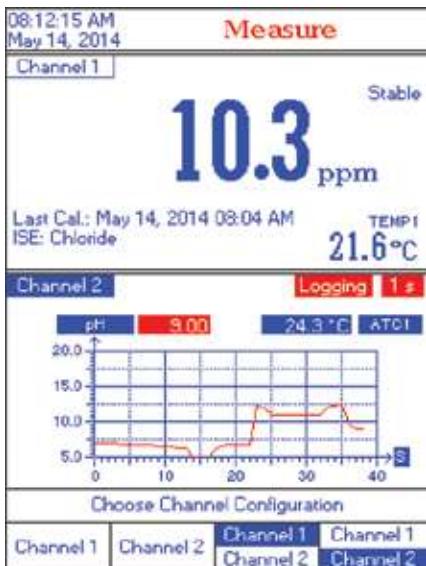
Data can be transferred to a PC with USB cable and HI92000 software (both sold separately).

## Contextual Help

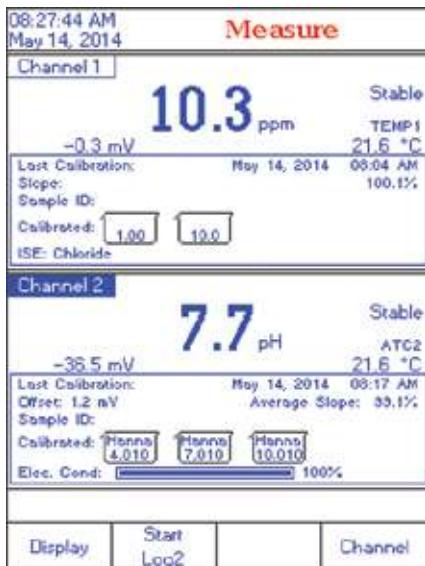
Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.



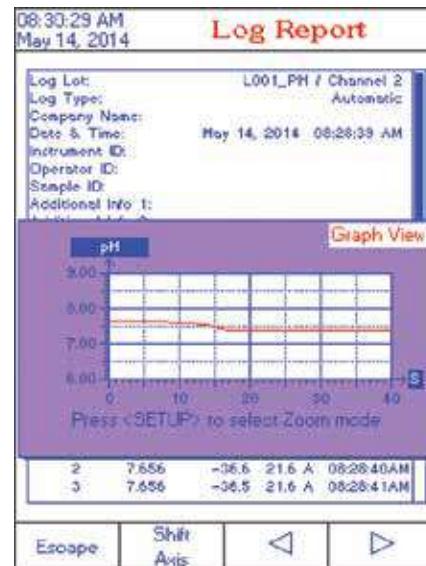
## Additional Features by Screen



Channel Configuration



Good Laboratory Practices



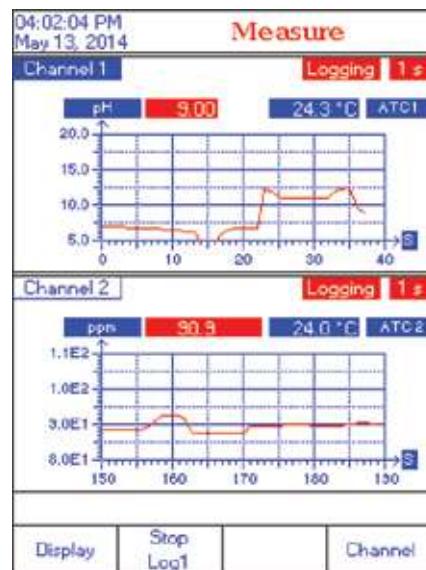
Log Recall



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 $\pm 0.1$ pH; $\pm 0.01$ pH; $\pm 0.002$ pH $\pm 1$ 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 $\pm 2000$ mV
	Resolution 0.1 mV
	Accuracy $\pm 0.2$ mV $\pm 1$ LSD
	Relative mV Offset Range $\pm 2000$ mV
ISE	Range $1 \times 10^{-6}$ to $9.99 \times 10^{10}$ concentration
	Resolution 1; 0.1; 0.01; 0.001 concentration
	Accuracy $\pm 0.5\%$ (monovalent ions); $\pm 1\%$ (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 $\pm 0.2^\circ\text{C}$ ; $\pm 0.4^\circ\text{F}$ ; $\pm 0.2\text{K}$
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 <b>record</b> : Up to 100 lots, 50,000 records max/lot / maximum 100,000 data points/channel; <b>interval</b> : 14 selectable between 1 second and 180 minutes; <b>type</b> : 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.

(\* ) Reduced to actual probe limits

pH and ORP electrodes begin on page 2.122; pH and ORP solutions begin on page 2.142;  
ISE electrodes and solutions begin on page 3.22;

[www.hannainst.com](http://www.hannainst.com) | 

## Research Grade Meter

pH/ORP and Temperature

pH

benchtop



The HI5221 is an advanced research grade benchtop pH/mV meter that is completely 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. 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. 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 from fast, moderate, and 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 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

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. 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.

## 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	<b>record:</b> Up to 100 lots, 50,000 records max/lot / maximum 100,000 data points/channel; <b>interval:</b> 14 selectable between 1 second and 180 minutes; <b>type:</b> 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.	

(\* ) Reduced to actual probe limits

## 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 separately).

pH

benchtop



### 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

pH calibration can be performed 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.

### Built-in impact printer



### 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 <sup>12</sup> 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.	

# 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.

pH

## 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).

benchtop

## 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 consideration 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 <sup>12</sup> 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, HI70825 electrolyte solution, HI700661 cleaning solution sachet, 12 VDC adapter, and instructions.

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.

Designed to be easy to use, these instruments also feature a reading stability indicator used during calibration and a measurement recall function.

pH measurements for both instruments are compensated for the temperature effect 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
	Resolution	0.01 pH
	Accuracy	±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
	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 <sup>12</sup> 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 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 new, larger 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 of measuring pH. The HI22091 features a large, easy to read LCD and built-in solution holders. 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.



		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 <sup>12</sup> Ohm	10 <sup>12</sup> 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.	

HI208

# Educational pH Meter



- **Simple User Interface**

- Operation is simple with limited 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**

- 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 HI208 features 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

### 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); ±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	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	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.	

\* temperature range is limited to 80°C (176°F) if using HI1291D probe.

pH and ORP solutions begin on page 2.144

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

The HI208 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 HI208 also utilizes the HI1291D two-in-one pH and temperature probe which allows for automatic temperature compensation with accuracy of ±0.5°C (up to 60°C).

The compact design of the HI208, makes it 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.

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  $\pm 2000$  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.

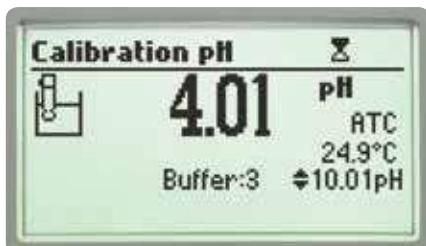
## Waterproof Protection

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  $\pm 0.002$  and up to  $\pm 0.001$  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.

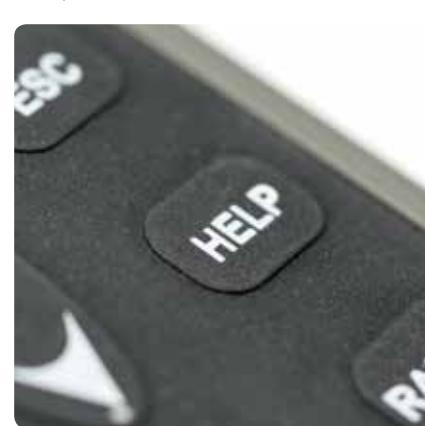
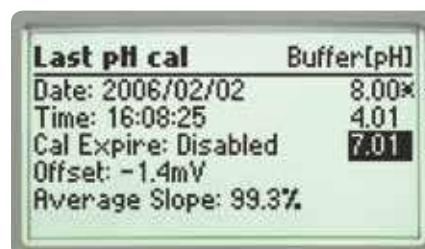


## AutoHold

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

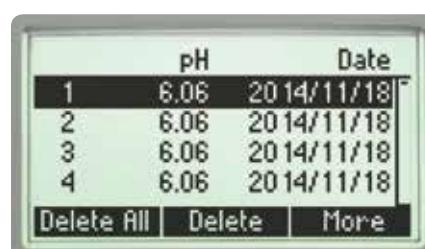
## CAL Check™

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.



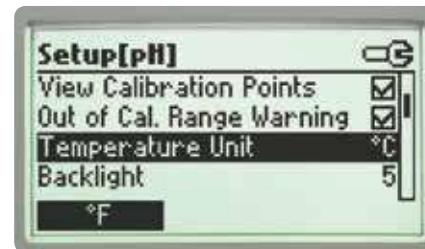
## GLP

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.



## 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

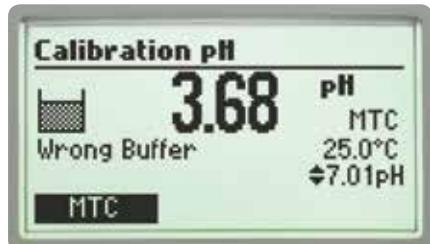
Our extensive setup screen features a host of configurable options such as time, date, temperature units and language for help screens and guides.

pH

portable

## Calibration Error Messages

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



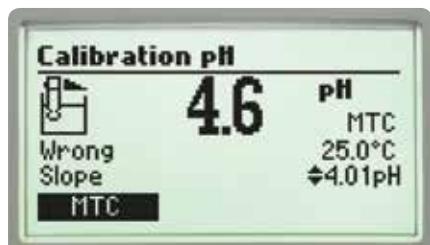
Wrong Buffer – The pH reading is not within range of the selected buffer.



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.

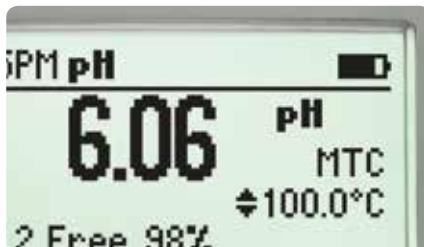


Wrong or Wrong Old Slope – An inconsistency between new and previous (old) calibration is detected.



## 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

The HI98190 meter, probe, and all 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.

## Calibrate right in the case with custom beaker holders

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



### 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 <sup>12</sup> 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	<b>HI98190</b> 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.

\* Limits will be reduced to actual sensor limits

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 food quality pH meters are rugged and portable with the performance and features of a benchtop. Five models are available in this series to measure food, milk, meat, yogurt and cheese. 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.

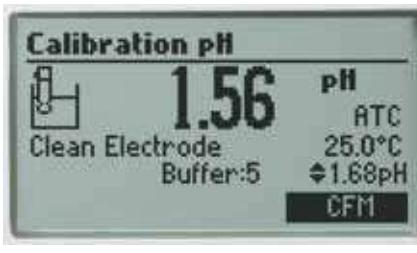


## Quick Connect Probe

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  $\pm 0.002$ .

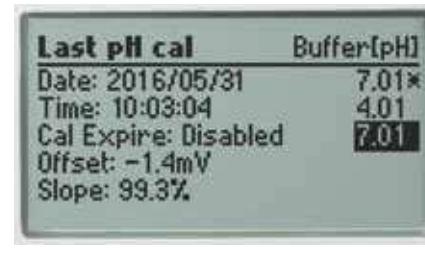
## Enhanced Calibration

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.

	pH	Date
1	6.06	2006/01/18
2	6.06	2006/01/18
3	6.06	2006/01/18
4	6.06	2006/01/18
<b>Delete All   Delete   More</b>		

## Data Logging

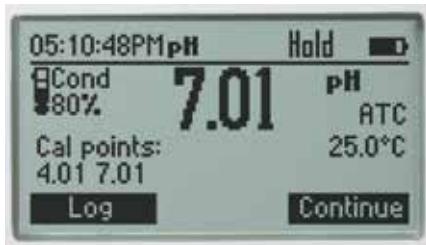
The log-on-demand feature allows users to store up to 200 samples that can be later transferred to a PC with the HI920015 USB cable and HI92000 software.

## 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 $\pm 0.1$ pH; $\pm 0.01$ pH; $\pm 0.002$ 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 $\pm 2000$ mV
	Resolution 0.1 mV
	Accuracy $\pm 0.2$ mV
	Relative mV Offset Range $\pm 2000$ mV
Temperature*	Range -20.0 to 120.0°C (-4.0 to 248.0°F)
	Resolution 0.1°C (0.1°F)
	Accuracy $\pm 0.4$ °C ( $\pm 0.8$ °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), quick start guide, quality certificate and instruction manual in a rugged carrying case with custom insert.

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

# 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) - LT
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 (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



# Milk pH Meter

designed for food professionals

Hanna food quality pH meters are rugged and portable with the performance and features of a benchtop. Five models are available in this series to measure food, milk, meat, yogurt and cheese. 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.

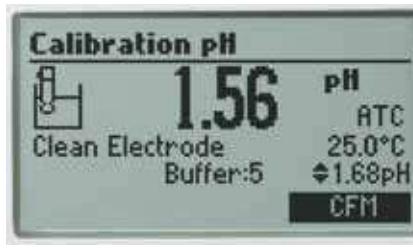


## Quick Connect Probe

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  $\pm 0.002$ .

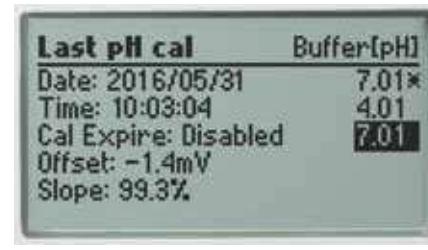
## Enhanced Calibration

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.

	pH	Date
1	6.06	2006/01/18
2	6.06	2006/01/18
3	6.06	2006/01/18
4	6.06	2006/01/18
<b>Delete All</b>	<b>Delete</b>	<b>More</b>

## Data Logging

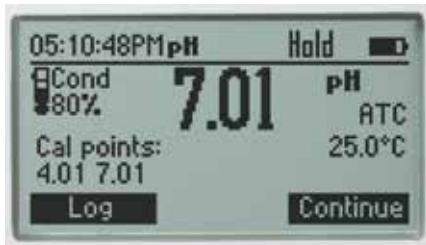
The log-on-demand feature allows users to store up to 200 samples that can be later transferred to a PC with the HI920015 USB cable and HI92000 software.

## 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 <sup>12</sup> 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), quick start guide, quality certificate and instruction manual in a rugged carrying case with custom insert.	

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

# 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 an integral 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.



## 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.

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) - GP
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

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 (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



# Meat pH Meter

designed for food professionals

Hanna food quality pH meters are rugged and portable with the performance and features of a benchtop. Five models are available in this series to measure food, milk, meat, yogurt and cheese. 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.

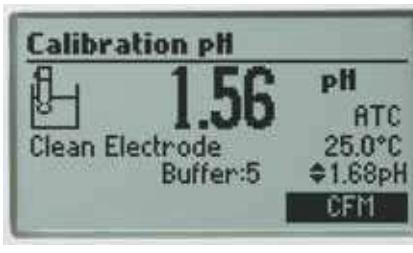


## Quick Connect Probe

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  $\pm 0.002$ .

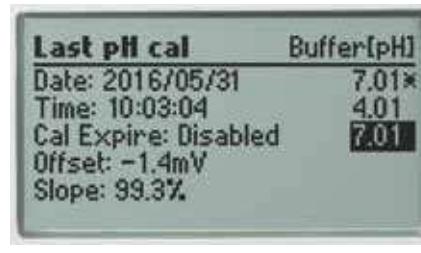
## Enhanced Calibration

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.

	pH	Date
1	6.06	2006/01/18
2	6.06	2006/01/18
3	6.06	2006/01/18
4	6.06	2006/01/18
<b>Delete All</b>	<b>Delete</b>	<b>More</b>

## 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.

## Automatic Temperature Compensation

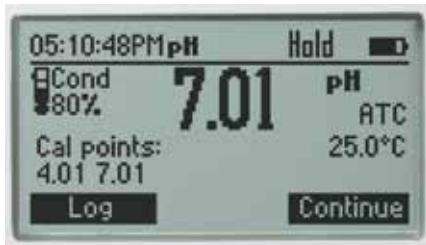
pH sensors incorporate a built-in temperature sensor in the tip of the electrode for a fast and accurate temperature compensated value.

## 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.

pH

portable



## 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

	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
mV	±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)
Temperature*	Range
	±2000 mV
	Resolution
	0.1 mV
Additional Specifications	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
Additional Specifications	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
Ordering Information	10 <sup>12</sup> 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	Environment
	0 to 50°C (32 to 122°F); RH 100% IP67
Dimensions / Weight	Dimensions / Weight
	185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.)
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), quick start guide, quality certificate and instruction manual in a rugged carrying case with custom insert.	

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

# 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 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.

## 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) - LT
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 (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



# Yogurt pH Meter

designed for food professionals

Hanna food quality pH meters are rugged and portable with the performance and features of a benchtop. Five models are available in this series to measure food, milk, meat, yogurt and cheese. 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  $\pm 0.002$ .

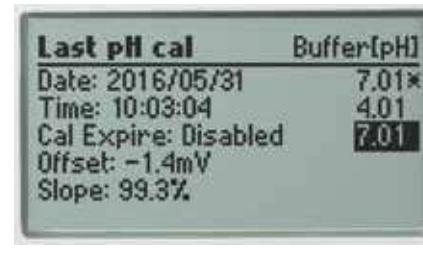
## Enhanced Calibration

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.

	pH	Date
1	6.06	2006/01/18
2	6.06	2006/01/18
3	6.06	2006/01/18
4	6.06	2006/01/18
<b>Delete All</b>	<b>Delete</b>	<b>More</b>

## Data Logging

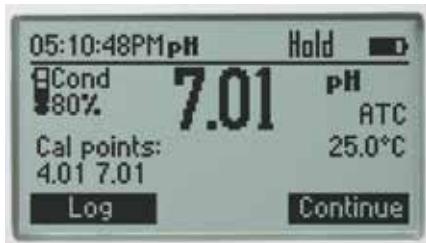
The log-on-demand feature allows users to store up to 200 samples that can be later transferred to a PC with the HI920015 USB cable and HI92000 software.

## 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 $\pm 0.1$ pH; $\pm 0.01$ pH; $\pm 0.002$ 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 $\pm 2000$ mV
	Resolution 0.1 mV
	Accuracy $\pm 0.2$ mV
	Relative mV Offset Range $\pm 2000$ mV
Temperature*	Range -20.0 to 120.0°C (-4.0 to 248.0°F)
	Resolution 0.1°C (0.1°F)
	Accuracy $\pm 0.4$ °C ( $\pm 0.8$ °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), quick start guide, quality certificate and instruction manual in a rugged carrying case with custom insert.

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

# 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. 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.



## 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.

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)
Tip / Shape	conic
Temperature Sensor	yes
Amplifier	yes
Body Material	glass
Cable	coaxial; 1 m (3.3')
Connection	quick connect DIN

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 (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



# Cheese pH Meter

designed for food professionals

Hanna food quality pH meters are rugged and portable with the performance and features of a benchtop. Five models are available in this series to measure food, milk, meat, yogurt and cheese. 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.

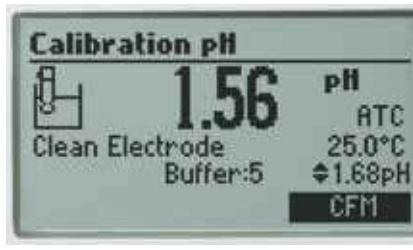


## Quick Connect Probe

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  $\pm 0.002$ .

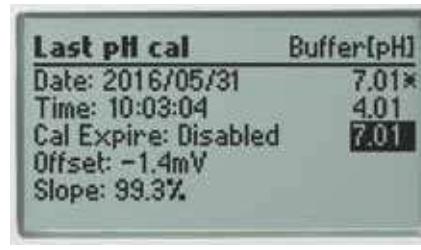
## Enhanced Calibration

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.

	pH	Date
1	6.06	2006/01/18
2	6.06	2006/01/18
3	6.06	2006/01/18
4	6.06	2006/01/18
<b>Delete All</b>	<b>Delete</b>	<b>More</b>

## Data Logging

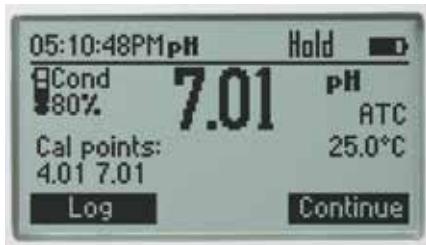
The log-on-demand feature allows users to store up to 200 samples that can be later transferred to a PC with the HI920015 USB cable and HI92000 software.

## 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

### 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 stainless steel 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 <sup>12</sup> 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), quick start guide, quality certificate and instruction manual in a rugged carrying case with custom insert.	

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

# pH / Temperature Probe for Cheese

FC2423 electrode has a stainless steel 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.

## AISI 316 stainless steel body

The metal 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)
Tip /Shape	conic
Temperature Sensor	yes
Amplifier	yes
Body Material	AISI 316 stainless steel
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.

# Portable pH/mV Meter

- **CAL Check™**
  - Alerts users of 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: $\pm 0.01$ 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: $\pm 699.9$ mV; $\pm 1999$ mV Resolution: 0.1 mV; 1 mV Accuracy: $\pm 0.2$ mV; $\pm 1$ mV
Temperature*	Range: -20.0 to 120.0°C; -4.0°F to 248.0°F Resolution: 0.1°C; 0.1°F Accuracy: $\pm 0.4$ °C; $\pm 0.8$ °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% / $\pm 1$ 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%
Ordering Information	Dimensions / Weight: 185 x 72 x 36 mm (7.3 x 2.8 x 1.4") / 300 g (10.6 oz)
	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

# 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.

pH

portable



## Specifications

	HI9124	HI9125
pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.01 pH
	Calibration	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
mV	Range	-
	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)
	pH Electrode	HI1230B PEI body pH electrode with BNC connector and 1 m (3.3') cable (included)
Additional Specifications Both All Meters	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 <sup>12</sup> 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 2.122; pH and ORP solutions begin on page 2.142



## pH/pH-mV/ORP and Temperature Meters

- **Sensor Check™**
  - (HI991003) Allows users to check the pH electrode status at any time
- **Automatic Temperature Compensation (ATC)**
- **Two-point calibration**
  - Up to two points automatic calibration
- **Battery Error Prevention System (BEPS)**
  - Alerts the user of low battery power that could adversely affect readings
- **Waterproof**
  - Compact, heavy-duty, and waterproof protected casing
- **Battery life indicator**
  - Battery percentage displayed on startup
- **HELP feature**
  - Tutorial messages displayed on LCD

HI991001, HI991002 and HI991003 are ideal for plating baths, wastewater, swimming pool and spa water quality and environmental applications.

HI991003 is a portable pH/pH-mV/ORP and temperature meter with our unique Sensor Check™ feature that allows the user to determine the electrode status at any time. HI991002 measures pH/ORP and temperature while the HI991001 measures pH and temperature.

The HI1296D pH/temperature and HI1297D pH/ORP/temperature probes feature an easy to clean recessed tip that prevents solids in solutions from collecting on the sensor. The titanium body of these probes function as a potential matching pin for increased stability of readings and extended sensor life.



- **Pre-amplified pH electrodes**
  - The HI1297D pH/ORP electrode and HI1296D pH electrode have an internal temperature sensor and also contain a pre-amplifier to render measurements impervious to noise and electrical interferences.



Specifications	HI991001	HI991002	HI991003		
pH*	Range	-2.00 to 16.00 pH	-2.00 to 16.00 pH		
	Resolution	0.01 pH	0.01 pH		
	Accuracy	±0.02 pH	±0.02 pH		
	Calibration	automatic one or two-point calibration with two sets of standard buffers available (standard 4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)			
mV	Range	–	±1999 mV		
	Resolution	–	1 mV		
	Accuracy	–	±2 mV		
pH-mV	Range	–	±825 mV (pH-mV)		
	Resolution	–	1 mV		
	Accuracy	–	±1 mV		
Temperature*	Range	-5.0 to 105.0°C; 23.0 to 221.0°F			
	Resolution	0.1°C; 0.1°F			
	Accuracy	±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside)			
Additional Specifications	pH Electrode (HI991003 & HI991002)	HI1297D pre-amplified pH/ORP probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)			
	pH Electrode (HI991001)	HI1296D pre-amplified pH probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)			
	Temperature Compensation	automatic, -5.0 to 105.0°C (23.0 to 221.0°F)			
	Battery Type / Life	1.5V (3) AAA / approximately 1200 hours of continuous use.			
Ordering Information	Auto-off	auto-off after eight minutes of non-use			
	Environment	0 to 50°C (32 to 122°F); RH max. 100%			
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)			
	<b>HI991001</b> is supplied with HI1296D pH/ORP probe with internal temperature sensor, HI70004 pH 4.01 buffer sachet, HI70007 pH 7.01 buffer sachet, HI700601 electrode cleaning solution sachet (2), batteries, instructions and rugged carrying case.				
	<b>HI991002</b> and <b>HI991003</b> are supplied with HI1297D pH/ORP probe with internal temperature sensor, HI70004 pH 4.01 buffer sachet, HI70007 pH 7.01 buffer sachet, HI700601 electrode cleaning solution sachet (2), batteries, instructions and rugged carrying case.				

\* Limits will be reduced to actual sensor limits

HI99121

## Direct Soil pH Meter

with Measurement Kit

- Automatic Temperature Compensation (ATC)
- Two-point calibration
- Battery Error Prevention System (BEPS)**
  - Alerts the user of low battery power that could adversely affect readings
- Waterproof**
  - Compact, heavy-duty, and waterproof protected casing
- Battery life indicator**
  - Battery percentage displayed on startup
- Help feature**
  - Tutorial messages displayed on LCD

The HI99121 is the perfect portable pH meter for soil testing. With the HI99121 and HI1292D 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 HI1292D features a conical, rugged tip that can be directly inserted in moist or soft soil. For harder soils, the kit includes a plastic auger to perforate the ground.



### Specifications

HI99121	
pH*	Range -2.00 to 16.00 pH
	Resolution 0.01 pH
	Accuracy $\pm 0.02$ pH
	Calibration one or two-point calibration, two sets of standard buffers available (4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
	Temperature Compensation automatic from -5.0 to 105.0°C (23 to 221°F)
Temperature*	Range -5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution 0.1°C; 0.1°F
	Accuracy $\pm 0.5$ °C (up to 60°C), $\pm 1.0$ °C (outside); $\pm 1.0$ °F (up to 140°F), $\pm 2.0$ °F (outside)
Additional Specifications	Electrode HI1292D glass body, pre-amplified pH electrode for soil measurement with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)
	Battery Type / Life 1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off after 8 minutes of non-use
	Environment 0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight 152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)
Ordering Information	HI99121 is supplied with HI1292D pH electrode, HI721319 soil auger, HI7051M soil preparation solution, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700663 cleaning solution sachet for inorganic soil deposits, HI700664 cleaning solution sachet for organic soil deposits, 100 mL plastic beaker, batteries, instructions and a hard carrying case.

\* Limits will be reduced to actual sensor limits

pH solutions begin on page 2.142; electrode cleaning solutions begin on page 2.156



### Optional shockproof rubber boot

- Specially designed to protect your instrument from damage or impact

HI710023 Orange

HI710024 Blue

## Portable pH Meter

for Plating Baths

pH

- Automatic Temperature Compensation (ATC)
- Two-point calibration
- Waterproof
  - Compact, heavy-duty, and waterproof protected casing
- Battery Error Prevention System (BEPS)
  - Alerts the user of low battery power that could adversely affect readings
- Battery life indicator
  - Battery percentage displayed on startup
- HELP feature
  - Tutorial messages displayed on LCD

HI99131 is a waterproof, portable pH and temperature meter supplied with a flat tip probe specifically designed for use in plating baths.

The HI62911D pre-amplified, double junction pH probe features a recessed flat tip that is easy to clean and prevents solids in solutions from collecting on the sensor. The titanium body of the HI 62911D functions as a potential matching pin for increased stability of readings and extended sensor life.



portable



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

HI710023 Orange  
HI710024 Blue

Specifications		HI99131
pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	one or two-point calibration, two sets of standard buffers available (4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
Temperature*	Range	-5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution	0.1°C; 0.1°F
	Accuracy	±0.5°F (up to 60°C), ±1.0°F (outside); ±1.0°F (up to 140°F), ±2.0°F (outside)
Additional Specifications	Electrode	HI62911D titanium body, pre-amplified pH probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)
	Battery Type / Life	1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off	after 8 minutes of non-use
	Environment	0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz)
Ordering Information		HI99131 is supplied with HI62911D pH probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachets (2), batteries, instructions and hard carrying case.

\* Limits will be reduced to actual sensor limits

HI99141

# Portable pH Meter

for Boiler and Cooling Towers



- Automatic Temperature Compensation (ATC)
- Two-point calibration
- Battery Error Prevention System (BEPS)**
  - Alerts the user of low battery power that could adversely affect readings
- Waterproof**
  - Compact, heavy-duty, and waterproof protected casing
- Battery life indicator**
  - Battery percentage displayed on startup
- Help feature**
  - Tutorial messages displayed on LCD

HI99141 is a waterproof, portable pH and temperature meter supplied with a flat tip probe specifically designed for boiler and cooling tower applications.

The HI72911D pre-amplified double junction pH probe features a flat tip sensor that is easy to clean and prevents solids in solutions from collecting on the sensor. The titanium body of the HI72911D functions as a potential matching pin for increased stability of readings and extended sensor life.

## Specifications

### HI99141

pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	one or two-point calibration, two sets of standard buffers available (4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
Temperature*	Range	-5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution	0.1°C; 0.1°F
	Accuracy	±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside)
Additional Specifications	Electrode	HI72911D titanium body, pre-amplified pH electrode with internal temperature sensor, DIN connector and 1 m (3.3' cable) (included)
	Battery Type / Life	1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off	after 8 minutes of non-use
	Environment	0 to 50°C (32 to 122°F); RH max. 100%
Ordering Information	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)
	HI99141	is supplied with HI72911D pH probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachets (2), batteries, instructions and hard carrying case.

\* Limits will be reduced to actual sensor limits

pH solutions begin on page 2.142; electrode cleaning solutions begin on page 2.156



- Optional shockproof rubber boot**

Specially designed to protect your instrument from damage or impact

HI710023 Orange

HI710024 Blue

## Portable pH Meter

for Leather and Paper

- Automatic Temperature Compensation (ATC)
- Two-point calibration
- **Battery Error Prevention System (BEPS)**
  - Alerts the user of low battery power that could adversely affect readings
- **Waterproof**
  - Compact, heavy-duty, and waterproof protected casing
- **Battery life indicator**
  - Battery percentage displayed on startup
- **Help feature**
  - Tutorial messages displayed on LCD

The HI99171 is a portable, waterproof meter designed for use with leather and paper. It provides fast, accurate, direct pH measurements. The LCD features a multi-level display with on-screen tutorial messages for calibration and set-up. HI99171 utilizes a flat tip probe designed to optimize surface contact with the sample.

pH measurement of papers and cartons is important, not only in the production phase, but also in the packaging phase. The food industry, for example, will perform pH compatibility tests between the product and packaging material.



pH

portable



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

HI710023 Orange  
HI710024 Blue

Specifications		HI99171
pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	one or two-point calibration, two sets of standard buffers available (4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
Temperature*	Range	-5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution	0.1°C; 0.1°F
	Accuracy	±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside)
Additional Specifications	Electrode	HI1414D glass body, pre-amplified pH electrode with flat tip, internal temperature sensor, DIN connector and 1 m (3.3') cable (included)
	Battery Type / Life	1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off	after 8 minutes of non-use
	Environment	0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz)
Ordering Information	HI99171 is supplied with HI1414D flat tipped pH and temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700680 electrode cleaning solution for cellulose deposits sachets (2), HI70960 conductive electrolyte solution for pH measurement (30 mL), batteries, instructions and hard carrying case.	

\* Limits will be reduced to actual sensor limits



HI99181

## Portable pH Meter

for Skin

- Automatic Temperature Compensation (ATC)
- Two-point calibration
- Battery Error Prevention System (BEPS)**
  - Alerts the user of low battery power that could adversely affect readings
- Waterproof**
  - Compact, heavy-duty, and waterproof protected casing
- Battery life indicator**
  - Battery percentage displayed on startup
- Help feature**
  - Tutorial messages displayed on LCD

The HI99181 is a pH meter specifically designed for the analysis of skin. Essential for labs researching the biological compatibility of cosmetics and pharmaceuticals, the HI99181 provides quick and simple measurements without compromising precision.

The pre-amplified HI1414D/50 probe has been specially designed with a flat tip for accurate skin pH measurement with maximum surface contact. It is easy to clean and maintain.

### Specifications

#### HI99181

pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	one or two-point calibration, two sets of standard buffers available (4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
Temperature*	Range	-5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution	0.1°C; 0.1°F
	Accuracy	±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside)
Additional Specifications	Electrode	HI1414D/50 glass body, pre-amplified pH electrode with flat tip, internal temperature sensor, DIN connector and 1 m (3.3') cable
	Battery Type / Life	1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off	after 8 minutes of non-use
	Environment	0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)
Ordering Information	<b>HI99181</b> is supplied with HI1414D/50 flat tipped pH/temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700620 electrode cleaning and disinfection solution for skin residuals sachets (2), HI700621 electrode cleaning solution for skin grease and sebum sachets (2), batteries, instructions and hard carrying case.	

\* Limits will be reduced to actual sensor limits



#### • Optional shockproof rubber boot

- Specially designed to protect your instrument from damage or impact

**HI710023** Orange

**HI710024** Blue

# pH / Temperature Meter for Milk

with Application Specific Probe

- Waterproof
- Application specific electrode
- Automatic Temperature Compensation (ATC)
- Automatic one or two-point calibration
- Multi-level LCD display
- On-screen tutorial for calibration and set up
- Stability indicator for accurate data recording
- Battery Error Prevention System
- Battery life displayed on startup
- Supplied as a complete kit

pH

The Hanna Instruments HI99162 is a durable, waterproof, and portable pH and temperature meter designed specifically for milk analysis. Automatic calibration is done at one or two points with two sets of buffers. All calibration and measurement readings are automatically compensated for temperature variations. The split-level LCD displays both pH and temperature readings, along with indicators for reading stability, battery percentage, and calibration instructions.

portable



Calibrate and measure samples right in the case

Our custom carrying case features a beaker holder for calibration on the farm or production floor.



## On-screen Features



- Temperature
  - °C and °F measurement modes



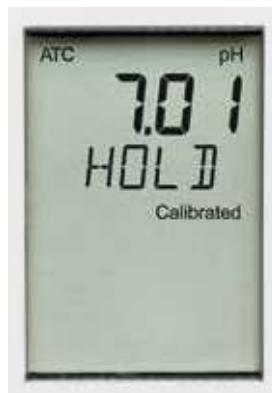
- Buffer sets
  - Calibrate to standard (pH 4.01, pH 7.01, pH 10.01) or NIST (pH 4.01, pH 6.86, pH 9.18) buffers



- Calibration prompts
  - On-screen prompts during the calibration process



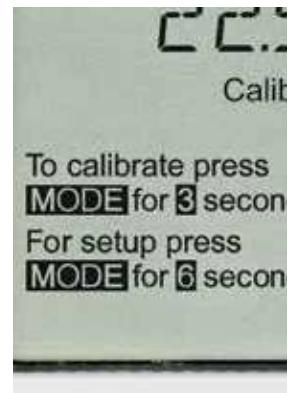
- Stability indicator
  - "Not Stable" tag disappears when the reading is stable for accurate data recording



- Freeze readings
  - Press the SET/HOLD button to hold readings on the display



- Battery percentage
  - Battery percentage is displayed at startup



- On-screen guides
  - On-screen quick guides for entering calibration and set up

### Specifications

### HI99162

pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	automatic, one or two-point calibration with two sets of standard buffers (standard pH 4.01, 7.01, 10.01 or NIST pH 4.01, 6.86, 9.18)
	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
Temperature*	Range	-5.0 to 105.0°C / 23.0 to 221.0°F
	Resolution	0.1°C/0.1°F
	Accuracy	±0.5°C (up to 60°C); ±1.0°C (outside) / ±1°F (up to 140°F); ±2.0°F (outside)
Additional Specifications	Probe (included)	FC101D pre-amplified pH probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)
	Battery Type/Life	1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off	auto-off after 8 minutes of non-use
	Environment	0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz)
Ordering Information	HI99162 is supplied with FC101D pH probe with internal temperature sensor, HI70004 pH 4.01 buffer sachet, HI70007 pH 7.01 buffer sachet, HI700640 electrode cleaning solution sachets (2), batteries, instruction manual, and rugged carrying case.	

\* Limits will be reduced to actual sensor limits

pH solutions begin on page 2.142; electrode cleaning solutions begin on page 2.156



### Rugged custom carrying case

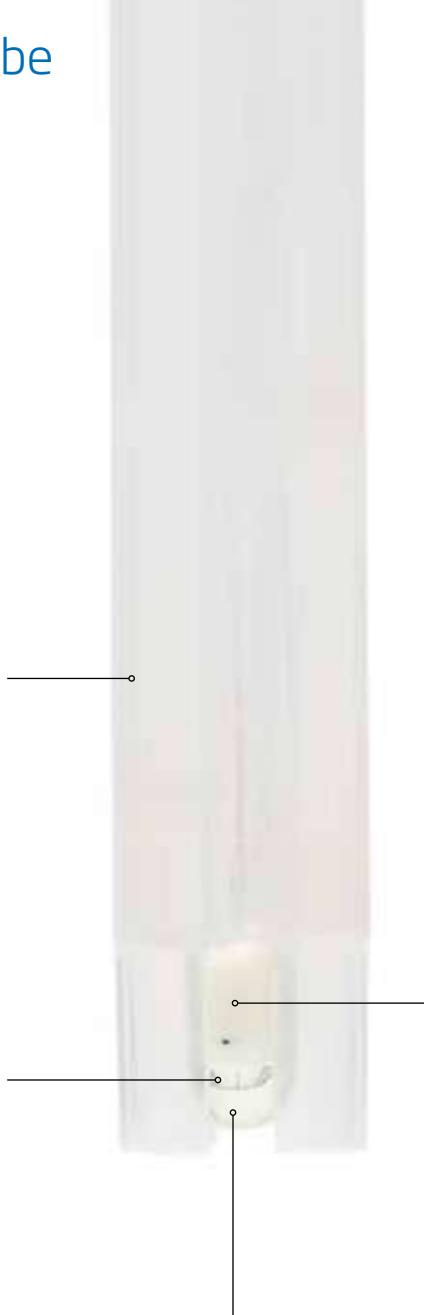
The HI99162 meter, probe, and all accessories are supplied in a rugged carrying case designed to provide years of use. The inside compartment of the carrying case is thermoformed to securely hold and protect all of the components.

## pH / Temperature Probe for Milk

pH

portable

- PVDF body
- Spheric glass tip
- Single ceramic junction
- Double junction
- Built-in temperature sensor



- **PVDF body**
  - The FC101D is composed of food grade PVDF plastic. This material is highly durable and chemically resistant.
- **General purpose glass**
  - The FC101D uses general purpose (GP) glass. The formulation allows for fast response over a wide range of temperatures. The FC101D is suitable to use with samples that measure from 0 to 80°C.

Specifications	FC101D
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) - GP
Tip /Shape	spheric (dia: 7.5 mm)
Temperature Sensor	yes
Amplifier	yes
Body Material	PVDF
Cable	coaxial; 1 m (3.3')
Connection	DIN

- **Refillable electrolyte**
  - The silver-free electrolyte ensures no 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.
- **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.
- **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.

## 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.



## pH / Temperature Meter for Yogurt

with Application Specific Probe

- Waterproof
- Application specific electrode
- Automatic Temperature Compensation (ATC)
- Automatic one or two-point calibration
- Multi-level LCD display
- On-screen tutorial for calibration and set up
- Stability indicator for accurate data recording
- Battery Error Prevention System
- Battery life displayed on startup
- Supplied as a complete kit

pH

The Hanna Instruments HI99164 is a durable, waterproof, and portable pH and temperature meter designed specifically for yogurt analysis. Automatic calibration is done at one or two points with two sets of buffers. All calibration and measurement readings are automatically compensated for temperature measurements. The split-level LCD displays both pH and temperature readings, along with indicators for reading stability, battery percentage, and calibration instructions.

portable



Calibrate and measure samples right in the case

Our custom carrying case features a beaker holder for calibration on the production floor.



## On-screen Features



- Temperature
  - °C and °F measurement modes



- Buffer sets
  - Calibrate to standard (pH 4.01, pH 7.01, pH 10.01) or NIST (pH 4.01, pH 6.86, pH 9.18) buffers



- Calibration prompts
  - On-screen prompts during the calibration process



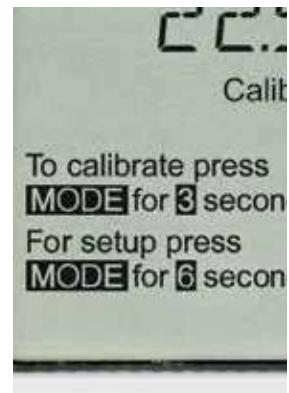
- Stability indicator
  - "Not Stable" tag disappears when the reading is stable for accurate data recording



- Freeze readings
  - Press the SET/HOLD button to hold readings on the display



- Battery percentage
  - Battery percentage is displayed at startup



- On-screen guides
  - On-screen quick guides for entering calibration and set up

### Specifications

#### HI99164

pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	automatic, one or two-point calibration with two sets of standard buffers (standard pH 4.01, 7.01, 10.01 or NIST pH 4.01, 6.86, 9.18)
	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
Temperature*	Range	-5.0 to 105.0°C / 23.0 to 221.0°F
	Resolution	0.1°C/0.1°F
	Accuracy	±0.5°C (up to 60°C); ±1.0°C (outside) / ±1°F (up to 140°F); ±2.0°F (outside)
Additional Specifications	Probe (included)	FC213D pre-amplified pH probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)
	Battery Type/Life	1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off	auto-off after 8 minutes of non-use
	Environment	0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz)
Ordering Information	HI99164 is supplied with FC213D pH probe with internal temperature sensor, HI70004 pH 4.01 buffer sachet, HI70007 pH 7.01 buffer sachet, HI700643 electrode cleaning solution sachets (2), batteries, instruction manual, and rugged carrying case.	

\* Limits will be reduced to actual sensor limits

pH solutions begin on page 2.142; electrode cleaning solutions begin on page 2.156



### Rugged custom carrying case

The HI99164 meter, probe, and all accessories are supplied in a 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.

## pH / Temperature Probe for Yogurt

- Glass body
- Conic glass tip
- Low temperature glass
- Open Junction reference
- Built-in temperature sensor



- **Glass body**
  - The glass body of the FC213D allows standards and samples to more quickly reach thermal equilibrium while also providing chemical resistance.
- **Low temperature glass**
  - The FC213D 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 FC213D 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 FC213D resists clogging and continues to provide accurate, stable readings.
- **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 semisolids and emulsions for the direct measurement of pH in yogurt products.

Specifications	FC213D
Description	pre-amplified pH / temperature probe
Reference	double
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)
Tip /Shape	conic
Temperature Sensor	yes
Amplifier	yes
Body Material	glass
Cable	coaxial; 1 m (3.3')
Connection	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.



## pH / Temperature Meter for Cheese

with Application Specific Probe

- Waterproof
- Application specific electrode
- Automatic Temperature Compensation (ATC)
- Automatic one or two-point calibration
- Multi-level LCD display
- On-screen tutorial for calibration and set up
- Stability indicator for accurate data recording
- Battery Error Prevention System
- Battery life displayed on startup
- Supplied as a complete kit

pH

The Hanna Instruments HI99165 is a durable, waterproof, and portable pH and temperature meter designed specifically for cheese analysis. Automatic calibration is done at one or two points with two sets of buffers. All calibration and measurement readings are automatically compensated for temperature measurements. The split-level LCD displays both pH and temperature readings, along with indicators for reading stability, battery percentage, and calibration instructions.



Calibrate samples right  
in the case

Our custom carrying case features a beaker holder for calibration on the production floor.



## On-screen Features



- Temperature
  - °C and °F measurement modes



- Buffer sets
  - Calibrate to standard (pH 4.01, pH 7.01, pH 10.01) or NIST (pH 4.01, pH 6.86, pH 9.18) buffers



- Calibration prompts
  - On-screen prompts during the calibration process



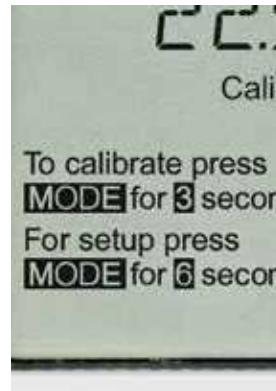
- Stability indicator
  - "Not Stable" tag disappears when the reading is stable for accurate data recording



- Freeze readings
  - Press the SET/HOLD button to hold readings on the display



- Battery percentage
  - Battery percentage is displayed at startup



- On-screen guides
  - On-screen quick guides for entering calibration and set up

### Specifications

#### HI99165

pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	automatic, one or two-point calibration with two sets of standard buffers (standard pH 4.01, 7.01, 10.01 or NIST pH 4.01, 6.86, 9.18)
	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
Temperature*	Range	-5.0 to 105.0°C / 23.0 to 221.0°F
	Resolution	0.1°C/0.1°F
	Accuracy	±0.5°C (up to 60°C); ±1.0°C (outside) / ±1°F (up to 140°F); ±2.0°F (outside)
Additional Specifications	Probe (included)	FC242D pre-amplified pH probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)
	Battery Type/Life	1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off	auto-off after 8 minutes of non-use
	Environment	0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz)
Ordering Information	HI99165 is supplied with FC242D pH probe with internal temperature sensor, HI70004 pH 4.01 buffer sachet, HI70007 pH 7.01 buffer sachet, HI700642 electrode cleaning solution sachets (2), batteries, instruction manual, and rugged carrying case.	

\* Limits will be reduced to actual sensor limits

pH solutions begin on page 2.142; electrode cleaning solutions begin on page 2.156



### Rugged custom carrying case

The HI99165 meter, probe, and all accessories are supplied in a 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.

## pH / Temperature Probe for Cheese

pH

portable

- Stainless steel body
- Conic glass tip
- Low temperature glass
- Built-in temperature sensor



- **AISI 316 stainless steel body**
  - The metal body offers durability in the production facility and can withstand chloride concentrations that cause corrosion in other types of alloys.

- **Low temperature glass**
  - The FC242D 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 FC242D 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 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	FC242D
Description	pre-amplified pH / temperature probe
Reference	single
Junction	ceramic
Electrolyte	viscolene
Max Pressure	0.1 bar
Range	pH: 0 to 12
Recommended Operating Temperature	0 to 50°C (32 to 122°F)
Tip /Shape	conic
Temperature Sensor	yes
Amplifier	yes
Body Material	AISI 316 stainless steel
Cable	coaxial; 1 m (3.3')
Connection	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.



## Portable pH Meter

for yogurt, cheese, and semi-solids

- For HACCP compliant testing
- Automatic Temperature Compensation (ATC)
- Two-point calibration
- Battery Error Prevention System (BEPS)
  - Alerts the user of low battery power that could adversely affect readings
- Waterproof
  - Compact, heavy-duty, and waterproof protected casing
- Battery life indicator
  - Battery percentage displayed on startup
- Help feature
  - Tutorial messages displayed on LCD

The HI99161 is a portable pH and temperature meter is designed specifically for yogurt and cheese applications. Monitoring pH in the dairy process is critical to ensure the quality of product is upheld.

The FC202D pH electrode features a rugged, easy to clean PVDF body with a conical tip making it ideal for measurements in semi-solids such as meats and cheeses. The FC202D uses a free diffusion sleeve type reference junction which helps prevent clogging.

- Specialized electrode
  - The FC202D is the ideal electrode to measure the pH of yogurt, meats, cheeses, fruit, sushi, rice, jams, jellies, dough, ice cream.

pH

portable



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

HI710023 Orange  
HI710024 Blue



### Specifications

	HI99161
pH*	Range -2.00 to 16.00 pH
	Resolution 0.01 pH
	Accuracy $\pm 0.02$ pH
	Calibration one or two-point calibration, two sets of standard buffers available (4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
	Temperature Compensation automatic from -5.0 to 105.0°C (23 to 221°F)
Temperature*	Range -5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution 0.1°C; 0.1°F
	Accuracy $\pm 0.5$ °C (up to 60°C), $\pm 1.0$ °C (outside); $\pm 1.0$ °F (up to 140°F), $\pm 2.0$ °F (outside)
Additional Specifications	Electrode FC202D PVDF body, pre-amplified pH electrode with conical tip, internal temperature sensor, DIN connector and 1 m (3.3') cable (included)
	Battery Type / Life 1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off after 8 minutes of non-use
	Environment 0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight 152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz)
Ordering Information	HI99161 is supplied with FC202D pH and temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700642 electrode cleaning solution sachets (2), batteries, instructions and hard carrying case.

\* Limits will be reduced to actual sensor limits

HI99163

## Portable pH Meter

and Sensor for Meat

- For HACCP compliant testing
- Automatic Temperature Compensation (ATC)
- Two-point calibration
- Battery Error Prevention System (BEPS)
  - Alerts the user of low battery power that could adversely affect readings
- Waterproof
  - Compact, heavy-duty, and waterproof protected casing
- Battery life indicator
  - Battery percentage displayed on startup
- Help feature
  - Tutorial messages displayed on LCD

HI99163 is a portable pH and temperature meter specially designed for the meat processing industry.

The FC232D pre-amplified pH electrode and removable stainless steel blade enables users to perform non-intrusive measurements of meat products inside and out. The free diffusion junction helps to avoid a clogged reference, where the external body material is non-toxic and food compatible.



- Two blade lengths available
  - Use the optional FC098 (20 mm) or the included FC099 (35 mm) stainless steel penetration blades for meat processing applications



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

**HI710023** Orange  
**HI710024** Blue

### Specifications

### HI99163

pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	one or two-point calibration, two sets of standard buffers available (4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
Temperature*	Range	-5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution	0.1°C; 0.1°F
	Accuracy	±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside)
Additional Specifications	Electrode	FC232D pre-amplified pH probe with internal temperature sensor, DIN connector and 1 m (3.3' cable)
	Battery Type / Life	1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off	after 8 minutes of non-use
	Environment	0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)
Ordering Information	HI99163 is supplied with FC232D pH and temperature probe with FC099 stainless steel blade tip, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700630 electrode acid cleaning solution sachets for meat, grease and fats (2), batteries, instructions and hard carrying case.	

\* Limits will be reduced to actual sensor limits

pH solutions begin on page 2.142; electrode cleaning solutions begin on page 2.156

## Portable pH Meter

for Drinking Water

- Automatic Temperature Compensation (ATC)
- Two-point calibration
- **Battery Error Prevention System (BEPS)**
  - Alerts the user of low battery power that could adversely affect readings
- **Waterproof**
  - Compact, heavy-duty, and waterproof protected casing
- **Battery life indicator**
  - Battery percentage displayed on startup
- **Help feature**
  - Tutorial messages displayed on LCD

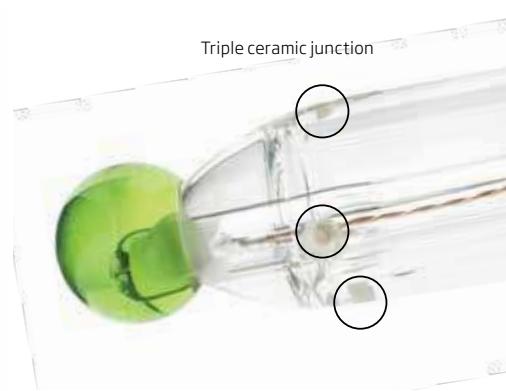
The Hanna HI99192 is a waterproof portable pH and temperature meter designed specifically for measuring the pH of drinking water.

The HI99192 measures pH from -2.00 to 16.00 pH and temperature from -5.0 to 105.0 °C (23.0 to 221.0 °F). Automatic calibration is performed at one or two points and all readings are automatically compensated. Indicators for stability, battery percentage, and calibration instructions are viewed on the LCD display. The HI99192 uses three 1.5V AAA batteries for an exceptional battery life of 1200 hours of continuous use.

pH

portable





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

## 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 efficiency. In the United States, the pH of water is determined by a pH meter according to EPA method 150.1 and Standard Methods 4500-H.

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

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

Specifications	HI99192
pH*	Range -2.00 to 16.00 pH
	Resolution 0.01 pH
	Accuracy $\pm 0.02$ pH
	Calibration one or two-point calibration, two sets of standard buffers available (4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
	Temperature Compensation automatic from -5.0 to 105.0°C (23 to 221°F)
Temperature*	Range -5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution 0.1°C; 0.1°F
	Accuracy $\pm 0.5$ °C (up to 60°C), $\pm 1.0$ °C (outside); $\pm 1.0$ °F (up to 140°F), $\pm 2.0$ °F (outside)
Additional Specifications	Electrode FC215D pre-amplified pH electrode with internal temperature sensor, DIN connector, 1 m (3.3') cable (included)
	Battery Type / Life 1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off after 8 minutes of non-use
	Environment 0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight 152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)
Ordering Information	HI99192 is supplied with FC215D pH and temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700661 electrode cleaning solution sachets (2), HI7082 3.5 KCl filling solution, batteries, instructions and hard carrying case.

\* Limits will be reduced to actual sensor limits

## Portable pH Meter

for Beer Analysis

- Automatic Temperature Compensation (ATC)
- Two-point calibration
- **Battery Error Prevention System (BEPS)**
  - Alerts the user of low battery power that could adversely affect readings
- **Waterproof**
  - Compact, heavy-duty, and waterproof protected casing
- **Battery life indicator**
  - Battery percentage displayed on startup
- **Help feature**
  - Tutorial messages displayed on LCD

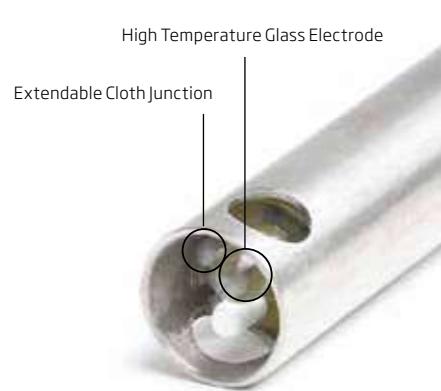
The HI99151 is a rugged, waterproof, portable pH and temperature meter designed specifically for the brewing industry. The HI99151 uses the FC214D, a titanium bodied, gel filled pH electrode that features high temperature glass and an extendable cloth junction.

The HI99151 measures pH from -2.00 to 16.00 pH and temperature from -5.0 to 105.0 °C (23.0 to 221.0 °F). Automatic calibration is done at one or two points with two sets of buffers and all readings are automatically compensated for temperature variations. Indicators for stability, battery percentage, and calibration instructions are viewed on the primary display. The HI99151 uses three 1.5V AAA batteries for an exceptional battery life of 1200 hours of continuous use.

pH

portable





## FC214D 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**
- **Extendable cloth junction to prevent clogging**
- **High temperature glass**

The HI99151 beer pH meter uses the titanium bodied FC214D 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 that allows the transfer of heat to the internal temperature sensor for rapid temperature compensation.

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

### 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.

### Specifications

	HI99151
pH*	Range -2.00 to 16.00 pH
	Resolution 0.01 pH
	Accuracy $\pm 0.02$ pH
	Calibration one or two-point calibration, two sets of standard buffers available (4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
	Temperature Compensation automatic from -5.0 to 105.0°C (23 to 221°F)
Temperature*	Range -5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution 0.1°C; 0.1°F
	Accuracy $\pm 0.5$ °C (up to 60°C), $\pm 1.0$ °C (outside); $\pm 1.0$ °F (up to 140°F), $\pm 2.0$ °F (outside)
Additional Specifications	Electrode FC214D pre-amplified pH electrode with internal temperature sensor, DIN connector, 1m (3.3') cable (included)
	Battery Type / Life 1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off after 8 minutes of non-use
	Environment 0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight 152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)
Ordering Information	HI99151 is supplied with FC214D pH and temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700661 electrode cleaning solution sachets (2), batteries, instructions and hard carrying case.

\* Limits will be reduced to actual sensor limits

## Portable pH Meter

for Wine Analysis

- Clogging prevention system (CPS™)
- Automatic Temperature Compensation (ATC)
- Two-point calibration
- Battery Error Prevention System (BEPS)
  - Alerts the user of low battery power that could adversely affect readings
- Waterproof
  - Compact, heavy-duty, and waterproof protected casing
- Battery life indicator
  - Battery percentage displayed on startup
- Help feature
  - Tutorial messages displayed on LCD

The HI99111 is a portable, waterproof pH and temperature meter designed specifically for the wine industry. The HI99111 uses the HI1048D glass bodied pH electrode. Hanna's Clogging Prevention System (CPS™) utilizes the electrodes PE sleeve.

HI99111 measures pH from -2.00 to 16.00 and temperature from -5.0 to 105.0 °C (23.0 to 221.0 °F). Automatic calibration is performed at one or two points with two sets of buffers and all readings are automatically temperature compensated. Indicators for stability, battery percentage, and calibration instructions are viewed on the primary display. The HI99111 uses three 1.5V AAA batteries for an exceptional battery life of 1200 hours of continuous use.

pH

portable





## 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

	HI99111
pH*	Range -2.00 to 16.00 pH
	Resolution 0.01 pH
	Accuracy $\pm 0.02$ pH
	Calibration one or two-point calibration, two sets of standard buffers available (3.00, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
	Temperature Compensation automatic from -5.0 to 105.0°C (23 to 221°F)
Temperature*	Range -5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution 0.1°C; 0.1°F
	Accuracy $\pm 0.5$ °C (up to 60°C), $\pm 1.0$ °C (outside); $\pm 1.0$ °F (up to 140°F), $\pm 2.0$ °F (outside)
Additional Specifications	Electrode HI1048D pH/temperature probe with CPS™ technology, DIN connector, 1 m (3.3') cable (included)
	Battery Type / Life 1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off after 8 minutes of non-use
	Environment 0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight 152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)
Ordering Information	<b>HI99111</b> is supplied with HI1048D pH and temperature probe, pH 3.00 buffer solution sachet, pH 7.01 buffer solution sachet, electrode cleaning solution sachet for wine deposits and electrode cleaning solution sachet for wine stains, batteries, instructions and hard carrying case.

\* Limits will be reduced to actual sensor limits

pH solutions begin on page 2.142; electrode cleaning solutions begin on page 2.156

## HI1048D pH electrode

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

The HI99111 portable pH meter for wine uses the glass body HI1048D 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 porosity 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.

## 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
  - HOLD function
- Battery indicator
  - Low battery indicator

pH

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 <sup>12</sup> 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.

\* Limits will be reduced to actual sensor limits

## 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	<b>HI83141</b> 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.		
	<b>HI8314</b> 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.		

\* Limits will be reduced to actual sensor limits

## 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.

pH

portable



		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 <sup>12</sup> 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.		

\* Limits will be reduced to actual sensor limits

## pH/mV Precision Simulators



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

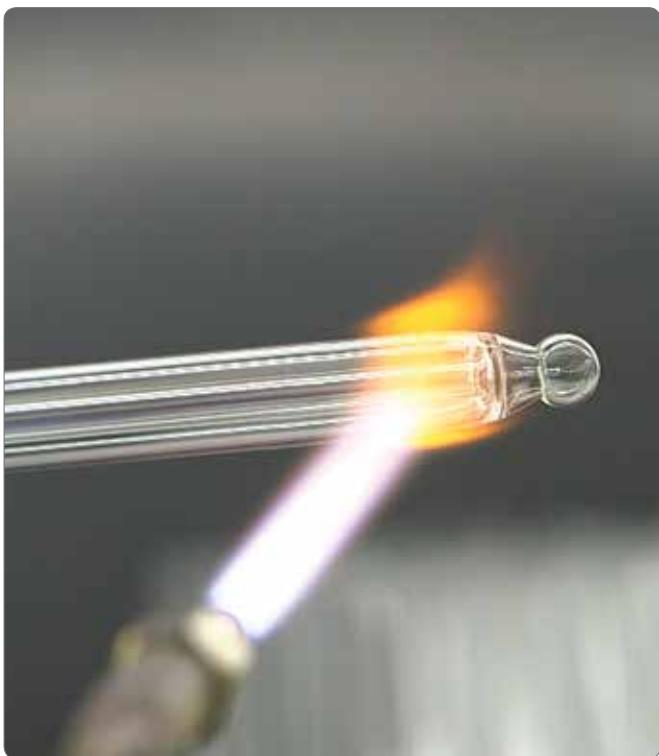
HI8427 is designed specifically to simulate pH and ORP electrodes to confirm proper functioning of your meter. Standard pH and mV ranges are selectable with a dial on the front panel and pH can simulate sensor response at temperatures between 0 to 50°C.

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<sup>9</sup> 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.





## 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 its 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:

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

**$E_{\text{obs}}$**  = Observed potential

**$E^{\circ}$**  = Reference potential including other stable and fixed potentials

**$a_{\text{H}^+}$**  = The hydrogen ion activity

**T** = Temperature in Kelvin ( $^{\circ}\text{C} + 273.15$ )

**n** = Valence of the ion measured (1)

**F** = Faraday's constant ( $9.6485 \times 10^4$ )

**R** = Gas constant ( $8.31432 \text{ J} / \text{KMol}$ )

From this equation one can see 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 Measuring System

### pH Electrode

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

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

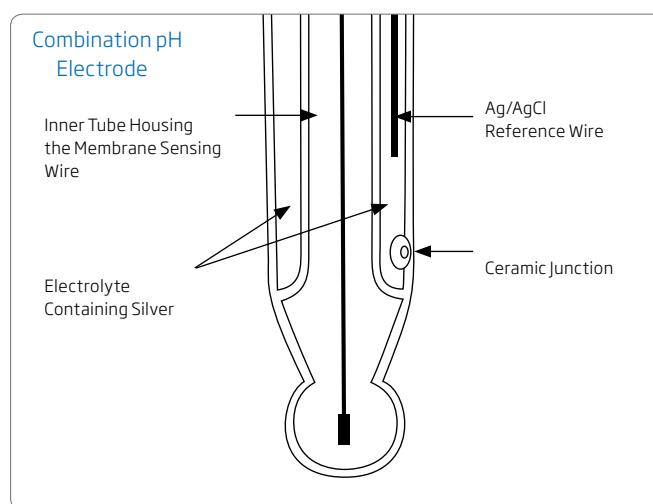
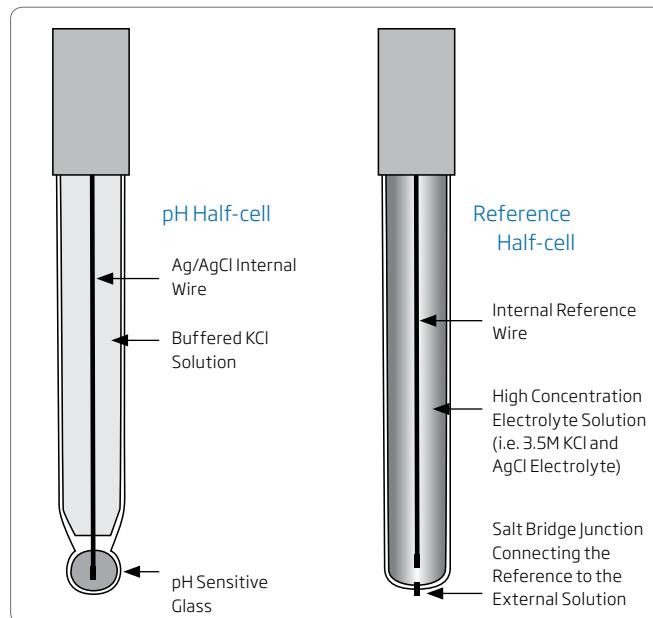
A temperature measurement is desired during calibration and measurement to make adjustments to the Nernst slope factor. An auxiliary or built-in temperature probe ensures both calibration and measurement are automatically temperature compensated, thus eliminating error.

### 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

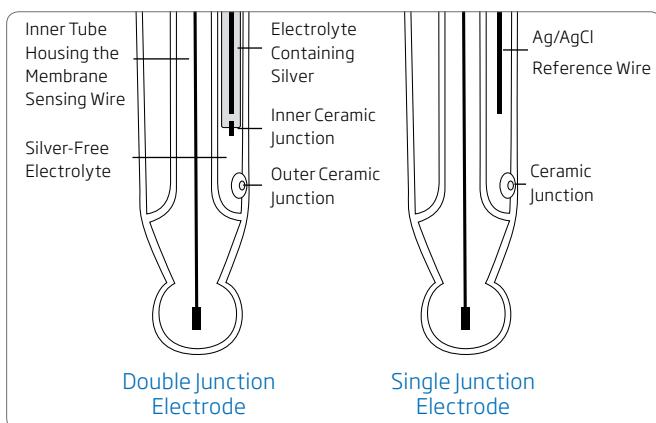
Until the 1970s, it was a common practice to offer two half cells separately, a glass pH sensor and a reference electrode. Today it is more common to use a single combined electrode that has both sensing and reference components. Reference electrodes still enjoy use in other electrochemical techniques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

## 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 drift 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 evident. 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, there is no precipitate forming 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 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 advantages, PTFE is widely used in industrial applications.



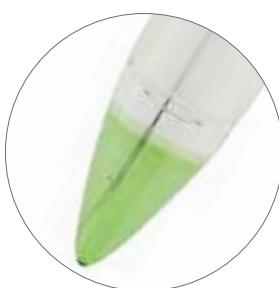
### Fiber Wick

This type of junction is often used on plastic bodied electrodes with gelled electrolytes. The advantage of this junction is it is renewable; as the cloth like material is pulled out from its position, the junction is renewed with a fresh, uncontaminated surface.



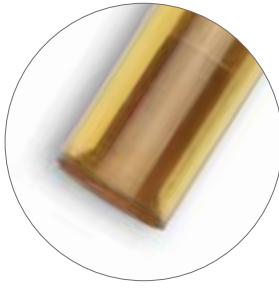
### Open Junction

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 can then increase 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.



### 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.

## Matching Pin

A matching pin is a differential measurement technique used to eliminate ground loops and common mode perturbations for the 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 a 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  $\mu\text{S}/\text{cm}$  to function properly.

*In the case of low conductivity samples that are below 200  $\mu\text{S}/\text{cm}$ , 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
10.5				0.14
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		

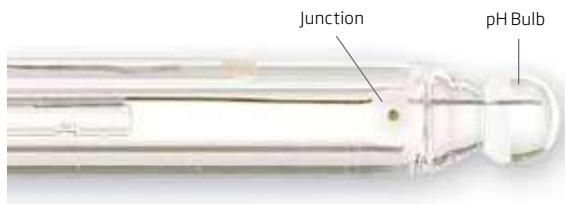
## Calibration

### 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<sub>2</sub> diffusing into the buffer, forming carbonic acid. If the buffer is old, the actual value might be less than stated on the bottle, resulting 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.

### Submerge Electrode Past Junction

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

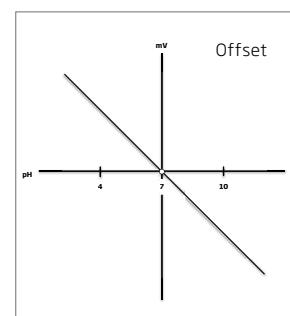


### Use a Magnetic Stirrer

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.

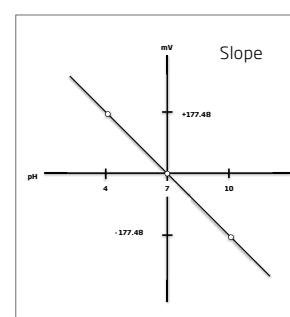
### One-point Calibration

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 recommended 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.



*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).*

## 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  $\pm 30$  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  $\pm 8.0$  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

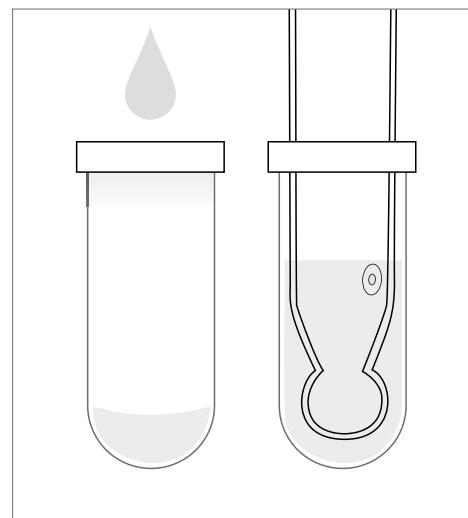
Absolute mV difference is +160 mV - (-15 mV) = +145 mV

At 25°C pH 7.01 (offset) =  $\pm 30$  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  $\pm 30$  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.

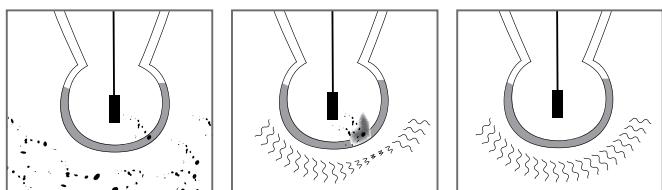
Inspect the electrode for any scratches or cracks on the bulb or stem.  
If any are present, replace the electrode.

## 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  $\pm 60$  mV. The deviation from 0 mV is not unusual but ideally should be no greater than  $\pm 30$  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 dissipates, 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<sub>3</sub> 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. The open junction design of the FC200 resists clogging, while those with a cloth junction can have the junction extracted, effectively renewing the 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  $\pm 30$  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<sub>2</sub> 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.

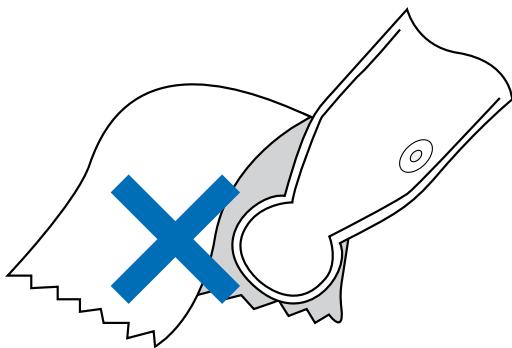
## pH Electrode has a Short Life Span (< 6 months)

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.

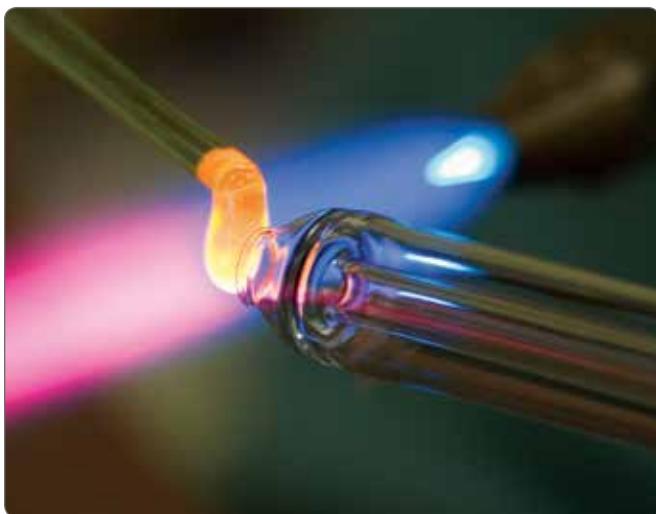
The scale of measurement may be positive (indicating oxidizing potential) or negative (indicating reducing). It should be noted that when zero mV is observed, it is really an oxidizing situation because the reference voltage (~200 mV for an Ag/AgCl with KCl electrolyte) is included in the observed mV 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:

$$rH = \frac{mV}{0.0992(273.15 + T_c)} - 2 \text{ pH}$$

In this equation, where  $T$  is the temperature ( $^{\circ}\text{C}$ ) of the sample,  $mV$  is the ORP (mV) reading, and  $\text{pH}$  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  $\pm 2000$  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

Integral pre-amplifiers are encapsulated in this series 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

electrodes

Abbreviation Guide			
Spheric (S)	Glass (G)		
Conic (C)	Plastic (P)		
Flat (F)	Metal (M)		

Application	Recommended Electrodes	Tip Shape	Body Material	Single Reference	Double Reference	Cloth Junction	Ceramic Junction	Open Junction	Viscolelectricolyte	Gel Electrolyte	KCl 3.5M Electrolyte	KCl 3.5M + AgCl Electrolyte	Refillable	SMART	Temperature Sensor	Amplifier	Pressure (Bar)	Page
Acids, Strong	HI1043B/P HI10430*	S G	G	•							•	•	•	•	•	•	0.1	2.122
Alkaline, Strong	HI2111B (half-cell) + HI5311	S G	G	•	•						•	•	•	•	•	0.1	2.139, 2.140	
Aquariums	HI1332B/P	S P	P	•	•						•	•	•	•	0.1	2.127		
Bases, Strong	HI1043B/P HI10430*	S G	G	•	•						•	•	•	•	•	0.1	2.122	
Beer	HI1131B/P/D HI11310* HI11311* FC214D	S G	G	•	•						•	•	•	•	•	0.1	2.123	
Biotechnology (< 100 µl)	HI1083B/P	S G	G	•				•	•						0.1	2.122		
Boilers and Cooling Towers	HI72911D	F M	M	•		PTFE				Polymer			•	•	3	2.138		
Cheese	FC200B/D FC242D, FC2423 FC240B FC202D, FC2023, FC2053	C P	P	•				•	•						0.1	2.132		
Chemicals	HI1332B/P/D HI10430*	S P	P	•	•						•	•	•	•	0.1	2.128		
Conductivity, Low	HI1053B/P HI10530* HI10533	C G	G	•	•						•	•	•	•	0.1	2.129		
Conductivity, High	HI1043B/P	S G	G	•	•						•	•	•	•	0.1	2.122		
Creams	FC210B FC220B FC911B	C G	G	•		•	•								0.1	2.132		
Dairy (general use)	HI2031B FC100B FC101D, FC1013	C G	G	•	•						•	•	•	•	0.1	2.125		
Emulsions	HI1053B/P HI10530* HI10533 HI1612D HI1413B HI1414D	C G	G	•	•						•	•	•	•	0.1	2.122		
Fats and Creams	HI1053B/P HI10530* HI10533	C G	G	•	•						•	•	•	•	0.1	2.129		
Flasks	HI1331B	S G	G	•		•					•	•	•	•	0.1	2.124		
Fluoride, Samples with	HI1143B	S G	G	•	•						•	•	•	•	0.1	2.124		
Food Industry (General Use)	FC100B FC911B	S P	P	•	•						•	•	•	•	0.1	2.132		

\*edge® specific electrode

# pH Electrode Application Guides

## Abbreviation Guide

Spheric (S)	Glass (G)
Conic (C)	Plastic (P)
Flat (F)	

Application	Recommended Electrodes	Tip Shape	Body Material	Single Reference	Double Reference	Cloth Junction	Ceramic Junction	Open Junction	Viscose Electrolyte	Gel Electrolyte	KCl 3.5M + AgCl Electrolyte	Refillable	SMART	Temperature Sensor	Amplifier	Pressure (Bar)	Page
Food, Semi-solid	FC202D, FC2023, FC2053	C	P	•		•	•					•	•	•	0.1	2.134	
	FC200B/D	C	P	•		•	•	•							0.1	2.132	
Fruits	FC200B/D	C	P	•		•	•	•							0.1	2.132	
	FC202D, FC2023, FC2053	C	P	•		•	•	•					•	•	0.1	2.134	
Fruit Juices, Organic	FC220B	S	G	•		•					•	•			0.1	2.133	
	FC911B	S	P	•		•				•	•		•	•	0.1	2.134	
Frozen, Semi	FC230B	C	P	•		•	•	•							0.1	2.133	
	FC200B/D	C	P	•		•	•	•							0.1	2.132	
Ham and Sausages	FC202D, FC2023, FC2053	C	P	•		•	•						•	•	0.1	2.134	
	FC230B	C	P	•		•	•								0.1	2.133	
Humidity, High	FC911B	S	P	•		•				•	•		•	•	0.1	2.134	
Hydrocarbons	HI1043B/P	S	G	•		•				•	•				0.1	2.122	
	HI10430*	S	G	•		•				•	•	•	•	•	0.1	2.129	
	HI1131B/P/D	S	G	•		•				•	•				0.1	2.123	
	HI1230B/D	S	P	•		•				•					2	2.124	
	HI1217D	S	P	•		•				•				•	2	2.126	
	HI1610D	S	G	•		•				•	•			•	0.1	2.127	
	HI11310*	S	G	•		•				•	•	•	•	•	0.1	2.129	
	HI11311*	S	G	•		•				•	•	•	•	•	0.1	2.129	
	HI12300*	S	P	•		•				•					2	2.131	
	HI12301*	S	P	•		•				•					2	2.131	
Leather	HI1413B	F	G	•		•	•								0.1	2.136	
	HI1414D	F	G	•		•	•						•	•	0.1	2.136	
	FC230B	C	P	•		•	•								0.1	2.133	
	FC400B	C	P	•		•	•								0.1	2.133	
Meats	FC232D, FC2323	C	P	•		•	•							•	0.1	2.135	
	FC202D, FC2023, FC2053	C	P	•		•	•						•	•	0.1	2.134	
	FC2320*	C	P	•		•	•						•	•	0.1	2.130	
	FC100B	S	P	•		•				•	•				0.1	2.132	
Milk	FC101D, FC1013	S	P	•		•				•	•			•	0.1	2.132	
	FC260B (half-cell)	S	G													2.139	
Monitoring, Continuous	HI1135B	S	G	•		•				•	•				3	2.123	
	HI1611D	S	G	•		•				•				•	2	2.127	
Must in Winemaking	HI1048B/P, HI1048B/50	S	G	•		•				•	•				0.1	2.134	
	HI1048D	S	G	•		•				•	•			•	0.1	2.134	
	HI10480*	S	G	•		•				•	•			•	0.1	2.130	
	HI1093B	S	G	•		•	•								0.1	2.123	
NMR Tubes	HI1043B/P	S	G	•		•				•	•				0.1	2.122	
	HI10430*	S	G	•		•				•	•	•	•	•	0.1	2.129	
Paper	HI1413B	F	G	•		•	•								0.1	2.136	
	HI1414D	F	G	•		•	•						•	•	0.1	2.136	
Photographic Chemicals	HI1230B/D	S	P	•		•				•						2.124	
Plating Baths	HI62911D	F	M	•		PTFE				Polymer			•	•	3	2.138	
Quality Control	HI1332B/P/D	S	P	•		•				•	•				0.1	2.127	
	FC240B	C	M	•		•	•			•					0.1	2.133	

\*edge® specific electrode

Unsure about which electrode to choose? Give your local Hanna office a call for assistance.

[www.hannainst.com](http://www.hannainst.com) | 

electrodes

# pH Electrode Application Guides

Abbreviation Guide			
Spheric (S)	Glass (G)		
Conic (C)	Plastic (P)		
Flat (F)	Metal (M)		

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	2.133		
	FC911B	S	P	•	•	•				•	•				0.1	2.134		
Seawater	HI1043B/P	S	G	•	•	•				•	•				0.1	2.122		
	HI10430*	S	G	•	•	•				•	•	•	•	•	0.1	2.129		
Semi-solid Products	HI1053B/P	C	G	•	•	•				•	•				0.1	2.122		
	HI10530*	C	G	•	•	•				•	•	•	•	•	0.1	2.129		
	HI10533	C	G	•	•	•				•	•	•	•	•	0.1	2.122		
	HI1612D	C	G	•	•	•				•	•	•	•	•	0.1	2.127		
	FC200B/D	C	P	•		•	•								0.1	2.132		
	HI2031B	C	G	•		•				•	•				0.1	2.125		
Skin, Scalp	HI1413B	F	G	•		•	•								0.1	2.136		
	HI1414D/50	F	G	•		•	•					•	•		0.1	2.136		
Soil, Direct	HI1292D	C	G	•		•				•	•	•	•	•	0.1	2.136		
	HI1294D**	C	G	•		•				•	•	•	•	•	0.1	2.137		
Soil Solution	HI1053B/P	C	G	•		•				•	•				0.1	2.122		
	HI10530*	C	G	•		•				•	•	•	•	•	0.1	2.129		
	HI10533	C	G	•		•				•	•	•	•	•	0.1	2.122		
	HI1230B/D	S	P	•		•			•						2	2.124		
	HI1292D	C	G	•		•				•	•	•	•	•	0.1	2.136		
	HI1294D**	C	G	•		•				•	•	•	•	•	0.1	2.137		
Solvents	HI1043B/P	S	G	•		•				•	•				0.1	2.122		
	HI10430*	S	G	•		•				•	•	•	•	•	0.1	2.129		
Surface Measurements	HI1413B	F	G	•		•	•								0.1	2.136		
	HI1414D	F	G	•		•	•								0.1	2.136		
Swimming Pools	HI1297D	C	M	•		•			•						•	•	3	2.137
Titrations, Non Aqueous	HI1151B	S	G	•		•				•	•				0.1	2.123		
Tris Buffer	HI1043B/P	S	G	•		•				•	•				0.1	2.122		
	HI10430*	S	G	•		•				•	•	•	•	•	0.1	2.129		
	HI1144B/D	S	G	•		•				•	•				0.1	2.125		
	HI1343B	S	P	•		•				•	•				0.1	2.125		
Vials and Test Tubes	HI1330B/P	S	G	•		•				•	•				0.1	2.125		
Wastewater	HI1296D/HI12963	S	M	•		•			•						•	•	3	2.137
	HI1297D	C	M	•		•			•						•	•	3	2.137
Water, High Purity	HI1053B/P	C	G	•		•				•	•				0.1	2.122		
	HI10530*	C	G	•		•				•	•	•	•	•	0.1	2.129		
	HI10533	C	G	•		•				•	•	•	•	•	0.1	2.122		
Water, Municipal	HI1297D	C	M	•		•			•						•	•	3	2.137
Water, Potable	HI1053B/P	C	G	•		•				•	•				0.1	2.122		
	HI10530*	C	G	•		•				•	•	•	•	•	0.1	2.129		
	HI10533	C	G	•		•				•	•	•	•	•	0.1	2.122		
	FC215D	S	G	•		•				•	•				0.1	2.137		
Water Treatment	HI1297D	C	M	•		•			•						•	•	3	2.137
Yogurt	FC200B/D	C	P	•		•	•								0.1	2.132		
	FC210B	C	G	•		•	•								0.1	2.132		
	FC213D, FC2133	C	G	•		•	•								•	•	0.1	2.135
	FC202D, FC2023, FC2053	C	P	•		•	•								•	•	0.1	2.134
	FC2100*	C	G	•		•	•								•	•	0.1	2.130
	FC2020*	C	P	•		•	•								•	•	0.1	2.130

\*edge® specific electrode; \*\*HI9814 GroLine portable meter specific electrode

# ORP Electrode Application Guides

Abbreviation Guide	
Platinum (Pt)	Glass (G)
Gold (Au)	Plastic (P)

Application	Recommended Electrodes	Sensor	Body Material	Single Reference	Double Reference	Cloth Junction	Ceramic Junction	Open Junction	Gel Electrolyte	KCl 3.5M Electrolyte	Refillable	Smart	Temperature Sensor	Amplifier	Pressure (Bar)	Page	
Laboratory (General Use)	HI3131B/P	Pt	G	•		•				•	•					0.1	2.126
	HI3618D, HI36183	Pt	G	•		•				•	•	•	•	•	•	0.1	2.126
	HI36180*	Pt	G	•	•	•				•	•	•	•	•	•	0.1	2.131
	HI36200*	Pt	P	•		•		•				•	•	•	•	2	2.131
Oxidants	HI4430B	Au	P	•		•		•								2	2.128
Ozone	HI4430B	Au	P	•		•		•								2	2.128
Quality Control	HI3230B	Pt	P	•		•		•								2	2.128
Titrations, ORP	HI3131B/P	Pt	G	•		•				•	•					0.1	2.126
Water, Municipal	HI3230B	Pt	P	•		•		•								2	2.128
Must in Winemaking	HI3148B	Pt	G	•		•		•		•	•					0.1	2.135

\*edge® specific electrode

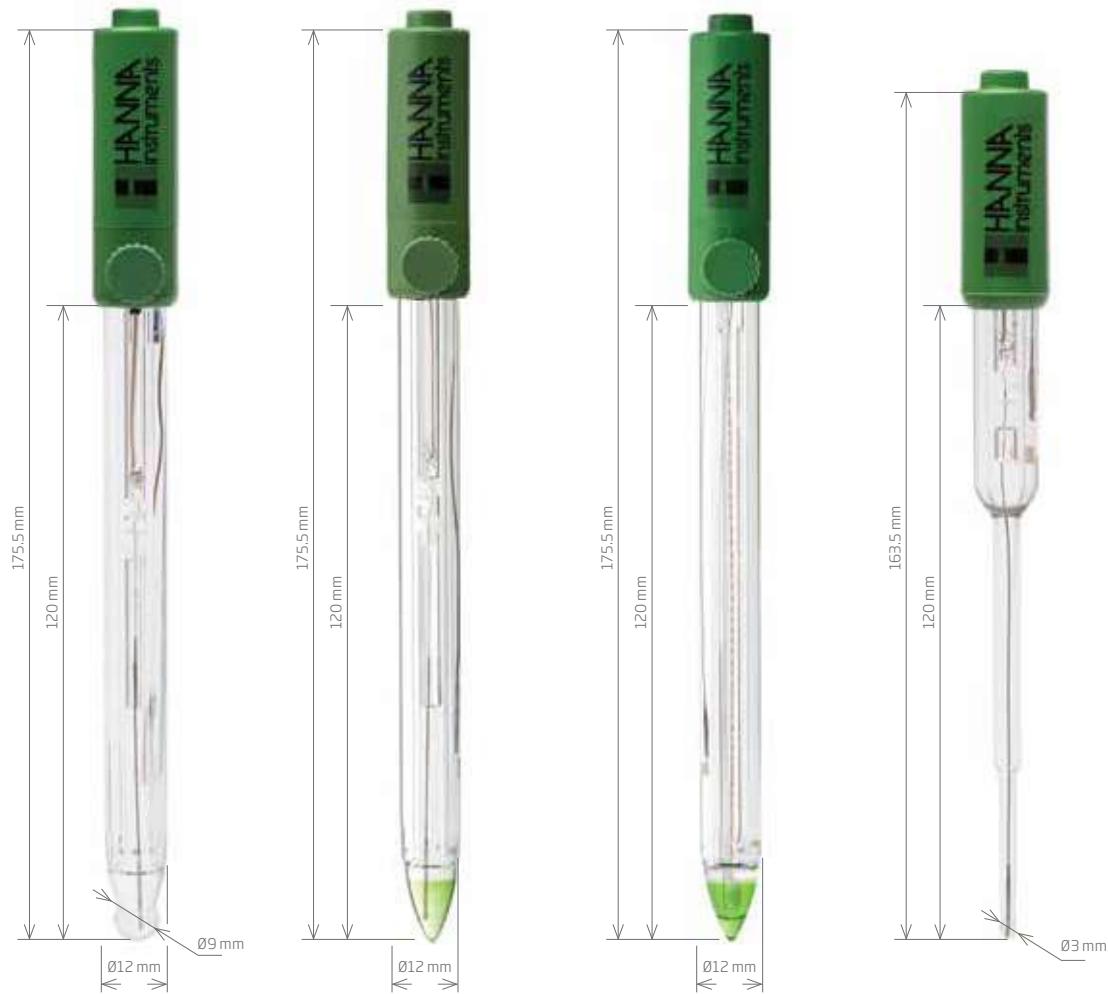
# Half-Cell and Reference Electrode Application Guides

Abbreviation Guide	
Spheric (S)	Glass (G)
Cylindric (C)	Plastic (P)
Platinum (Pt)	
Gold (Au)	

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							2.139
	HI2112B		•		S	P							2.139
	HI3133B			•	Pt	G							2.139
	HI5412			•	G	•			•	•	•	0.1	2.140
Milk	HI5311			•	G	•			•	•	•	0.1	2.140
	FC260B		•		S	G							2.139
Remote Filling	HI5314			•	G	•			•	•	•	3	2.140
	HI5414			•	G	•			•	•	•	3	2.140
Strong Alkaline Solutions	HI2111B		•		S	G							2.139
	HI5413			•	G	•			•	•	•	0.1	2.141
	HI5312			•	G	•			•	•	•	0.1	2.141
Suspended Solids	HI5313			•	P	•			•	•	•	0.1	2.141
	HI5412			•	G	•			•	•	•	0.1	2.140
Titrations, General	HI5311			•	G	•			•	•	•	0.1	2.140
	HI5312			•	G	•			•	•	•	0.1	2.141
	HI5313			•	P	•			•	•	•	0.1	2.141
Titration, Argentometric	HI5110B			•	C	G							2.139
	HI5412			•	G	•			•	•	•	0.1	2.140
Titration, Potentiometric	HI5311			•	G	•			•	•	•	0.1	2.140
	HI5312			•	G	•			•	•	•	0.1	2.141
	HI3133B			•	Pt	G							2.139

Unsure about which electrode to choose? Give your local Hanna office a call for assistance.

## 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 13	pH: 0 to 13
Recommended Operating Temp.	0 to 100°C (32 to 212°F) - HT	-5 to 70°C (23 to 158°F) - LT	-5 to 100°C (23 to 212°F) - LT	0 to 50°C (32 to 122°F) - GP
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	<b>HI1043B</b> BNC <b>HI1043P</b> BNC + pin*	<b>HI1053B</b> BNC <b>HI1053P</b> BNC + pin*	<b>HI10533</b> Quick Connect DIN	<b>HI1083B</b> BNC <b>HI1083P</b> BNC + pin*

\* For pH meters with CAL Check™ system

\* For pH meters with CAL Check system

\* For pH meters with CAL Check system

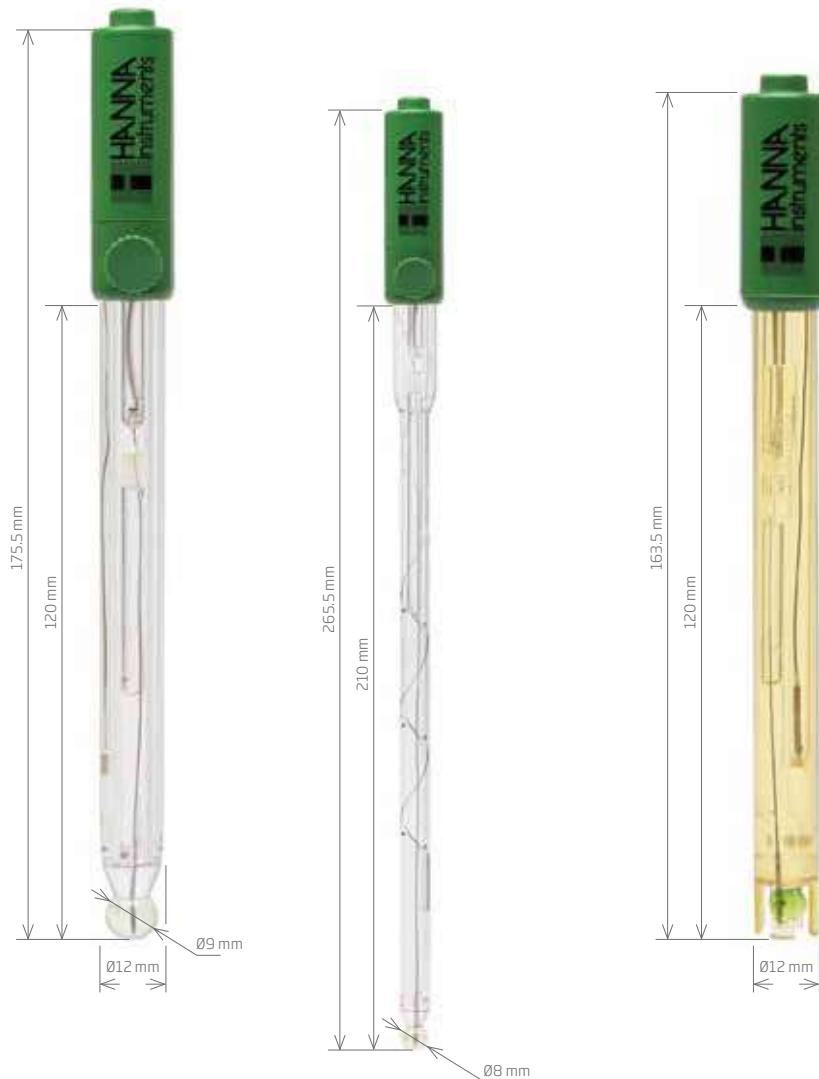
## Combination Electrodes



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 13	pH: 0 to 13	pH: 0 to 13	pH: 0 to 14
Recommended Operating Temp.	0 to 50°C (32 to 122°F) - GP	0 to 100°C (32 to 212°F) - HT	0 to 100°C (32 to 212°F) - HT	0 to 100°C (32 to 212°F) - HT
Tip / Shape	spheric (dia: 3 mm)	spheric (dia: 9.5 mm)	spheric (dia: 9.5 mm)	spheric (dia: 9.5 mm)
Temperature Sensor	no	no	no	no
Amplifier	no	no	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	<b>HI1093B</b> BNC	<b>HI1131B</b> BNC <b>HI1131P</b> BNC + pin*	<b>HI1151B</b> BNC	<b>HI1135B</b> BNC

\* For pH meters with CAL Check™ system

## Combination Electrodes



Code	HI1143B	HI1331B	HI1230[ ]
Description	refillable, combination pH electrode for fluoride applications	combination pH electrode	combination pH electrode
Reference	double, 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
Electrolyte	KCl 3.5M	KCl 3.5M + AgCl	gel
Max Pressure	0.1 bar	0.1 bar	2 bar
Range	pH: 0 to 10	pH: 0 to 13	pH: 0 to 12
Recommended Operating Temp.	-5 to 60°C (23 to 140°F) – HF	0 to 70°C (32 to 158°F) – GP	-5 to 70°C (23 to 158°F) – LT
Tip / Shape	spheric (dia: 9.5 mm)	spheric (dia: 7.5 mm)	spheric (dia: 7.5 mm)
Temperature Sensor	no	no	no
Amplifier	no	no	no
Body Material	glass	glass	PEI
Cable	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)	specific for flasks	field applications, soil solution, photographic chemicals, laboratory (general use)
Connection	<b>HI1143B</b> BNC	<b>HI1331B</b> BNC	<b>HI1230B</b> BNC

## 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 <sub>2</sub> Cl <sub>2</sub>	single, Ag/AgCl	single, Hg/Hg <sub>2</sub> Cl <sub>2</sub>	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
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	<b>HI1144B</b> BNC <b>HI1330P</b> BNC + pin*	<b>HI1330B</b> BNC <b>HI1330P</b> BNC + pin*	<b>HI1343B</b> BNC	<b>HI2031B</b> BNC

\* For pHmeters with CAL Check™ system

## Special pH and ORP Electrodes



Code	HI3131B	HI3618D/HI36183	HI1217D
Description	refillable combination ORP electrode	ORP combination electrode	pH electrode
Reference	single, Ag/AgCl	single, Ag/AgCl	single, Ag/AgCl
Junction / Flow Rate	ceramic, single / 15-20 $\mu$ L/h	ceramic, single / 15-20 $\mu$ L/h	ceramic, single
Electrolyte	KCl 3.5M + AgCl	KCl 3.5M + AgCl	gel
Max Pressure	0.1 bar	0.1 bar	2 bar
Range	ORP: $\pm$ 2000 mV	ORP: $\pm$ 2000 mV	pH: 0 to 13
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) - GP
Tip / Shape	platinum pin	platinum pin	spheric (dia: 5.0 mm)
Temperature Sensor	no	yes	yes
Amplifier	no	yes	yes
Body Material	glass	glass	PEI
Cable	coaxial; 1 m (3.3')	5-pole; 1 m (3.3')	coaxial; 1 m (3.3')
Recommended Use	laboratory general use, ORP titrations	laboratory	general purpose
Connection	<b>HI3131B</b> BNC	<b>HI36183</b> Quick Connect DIN <b>HI3618D</b> DIN**	<b>HI1217D</b> DIN**

\*\* 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 as 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.

# 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) - GP	0 to 80°C (32 to 176°F) - HT	-5 to 70°C (23 to 158°F) - LT
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	<b>HI1610D DIN*</b>	<b>HI1611D DIN*</b>	<b>HI1612D DIN*</b>

\* Recommended for use with HI8314 pH meter

\* Recommended for use with HI8314 pH meter

\* Recommended for use with HI8314 pH meter

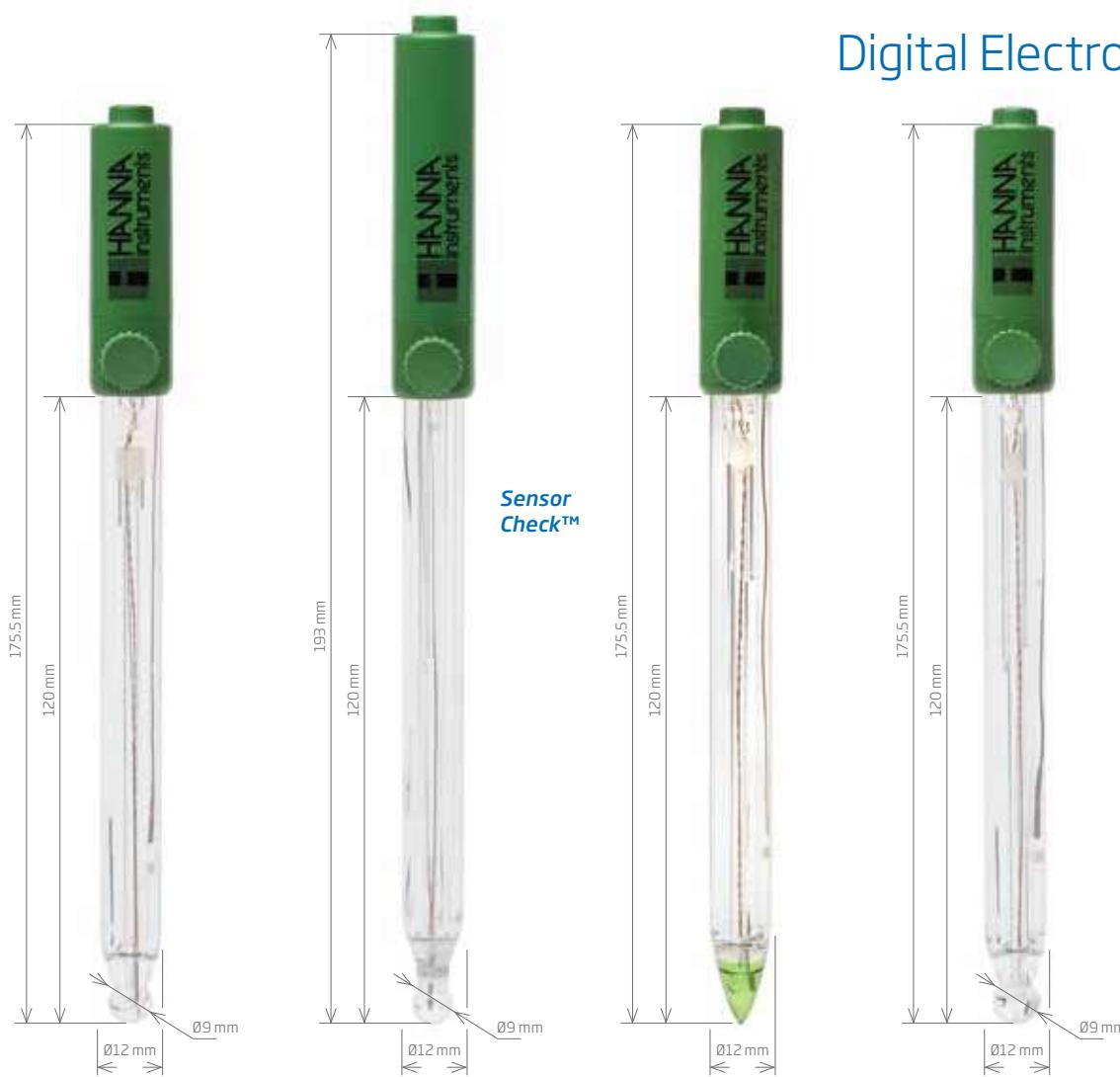
## Rugged pH and ORP Electrodes



Code	HI1332[ ]	HI3230B	HI4430B
Description	pH electrode	gel-filled, combination ORP electrode w/ platinum contact	gel-filled, combination ORP electrode w/ gold contact
Reference	double, Ag/AgCl	single, Ag/AgCl	single, Ag/AgCl
Junction / Flow Rate	ceramic, single / 15-20 $\mu$ L/h	ceramic, single	ceramic, single
Electrolyte	KCl 3.5M	gel	gel
Max Pressure	0.1 bar	2 bar	2 bar
Range	pH: 0 to 13	ORP: $\pm$ 2000 mV	ORP: $\pm$ 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)
Tip / Shape	spheric (dia: 7.5 mm)	platinum pin	gold pin
Temperature Sensor	no	no	no
Amplifier	no	no	no
Body Material	PEI	PEI	PEI
Cable	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	oxidants, ozone
Connection	<b>HI1332B</b> BNC <b>HI1332P</b> BNC + pin* <b>HI1332D</b> DIN	<b>HI3230B</b> BNC	<b>HI4430B</b> BNC

\* For pH meters with CAL Check™ system

## Digital Electrodes



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 13	pH: 0 to 13	pH: 0 to 13	pH: 0 to 13
Recommended Operating Temp.	-5 to 100°C (23 to 212°F) - HT	-5 to 100°C (23 to 212°F) - HT	-5 to 100°C (23 to 212°F) - LT	-5 to 100°C (23 to 212°F) - HT
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	<b>HI11310</b> 3.5 mm connector	<b>HI11311</b> 3.5 mm connector	<b>HI10530</b> 3.5 mm connector	<b>HI10430</b> 3.5 mm connector

## Digital Electrodes

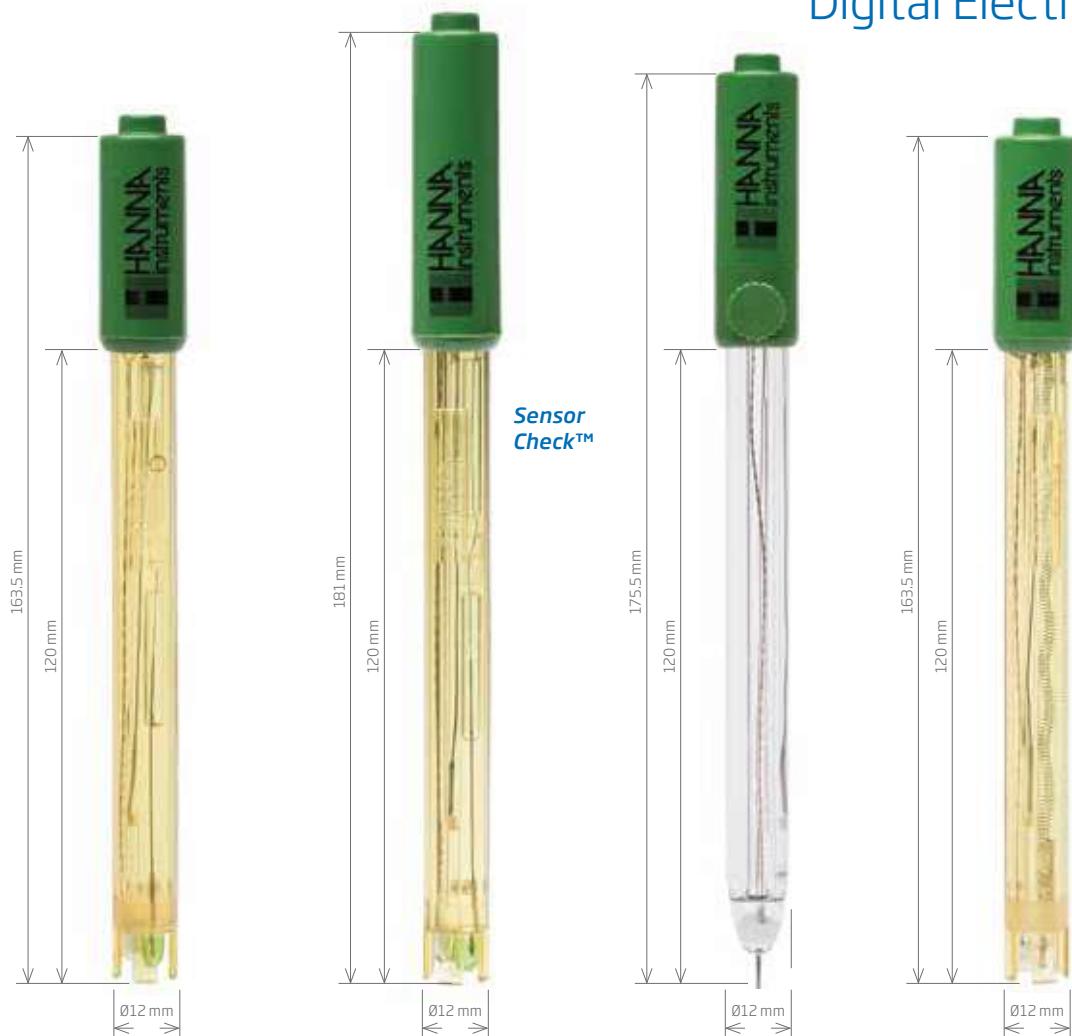


Code	HI10480	FC2320	FC2100	FC2020
Description	refillable, digital pH electrode w/ CPS™ (clogging prevention system)	digital pH electrode	digital pH electrode	digital pH Electrode
Reference	double, Ag/AgCl	double, Ag/AgCl	double, Ag/AgCl	double, Ag/AgCl
Junction	CPS™	open	open	open
Electrolyte	KCl 3.5M	viscolene	viscolene	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 12	pH: 0 to 12
Recommended Operating Temp.	-5 to 60°C (23 to 140°F) - LT	0 to 60°C (32 to 140°F) - LT	0 to 60°C (32 to 140°F) - LT	0 to 60°C (32 to 140°F) - LT
Tip /Shape	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
Matching Pin	no	no	no	no
Amplifier	yes	yes	yes	yes
Body Material	glass	PVDF	glass	PVDF
Cable	1 m (3.3')	1 m (3.3')	1 m (3.3')	1 m (3.3')
Recommended Use	application specific purpose, must in winemaking	application specific purpose, meat	application specific purpose, yogurt	application specific purpose, yogurt, cheese
Connection	<b>HI10480</b> 3.5 mm connector	<b>FC2320</b> 3.5 mm connector	<b>FC2100</b> 3.5 mm connector	<b>FC2020</b> 3.5 mm connector

## Digital Electrodes

pH

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) - LT	-5 to 70°C (23 to 158°F) - LT	-5 to 100°C (23 to 212°F)	-5 to 70°C (23 to 158°F)
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	<b>HI12300</b> 3.5 mm connector	<b>HI12301</b> 3.5 mm connector	<b>HI36180</b> 3.5 mm connector	<b>HI36200</b> 3.5 mm connector

## Electrodes for the Food Industry



Code	FC100B	FC101D/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 80°C (32 to 176°F) - GP	0 to 80°C (32 to 176°F) - GP	0 to 50°C (32 to 122°F) - LT	0 to 50°C (32 to 122°F) - LT
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	<b>FC100B</b> BNC	<b>FC101D</b> DIN* <b>FC1013</b> Quick Connect DIN**	<b>FC200B</b> BNC <b>FC200D</b> DIN	<b>FC210B</b> BNC

\* Recommended for use with HI99162 pH meter  
\*\* Recommended for use with HI98162 pH meter

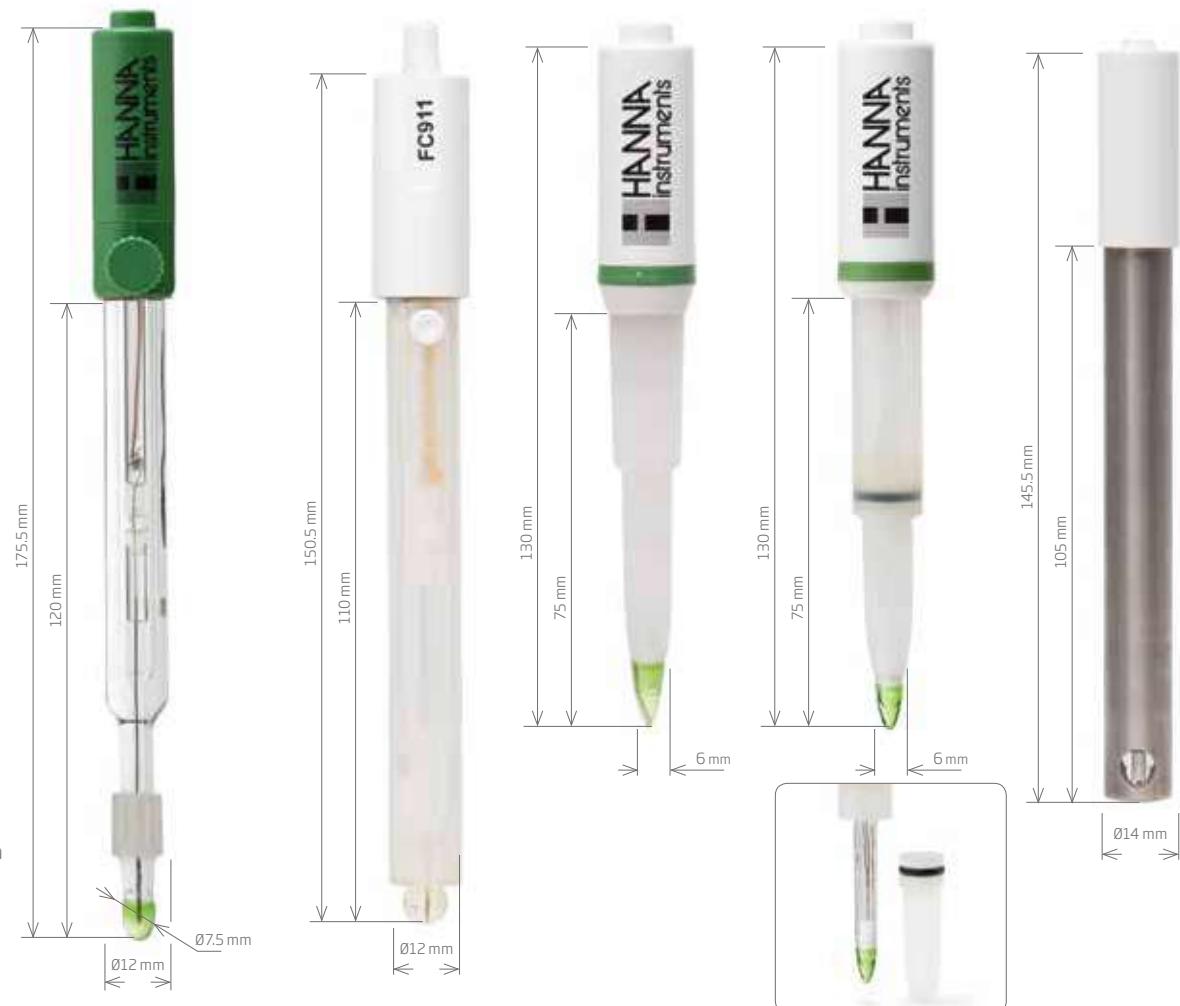
# Electrodes for the Food Industry



pH

electrodes

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) - LT	0 to 50°C (32 to 122°F) - LT	0 to 50°C (32 to 122°F) - GP	0 to 50°C (32 to 122°F) - LT
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	AISI 316	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	<b>FC220B</b> BNC	<b>FC230B</b> BNC	<b>FC240B</b> BNC	<b>FC400B</b> BNC



Code	HI1048[ ]	FC911	FC202D/FC203	FC2053	FC214D
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	0.1bar	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 13
Recommended Operating Temp.	-5 to 60°C (23 to 140°F) - LT	-5 to 80°C (23 to 176°F) - GP	0 to 50°C (32 to 122°F) - LT	0 to 50°C (32 to 122°F) - LT	0 to 80°C (32 to 176°F) - HT
Tip / Shape	dome (dia: 8 mm)	spheric (dia: 7.5 mm)	conic (6 x 10 mm)	conic (6 x 10 mm)	spheric (dia: 5 mm)
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 HI1048B/50 BNC (4 m (1.3') cable) HI1048P BNC + pin* HI1048D DIN**	FC911B BNC	FC202D DIN * FC2023 Quick Connect DIN **	FC2053 Quick Connect DIN **	FC214D DIN†

\* For pH meters with CAL Check™ system

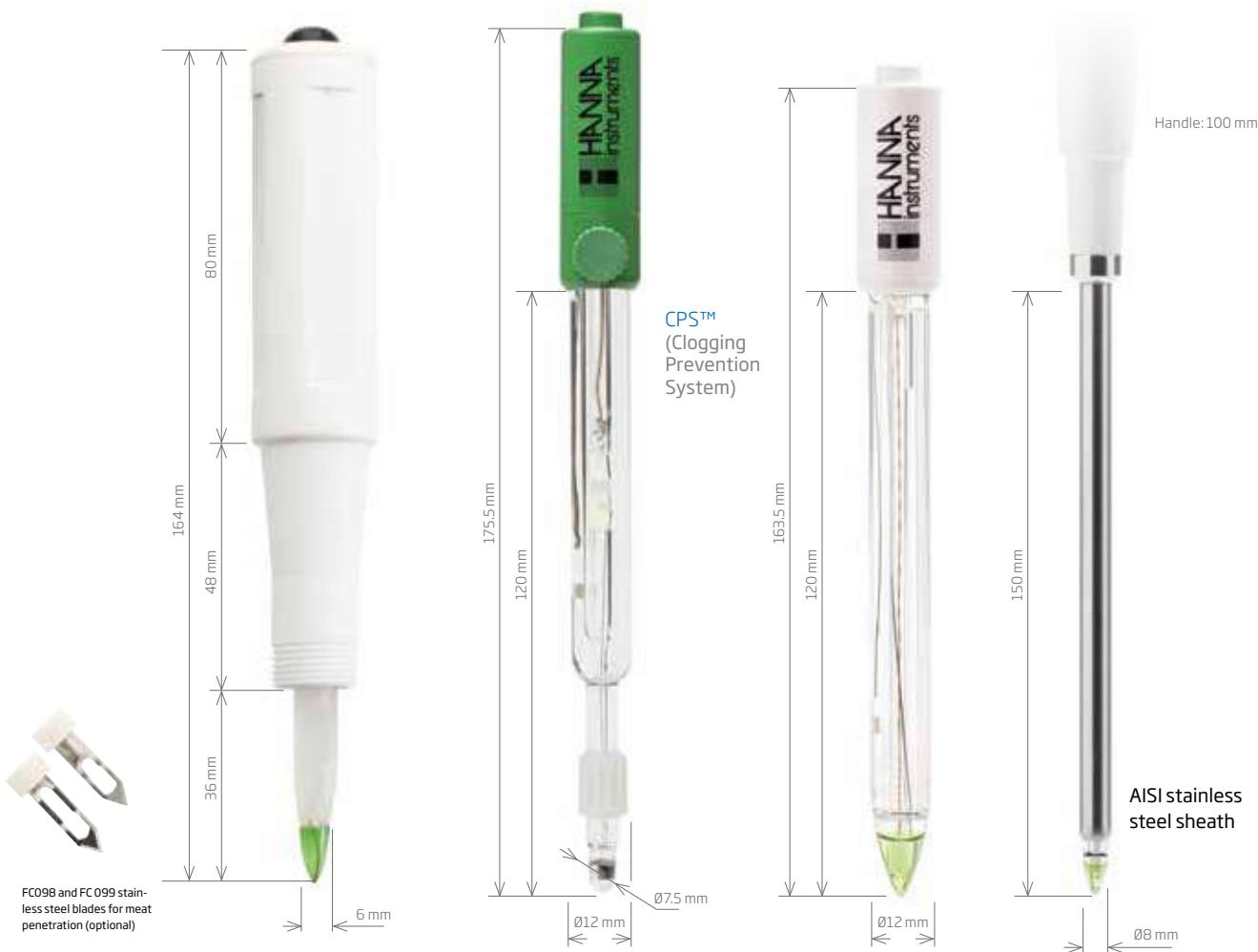
\*\* Recommended for use with HI99111 pH meter

\* Recommended for use with HI98161 pH meter

\*\* Recommended for use with HI98161 pH meter

\* Recommended for use with HI98161 pH meter

# Electrodes for the Food Industry



Code	FC232D/FC2323	HI3148B	FC213D/FC2133	FC242D/FC2423
Description	pH electrode	ORP electrode	pre-amplified pH / temperature probe	pre-amplified pH / temperature probe
Reference	single, Ag/AgCl	double, Ag/AgCl	double	single
Junction	open	CPS™	open	open
Electrolyte	viscolene	KCl 3.5M	viscolene	viscolene
Max Pressure	0.1 bar	0.1 bar	0.1 bar	0.1 bar
Range	pH: 0 to 12	ORP: $\pm 2000$ mV	pH: 0 to 12	pH: 0 to 12
Recommended Operating Temp.	0 to 50°C (32 to 122°F) - LT	-5 to 80°C (23 to 176°F)	0 to 50°C (32 to 122°F)	0 to 50°C (32 to 122°F)
Tip / Shape	conic (6 x 10 mm)	platinum ring	conic	conic (6 x 8 mm)
Temperature Sensor	yes	no	yes	yes
Amplifier	yes	no	yes	yes
Body Material	PVDF	glass	glass	AISI 316 stainless steel
Cable	7-pole; 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
Connection	<b>FC232D</b> DIN* <b>FC2323</b> Quick Connect DIN**	<b>HI3148B</b> BNC <b>HI3148B/50</b> BNC (.4 m (1.3') cable)	<b>FC213D</b> DIN* <b>FC2133</b> Quick Connect DIN**	<b>FC242D</b> DIN* <b>FC2423</b> DIN**

\* Recommended for use with HI99163 pH meter

\*\* Recommended for use with HI98163 pH meter

\* Recommended for use with HI99164 pH meter

\*\* Recommended for use with HI98164 pH meter

\* Recommended for use with HI99165 pH meter

\*\* Recommended for use with HI98165 pH meter

## Electrodes for Specific Analysis

pH

electrodes



Code	HI1413B	HI1414D	HI1414D/50	HI1292D
Description	pH electrode	pH electrode	pH electrode	pH electrode
Reference	single, Ag/AgCl	single, Ag/AgCl	single, Ag/AgCl	single, Ag/AgCl
Junction	open	open	open	ceramic, triple / 40-50 µL/h
Electrolyte	viscolene	viscolene	viscolene	KCl 3.5M + AgCl
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 12	pH: 0 to 12
Recommended Operating Temp.	0 to 50°C (32 to 122°F) - LT	0 to 50°C (32 to 122°F)	0 to 50°C (32 to 122°F)	-5 to 70°C (23 to 158°F) - LT
Tip / Shape	flat	flat	flat	conic (12 x 12 mm)
Temperature Sensor	no	yes	yes	yes
Amplifier	no	yes	yes	yes
Body Material	glass	glass	glass	glass
Cable	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	surface, skin, leather, paper, emulsions	surface, leather, paper, emulsions	skin, scalp	direct soil pH measurement, soil solution
Connection	<b>HI1413B</b> BNC	<b>HI1414D</b> 7-pin DIN*	<b>HI1414D/50</b> DIN†	<b>HI1292D</b> 7-pin 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	HI1294D	FC215D	HI1296[ ]	HI1297D
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) - LT	0 to 70°C (32 to 158°F) - LT	0 to 80°C (32 to 176°F) - GP	0 to 80°C (32 to 176°F) - GP
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 pH measurement, soil solution	drinking water	wastewater	wastewater, municipal water, water treatment, swimming pools
Connection	<b>HI1294D</b> DIN**	<b>FC215D</b> DIN*	<b>HI1296D</b> DIN** <b>HI12963</b> Quick Connect DIN†	<b>HI1297D</b> DIN‡

\*\* Recommended for use with HI9814 GroLine multiparameter meter

\*\* Recommended for use with  
HI991001 pH meter  
† Quick connect DIN. For use with  
HI98190 pH meter only

‡ Recommended for use with HI991002 and  
HI991003 pH meters

## Electrodes for Specific Analysis



Code	HI62911D	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) - GP	0 to 80°C (32 to 176°F) - GP
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	<b>HI62911D</b> DIN*	<b>HI72911D</b> DIN** <b>HI72911B</b> BNC + phonot

\* Recommended for use with HI99131 pH meter

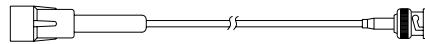
\*\* Recommended for use with HI99141 pH meter

† Recommended for use with HI98191 pH meter



## Electrode Extension Cables

### Screw Type to BNC Cables / Connectors

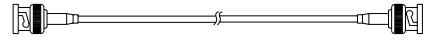


### Description

3.0 mm (0.12") cable with screw type and BNC connectors

Part #	Cable Length
<b>HI7855/1</b>	1 m (3.3')
<b>HI7855/3</b>	3 m (9.9')
<b>HI7855/5</b>	5 m (16.5')
<b>HI7855/10</b>	10 m (33')
<b>HI7855/15</b>	15 m (49.5')

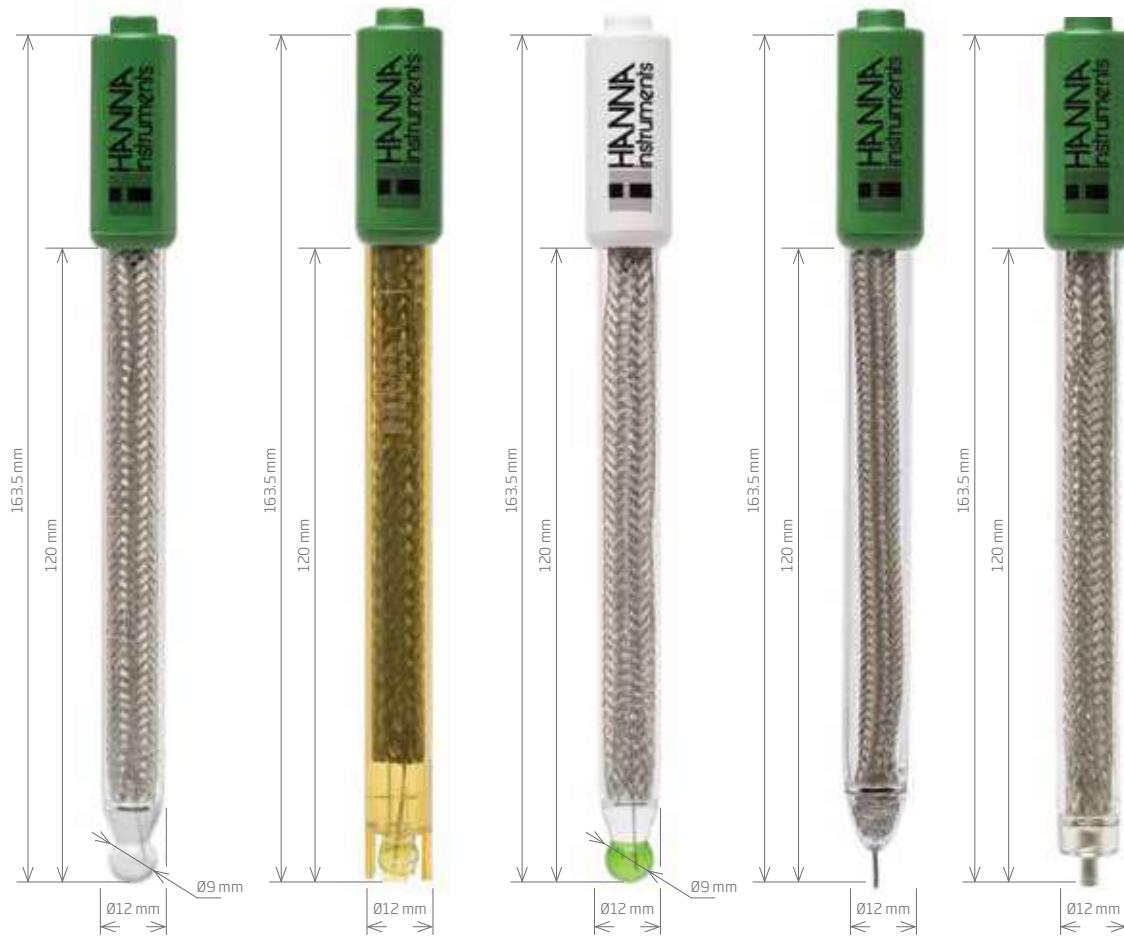
### BNC to BNC Cables / Connectors



### Description

3.0 mm (0.12") cable with BNC connectors

Part #	Cable Length
<b>HI7858/1</b>	1 m (3.3')
<b>HI7858/5</b>	5 m (16.5')
<b>HI7858/10</b>	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) - GP	-5 to 100°C (23 to 212°F) - LT	-5 to 100°C (23 to 212°F)	0 to 70°C (32 to 158°F)
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	<b>HI2111B</b> BNC	<b>HI2112B</b> BNC	<b>FC260B</b> BNC	<b>HI3133B</b> BNC	<b>HI5110B</b> BNC

## Reference Electrodes



Code	HI5412	HI5311	HI5314	HI5414
Description	reference electrode	reference electrode	reference electrode	reference electrode
Reference	single, Hg/Hg <sub>2</sub> Cl <sub>2</sub>	double, Ag/AgCl	double, Ag/AgCl	single, Hg/Hg <sub>2</sub> Cl <sub>2</sub>
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	<b>HI5412</b> 4 mm banana	<b>HI5311</b> 4 mm banana	<b>HI5314</b> 4 mm banana	<b>HI5414</b> 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.



Code	HI5413	HI5312	HI5313
Description	reference electrode	reference electrode	reference electrode
Reference	single, Hg/Hg <sub>2</sub> Cl <sub>2</sub>	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)	-5 to 80°C (23 to 176°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	<b>HI5413</b> 4 mm banana	<b>HI5312</b> 4 mm banana	<b>HI5313</b> 4 mm banana



### 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](http://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, light-tight 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.

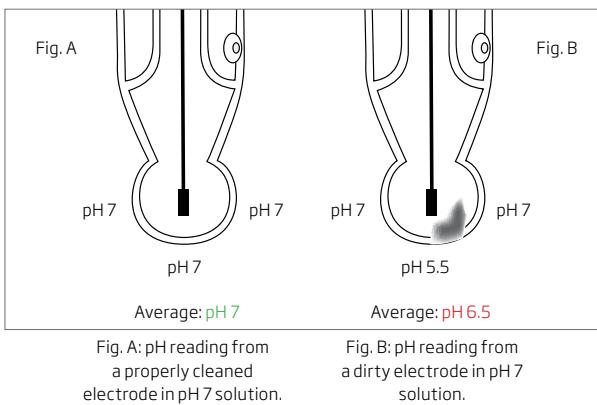
A wide range of pH, conductivity, TDS and cleaning solutions are available.

### 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



### 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.

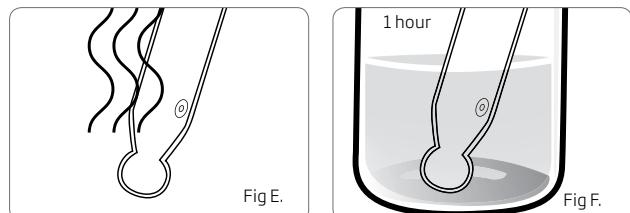
Contamination can take time to work its way around the beaker. If you notice fluctuations in your readings, it may be time to calibrate with fresh solutions.

### 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 light-tight 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  $\pm 60$  mV while Hanna only allows an offset of approximately  $\pm 30$  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.

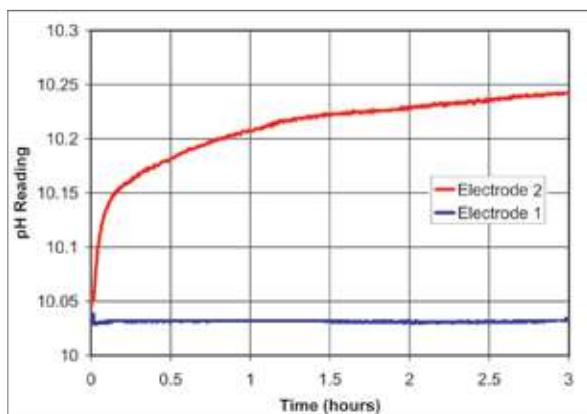


Fig G.

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 submerge the pH sensor tip and reference junction ( $\sim 3$  cm / $1\frac{1}{4}$ " in the stirred sample.

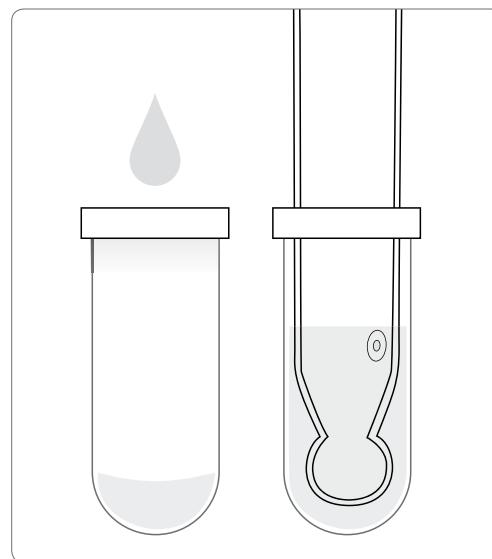


Fig H

### 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  $\pm 0.01$  pH @  $25^\circ\text{C}$
- Safety Data Sheets
  - Safety data sheets for all Hanna solutions are available at [hannainst.com](http://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
  - Light block packaging prevents oxidation from UV light that could alter the value. Every sachet is as fresh as the day it was packaged.

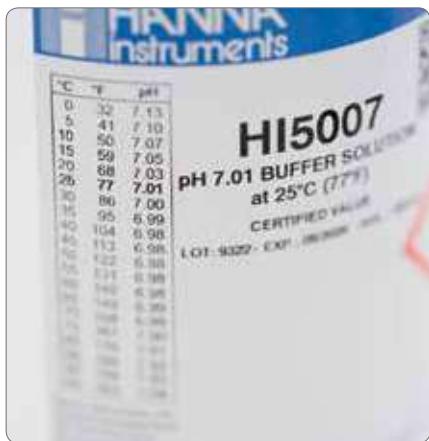
Technical Solutions ( $\pm 0.01$  pH) for Each Point of the pH Scale

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  $\pm 0.01$  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	<b>HI5001</b>	500 mL	•
1.68	<b>HI5016</b>	500 mL	•
2.00	<b>HI5002</b>	500 mL	•
2.00	<b>HI5002-01</b>	1L	•
3.00	<b>HI5003</b>	500 mL	•
4.01	<b>HI5004</b>	500 mL	•
4.01	<b>HI5004-01</b>	1L	•
4.01	<b>HI5004-R</b>	500 mL (color coded solution)	•
4.01	<b>HI5004-R08</b>	1G (3.78 L) (2) (color coded solution)	•
5.00	<b>HI5005</b>	500 mL	•
5.00	<b>HI5005-01</b>	1L	•
6.00	<b>HI5006</b>	500 mL	•
6.86	<b>HI5068</b>	500 mL	•
7.01	<b>HI5007</b>	500 mL	•
7.01	<b>HI5007-01</b>	1L	•
7.01	<b>HI5007-G</b>	500 mL (color coded solution)	•
7.01	<b>HI5007-G08</b>	1G (3.78 L) (2) (color coded solution)	•
7.41	<b>HI5074</b>	500 mL	•
8.00	<b>HI5008</b>	500 mL	•
8.00	<b>HI5008-01</b>	1L	•
9.00	<b>HI5009</b>	500 mL	•
9.18	<b>HI5091</b>	500 mL	•
10.01	<b>HI5010</b>	500 mL	•
10.01	<b>HI5010-01</b>	1L	•
10.01	<b>HI5010-V</b>	500 mL (color coded solution)	•
10.01	<b>HI5010-V08</b>	1G (3.78 L) (2) (color coded solution)	•
11.00	<b>HI5011</b>	500 mL	•
12.00	<b>HI5012</b>	500 mL	•
12.45	<b>HI5124</b>	500 mL	•
13.00	<b>HI5013</b>	500 mL	•

## Sachets

pH Value @25°C	Code	Package	Certificate of Analysis
1.00	<b>HI50001-02</b>	20 mL (25)	•
1.68	<b>HI50016-01</b>	20 mL (10)	•
1.68	<b>HI50016-02</b>	20 mL (25)	•
2.00	<b>HI50002-02</b>	20 mL (25)	•
3.00	<b>HI50003-02</b>	20 mL (25)	•
4.01	<b>HI50004-01</b>	20 mL (10)	•
4.01	<b>HI50004-02</b>	20 mL (25)	•
5.00	<b>HI50005-02</b>	20 mL (25)	•
6.86	<b>HI50068-02</b>	20 mL (25)	•
7.01	<b>HI50007-01</b>	20 mL (10)	•
7.01	<b>HI50007-02</b>	20 mL (25)	•
9.00	<b>HI50009-02</b>	20 mL (25)	•
9.18	<b>HI50091-02</b>	20 mL (25)	•
10.01	<b>HI50010-01</b>	20 mL (10)	•
10.01	<b>HI50010-02</b>	20 mL (25)	•
11.00	<b>HI50011-02</b>	20 mL (25)	•
12.00	<b>HI50012-01</b>	20 mL (10)	•
12.00	<b>HI50012-02</b>	20 mL (25)	•
12.45	<b>HI50124-02</b>	20 mL (25)	•
13.00	<b>HI50013-02</b>	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
<b>HI54710</b>	pH 4.01, pH 7.01, pH 10.01	500 mL (3)	•
<b>HI54710-10</b>	pH 4.01, pH 7.01, pH 10.01, HI70300L	500 mL (4)	•
<b>HI54710-11</b>	pH 4.01, pH 7.01, pH 10.01, HI70300L, HI7061L	500 mL (5)	•

## ±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](http://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
  - Light block packaging prevents oxidation from UV light that could alter the value. Every sachet is as fresh as the day it was packaged.
- Light-tight 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	<b>HI6001</b>	500 mL	•
1.679	<b>HI6016</b>	500 mL	•
2.000	<b>HI6002</b>	500 mL	•
3.000	<b>HI6003</b>	500 mL	•
4.010	<b>HI6004</b>	500 mL	•
4.010	<b>HI6004-01</b>	1 L	•
6.000	<b>HI6006</b>	500 mL	•
6.862	<b>HI6068</b>	500 mL	•
7.010	<b>HI6007</b>	500 mL	•
7.010	<b>HI6007-01</b>	1 L	•
7.413	<b>HI6074</b>	500 mL	•
8.000	<b>HI6008</b>	500 mL	•
9.000	<b>HI6009</b>	500 mL	•
9.177	<b>HI6091</b>	500 mL	•
10.010	<b>HI6010</b>	500 mL	•
10.010	<b>HI6010-01</b>	1 L	•
12.000	<b>HI6012</b>	500 mL	•
12.450	<b>HI6124</b>	500 mL	•
13.000	<b>HI6013</b>	500 mL	•

### Sachets

pH Value @25°C	Code	Package	Certificate of Analysis
1.000	<b>HI60001-02</b>	20 mL (25)	•
1.679	<b>HI60016-02</b>	20 mL (25)	•
2.000	<b>HI60002-02</b>	20 mL (25)	•
4.010	<b>HI60004-02</b>	20 mL (25)	•
7.010	<b>HI60007-02</b>	20 mL (25)	•
10.010	<b>HI60010-02</b>	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.

# 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 Gro line pH and EC/TDS meters
- pH calibration buffer value of pH 6.86
- EC calibration standard value of 5,000  $\mu\text{S}/\text{cm}$  (5.00 mS/cm)
- Safety Data Sheets
  - Safety data sheets for all Hanna solutions are available at [hannainst.com](http://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.

# GroLine



- Air-tight bottles
  - Air tight bottle with tamper-proof seal of freshness to ensure quality.
- Single use sachets
  - Light block 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
<b>HI5036-050</b>	500 mL (GroLine)	•
<b>HI5036-023</b>	230 mL (GroLine)	•
<b>HI5036-012</b>	120 mL (GroLine)	•

### Quick Cal pH/EC Sachets

Code	Size	Certificate of Analysis
<b>HI50036P</b>	20 mL sachets, 25 pcs. (GroLine)	•

## pH Buffer Solutions

- Safety Data Sheets
  - Safety data sheets for all Hanna solutions are available at [hannainst.com](http://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.



### 4.01 pH @ 25°C - Bottles

- Air-tight bottles
  - Air tight bottle with tamper-proof seal of freshness to ensure quality.
- Single use sachets
  - Light block 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 light-tight 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.



Code	Size	FDA Bottle	Certificate of Analysis
<b>HI7004/1G</b>	1 G (3.78 L) (color coded solution)		on request
<b>HI7004/1L</b>	1 L (color coded solution)		on request
<b>HI7004L</b>	500 mL		on request
<b>HI7004L/C</b>	500 mL		•
<b>HI7004C</b>	500 mL (color coded solution)		on request
<b>HI7004M</b>	230 mL		on request
<b>HI7004-050</b>	500 mL (GroLine)		•
<b>HI7004-023</b>	230 mL (GroLine)		•
<b>HI7004-012</b>	120 mL (GroLine)		•
<b>HI8004L</b>	500 mL	•	•
<b>HI8004L/C</b>	500 mL	•	•

### 4.01 pH @ 25°C - Sachets

Code	Size	Package	Certificate of Analysis
<b>HI70004C</b>	20 mL	25 pcs.	•
<b>HI70004G</b>	20 mL (GroLine)	25 pcs.	•
<b>HI70004P</b>	20 mL	25 pcs.	
<b>HI7004P/5</b>	20 mL	500 pcs.	•

### 4.01 and 7.01 pH @ 25°C - Sachets

Code	Size	Package	Certificate of Analysis
<b>HI77400C</b>	20 mL	10 pcs., 5 ea	•
<b>HI77400P</b>	20 mL	10 pcs., 5 ea	

## pH Buffer Solutions

- Safety Data Sheets**

- Safety data sheets for all Hanna solutions are available at [hannainst.com](http://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.



### 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	20 mL	25 pcs.	•
HI70007P	7.01 pH	20 mL	25 pcs.	
HI7700P	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 $\mu$ S/cm & 7.01 pH	20 mL	20 pcs., 10 ea	•
HI77100P	1413 $\mu$ S/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	

- Air-tight bottles**

- Air tight bottle with tamper-proof seal of freshness to ensure quality.

- Single use sachets**

- Light block 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 light-tight bottles that meet FDA requirements.

### 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](http://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
  - Light block 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 light-tight 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
HI5100-12	120 mL		on request
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.	
HI70010P/5	10.01	20 mL	500 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

## 6.86 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](http://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

- Light block 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 light-tight 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 is available.

## 9.18 pH Buffer Solution

To increase accuracy of your measurement 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 fulfill this requirement.

# ORP and Sample Preparation Solutions

- **Safety Data Sheets**
  - Safety data sheets for all Hanna solutions are available at [hannainst.com](http://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
<b>HI7021L</b>	240 mV ORP solution for platinum and gold electrodes	500 mL	on request
<b>HI7021M</b>	240 mV ORP solution for platinum and gold electrodes	230 mL	on request
<b>HI7022L</b>	470 mV ORP solution for platinum and gold electrodes	500 mL	on request
<b>HI7022M</b>	470 mV ORP solution for platinum and gold electrodes	230 mL	on request
<b>HI7091L</b>	reducing pretreatment solution (2 components)	500 mL + 14g (set)	
<b>HI7092L</b>	oxidizing pretreatment solution for ORP electrodes	500 mL	
<b>HI7092M</b>	oxidizing pretreatment solution for ORP electrodes	230 mL	

### Sample Preparation Solution Bottles

Code	Description	Size
<b>HI7051M</b>	soil sample preparation solution	230 mL
<b>HI7051L</b>	soil sample preparation solution	500 mL
<b>HI70960</b>	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
  - Light block 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 light-tight 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
HI70300G	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

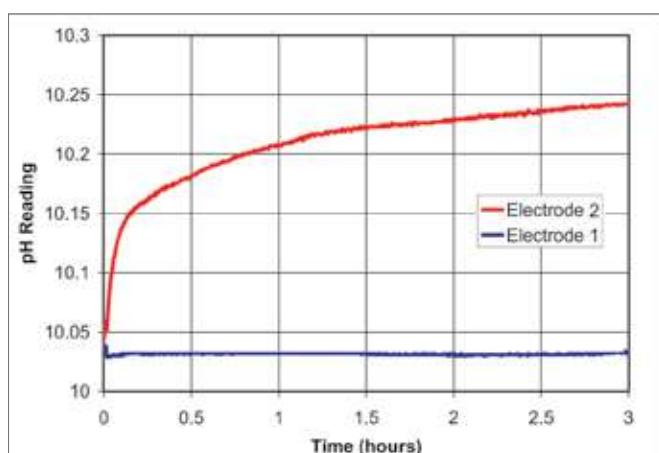


## Electrode Cleaning Solutions for a Top Performing Sensor

- **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**
  - Light block 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 light-tight 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
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
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



## General Use Electrode Cleaning Solutions - Sachets

Code	Application	Package
HI70000P	rinsing	20 mL sachet (25)
HI70061G	general purpose (GroLine)	20 mL sachet (25)

## Specific Electrode Cleaning Solutions - Sachets

Code	Description	Qty/Size
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)

## 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, light-tight 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
<b>HI7071</b>	3.5M KCl with AgCl reference electrolyte	30 mL bottle (4)
<b>HI7071M</b>	3.5M KCl with AgCl reference electrolyte	230 mL bottle
<b>HI7071L</b>	3.5M KCl with AgCl reference electrolyte	500 mL bottle
<b>HI7072</b>	1M potassium nitrate electrode fill solution	30 mL bottle (4)
<b>HI7072L</b>	1M potassium nitrate electrode fill solution	500 mL bottle
<b>HI7075</b>	1M potassium nitrate, 0.7M potassium chloride electrode fill solution	30 mL bottle (4)
<b>HI7076</b>	1M sodium chloride electrode fill solution	30 mL bottle (4)
<b>HI7078</b>	0.5M ammonium sulfate electrode fill solution	30 mL bottle (4)
<b>HI7082</b>	3.5M KCl reference electrolyte for double junction electrodes	30 mL bottle (4)
<b>HI7082M</b>	3.5M KCl reference electrolyte for double junction electrodes	230 mL bottle
<b>HI7082L</b>	3.5M KCl reference electrolyte for double junction electrodes	460 mL bottle
<b>HI8071</b>	3.5M KCl with AgCl reference electrolyte	30 mL FDA bottle (4)
<b>HI8082</b>	3.5M KCl reference electrolyte for double junction	30 mL FDA bottle (4)
<b>HI8093</b>	1M KCl with AgCl reference electrolyte	30 mL FDA bottle (4)

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ISE

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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  $\text{Ca}^{2+}$  ion concentration as more EDTA is added. The endpoint corresponds to the point at which all of the  $\text{Ca}^{2+}$  is complexed. The progress of this titration can be monitored using a calcium ISE.

**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.

### Ion Selective Electrode Types

Hanna's ISEs can be grouped into three general categories based upon construction.



**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.

### 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.



## 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.



### 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

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.

## Benchtop Meters

	pH Range	ISE Range	ORP Range/Relative mV	EC/TDS/Salinity Range	Resistivity Range	Temperature Range	(D)irect / (I)ncrmental Measurement	ISE Calibration Points	ISE Buffers: Standard/Custom	pH CAL Check™	Temperature Compensation: (A)utomatic or (M)anual	GLP	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 Range	Temperature Range	(D)irect / (I)ncrmental 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	•	A, L, E	•	•	USB	•	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					Other
					(4) 30 mL bottles	ISE Standards 1, 500 mL bottle	ISE Standards 2, 500 mL bottle	ISE Standards 3, 500 mL bottle		
Ammonia	gas	–	HI4101	HI4001-00	HI4001-40	HI4001-01, 0.1M	HI4001-02, 100 mg/L (ppm)	HI4001-03, 1000 mg/L (ppm)	HI4000-52 replacement cap HI4001-51 membrane kit HI4000-51 replacement pH internal and cap for ammonia HI4001-45 conditioning solution HI4000-47 4 and 7 pH buffers with chloride ions background HI740159 plastic tweezers	
Bromide	solid	HI4002	HI4102	HI4000-00	HI7072, 1M KNO <sub>3</sub>	HI4002-01, 0.1M			HI4000-70 polishing strip	
Cadmium	solid	HI4003	HI4103	HI4000-00	HI7072, 1M KNO <sub>3</sub>	HI4003-01 0.1M			HI4000-70 polishing strip	
Calcium	polymer membrane	HI4004	HI4104	HI4004-00	HI7082, 3.5M KCl	HI4004-01, 0.1M			HI4004-51 module HI4104-51 module for combination HI4004-45 conditioning solution	
Carbon Dioxide	gas	–	HI4105	HI4005-00	HI4005-40	HI4005-01, 0.1M	HI4005-03, 1000 mg/L (ppm) CO <sub>2</sub> as CaCO <sub>3</sub>		HI4000-54 replacement pH internal and cap for CO <sub>2</sub> HI4005-53 CO <sub>2</sub> membrane kit (3 pack) HI4000-47 4 and 7 pH buffers with chloride background HI4005-45 conditioning solution HI740159 plastic tweezers	
Chloride	solid	HI4007	HI4107	HI4000-00	HI7072, 1M KNO <sub>3</sub>	HI4007-01, 0.1M	HI4007-02, 100 mg/L (ppm)	HI4007-03, 1000 mg/L (ppm)	HI4000-70 polishing strip	
Cupric	solid	HI4008	HI4108	HI4000-00	HI7072, 1M KNO <sub>3</sub>	HI4008-01, 0.1M			HI4000-70 polishing strip	
Cyanide	solid	HI4009	HI4109	HI4001-00	HI7072, 1M KNO <sub>3</sub>				HI4000-70 polishing strip	
Fluoride	solid	HI4010	HI4110	HI4010-00 HI4010-05 HI4010-06 HI4010-30, TISAB II, 1 ppm TISAB II, 10 ppm TISAB II	HI7075, 1M KNO <sub>3</sub> , 0.7M KCl	HI4010-01, 0.1M	HI4010-02, 100 mg/L (ppm)	HI4010-03, 1000 mg/L (ppm)	HI4010-11 1 ppm with TISAB II HI4010-12 2 ppm with TISAB II HI4010-10 10 ppm with TISAB II HI4110-51 module for combination HI4010-30 fluoride measurement kit	
Iodide	solid	HI4011	HI4111	HI4000-00	HI7072, 1M KNO <sub>3</sub>	HI4011-01, 0.1M			HI4000-70 polishing strip	
Lead/ Sulfate	solid	HI4012	HI4112	HI4012-00	HI7072, 1M KNO <sub>3</sub>	HI4012-01, lead, 0.1M HI4012-21 sulfate, 0.1M			HI4000-70 polishing strip	
Nitrate	polymer membrane	HI4013	HI4113	HI4013-00	HI7078, (NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> 0.5M	HI4013-01, 0.1M	HI4013-02, 100 mg/L (ppm) nitrate-nitrogen	HI4013-03, 1000 mg/L (ppm) nitrate-nitrogen	HI4013-53 module (3 pack) HI4113-53 module for combination (3 pack) HI4013-06 interferent suppressant ISA	
Potassium	polymer membrane	HI4014	HI4114	HI4014-00	HI7076, 1M NaCl	HI4014-01, 0.1M			HI4014-51 module HI4114-51 module for combination	
Silver/ Sulfide	solid	HI4015	HI4115	HI4000-00 (Ag <sup>+</sup> ) HI4015-00 (S <sup>2-</sup> )	HI7072, 1M KNO <sub>3</sub>	HI4015-01, 0.1M Ag <sup>+</sup>			HI4000-70 polishing strip	
Sodium	–	FC300		HI4016-00	HI7079, 2M NH <sub>4</sub> Cl + AgCl	HI4016-01, 0.1M	HI4016-02, 100 mg/L (ppm)	HI4016-03, 1000 mg/L (ppm)	HI4016-10, 10 mg/L (ppm) HI4016-45 storage solution HI4016-46 conditioning solution	
Reference		HI5315			HI7072, 1M KNO <sub>3</sub> HI7076, 1M NaCl HI7078, (NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> HI7082, 3.5M KCl HI7075, 1.7M KNO <sub>3</sub> , 0.7M KCl					

## 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/Resistivity/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

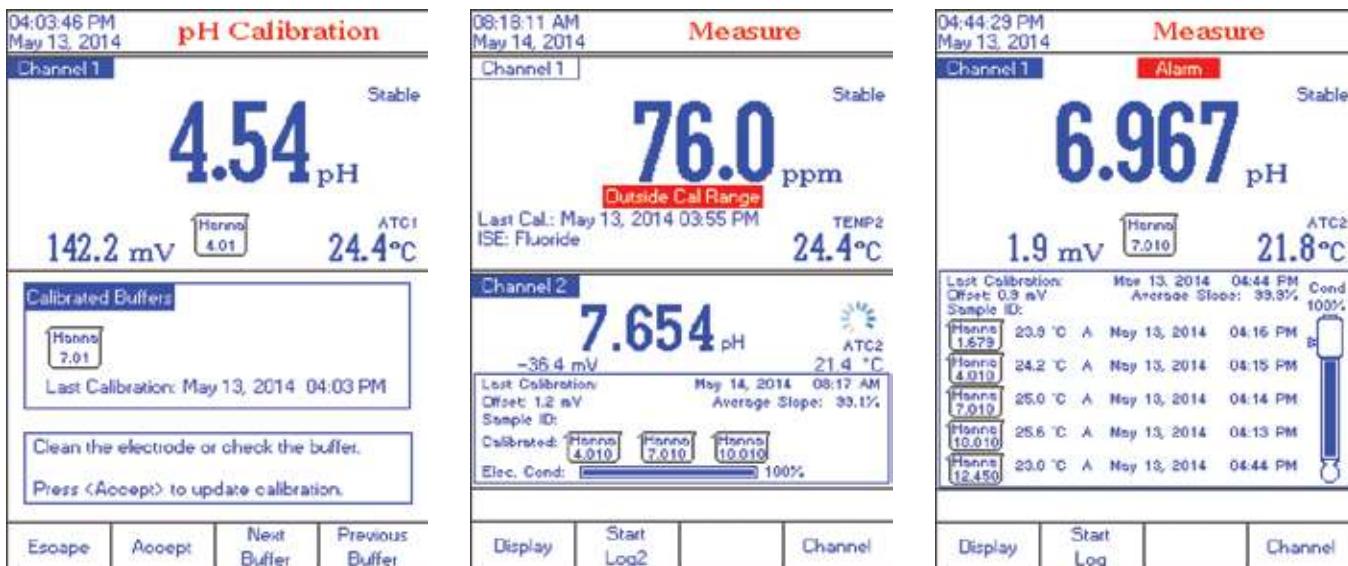
Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.

## 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.

08:05:39 AM  
May 14, 2014 **Known Subtraction**

Channel 1

**14.8** mV Stable  
TEMP1  
22.4 °C

**First Step**  
First Reading  
Manual Edit

Sample Vol.	100.000	mL
ISA Vol.	2.000	mL
Std. Vol.	10.000	mL
Std. Conc.	100	ppm
Stoich. Factor	1.0	

then press <Continue>.

Escape Edit Next Previous

#### 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.

08:09:43 AM  
May 14, 2014 **Known Addition**

Channel 1

**10.5** mV Stable  
TEMP1  
21.7 °C

**First Step**  
First Reading  
Second Step  
Second Reading

Sample Volume:	100.000	mL
ISA Buffer Vol.:	2.000	mL
Reagent Volume:	2.000	mL
Reagent Conc.:	1000	ppm

Press <Read> to memorize the current reading and to pass to the next method step.

Escape Read

#### 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.

08:11:14 AM  
May 14, 2014 **ISE Results**

Channel 1

**35.9** ppm

Sample ID: **Calculated Slope:** 100.1 %  
Reading 1: 10.5 mV  
Reading 2: -0.4 mV  
Sample Volume: 100.000 mL  
Reagent Volume: 2.000 mL  
ISA Volume: 2.000 mL  
Reagent Conc.: 1000 ppm

Press <Direct Measure> to return to main measurement panel.  
Press <Save> to log the current results.

Direct Measure Save Edit Start KA

#### 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

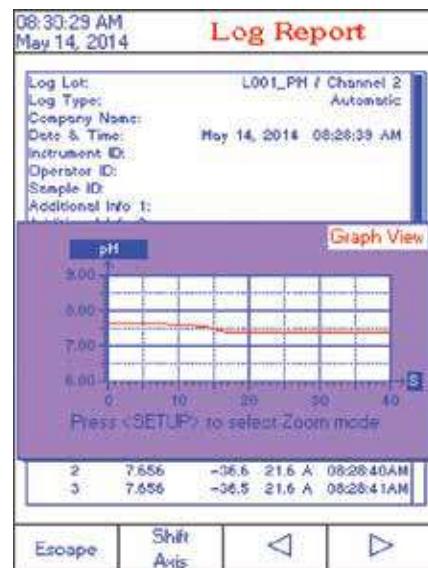
## Additional Features by Screen



Channel Configuration



Good Laboratory Practices



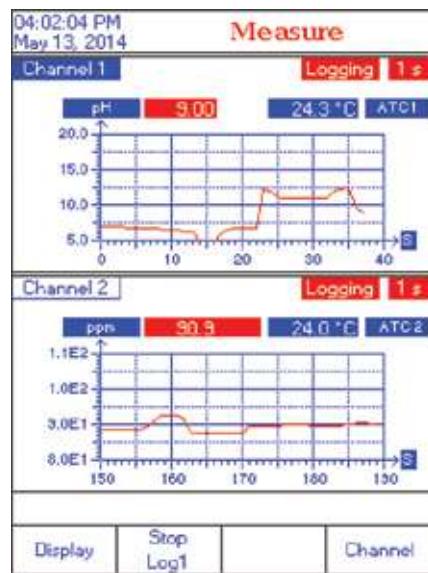
Log Recall



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 × 10 <sup>-6</sup> to 9.99 × 10 <sup>10</sup> 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
TDS	Profiles	up to 10, 5 each channel
	USP Compliant	yes
	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)
Resistivity	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)
	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
Salinity	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)
	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%
	Calibration	0.01 for practical scale/natural sea water scale; 0.1% for percent scale
Additional Specifications	Accuracy	±1% of reading
	Calibration	percent scale—one-point (with HI7037 standard); all others through EC
	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	<b>record:</b> Up to 100 lots, 50,000 records max/lot / maximum 100,000 data points/channel; <b>interval:</b> 14 selectable between 1 second and 180 minutes; <b>type:</b> automatic, manual, AutoHOLD; <b>additional:</b> 200 records USP; 200 records incremental methods
	PC Connection	USB
	Power Supply	12 VDC adapter (included)
Ordering Information	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	

(\*) 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 2.122; pH and ORP solutions begin on page 2.142;  
ISE electrodes and solutions begin on page 3.22; EC, TDS and salinity solutions begin on page 5.39

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# Research Grade Meter

pH/ORP/ISE and Temperature

ISE

benchtop



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, 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.

## 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.

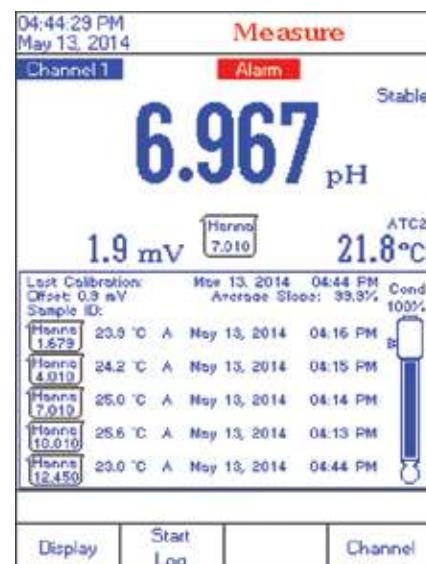
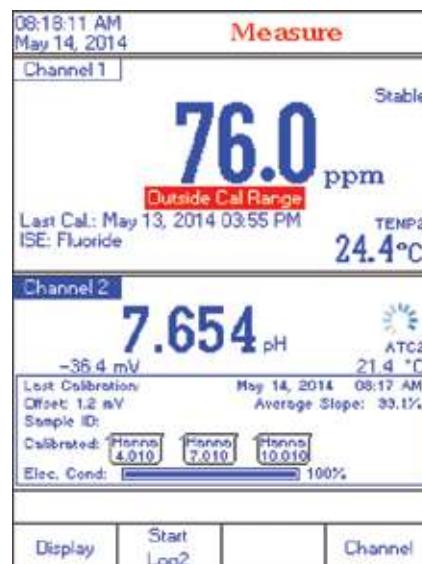
## Data Transfer

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

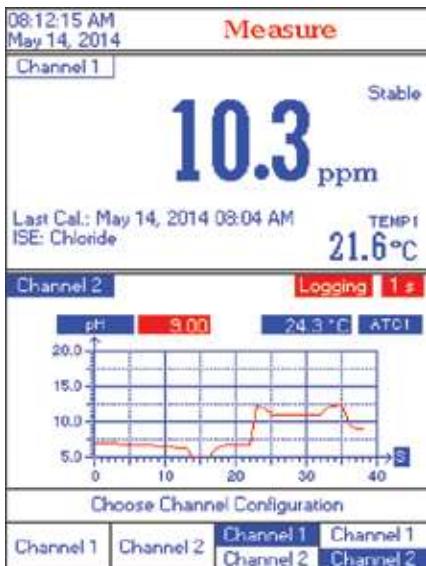
## Contextual Help

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



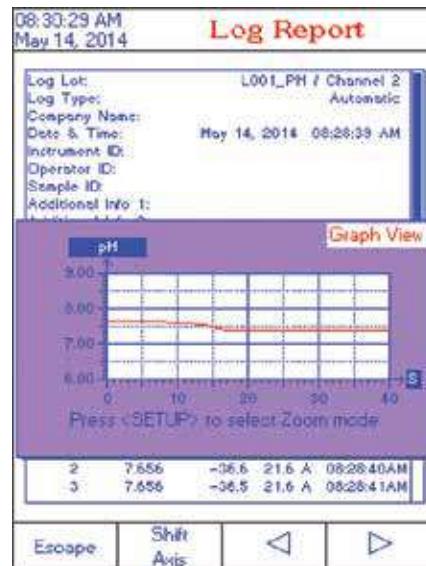
## Additional Features by Screen



Channel Configuration



Good Laboratory Practices



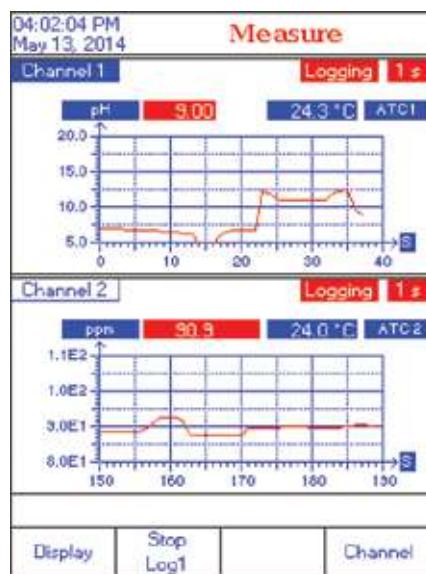
Log Recall



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 $\pm 0.1$ pH; $\pm 0.01$ pH; $\pm 0.002$ pH $\pm 1$ 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 $\pm 2000$ mV
	Resolution 0.1 mV
	Accuracy $\pm 0.2$ mV $\pm 1$ LSD
	Relative mV Offset Range $\pm 2000$ mV
ISE	Range $1 \times 10^{-6}$ to $9.99 \times 10^{10}$ concentration
	Resolution 1; 0.1; 0.01; 0.001 concentration
	Accuracy $\pm 0.5\%$ (monovalent ions); $\pm 1\%$ (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 $\pm 0.2^\circ\text{C}$ ; $\pm 0.4^\circ\text{F}$ ; $\pm 0.2\text{K}$
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 <b>record</b> : Up to 100 lots, 50,000 records max/lot / maximum 100,000 data points/channel; <b>interval</b> : 14 selectable between 1 second and 180 minutes; <b>type</b> : 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.

(\* ) Reduced to actual probe limits

pH and ORP electrodes begin on page 2.122; pH and ORP solutions begin on page 2.142;  
ISE electrodes and solutions begin on page 3.22

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HI98191

# Professional Waterproof Meters

pH/ORP/ISE

- ISE measurement units

- Extensive choice of units to display readings (ppm, ppt, g/L,  $\mu$ g/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  $\pm 2000$  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.

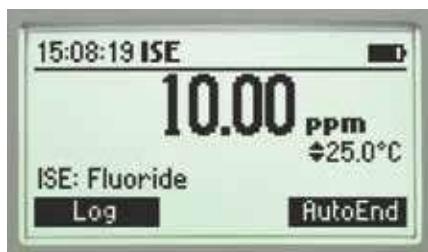


## Backlit Graphic LCD Display

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.

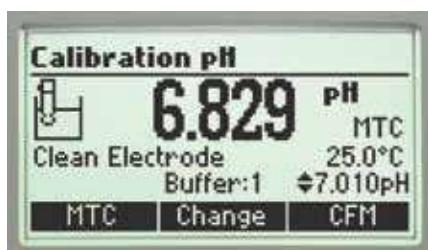
## Waterproof Protection

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,  $\mu$ g/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

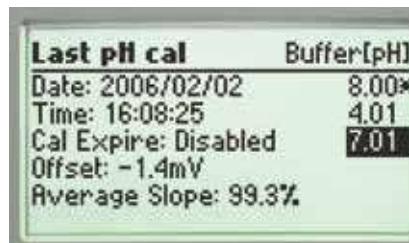
Choose from seven standard pH buffers and five custom pH buffers to obtain up to five point calibration and achieve high precision readings with a pH accuracy of  $\pm 0.002$  and up to  $\pm 0.001$  pH resolution.

## 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.

	pH	Date
1	6.06	2014/11/18
2	6.06	2014/11/18
3	6.06	2014/11/18
4	6.06	2014/11/18
<b>Delete All</b>		<b>Delete</b>
<b>More</b>		

## 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

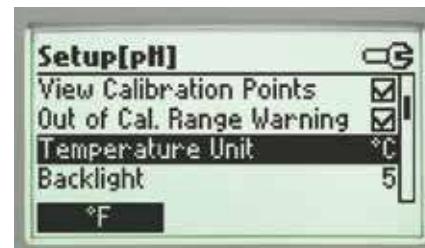
The fitted rubber keypad has dedicated keys for power, backlight, up/down arrows, help and alphanumeric characters. The meter also features two virtual soft keys that navigate the user through the configuration of each parameter, meter setup, and logging of data. The interface is intuitive for any user's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

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

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 <sup>-7</sup> to 9.99 E <sup>10</sup> 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 <sup>12</sup> 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 HI20191 rugged carrying case with custom insert.	

\* Will be reduced to actual sensor limits

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) 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 (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) 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 <sup>12</sup> 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.

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 <sup>12</sup> 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%	
Ordering Information	Dimensions	185 x 72 x 36 mm (7.3 x 2.8 x 1.4")	
	Weight	300 g (10.6 oz.)	
	HI931100 and HI931101 are supplied with batteries, instructions and hard carrying case.		

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.

ISE

portable

## Specifications

### HI931102

NaCl	Range	0.150 to 1.500 g/L NaCl; 1.50 to 15.0 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 <sup>12</sup> 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")
Ordering Information	Weight	300 g (10.6 oz.)
	HI931102	is supplied with batteries, instructions and hard carrying case.

# Ion Selective Electrodes

Ammonia · Bromide · Cadmium



Parameter	Ammonia	Bromide	Cadmium	
Code	<b>HI4101</b>	<b>HI4002</b>	<b>HI4102</b>	<b>HI4003</b>
Type	gas-sensing; combination	solid-state; half-cell	solid-state; combination	solid-state; half-cell
Measurement Range	1M to $1 \cdot 10^{-6}$ M 17000 to 0.02 mg/L (ppm) 14000 to 0.016 mg/L as N	1M to $1 \cdot 10^{-6}$ M 79910 to 0.08 mg/L (ppm)		0.1M to $1 \cdot 10^{-7}$ M 11200 to 0.01 mg/L (ppm)
Optimum pH Range	>11	2 to 12.5	2 to 12.5	2 to 12
Temperature Range	0 to 40°C	0 to 80°C	0 to 80°C	0 to 80°C
Approximate Slope	-56	-56	-56	+28
Body O.D.	12 mm	12 mm	12 mm	12 mm
Insertion Length	120 mm	120 mm	120 mm	120 mm
Body Material	Delrin®	epoxy	PEI	epoxy
Cable	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

## Ion Selective Electrodes

Calcium · Carbon Dioxide · Chloride



ISE

sensors

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 $3 \cdot 10^{-6}$ M 40080 to 0.12 mg/L (ppm)		1·10 <sup>-2</sup> M to 1·10 <sup>-4</sup> M 440 to 4.4 mg/L (ppm)	1M to $5 \cdot 10^{-5}$ M 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 <sub>2</sub> 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

## Ion Selective Electrodes

Cupric · Cyanide



Parameter	Cupric	Cyanide
Code	<b>HI4008</b>	<b>HI4108</b>
Type	solid-state; half-cell	solid-state; combination
Measurement Range	0.1M to $1 \cdot 10^{-6}$ M 6355 to 0.06 mg/L (ppm)	0.01M to $1 \cdot 10^{-6}$ M 260 to 0.02 mg/L (ppm)
Optimum pH Range	3 to 7	>11
Temperature Range	0 to 80°C	0 to 80°C
Approximate Slope	+27	-56
Body O.D.	12 mm	12 mm
Insertion Length	120 mm	120 mm
Body Material	epoxy	epoxy
Cable	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

## Ion Selective Electrodes

Fluoride · Iodide



ISE

Sensors

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

# Ion Selective Electrodes

Lead/Sulfate · Nitrate · Potassium

ISE

Sensors



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 20700 to 0.21 mg/L (ppm)		1.0M to $1 \cdot 10^{-5}$ M 6200 to 0.62 mg/L (ppm) 1400 to 0.4 mg/L (ppm) as N		1.0M to $1 \cdot 10^{-6}$ M 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



ISE

sensors

Parameter	Silver/Sulfide	Sodium	Reference	
Code	<b>HI4015</b>	<b>HI4115</b>	<b>FC300B</b>	<b>HI5315</b>
Type	solid-state; half-cell	solid-state; combination	glass combination	N/A
Measurement Range	1.0M to $1 \cdot 10^{-6}$ M 107900 to 0.11ppm (Ag <sup>+</sup> ) 1.0M to $1 \cdot 10^{-7}$ M 32100 to 0.003 ppm (S <sup>2-</sup> )	Ag <sup>+</sup> 1.0M to $1 \cdot 10^{-6}$ M 107900 to 0.11ppm S <sup>2-</sup> 1.0M to $1 \cdot 10^{-7}$ M 32100 to 0.003 ppm	1M to $1 \cdot 10^{-5}$ M 22990 to 0.23 ppm	N/A
Optimum pH Range	2 to 8 (Ag <sup>+</sup> ) 12 to 14 (S <sup>2-</sup> )	Ag <sup>+</sup> 2 to 8 S <sup>2-</sup> 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 <sup>+</sup> ) / -28 (S <sup>2-</sup> )	+56 Ag <sup>+</sup> / -28 S <sup>2-</sup>	+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
<b>HI4001-01</b>	0.10 M ammonia standard	500 mL
<b>HI4001-02</b>	100 mg/L (ppm) ammonia standard (as NH <sub>3</sub> N)	500 mL
<b>HI4001-03</b>	1000 mg/L (ppm) ammonia standard (as NH <sub>3</sub> N)	500 mL
<b>HI4002-01</b>	0.10 M bromide standard	500 mL
<b>HI4003-01</b>	0.10 M cadmium standard	500 mL
<b>HI4004-01</b>	0.10 M calcium standard	500 mL
<b>HI4005-01</b>	0.10 M carbon dioxide standard	500 mL
<b>HI4005-03</b>	1000 ppm as CaCO <sub>3</sub> carbon dioxide standard	500 mL
<b>HI4007-01</b>	0.10 M chloride standard	500 mL
<b>HI4007-02</b>	100 ppm chloride standard	500 mL
<b>HI4007-03</b>	1000 ppm chloride standard	500 mL
<b>HI4008-01</b>	0.1 M cupric standard	500 mL
<b>HI4010-01</b>	0.1 M fluoride standard	500 mL
<b>HI4010-02</b>	100 ppm fluoride standard	500 mL
<b>HI4010-03</b>	1000 ppm fluoride standard	500 mL
<b>HI4010-10</b>	10 ppm fluoride standard premixed with TISAB II	500 mL
<b>HI4010-11</b>	1 ppm fluoride standard premixed with TISAB II	500 mL
<b>HI4010-12</b>	2 ppm fluoride standard premixed with TISAB II	500 mL
<b>HI4010-30</b>	kit containing 4 bottles each of : HI4010-10, HI4010-11 and HI4010-00	500 mL (3 x 4)
<b>HI4011-01</b>	0.1 M iodide standard	500 mL
<b>HI4012-01</b>	0.1 M lead standard	500 mL
<b>HI4012-21</b>	0.1 M sulfate standard	500 mL
<b>HI4013-01</b>	0.1 M nitrate standard	500 mL
<b>HI4013-02</b>	100 ppm nitrate standard (as N)	500 mL
<b>HI4013-03</b>	1000 ppm nitrate standard (as N)	500 mL
<b>HI4014-01</b>	0.1 M potassium standard	500 mL
<b>HI4015-01</b>	0.1 M silver standard	500 mL
<b>HI4016-01</b>	0.1 M sodium standard	500 mL
<b>HI4016-02</b>	100 ppm sodium standard	500 mL
<b>HI4016-03</b>	1000 ppm sodium standard	500 mL
<b>HI4016-10</b>	10 ppm sodium standard	500 mL



## Gas Sensor Fill Solutions

Code	Description	Size
<b>HI4001-40</b>	ammonia filling solution	30 mL bottles (4)
<b>HI4005-40</b>	carbon dioxide filling solution	30 mL bottles (4)

## Specific Solutions for ISE Sensors

Code	Description	Size
<b>HI4000-47</b>	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
<b>HI4001-45</b>	conditioning and storage solution for HI4101 ammonia ISE	500 mL
<b>HI4004-45</b>	conditioning and storage solution for HI4004 and HI4104 calcium ISEs	500 mL
<b>HI4005-45</b>	conditioning and storage solution for HI4105 carbon dioxide ISE	500 mL
<b>HI4016-45</b>	storage solution for sodium ISE	500 mL
<b>HI4016-46</b>	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
<b>HI4000-00</b>	ISA for halide ISEs	500 mL
<b>HI4001-00</b>	alkaline ISA for ammonia and cyanide ISEs	500 mL
<b>HI4004-00</b>	ISA for calcium ISEs	500 mL
<b>HI4005-00</b>	ISA for carbon dioxide ISEs	500 mL
<b>HI4010-00</b>	TISAB II for fluoride ISEs	500 mL
<b>HI4010-05</b>	TISAB II for fluoride ISEs	1 gallon
<b>HI4010-06</b>	TISAB III concentrate for fluoride ISEs	500 mL
<b>HI4012-00</b>	ISA for lead/sulfate ISEs	100 mL (5)
<b>HI4013-00</b>	ISA for nitrate ISEs	500 mL
<b>HI4013-06</b>	nitrate interferent suppressant ISA	500 mL
<b>HI4014-00</b>	ISA for potassium ISEs	500 mL
<b>HI4015-00</b>	SAOB (sulfide antioxidant buffer)	500 mL + 18 g (2 components)
<b>HI4016-00</b>	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
<b>HI7072</b>	electrolyte solution, 1 M KNO <sub>3</sub>	30 mL bottles (4)
<b>HI7075</b>	electrolyte solution with KNO <sub>3</sub> and KCl	30 mL bottles (4)
<b>HI7076</b>	electrolyte solution, 1 M NaCl	30 mL bottles (4)
<b>HI7078</b>	electrolyte solution, (NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	30 mL bottles (4)
<b>HI7082</b>	electrolyte solution, 3.5 M KCl	30 mL bottles (4)

### Reference Fill Solutions Containing Silver Chloride (AgCl)

Code	Description	Size
<b>HI7079</b>	2M NH <sub>4</sub> Cl sat. with AgCl electrolyte for sodium ISEs (contains AgCl)	30 mL bottles (4)



# Solutions

## Sodium (Na<sup>+</sup>) 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	calibration solution for % readings (100% NaCl)	500 mL bottle
HI7037M	calibration solution for % readings (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
HI8084L	standard solution at 58.4 g/L sodium chloride	500 mL FDA bottle
HI8088L	standard solution at 5.84 g/L sodium chloride	500 mL FDA bottle
HI8089L	standard solution at 125 g/L sodium chloride	500 mL FDA bottle
HI8095L	standard solution at 146 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

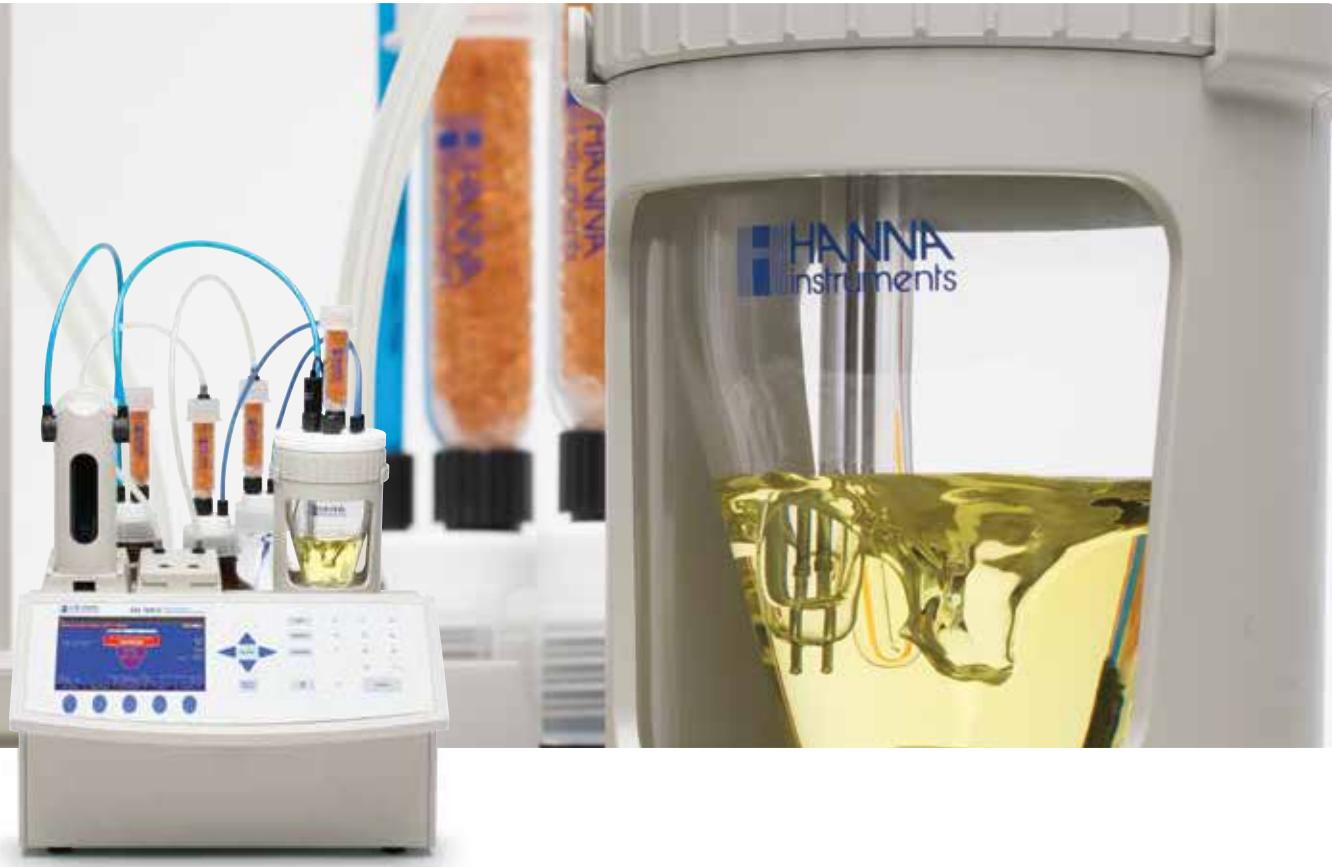
Both sodium/sodium chloride and fluoride solutions are available with a certificate of analysis on request.

## 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 <sup>-</sup>	1 L
HI70701L	standard solution at 1 g/L F <sup>-</sup>	500 mL
HI70701M	standard solution at 1 g/L F <sup>-</sup>	230 mL
HI70702/1L	standard solution at 10 mg/L F <sup>-</sup>	1 L
HI70702L	standard solution at 10 mg/L F <sup>-</sup>	500 mL
HI70702M	standard solution at 10 mg/L F <sup>-</sup>	230 mL
HI70703/1L	standard solution at 100 mg/L F <sup>-</sup>	1 L
HI70703L	standard solution at 100 mg/L F <sup>-</sup>	500 mL
HI70703M	standard solution at 100 mg/L F <sup>-</sup>	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 HI 4004 half-cell ISE
HI4104-51	calcium module for HI 4104 combination ISE
HI4005-53	carbon dioxide membrane kit (3 caps)
HI4110-51	fluoride module for HI 4110 combination ISE
HI4013-53	nitrate module for HI 4013 half-cell ISE (3 pack)
HI4113-53	nitrate module for HI 4113 combination ISE (3 pack)
HI4014-51	potassium module for HI 4014 half-cell ISE
HI4114-51	potassium module for combination ISE
HI740155P	capillary pipettes (20 pcs)
HI740159	plastic tweezers



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## Hanna Instruments® Titration Systems

Titration is used in analytical chemistry to determine the amount or concentration of a substance, known as the analyte. Titration is a quantitative measurement of an analyte in solution by its complete reaction with a reagent. In a titration, one reagent (the titrant) is slowly added to a solution containing the species being measured (the analyte). As it is added, a chemical reaction occurs between the titrant and analyte. The point at which the reaction is complete and an equivalent quantity of titrant and analyte are present (a stoichiometric equivalent) is called the equivalence point. This can be determined by a chemical indicator that is also present in the solution, or by a measurable physical change in the solution, like pH, electrode potential, conductivity, or light absorption (color). In practice, an abrupt change of this physical property signals the end of titration, called the endpoint.

The purpose of titration is to determine the quantity or concentration of an analyte with a known concentration and volume of a titrant. Titrations are based on chemical reactions which must fulfill four requirements:

- The reaction between the analyte and the titrant must occur quickly, without a secondary reaction
- The reaction must go to completion
- The reaction must have well-known stoichiometry (reaction ratio)
- Must have a convenient method of endpoint detection

Titrations are highly precise and can provide many advantages over alternative methods. Titrations are quickly performed and require relatively simple apparatus and instrumentation.

### Automatic Titration

Automatic titration is done with instrumentation that delivers the titrant, stops at the endpoint and calculates the concentration of the analyte automatically. Automatic titrators are best for accurate and repeatable results, as an electrochemical measurement is used to determine the endpoint as opposed to a subjective color indicator.

Analyses that can be performed by potentiometric automatic titrators include:

- Acid-base titrations
- Oxidation reduction titrations
- Complexometric titrations
- Precipitation titrations
- Non-aqueous titrations
- Argentometric titrations
- pH, ORP and Ion selective measurements

Analyses performed by bivoltammetric automatic titrators include:

- Coulometric Karl Fischer titration (trace amounts of water determination)
- Volumetric Karl Fischer titration (greater than 100 ppm water determination)

The required equipment for automatic titration include an automatic titrator equipped with a burette, a standardized titrant, a volumetric pipette (to measure the sample volume) or analytical balance (to measure or weigh a sample), a beaker, a sensor, and a stirring mechanism.

The automatic titrator must have an accurate liquid-dispensing system. In high accuracy systems, this is typically a motor-driven piston burette, a valve system to switch between titrant inlet and outlet, and a titration tip to dispense the titrant into the sample solution. These three main subsystems must be as accurate as possible, with very low gear backlash in the burette drive mechanism, low piston seal flexing, accurate burette glass cylinder diameter, low dead volume in the valve, minimal evaporation/permeation and chemically resistant tubing.

### Standards and Standardization

One of the substances involved in a titration must be used as a standard for which the amount of substance present is accurately known. The standard can be present either in the form of a pure substance or as a solution. The titrant solution can be standardized in two ways; using a primary standard, or more commonly, titrating it against a previously standardized solution.



## Product Spotlights

HI921

### Autosampler

The HI921 can utilize up to three peristaltic pumps for automatic reagent addition, sample leveling and waste aspiration and one membrane pump for spray rinsing. An included control panel allows for manual operation of the motors and pumps. The HI921 also features a built-in magnetic stirrer, electrode rinse feature, USB interface with compatible barcode reader and built-in RFID for each tray.

[See page 4.10](#)



HI902C

### Automatic Titration System

The HI902C is an automatic titrator that performs acid-base, redox, complexometric, precipitation, non-aqueous argentometric and ion selective titrations. The HI902C dispenses the titrant, detects the endpoint and performs all necessary calculations automatically.

This versatile titrator supports up to 100 standard or user-defined methods. When powered on, the instrument initiates an internal diagnostics check and then readies itself for the first titration of the day. A large color LCD screen clearly shows the chosen method and related information. A real-time titration curve can be shown on the display; this feature is useful when new methods are tested or when a procedure needs to be optimized. At the end of the titration, the data (including the graph) is automatically stored and can be transferred to a flash drive or PC by USB connection.

[See page 4.6](#)



HI901C

### Automatic Titration System

The HI901C automatic titrator complements our wide range of products dedicated to efficient and accurate laboratory analysis. The HI901C potentiometric titrator can perform acid/base, redox (ORP), complexometric, precipitation, non-aqueous, argentometric, and ion selective titrations. This powerful titrator dispenses the titrant, detects the endpoint, and performs all necessary calculations and graphing automatically. In addition to titration mode, the HI901C also operates as a fully functional pH, mV/ORP, and ion selective electrode (ISE) meter.

[See page 4.14](#)



# Automatic Benchtop Mini Titrator Comparison Guides

HI84530 • HI84531

## Total Titratable Acidity and Titratable Alkalinity



HI84530	• Low Range Acidity	• High Range Acidity	• Low Range Alkalinity	• High Range Alkalinity	• pH Range	• Temperature Range (°C)	• Three-point pH Calibration	• Automatic Temperature Compensation	• GLP Features	• Backlit Display	• Data Logging	• PC Connectivity	Page 4.26
HI84531													Page 4.28

HI84529

## Dairy Products



HI84529	• Low Range Acidity	• High Range Acidity	• pH Range	• Temperature Range	• Automatic Temperature Compensation	• Three-point pH Calibration	• Automatic Temperature Compensation	• GLP Features	• Backlit Display	• Data Logging	• PC Connectivity	Page 4.30
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HI84532

## Acidity in Fruit Juice



HI84532	• pH Range	• Temperature Range	• Citric Acid Range	• Malic Acid Range	• Tartaric Acid Range	• Three-point pH Calibration	• Automatic Temperature Compensation	• GLP Features	• Backlit Display	• Data Logging	• PC Connectivity	Page 4.32
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HI84500 • HI84502 • HI84533

## Wine Products



HI84533	• Formic Number	• Tartaric Acid Range	• ORP Range	• Sulfur Dioxide Range	• pH Range	• Temperature Range	• Three-point pH Calibration	• Automatic Temperature Compensation	• GLP Features	• Data Logging	• Backlit Display	• PC Connectivity	Page 4.34
HI84500													Page 4.36
HI84502													Page 4.38

## Automatic Titration System



HI921 Autosampler  
compatible

Reagent addition  
feature

The HI902C is an automatic titrator that complements our wide range of products dedicated to efficient and accurate laboratory analysis. The HI902C potentiometric titrator can perform acid/base, redox (ORP), complexometric, precipitation, non-aqueous, argentometric, and ion selective titrations, as well as back titrations and titre determinations. This powerful titrator dispenses the titrant, detects the endpoint, and performs all necessary calculations and graphing automatically. In addition to titration mode, the HI902C also operates as a fully functional pH, mV/ORP, and ion selective electrode (ISE) meter.

This titrator is supplied with a pack of standard methods or you can create your own. Methods (standard or user) can be easily transferred between titrators via USB flash drive.

### Burettes and Dosing System



### Exchangeable Burette System

With Hanna's Clip-Lock™ burette feature, it only takes a few seconds to exchange titrants and reagents, preventing cross-contamination and saving time.

### Multiple Burette Sizes

The HI902C comes standard with a 25 mL burette but may be equipped with a 5 mL, 10 mL, or 50 mL burette. Each burette is constructed with a ground glass syringe and chemically resistant PTFE plunger.

### Linear and Dynamic Dosing

#### Precision Dosing Pump

Our unmatched 40,000 step piston driven pump is capable of dosing extremely small and precise volumes of titrant or reagent.

### Chemically Resistant Tubing

Aspiration and dispensing tubes are constructed of durable, chemically resistant PTFE and feature a light-blocking polyurethane outer sleeve to protect light sensitive reagents.

## Titration Capabilities

### Dynamic Titrant Dosing

The dynamic dosing feature allows for timely and accurate titration results by relating the titrant volume dosed to the mV response from the titration reaction. This provides for larger doses near the beginning of a titration and smaller, more precise doses near the titration endpoint.

### Signal Stability Timing

The signal stability feature monitors when the mV response of the titration reaction stabilizes before providing the next titrant dose. This ensures reliable measurement values throughout the length of a titration.

### Equivalence Endpoint Detection

Equivalence endpoint detection is critical in applications where fixed endpoints are not specified in standard methods. This endpoint indicates where the mV response from the titration is greatest with respect to the volume of titrant dosed.

### Multiple Equivalence Point Detection

The HI902C can detect multiple equivalence points during one titration as specified and required in several standard methods and applications.

### Method Sequencing

The HI902C offers users the option of linking two methods. This allows for two analyses to be run on the same sample or for back titrations to be performed.

### Multiple Titration Types

Paired with the right electrode from our sensor line, our potentiometric titrator can perform acid/base, redox (ORP), complexometric, precipitation, non-aqueous, argentometric, and ion selective titrations, as well as back titrations and titre determinations.

## Interface and Display

### Detailed Titration Graphs

A real-time titration curve can be displayed during each titration; this feature is useful when new methods are tested or when a procedure requires optimization.

### Interactive Color Display

A large, color LCD screen clearly shows the chosen titration method along with results, units, titration volume, temperature, and mV or pH values. The HI902C also offers multi-language support.

### Simple and Quick Navigation

Virtual key selections present on the display allow for simple and quick navigation between screens and menus without getting lost in a nest of information.

### Data and Storage

#### Customizable Titration Reports

Each titration report is fully customizable so users can ensure they are storing and filing the appropriate data required for their application and procedures.

#### Flexible GLP Management

All necessary GLP (Good Laboratory Practice) information can be recorded with each sample including: sample identification, company and operator name, date, time, electrode ID codes, and calibration information.



#### Effortless Data Transfer

Data can easily be transferred to a USB flash drive or PC with the Hanna HI900PC application software. The USB port allows for the transfer of titration methods, titration reports, and software upgrades via USB flash drive.

### Methods of Analysis

#### Customizable Methods

The HI902C can store up to 100 user-defined or standard titration methods. Each method may be customized and optimized for performance based on application and user requirements.

#### Titration Method Support

Onsite installation, training, and customization is available from one of our Applications or Service experts. Hanna offers continued support via phone or webinar for any questions you might have along the way.

### Market Specific Methods Packs

Hanna offers titration method packages for various markets including food, beverage, dairy, wine, and more. Ask our Sales Consultants about which methods in our library are available for your specific needs.

#### Adaptable Standard Methods

Our technical experts can program and customize standard methods developed by such affiliations as ISO, ASTM, AOAC, AOCS, EPA, and more directly onto your titrator. Ask our Sales Consultants which standard methods are possible with our HI902C system.

### Connectivity and Functionality

#### Multifunctional with Four Working Modes

The HI902C functions as a titrator, pH meter, mV/ORP meter, and ISE meter. Valuable laboratory bench space is saved, and multiple analyses can be performed on one sample.



#### Multiple Connections

The titrator offers device support for two analog boards, allowing up to two electrodes, two burettes, and two stirrers to be simultaneously connected to one unit.

#### Autosampler Connectivity

The HI902C works seamlessly with our HI921 Autosampler. The HI921 features 16 or 18 sample tray options, automatic tray identification, automatic beaker detection, up to three peristaltic pumps for reagent addition and removal, real-time titration and sequencing progress, and more.

#### Multiple Peripherals

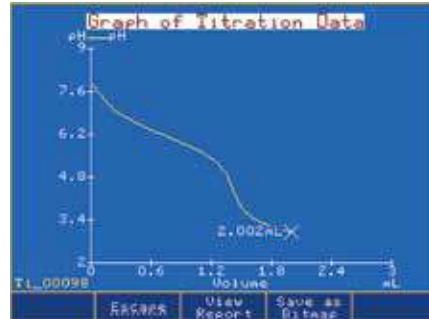
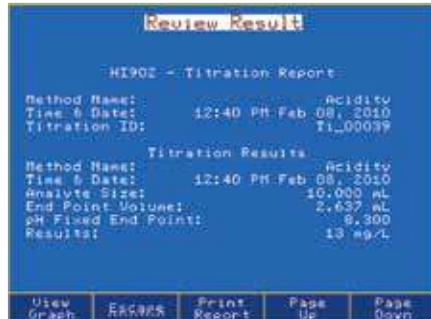
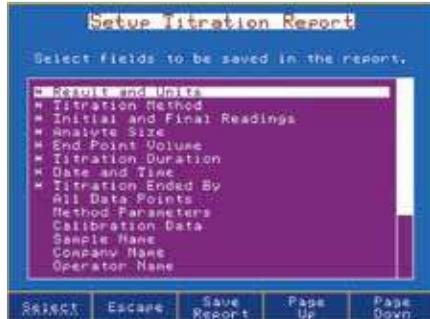
Users can print reports directly from the titrator using a standard parallel printer. An external monitor and keyboard may be attached for added versatility, as well as an analytical balance for automatic sample mass entry for titrations.

## Versatile Data Management

4

- HI902C titration system can be easily incorporated into any existing GLP data management program:
  - Easily record all necessary GLP information with every sample, such as sample identification, company and operator name, date, time, electrode ID codes and calibration information.

- Data can be transferred to a PC using Hanna HI900PC software
- The USB port allows for the easy transfer of methods, reports and software upgrades via USB flash drive
- Users can print reports of analyses directly from the titrator using a standard parallel printer
- An external monitor and keyboard can be attached for added versatility



### Customizable reports

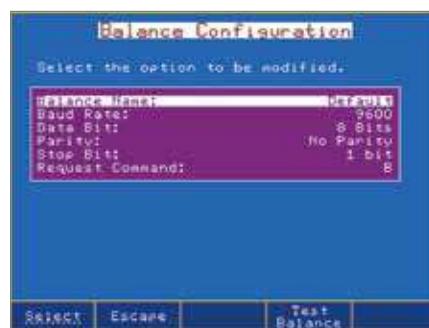
Data to be stored in titration reports is fully customizable

### Titration reports

Titration or pH/mV/ISE results can be viewed on-screen or transferred to a USB flash drive or PC

### Titration graphs

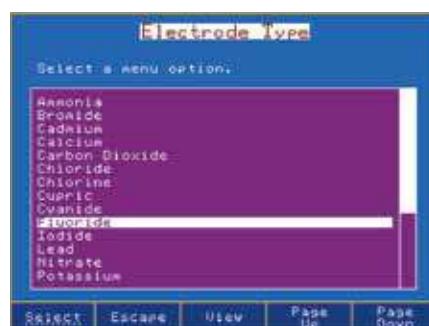
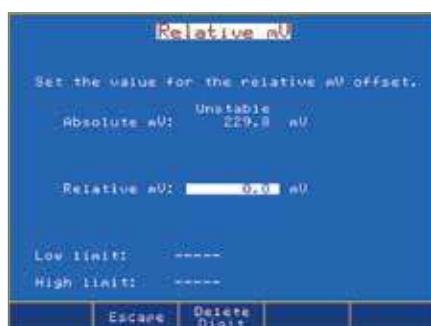
Titration graphs can be viewed on-screen or saved as images and transferred along with titration report



### Fully customizable titration methods

Linked methods allow two methods to run in sequence

Fully configurable balance interface



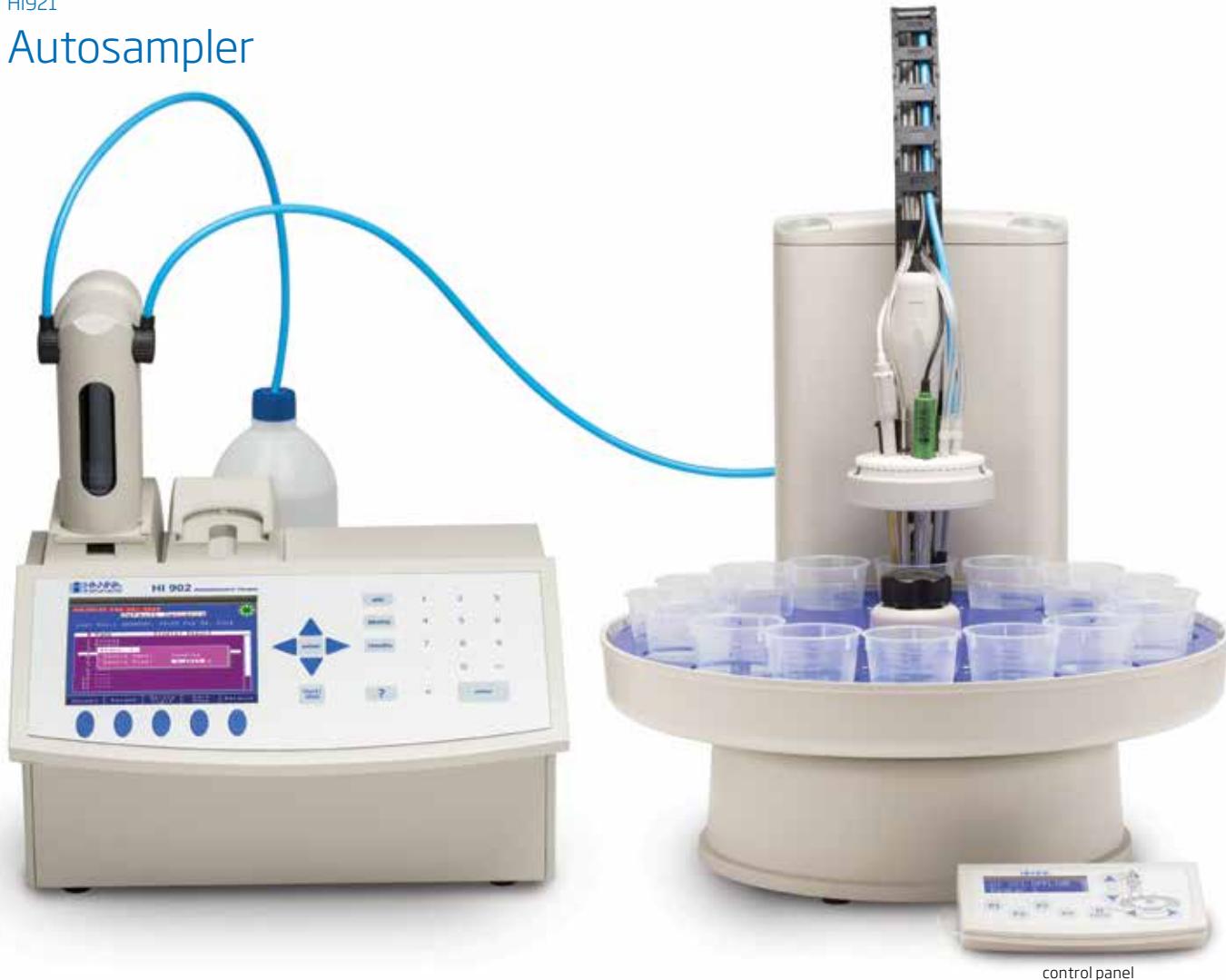
Up to five-point pH calibration with automatic buffer recognition

Relative mV calibration allows for a mV offset

Selectable ISEs preprogrammed with molecular weight and ion charge

Specifications		HI902C
pH	Range	-2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH
	Resolution	0.1; 0.01; 0.001 pH
	Accuracy (@25°C/77°F)	±0.001 pH
mV	Range	-2000.0 to 2000.0 mV
	Resolution	0.1 mV
	Accuracy (@25°C/77°F)	±0.1 mV
ISE	Range	1•10 <sup>-6</sup> to 9.99•10 <sup>10</sup>
	Resolution	1; 0.1; 0.01
	Accuracy (@25°C/77°F)	±0.5% monovalent; ±1% divalent
Temperature	Range	-5.0 to 105.0°C; 23.0 to 221.0°F; 268.2 to 378.2 K
	Resolution	0.1°C; 0.1°F; 0.1K
	Accuracy (@25°C/77°F)	±0.1°C; ±0.2°F; ±0.1K, excluding probe error
Other Specifications	Burette Sizes	5, 10, 25 and 50 mL
	Burette Resolution	1/40000
	Display Resolution	0.001 mL
	Dosing Accuracy	±0.1% of full burette volume
	Display	5.7" (320 x 240 pixel) backlit color LCD
	Languages	English, Portuguese, Spanish
	Methods	load up to 100 methods (standard and user-defined)
	Burette Auto-Detection	burette size is automatically recognized when inserted into the unit
	Programmable Stirrer	overhead propeller type, 100-2500 RPM, resolution 100 rpm
	Flow Rate	user-selectable from 0.1 mL/min to 2 x burette volume/min
	Temperature Compensation	manual (MTC) or automatic (ATC)
	Endpoint Determination	equivalence point (1st or 2nd derivative) or fixed pH/mV value
	pH Calibration	up to five-point calibration, eight standard buffers and five custom buffers
	mV Calibration	single point offset
	ISE Calibration	up to five-point calibration, seven standard solutions and five user-defined standards
	Potentiometric Titrations	acid-base, redox, precipitation, complexometric, non-aqueous, argentometric
	Measurement Units	user-specified expression of concentration units to suit specific calculation requirements
	Real Time & Stored Graphs	mV-volume or pH-volume titration curve, 1st derivative curve or 2nd derivative curve pH mode, mV mode or ISE mode: pH/mV/concentration versus time
	Data Storage	up to 100 titration and pH/mV/ISE reports
	USB Host (Side)	flash drive compatibility for transfers of methods and reports
Ordering Information	Peripherals (Rear)	connections for VGA display, PC-keyboard, parallel printer, USB device input, RS232, interface for autosampler
	GLP Conformity	instrumentation data storage and printing capabilities
	Operating Environment	10 to 40°C (50 to 104°F), up to 95% RH
	Storage Environment	-20 to 70°C (-4 to 158°F), up to 95% RH
	Power	100-240 VAC "-01" models, US plug (type A) "-02" models, European plug (type C)
	Dimensions	390 x 350 x 380 mm (15.3 x 13.8 x 14.9 in)
	Weight	approximately 9 kg (20 lbs.) with one pump, stirrer and sensors
	<b>HI902C1-01</b> and <b>HI902C1-02</b> : titrator with one analog board, overhead propeller stirrer with stand, 25 mL glass burette, dosing pump drive, temperature sensor, USB cable, 256 Mb USB flash drive and PC software.	
	<b>HI902C2-01</b> and <b>HI902C2-02</b> : titrator with two analog boards, overhead propeller stirrer with stand, 25 mL glass burette, dosing pump, temperature sensor, USB cable, 256 Mb USB flash drive and PC software.	

## Autosampler



control panel

### Automate up to 18 samples

The HI921 Autosampler is an automated titration sample handling system designed for use with the HI902C Automatic Titration System, making multiple sample titrations quick and easy.

With the Autosampler, up to 18 samples can be run consecutively. The HI921 Autosampler interfaces directly with the HI902C to access titration methods. Once a titration method is established, the user can fully customize the automation sequence of their samples for this method. Sample names and size can be customized or auto-filled with preset values. One beaker can be designated for storage purposes

before and after titration sequences; up to three beakers per tray can be designated for an electrode rinse sequence, allowing for sufficient removal of solutions that are hard to clean between each sample titration. During each sample titration, the real-time progress is shown on the HI902C display. Finished sample results and graphs can be accessed during and after the titrations have finished.

Once the Autosampler sequence is complete, two reports are available for review: a sequence report featuring a table outlining each sample name, beaker position, sample size, and result for the tray, and a detailed titration report for each individual sample, including the graph of the titration data.

### 16 or 18 Sample Tray

The HI921 is able to automate samples using a 16 sample tray or an 18 sample tray. The 16 sample tray holds 150 mL beakers; the 18 sample tray holds 100 mL beakers. The Autosampler trays are composed of chemically resistant materials and are removable to allow for easy handling. The dishwasher safe trays provide a quick and simple way for users to clean regularly.

### Built-in Magnetic Stirrer

A magnetic stirrer comes built-in with each Autosampler tray. Users simply need to add a small magnetic stir bar to each beaker to ensure homogeneity during titrations. An optional overhead propeller stirrer can also be installed for use instead of the built-in stirrer. The HI921 allows users to easily adjust the stirring speed of both the built-in and overhead stirrers for optimal use.

### Built-in RFID

The HI921 sample trays feature a built-in RFID reader that is able to communicate the tray size and serial number of each tray. Users can have multiple trays, each designated to a specific set of samples. The RFID reader can ensure that the appropriate tray is used each time.



## Absolute Encoder

The Autosampler consistently tracks the tray position without the need to "home" or calibrate.

## Barcode Reader

A USB-compatible barcode reader can be used to associate names with each sample for improved organization of data.

## Optical IR Beaker Detection

An optical IR beam is able to detect the presence or absence of beakers within the sample tray. Users can dictate the Autosampler action if a beaker is missing from the tray during a titration sequence. If a beaker is detected as missing, the HI921 can skip over the sample or stop the titration sequence.

## Versatile Electrode Holder

The durable electrode holder is able to accommodate three 12 mm electrodes, a temperature sensor, one aspiration tube, and five multipurpose tubes. The multipurpose tubes can be utilized for actions such as reagent addition or burette dosing.

## Electrode Rinse Feature

Up to 3 beakers per tray can be designated for electrode dip/spray rinses.

## Sample Leveling Feature

Automatic leveling for fast preparation of volumetric samples.

## Waste Removal Feature

Aspirate completed samples into a waste container.

## Use with the HI902 Automatic Titration System

Flexible, accurate detection of the titration endpoint with HI902C potentiometric titrator.

Real-time progress of the sequence and results shown on the HI902 titrator screen.



## Control Panel

The included control panel features multiple buttons to allow for manual operation of the Autosampler tray, electrode holder, and any auxiliary pumps. A two-line backlit display on the handheld panel clearly displays status information. Manual control with the control panel is desirable for calibration, sample preparation, and method optimization.



## Peristaltic and Membrane Pumps

- Up to three peristaltic pumps can be added at anytime
- User replaceable pump systems
- Peristaltic pumps**
  - Uses high performance plastic that is engineered to be chemically resistant and have long service life.
  - Reagent addition, sample leveling, waste removal
  - Greater than 200 mL/min flow
- Membrane pumps**
  - Simple plug connection for tubing
  - Greater than 400 mL/min flow

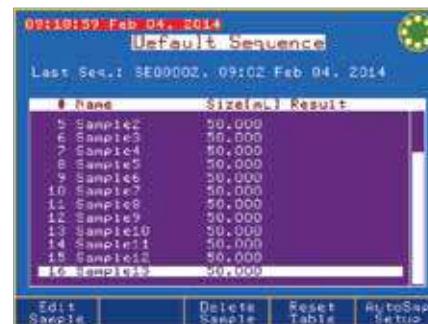
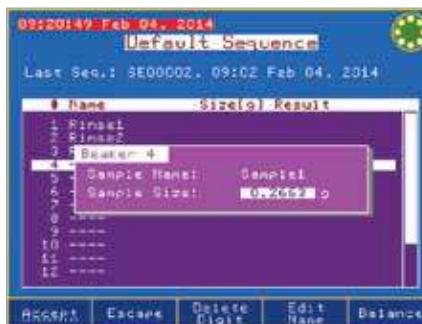
Users can add up to three peristaltic pumps or one membrane pump at any time with the user-replaceable pump systems on the HI921. The peristaltic pumps use high performance plastic that is engineered to be chemically resistant with a long service life. These pumps have a flow greater than 200 mL/min and can be utilized for reagent addition, sample leveling, and waste removal. The membrane pump is a simple plug connection for tubing that has a flow greater than 400 mL/min.

## Status indicator lights

Highly visible status lights are located on both sides of the Autosampler. These lights correspond to the status indicator on the HI902C display and can easily be seen from far away. The lights double as a safety feature, as pressing them at any time will automatically stop the current titration sequence.



- Steady green**
  - Idle, ready to start
- Flashing green**
  - Titration sequence running
- Steady yellow**
  - Titration sequence paused
- Steady Red**
  - Error or emergency stopped, or initializing during power on
- Flashing Red**
  - Error during sequence running or manual operation



## RFID recognition

Sample trays are automatically detected and identified when placed on the Autosampler.

## Digital balance compatibility

Sample weights are communicated when connected to a digital balance.

## Speedy sample entry

Sample names can be automatically incremented for speedy sample identification.



## Specifications

### HI921

Electrode Holder Slots	3 x 12-mm electrodes	Trays	16 beakers x 150 mL (HI920-11660)
	1 temperature sensor		18 beakers x 100 mL (HI920-11853)
	1 aspiration tube		built-in RFID, transmits the tray type and serial number to Autosampler
	5 multi - purpose slots (titrant/reagent tubes)	Beakers	ASTM short-form glass beakers
Temperature Sensor	HI7662-A (included)	Beakers	HI920-060 (120 mL), fits HI920-11660 tray - 20 plastic beakers
		Beakers	HI920-053 (100 mL), fits HI920-11853 tray - 20 plastic beakers
Stirrers	built-in magnetic stirrer	Control Panel	buttons for manual operation of tray and titration head
	overhead propeller stirrer (optional)		manual operation of peristaltic or membrane pumps
Peristaltic Pumps	up to 3 can be installed	Barcode Reader	2-line backlit display with status information
	installs in slots #1, 2, 3		compatible with USB barcode readers, used to add sample names
Membrane Pump (for cleaning)	installs in slot #4	Report Storage	up to 40 trays of samples (e.g.: 720 reports for 18-beaker tray)

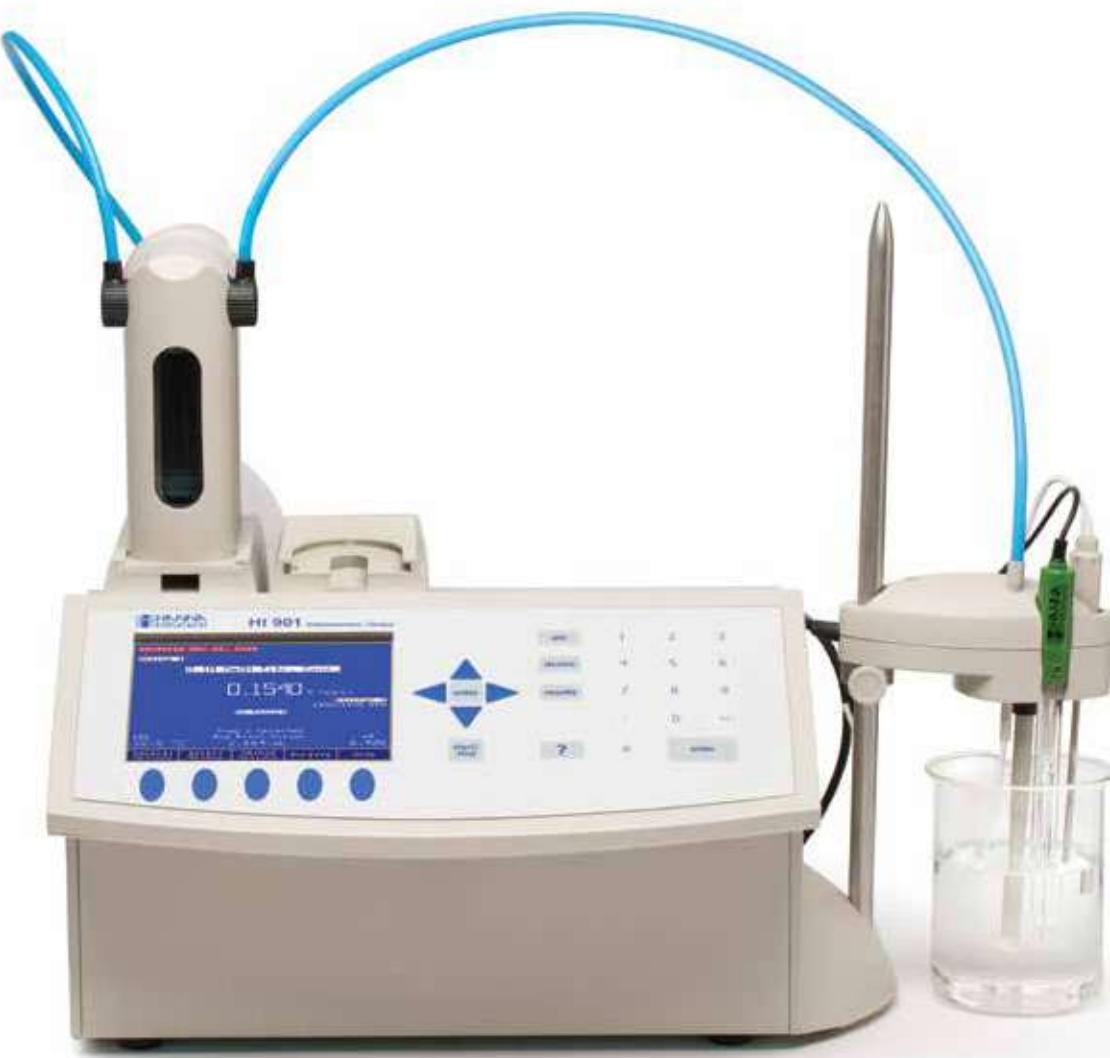
## Ordering Information

Choose your  
Autosampler  
configuration:

<b>x=</b>	<b>1</b>	16 sample tray
	<b>2</b>	18 sample tray
	<b>0</b>	no peristaltic pump
<b>y=</b>	<b>1</b>	one peristaltic pump
	<b>2</b>	two peristaltic pumps
<b>z=</b>	<b>3</b>	three peristaltic pumps
	<b>0</b>	no membrane pump
	<b>1</b>	one membrane pump

**HI921 - x y z**

## Automatic Titration System



The HI901C automatic titrator complements our wide range of products dedicated to efficient and accurate laboratory analysis. The HI901C potentiometric titrator can perform acid/base, redox (ORP), complexometric, precipitation, non-aqueous, argentometric, and ion selective titrations. This powerful titrator dispenses the titrant, detects the endpoint, and performs all necessary calculations and graphing automatically. In addition to titration mode, the HI901C also operates as a fully functional pH, mV/ORP, and ion selective electrode (ISE) meter.

This titrator is supplied with a pack of standard methods or you can create your own. Methods (standard or user) can be easily transferred between titrators via USB flash drive or PC application.

### Burettes and Dosing System



#### Exchangeable Burette System

With Hanna's Clip-Lock™ burette feature, it only takes a few seconds to exchange titrants and reagents, preventing cross-contamination and saving time.

### Multiple Burette Sizes

The HI901C comes standard with a 25 mL burette but may be equipped with a 5 mL, 10 mL, or 50 mL burette. Each burette is constructed with a ground glass syringe and chemically resistant PTFE plunger.

### Linear and Dynamic Dosing

#### Precision Dosing Pump

Our unmatched 40,000 step piston driven pump is capable of dosing extremely small and precise volumes of titrant or reagent.

### Chemically Resistant Tubing

Aspiration and dispensing tubes are constructed of durable, chemically resistant PTFE and feature a light-blocking polyurethane outer sleeve to protect light sensitive reagents.

## Titration Capabilities

### Dynamic Titrant Dosing

The dynamic dosing feature allows for timely and accurate titration results by relating the titrant volume dosed to the mV response from the titration reaction. This provides for larger doses near the beginning of a titration and smaller, more precise doses near the titration endpoint.

### Signal Stability Timing

The signal stability feature monitors when the mV response of the titration reaction stabilizes before providing the next titrant dose. This ensures reliable measurement values throughout the length of a titration.

### Equivalence Endpoint Detection

Equivalence endpoint detection is critical in applications where fixed endpoints are not specified in standard methods. This endpoint indicates where the mV response from the titration is greatest with respect to the volume of titrant dosed.

### Multiple Titration Types

Paired with the right electrode from our sensor line, our potentiometric titrator can perform acid/base, redox (ORP), complexometric, precipitation, non-aqueous, argentometric, and titrations with an ion selective electrode.

## Interface and Display

### Detailed Titration Graphs

A real-time titration curve can be displayed during each titration; this feature is useful when new methods are tested or when a procedure requires optimization.

### Interactive Color Display

A large, color LCD screen clearly shows the chosen titration method along with results, units, titration volume, temperature, and mV or pH values. The HI901C also offers multi-language support.

### Simple and Quick Navigation

Virtual key selections present on the display allow for simple and quick navigation between screens and menus without getting lost in a nest of information.

## Data and Storage

### Customizable Titration Reports

Each titration report is fully customizable so users can ensure they are storing and filing the appropriate data required for their application and procedures.

## Flexible GLP Management

All necessary GLP (Good Laboratory Practice) information can be recorded with each sample including: sample identification, company and operator name, date, time, electrode ID codes, and calibration information.



### Effortless Data Transfer

Data can easily be transferred to a USB flash drive or PC with the Hanna HI900PC application software. The USB port allows for the transfer of titration methods, titration reports, and software upgrades via USB flash drive.

## Methods of Analysis

### Customizable Methods

The HI901C can store up to 100 user-defined or standard titration methods. Each method may be customized and optimized for performance based on application and user requirements.

### Titration Method Support

Onsite installation, training, and customization is available from one of our Applications or Service experts. Hanna offers continued support via phone or webinar for any questions you might have along the way.

### Market Specific Methods Packs

Hanna offers titration method packages for various markets including food, beverage, dairy, wine, and more. Ask our Sales Consultants about which methods in our library are available for your specific needs.

### Adaptable Standard Methods

Our technical experts can program and customize standard methods developed by such affiliations as ISO, ASTM, AOAC, AOCS, EPA, and more directly onto your titrator. Ask our Sales Consultants which standard methods are possible with our HI901C system.

## Connectivity and Functionality

### Multifunctional with Four Working Modes

The HI901C functions as a titrator, pH meter, mV/ORP meter, and ISE meter. Valuable laboratory bench space is saved, and multiple analyses can be performed on one sample.



### Multiple Connections

The titrator offers device support for two burettes and two analog boards, which allows two electrodes and two stirrers to be simultaneously connected to one unit (HI901C2-01 and HI901C2-02 only).

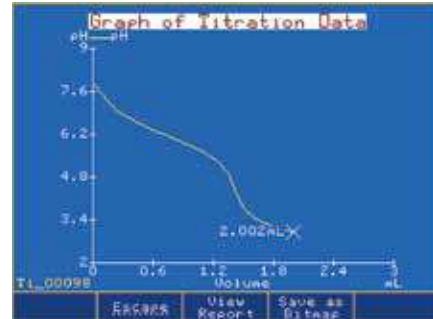
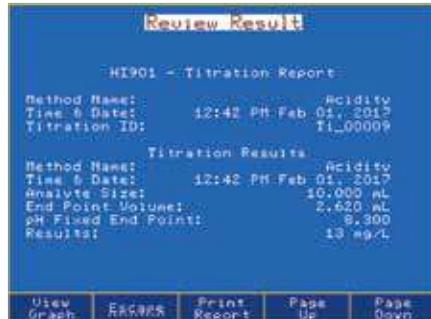
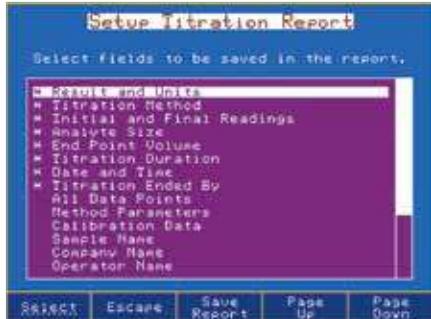
### Multiple Peripherals

Users can print reports directly from the titrator using a standard parallel printer. An external monitor and keyboard may be attached for added versatility, as well as an analytical balance for automatic sample mass entry for titrations.

## Versatile Data Management

- HI901C titration system can be easily incorporated into any existing GLP data management program:
  - Easily record all necessary GLP information with every sample, such as sample identification, company and operator name, date, time, electrode ID codes and calibration information.

- Data can be transferred to a PC using Hanna HI900PC software
- The USB port allows for the easy transfer of methods, reports and software upgrades via USB flash drive
- Users can print reports of analyses directly from the titrator using a standard parallel printer
- An external monitor and keyboard can be attached for added versatility



### Customizable reports

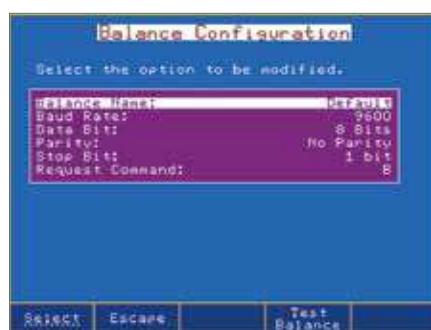
Data to be stored in titration reports is fully customizable

### Titration reports

Titration or pH/mV/ISE results can be viewed on-screen or transferred to a USB flash drive or PC

### Titration graphs

Titration graphs can be viewed on-screen or saved as images and transferred along with titration report



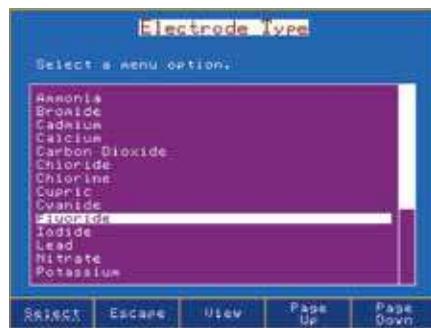
### Fully customizable titration methods

### Fully configurable balance interface

Up to five-point pH calibration with automatic buffer recognition



Relative mV calibration allows for a mV offset



Selectable ISEs preprogrammed with molecular weight and ion charge

Specifications		HI901C
pH	Range	-2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH
	Resolution	0.1; 0.01; 0.001 pH
	Accuracy (@25°C/77°F)	±0.001 pH
mV	Range	-2000.0 to 2000.0 mV
	Resolution	0.1 mV
	Accuracy (@25°C/77°F)	±0.1 mV
ISE	Range	1•10 <sup>-6</sup> to 9.99•10 <sup>10</sup>
	Resolution	1; 0.1; 0.01
	Accuracy (@25°C/77°F)	±0.5% monovalent; ±1% divalent
Temperature	Range	-20.0 to 120.0°C; -4.0 to 248.0°F; 253.2 to 393.2 K
	Resolution	0.1°C; 0.1°F; 0.1K
	Accuracy (@25°C/77°F)	±0.1°C; ±0.2°F; ±0.1K, excluding probe error
Other Specifications	Burette Sizes	5, 10, 25 and 50 mL
	Burette Resolution	1/40000
	Display Resolution	0.001 mL
	Dosing Accuracy	±0.1% of full burette volume
	Display	5.7" (320 x 240 pixel) backlit color LCD
	Languages	English, Portuguese, Spanish
	Methods	load up to 100 methods (standard and user-defined)
	Burette Auto-Detection	burette size is automatically recognized when inserted into the pump unit
	Programmable Stirrer	overhead propeller type, 200-2500 RPM, resolution 100 RPM
	Flow Rate	user-selectable from 0.1 mL/min to 2 x burette volume/min
	Temperature Compensation	manual (MTC) or automatic (ATC)
	Endpoint Determination	equivalence point (1st or 2nd derivative) or fixed pH/mV value
	pH Calibration	up to five-point calibration, eight standard buffers and five custom buffers
	mV Calibration	single point offset
	ISE Calibration	up to five-point calibration, seven standard solutions and five user-defined standards
	Potentiometric Titrations	acid-base, redox, precipitation, complexometric, non-aqueous, argentometric
	Measurement Units	user-specified expression of concentration units to suit specific calculation requirements
	Real Time & Stored Graphs	mV-volume or pH-volume titration curve, 1st derivative curve or 2nd derivative curve pH mode, mV mode or ISE mode: pH/mV/concentration versus time
	Data Storage	up to 100 titration and pH/mV/ISE reports
	USB Host (Side)	flash drive compatibility for transfers of methods and reports
	Peripherals (Rear)	connections for VGA display, PC-keyboard, parallel printer, USB device input, RS232
	GLP Conformity	instrumentation data storage and printing capabilities
	Operating Environment	10 to 40°C (50 to 104°F), up to 95% RH
	Storage Environment	-20 to 70°C (-4 to 158°F), up to 95% RH
	Power	100-240 VAC "-01" models, US plug (type A) "-02" models, European plug (type C)
	Dimensions	390 x 350 x 380 mm (15.3 x 13.8 x 14.9 in)
	Weight	approximately 9 kg (20 lbs.) with one pump, stirrer and sensors
Ordering Information	<b>HI901C1-01</b> and <b>HI901C1-02</b> : titrator with one analog board, overhead propeller stirrer with stand, 25 mL glass burette, dosing pump drive, temperature sensor, USB cable, 256 Mb USB flash drive and PC software.	
	<b>HI901C2-01</b> and <b>HI901C2-02</b> : titrator with two analog boards, overhead propeller stirrer with stand, 25 mL glass burette, dosing pump, temperature sensor, USB cable, 256 Mb USB flash drive and PC software.	

HI903

# Karl Fischer Volumetric Titrator

for Moisture Determination

The HI903 Karl Fischer Volumetric Titrator is an automatic titrator that complements our wide range of products dedicated to efficient and accurate laboratory analysis. The HI903 analyzes for water content ranging from 100 ppm to 100%. This powerful titrator automatically dispenses the titrant, detects the endpoint, and performs all necessary calculations and graphing.

## Burette and Dosing System

### Precision Dosing Pump

Our unmatched 40,000 step piston driven pump is capable of delivering as little as 0.125  $\mu\text{L}$  of titrant accurately and precisely.



### Anti-Diffusion Dispensing Tip

A specially designed glass dispensing tip delivers titrant precisely into high turbulence mixing zones, ensuring a rapid reaction. Its angular construction helps prevent titrant from diffusing into the sample solvent.

### Chemically Resistant Tubing and Syringe

Aspiration and dispensing tubes are constructed of durable, chemically resistant PTFE and feature a light-blocking polyurethane outer sleeve to protect light sensitive reagents.



Measures 100 ppm to 100% water content

## Titration and Solvent System

### Efficient Sample Handling

The HI903 features a quick-remove sample port with a replaceable rubber septum allowing for fast and easy sample introduction to the titration vessel. An integrated magnetic stirrer ensures homogeneity for an accurate and speedy reaction.

### Chemically Resistant Titration Vessel

The glass and PTFE titration cell and fittings are designed to withstand the harsh solvents and reagents involved in Karl Fischer reactions.

### Sealed Solvent System

The titration vessel is completely sealed to minimize exposure to ambient humidity, keep the system dry, and reduce titrant consumption while saving time between titrations. Solvent may be exchanged in a matter of seconds without opening the titration vessel.

### Visually Recognizable Desiccant

A rechargeable, color-indicating, silica gel desiccant prevents the ingress of ambient humidity into the sealed system while maintaining full titrator functionality. The desiccant color change allows user to recognize when its adsorption capacity has depleted and is ready for replacement or recharging.



## Titrator Capabilities

### Dynamic Titrant Dosing

The dynamic dosing feature allows for timely and accurate titration results by relating the titrant volume dosed to the mV response from the titration reaction. This provides for larger doses near the beginning of a titration and smaller, more precise doses near the titration endpoint.

### Drift Rate Compensation

The HI903 automatically adjusts the titration calculation to account for the effects of any ambient humidity entering the titration cell. This provides a more accurate result by correcting for water not present in the actual sample.

### Titration Results Averaging

Successive results from a titration method may be averaged with recording of the standard deviation.

### Titrant Recordkeeping

The HI903's titrant database can store information for up to 20 titrants. The database may be programmed to remind a user when to standardize their titrant, reducing error in analysis.

### Selectable Endpoint Criteria

The HI903 employs a dual platinum/pine electrode for bivoltammetric endpoint determination. Users may choose termination criteria based on mV stability times or drift rates.

### Multistage Cell Preparation

A pre-titration stage eliminates residual water present in the solvent and the cell, providing a reliable baseline start to analysis. Standby mode then keeps the solvent dry between titrations and when the titrator is not in use.

### Interface and Display

#### Detailed Titration Graphs

A real-time titration curve can be displayed during each titration; this feature is useful when new methods are tested or when a procedure requires optimization.

#### Interactive Color Display

A large, color LCD screen clearly shows the chosen titration method along with results, units, dosing size, titration volume, drift rate, and mV value.

#### Simple & Quick Navigation

Virtual key selections present on the display allow for simple and quick navigation between screens and menus without getting lost in a nest of information.

### Data and Storage

#### Customizable Titration Reports

Each titration report is fully customizable so users can ensure they are storing and filing the appropriate data required for their application and procedures.

### Flexible GLP Management

All necessary GLP (Good Laboratory Practice) information can be recorded with each sample including: sample identification, company and operator name, date, time, electrode ID codes, and calibration information.

### Effortless Data Transfer

Data can easily be transferred to a USB flash drive or PC with the Hanna HI900PC application software. The USB port allows for the transfer of titration methods, titration reports, and software upgrades via USB flash drive.

## Methods of Analysis

### Customizable Methods

The HI903 can store up to 100 user-defined or standard titration methods. Each method may be customized and optimized for performance based on application and user requirements.

### Titration Method Support

Onsite installation, training, and customization is available from one of our Applications or Service experts. Hanna offers continued support via phone or webinar for any questions you might have along the way.

### Adaptable Standard Methods

Our technical experts can program and customize standard methods developed by such affiliations as ISO, ASTM, AOAC, AOCS, EPA, and more directly onto your titrator. Ask our Sales Consultants which standard methods are possible with our HI903 Karl Fischer system.

## Connectivity and Functionality

### Configurable Balance Interface

Sample size may be automatically entered from any laboratory analytical balance with a RS232 serial output saving time and labor.

### Multiple Peripherals

Users can print reports directly from the titrator using a standard parallel printer. An external monitor and keyboard may be attached for added versatility, as well as an analytical balance for automatic sample mass entry for titrations.





## Specifications

## HI903

Titration	Range	100 ppm to 100%
	Resolution	1 ppm to 0.0001%
	Result Units	%, ppm, mg/g, µg/g, mg, µg, mg/mL, µg/mL, mg/pc, µg/pc
	Sample Type	liquid or solid
Determination	Pre-Titration Conditioning	automatic
	Background Drift Correction	automatic or user-selectable value
	Endpoint Criteria	fixed mV persistence, relative drift stop or absolute drift stop
	Dosing	dynamic with optional pre-dispensing rate
	Result Statistic	mean, standard deviation
Clip Lock™ Exchangeable Burette System	Dosing Pump Resolution	1/40000 of the burette volume (0.125 µL per dose) with 5 mL burette
	Dosing Pump Accuracy	±0.1% of full burette volume
	Syringe	5 mL precision ground glass with PTFE plunger
	Valve	motor-driven 3-way, PTFE liquid contact material
	Tubing	PTFE with light block and thermal jacketing
	Dispensing Tip	glass, fixed position, anti-diffusing
	Titration Vessel	conical with operation volume between 50-150 mL
Electrode	Solvent Handling System	sealed system, integrated diaphragm air pump
	Type	HI76320 dual platinum pin, polarization electrode
	Connection	BNC
	Polarization Current	1, 2, 5, 10, 15, 20, 30 or 40 µA
	Voltage Range	2 mV to 1000 mV
	Voltage Resolution	0.1 mV
Stirrer	Accuracy (@25°C/77°F)	±0.1 %
	Type	magnetic, optically regulated, digital stirrer
	Speed	200-2000 rpm
Peripheral Devices	Resolution	100 rpm
	PC	easily view, transfer, print or delete methods and reports via HI900PC application
	USB Flash Drive	easily upgrade software or transfer methods and reports between devices using a USB drive
	Laboratory Analytical Balance	RS232 to connect any laboratory balance
	Printer	print directly from the HI903 to a printer via parallel port
	Monitor	instrument status and titrations can be viewed on a larger screen using any VGA-compatible external monitor
	Keyboard	alphanumeric text can be entered using an optional PS/2 keyboard
Additional Specifications	Graphic Display	5.7" (320 x 240 pixel) color LCD
	Titration Methods	up to 100 (standard and user) methods
	Data Storage	up to 100 complete titration reports and drift rate reports can be stored
	GLP Conformity	Good Laboratory Practice and instrument data storage and printing
	Languages	English, Portuguese, Spanish, and French
	Enclosure Material	ABS plastic and steel
	Keypad	polycarbonate
	Power	100-240 VAC "-01" models, US plug (type A) "-02" models, European plug (type C)
	Operating Environment	10 to 40°C, up to 95% RH
	Storage Environment	-20 to 70°C, up to 95% RH
	Dimensions	390 x 350 x 380 mm (15.3 x 13.8 x 14.9")
	Weight	approximately 10 kg (22 lbs.)
Ordering Information	HI903-01 and HI903-02 are supplied with HI76320 dual platinum pin electrode, dosing pump, 5 mL burette assembly with tubing, air pump assembly with tubing, beaker and bottle top assemblies and all fittings, desiccant cartridges (4) with indicating desiccant, stir bar, waste bottle, calibration key, USB cable, power cable, HI900PC application, USB flash drive, quality certificate, ISO 8655 burette compliance report and instruction manual binder.	

## Specifications HI76320

Sensor Type	dual platinum pin polarization electrode
Voltage Range	2 mV to 1000 mV
Voltage Resolution	0.1 mV
Accuracy (@25°C/77°F)	±0.1%
Polarization Current	1, 2, 5, 10, 15, 20, 30 or 40 µA
Sensor Connection	BNC

HI904

## Karl Fischer Coulometric Titrator

The HI904 Karl Fischer (KF) Coulometric Titrator is an automatic titrator that complements our wide range of products dedicated to efficient and accurate laboratory analysis. The HI904 analyzes for water content ranging from 1 ppm to 5%. This powerful titrator effectively monitors the KF reaction, detects the endpoint, and performs all necessary calculations and graphing.

### Coulometric Reagent System

#### Precision Iodine Generation

Hanna's dosing algorithm allows for an extremely small amount of iodine necessary for the Karl Fischer reaction to be generated electrolytically using a pulsed current up to 400 mA delivering titrant accurately and precisely.

### Titration and Solvent System

#### Chemically Resistant Titration Vessel and Tubing

The glass titration cell and PTFE tubing is designed to withstand the harsh solvents and reagents involved in Karl Fischer reactions.

#### Sealed Solvent System

Ground glass joints completely seal the glass titration cell minimizing exposure to ambient humidity, keeping the system dry, and reducing reagent consumption while saving time between titrations. Solvent may be exchanged in a matter of seconds with a quick fitting adjustment.

#### Molecular Sieve Desiccant

High efficiency molecular sieve desiccant helps maintain low and stable drift rates within the titration cell while preventing the ingress of ambient humidity into the sealed solvent system.



Measures 1 ppm to 5% water content

#### Built-in stirrer

Automatic, integrated magnetic stirrer adjustable from 200-2000 RPM with optical feedback for automatic speed control.

#### Titrator Capabilities

##### Dynamic Titrant Dosing

The titration speed feature allows for timely and accurate titration results by relating the amount of iodine generated to the mV response from the Karl Fischer reaction.

#### Drift Rate Compensation

The HI904 automatically adjusts the titration calculation to account for the effects of any ambient humidity entering the titration cell. This provides a more accurate result by correcting for water not present in the actual sample.

#### Titration Results Averaging

Successive results from a titration method may be averaged with recording of the standard deviation.

## Selectable Endpoint Criteria

The HI904 employs a dual platinum pin electrode for bivoltammetric endpoint determination. Users may choose termination criteria based on mV stability times or drift rates.

## Multistage Cell Preparation

A pre-titration stage eliminates residual water present in the solvent and the cell, providing a reliable baseline start to analysis. Standby mode then keeps the solvent dry between titrations and when the titrator is not in use.

## Interface & Display

### Detailed Titration Graphs

A real-time titration curve can be displayed during each titration; this feature is useful when new methods are tested or when a procedure requires optimization.

### Interactive Color Display

A large, color LCD screen clearly shows the chosen titration method along with results, units, drift rate, and mV value.

### Simple and Quick Navigation

Virtual key selections present on the display allow for simple and quick navigation between screens and menus without getting lost in a nest of information.

## Data & Storage

### Customizable Titration Reports

Each titration report is fully customizable so users can ensure they are storing and filing the appropriate data required for their application and procedures.

### Flexible GLP Management

All necessary GLP (Good Laboratory Practice) information can be recorded with each sample including: sample identification, company and operator name, date, time, electrode ID codes, and calibration information.

### Effortless Data Transfer

Data can easily be transferred to a USB flash drive or PC with the Hanna HI900PC application software. The USB port allows for the transfer of titration methods, titration reports, and software upgrades via USB flash drive.

## Methods of Analysis

### Customizable Methods

The HI904 can store up to 100 user-defined or standard titration methods. Each method may be customized and optimized for performance based on application and user requirements.

## Titration Method Support

Onsite installation, training, and customization is available from one of our Applications or Service experts. Hanna offers continued support via phone or webinar for any questions you might have along the way.

### Adaptable Standard Methods

Our technical experts can program and customize standard methods developed by such affiliations as ISO, ASTM, AOAC, AOCS, EPA, and more directly onto your titrator. Ask our Sales Consultants which standard methods are possible with our HI904 Karl Fischer system.

## Connectivity and Functionality

### Configurable Balance Interface

Sample size may be automatically entered from any laboratory analytical balance with a RS232 serial output saving time and labor.

### Multiple Peripherals

Users can print reports directly from the titrator using a standard parallel printer. An external monitor and keyboard may be attached for added versatility, as well as an analytical balance for automatic sample mass entry for titrations.



- **Fitted (Diaphragm) Generator**
  - Anode/anolyte and cathode/catholyte separated by glass diaphragm
  - Prevents anode-generated iodine from being reduced to iodide at the cathode
  - Ideal for extremely low water content, high accuracy demand, nitrogenous compounds and easily reduced samples



- **Fritless (No Diaphragm) Generator**
  - Uses one easy-to-replace Karl Fischer reagent
  - Lower and more stable drift rates
  - Easier cleaning of generator cell

## Versatile Data Management

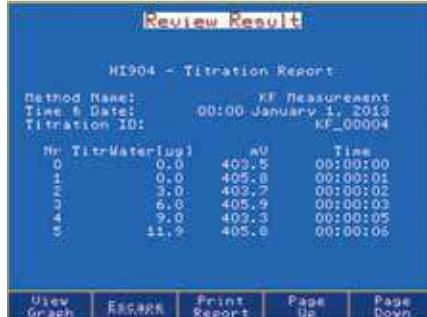
4

- HI900 Series titration systems can be easily incorporated into any existing GLP data management program:
  - Easily record all necessary GLP information with every sample, such as sample identification, company and operator name, date, time, electrode ID codes and calibration information
- Data can be transferred to a PC using Hanna HI900PC software
- The USB port allows for the easy transfer of methods, reports and software upgrades via a USB flash drive
- Users can print reports of analyses directly from the titrator using a standard parallel printer
- An external monitor and keyboard can be attached for added versatility



### Customizable general options

Titration general options can be configured to user requirements



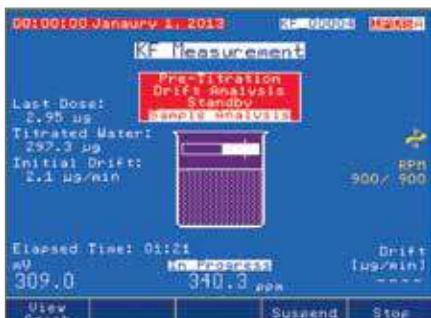
### Titration reports

Titration results can be viewed on-screen or transferred to a USB storage device



### Titration graphs

Titration graphs can be viewed on-screen or saved as images and transferred along with titration report



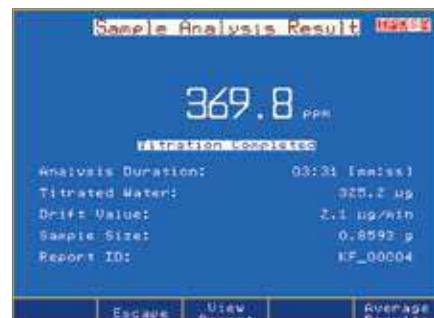
### Sample analysis

Interface displays real-time monitoring of water content and results



### Standby

The HI904 keeps the solvent dry between samples and monitors the drift rate



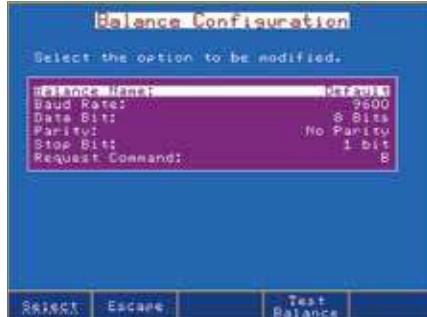
### Results

Titration results are displayed with options to average results or a user-customized report



### Sample addition

The HI904 recommends a sample size based on expected results



### Fully configurable balance interface

Enter sample weight automatically from any laboratory analytical balance with RS232 serial output



### Fully customizable titration methods

Customize methods for any application

Specifications	HI904	
Titration	Range	1 ppm to 5%
	Resolution	0.1ppm to 0.0001%
	Result Units	%, ppm, ppt, mg/g, $\mu$ g/g, mg, $\mu$ g, mg/mL, $\mu$ g/mL, mg Br/100g, g Br/100g, mg Br, g Br
	Sample Type	liquid or solid (external dissolution / extraction)
	Titration Vessel	operating volume between 100 - 200 mL
	Reagent Handling System	sealed system with integrated diaphragm air pump and beaker adapter
Generator Electrode	Configuration	diaphragm or diaphragm-less
	Current Control	automatic or fixed (400 mA)
	Electrode Type Detection	automatic
Determination	Pre Titration Conditioning	automatic
	Background Drift Correction	automatic or user-selectable value
	Endpoint Criteria	fixed mV persistence, relative drift stop, or absolute drift stop
	Dosing	dynamic
Detector Electrode	Result Statistic	mean, standard deviation
	Type / Connection	dual platinum pin, polarization electrode / BNC connector
	Polarization Current	1, 2, 5, or 10 $\mu$ A
	Voltage Range	2 mV to 1100 mV
	Voltage Resolution	0.1 mV
Peripheral Devices	Accuracy (@25°C/77°F)	$\pm$ 0.1%
	PC	easily view, transfer, print or delete methods and reports via HI900 PC application
	USB Flash Drive	easily upgrade software or transfer methods and reports between devices using a USB drive
	Laboratory Analytical Balance	RS232 to connect a laboratory analytical balance
	Printer	print directly from the HI904 to a parallel port printer
	Monitor	instrument status and titrations can be viewed on a larger screen using any VGA compatible external monitor
Additional Specifications	Keyboard	alphanumeric text can be entered using an optional PS/2 keyboard
	Graphic Display	5.7" (320 x 240 pixel) color LCD
	Titration Methods	up to 100 (standard and user methods)
	Data Storage	up to 100 (titration and drift rate reports)
	GLP Conformity	Good Laboratory Practice and instrument data storage and printing
	Languages	English, Portuguese, Spanish, and French
	Enclosure Material	ABS plastic and steel
	Keypad	polycarbonate
	Power	100-240 VAC "-01" models, US plug (type A) "-02" models, European plug (type C)
	Operating Environment	10 - 40°C, up to 95% RH
	Storage Environment	-20 to 70°C, up to 95% RH
	Dimensions / Weight	390 x 350 x 380 mm (15.3 x 13.8 x 14.9"); approximately 10 kg (22 lbs.)
Ordering Information	<b>HI904D-01</b> and <b>HI904D-02</b> are supplied with diaphragm, <b>HI904-01</b> and <b>HI904-02</b> are supplied without diaphragm	
	<b>All Models Include:</b> dual platinum pin electrode, air pump assembly, titration vessel assembly (glass vessel, accessory port stopper, sample port cap and septum, stir bar, desiccant, desiccant cartridge, fittings), vessel support with adapter, pump locking screw with plastic head, reagent bottle assembly (bottle cap, desiccant, desiccant cartridge, fittings, tubing (silicone and PTFE)), water bottle assembly (waste bottle, bottle cap, desiccant, desiccant cartridge, fittings, tubing (silicone and PTFE)), calibration key, reagent exchange adapter, accessory holder assembly, joint grease, Karl Fischer generator electrode (removable generator electrode cable), USB cable, USB storage device, HI900 PC application software, power adapter, quality certificate and instruction manual binder.	

# Total Titratable Acidity Titrator and pH Meter

for Water Analysis

- **Piston driven pump with dynamic dosing**
  - For highly accurate, repeatable results
- **Two endpoints and two ranges**
- **CAL Check™**
  - Alerts users to potential problems during calibration such as contaminated buffers or a dirty/broken pH electrode
- **Log-on-demand**
  - Log data up to 400 samples (200 for titration; 200 for pH/mV)
- **Graphic mode/exportable data**
  - Displays in-depth data on titration, which can then be stored and exported to either a USB drive or PC using the USB connection
- **Automatic stirrer speed control**
  - Maintains stirrer speed at approximately 600 rpm regardless of viscosity of solution
- **GLP features**
  - Date, time, offset, slope and buffers used
- **Easy-to-use interface**
  - User intuitive design with large keys and easy to navigate screens
- **HELP features**
  - Dedicated HELP key for content sensitive help
- **pH/mV meter**
  - Doubles as a benchtop pH meter



## An Easy-to-Use, Fast and Affordable All-in-one Solution

The HI84530 is an easy to use, fast and affordable mini automatic titrator with a pH meter designed for the rapid and accurate analysis of Total Titratable and Strong Acidity in water. This new generation of mini automatic titrator improves upon the titrant delivery system and measuring ranges for increased accuracy compared to previous models. This meter reflects Hanna's years of experience as a manufacturer of analytical instruments.

The HI84530 incorporates a precise piston dosing system, which allows for a highly accurate determination of the amount of titrant used. It is also capable of dynamic dosing, making testing both faster and more

accurate. Pump calibrations are performed with the provided Hanna standard and help assure the accuracy of the measurement.

An intuitive interface makes the instrument simple to use and the dedicated HELP key guides the user through set-up, calibration status, and troubleshooting.

This mini titrator includes a pre-programmed analysis method based on the Standard Methods of Water and Wastewater Determination. It uses a powerful algorithm which analyzes the shape of the electrode response in order to determine when the titration reaction has reached completion.

This mini titrator is also designed to be used as a benchtop pH/mV meter. The CAL Check function not only ensures an accurate pH

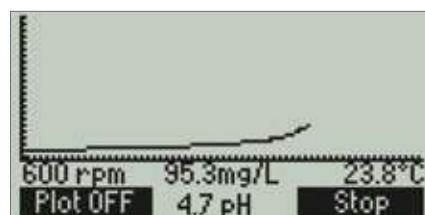
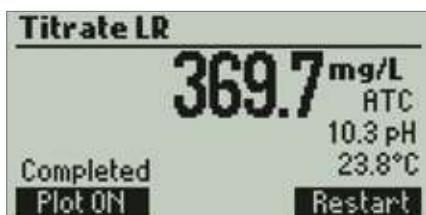
reading when the HI84530 is used as a pH meter but also an accurate titration since the endpoint is determined by a set pH value.

## Total Titratable Acidity

Water acidity is an important parameter to monitor as it can affect the corrosive capacity of a water, chemical reaction rates and biological processes. Acidity can also be used to monitor pollution in wastewater and drinking water.

Total titratable acidity is a measure of all of the acid compounds present in a sample. Many factors can contribute to the acidity of water in a sample, including strong acids (hydrochloric, sulfuric, nitric, etc.), weak acids (organic acids) and other acidic components (aluminum, iron, etc.).

## On-screen Features



### Easy and clear measurement

The HI84530 is a single parameter titrator designed to measure total acidity in a few easy steps. The HI84530 displays the results directly on the screen in user-selectable units.

### pH meter with electrode condition on display

The HI84530 also functions as a pH meter. The HI84530 also displays the electrode condition on the LCD using Hanna's exclusive electrode diagnostics.

### Titration curve displayed on screen

The HI84530 offers real time graphing of the titration curve on the LCD.

### Specifications

HI84530	
Titrator	Range (as CaCO <sub>3</sub> )
	Low Range: 15.0 to 400.0 mg/L; 0.3 to 8.0 meq/L High Range: 300 to 4000 mg/L; 6.0 to 80.0 meq/L
	Resolution
	Low Range: 0.1 mg/L / 0.1 meq/L High Range: 1 mg/L / 0.1 meq/L
	Accuracy (@25°C/77°F)
	Low Range: ±0.5 mg/L or 3% of reading, whichever is greater High Range: ±15 mg/L or 3% of reading, whichever is greater
pH Meter	Titration Method
	acid-base titration, total acidity / strong acidity
	Titration Principle
	fixed endpoint titration: 8.30 pH (phenolphthalein) or 3.7 pH (Methyl Orange)
	Pump Speed
mV Meter	10 mL/min
	Stirring Speed
	600 rpm
	Range
	-2.0 to 16.0 pH / -2.00 to 16.00 pH
Temperature	Resolution
	0.1 pH / 0.01 pH
	Accuracy (@25°C/77°F)
	± 0.01 pH
	Calibration
Additional Specifications	one, two or three-point calibration; four available buffers (pH 4.01, 7.01, 8.30, 10.01)
	Temperature Compensation
	manual or automatic from -20 to 120 °C (-4 to 248 °F)
	Range
	-2000.0 to 2000.0 mV
Ordering Information	Resolution
	0.1 mV
	Accuracy (@25°C/77°F)
	± 1.0 mV
	Logging
	up to 400 samples (200 pH/mV, 200 titration)
	pH Electrode
	HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included)
	Temperature Probe
	HI7662-T stainless steel temperature probe with 1 m (3.3') cable (included)
	Connectivity
	(1) Type-B USB for PC interface, (1) Type-A USB for storage
	Environment
	0 to 50 °C (32 to 122 °F); max 95% RH non-condensing
	Power Supply
	12 VDC power adapter
	Dimensions
	235 x 200 x 150 mm (9.2 x 7.9 x 5.9")
	Weight
	1.9 kg (67.0 oz.)
HI84530-01 (115V) and HI84530-02 (230V) are supplied with HI1131B pH electrode, HI7662-T temperature probe, HI7082 electrode fill solution, HI84530-70 reagent kit for water analysis, 100 mL beakers (2), dosing pump valve, 5 mL syringe, 1 mL plastic pipette, tube set (aspiration tube with titrant bottle cap and dispensing tube with tip), stir bar, power adapter, instruction manual and quality certificate.	

# Titratable Alkalinity Titrator and pH Meter

for Water Analysis

- **Piston driven pump with dynamic dosing**
  - For highly accurate, repeatable results
- **CAL Check™**
  - Alerts users to potential problems during calibration such as contaminated buffers or dirty/broken pH electrodes
- **Log-on-demand**
  - Log data up to 400 samples (200 for titration; 200 for pH/mV)
- **Graphic mode/exportable data**
  - Displays in-depth data on titration, which can then be stored and exported to either a USB drive or PC using the USB connection
- **Automatic stirrer speed control**
  - Maintains stirrer speed at approximately 600 rpm regardless of viscosity of solution
- **GLP features**
  - Date, time, offset, slope and buffers used
- **Easy-to-use interface**
  - User intuitive design with large keys and easy to navigate screens
- **HELP features**
  - Dedicated HELP key for content sensitive help
- **pH/mV meter**
  - Doubles as a benchtop pH meter



## An Easy-to-Use, Fast and Affordable All-in-one Solution

The HI84531 is a dedicated mini titrator and pH meter designed for low to high levels of alkalinity. It performs a potentiometric titration with a pH electrode to determine total titratable alkalinity or strong alkalinity in water. A titrant is slowly added to the sample while the pH and temperature are carefully monitored. The software analyzes the resulting titration curve and calculates the volume of titrant required to reach the endpoint. The user can choose either to measure strong alkalinity with a 8.30 pH endpoint (known as phenolphthalein alkalinity) or total alkalinity with a 4.50 pH endpoint (known as brom cresol green-methyl red alkalinity).

The dispensed titrant volume is used to automatically calculate the alkalinity, which can be displayed in mg/L or meq/L as  $\text{CaCO}_3$ .

This mini titrator is also designed to be used as a benchtop pH/mV meter. The CAL Check function not only ensures an accurate pH reading when the HI84531 is used as a pH meter but also an accurate titration since the endpoint is determined by a set pH value.

### Total Alkalinity

Total titratable alkalinity is a measure of primarily three types of alkalinities present in a water sample: hydroxide, carbonate and bicarbonate. Alkalinity in water can be the result of contributions from common

chemicals, including carbonate, bicarbonate, hydroxide, phosphates, borate and organic acid salts.

The alkalinity of a water sample indicates its ability to resist pH change. The amount of alkalinity in water is mostly due to the bicarbonate/carbonate present. A low alkalinity level indicates that the water is susceptible to pH changes, while a high alkalinity level indicates that the water will be able to resist pH changes. Alkalinity can also be used to determine the corrosive capacity of water and can provide an estimation of water hardness.

## On-screen Features



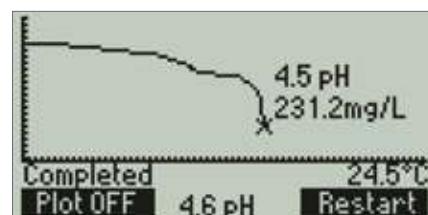
### Easy and clear measurement

These titrators are designed to measure in a few easy steps. The results are displayed directly on the screen.



### Electrode condition on display

These titrators feature a pH meter which also displays the electrode condition on the LCD.



### Titration Curve Displayed On Screen

The HI84531 offers real time graphing of the titration curve on the LCD.

## Specifications

### HI84531

Titrator	Range (as CaCO <sub>3</sub> )	Low Range: 30.0 to 400.0 mg/L; 0.6 to 8.0 meq/L High Range: 300 to 4000 mg/L; 6.0 to 80.0 meq/L
	Resolution	Low Range: 0.1 mg/L (ppm); 0.1 meq/L High Range: 1 mg/L (ppm); 1 meq/L
	Accuracy (@25°C/77°F)	Low Range: $\pm 1$ mg/L or 3% of reading, whichever is greater High Range: $\pm 10$ mg/L or 3% of reading, whichever is greater
	Titration Method	acid-base titration (strong alkalinity / total alkalinity)
	Titration Principle	endpoint titration: 8.30 pH (phenolphthalein) / 4.50 pH (bromcresol green-methyl red)
	Pump Volume	10 mL/min
	Stirring Speed	600 rpm
pH	Range	-2.0 to 16.0 pH / -2.00 to 16.00 pH
	Resolution	0.1 pH / 0.01 pH
	Accuracy (@25°C/77°F)	$\pm 0.01$ pH
	Calibration	one, two or three-point calibration; four available buffers (4.01, 7.01, 8.30, 10.01)
	Temperature Compensation	manual or automatic
mV	Range	-2000.0 to 2000.0 mV
	Resolution	0.1 mV
	Accuracy (@25°C/77°F)	$\pm 1.0$ mV
Temperature	Range	-20.0 to 120.0°C; -4.0 to 248.0°F; 253.2 to 393.2 K
	Resolution	0.1°C; 0.1°F; 0.1 K
	Accuracy	$\pm 0.4$ °C; $\pm 0.8$ °F; $\pm 0.4$ K
Additional Specifications	Logging	up to 400 samples (200 pH/mV, 200 titration)
	pH Electrode	HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included)
	Temperature Probe	HI7662-T stainless steel temperature probe with 1 m (3.3') cable (included)
	Connectivity	(1) Type-B USB for PC interface, (1) Type-A USB for storage
	Environment	0 to 50 °C (32 to 122 °F); max 95% RH non-condensing
	Power Supply	12 VDC adapter
	Dimensions	235 x 200 x 150 mm (9.2 x 7.9 x 5.9")
Ordering Information	Weight	1.9 kg (6.70 oz.)
	HI84531-01 (115V) and HI84531-02 (230V) are supplied with HI1131B pH electrode, HI7662-T temperature probe, HI7082 electrode fill solution, HI84531-70 reagent kit for water analysis, 100 mL beakers (2), dosing pump valve, 5 mL syringe, 2000 $\mu$ L automatic pipette (1) with plastic tips (2), 20 mL beakers (2), tube set (aspiration tube with titrant bottle cap and dispensing tube with tip), stir bar, power adapter, instruction manual and quality certificate.	

# Titratable Acidity Mini Titrator and pH Meter

for the Dairy Industry

- **Piston-driven pump with dynamic dosing**
  - For highly accurate, repeatable results
- **CAL Check™**
  - Alerts users to potential problems during calibration such as contaminated buffers or dirty electrodes
- **Log-on-demand**
  - Log data up to 400 samples (200 for titration; 200 for pH/mV)
- **Graphic mode/exportable data**
  - Displays in-depth data on titration, which can then be stored and exported to either a USB drive or PC using the USB connection
- **Automatic stirrer speed control**
  - Maintains stirrer speed regardless of viscosity of solution
- **GLP features**
  - Date, time, offset, slope and buffers used
- **Application-specific FC260B half-cell pH electrode**
  - This electrode is designed to measure all types of dairy related products
- **HI5315 double junction half-cell reference electrode**
  - Features a plunger design to clear any clogging of the outer junction
- **Help features**
  - Dedicated HELP key for content sensitive help
- **pH/mV meter**
  - Doubles as a benchtop pH meter



## An Easy-to-Use, Fast and Affordable All-in-one Solution

The HI84529 is an easy-to-use, fast and affordable mini automatic titrator and pH meter designed for testing acidity levels in dairy products. This new generation of mini automatic titrator improves upon the titrant delivery system and measuring ranges for increased accuracy compared to previous models. This meter reflects Hanna's years of experience as a manufacturer of analytical instruments.

This mini titrator includes a pre-programmed analysis method designed for acidity measurements for dairy analysis. It uses

a powerful algorithm which analyzes the electrode response in order to determine when the titration reaction has reached completion. By simply pressing the START key, the HI84529 automatically performs a pH endpoint titration and displays results immediately in a choice of units.

## Acidity Measurement and its Significance in the Dairy Industry

There are two fundamentally different measurements of dairy products: titratable acidity and pH. pH is a measurement of hydrogen ion concentration while titratable

acidity is the neutralizing capacity of a dairy product with NaOH.

An increase in acidity can be caused by bacteria formation. Monitoring acidity is a way of determining the quality and freshness of dairy products. Acidity is determined by a pH endpoint titration using sodium hydroxide (NaOH), and is defined as the consumption necessary to shift the pH value from 6.6 (corresponding to fresh milk) to a pre-determined pH value. While pH 7.0 is the actual point of neutralization, phenolphthalein is commonly employed as a color indicator to determine the endpoint of reaction; with phenolphthalein, a color change occurs at pH 8.3. Titratable acidity

is expressed in a variety of units based on the one which reflects the titration method and strength of NaOH used during titration.

Titratable acidity can be expressed in several units. Each of these units corresponds to a specific procedure used to titrate dairy products.

**% Lactic Acid (% l.a.):** is determined by titrating a 20 mL or 20 g sample diluted with twice its volume of deionized or distilled water with 0.1 M sodium hydroxide to a phenolphthalein endpoint.

**Degree Soxhlet Henkel (°SH):** is determined by titrating a 50 mL sample with 0.1 M sodium hydroxide to a phenolphthalein endpoint.

**Degree Dornic (°D):** is determined by titrating a 100 mL sample with N/9 sodium hydroxide to a phenolphthalein endpoint.

**Degree Thörner:** is determined by titrating a 10 mL sample diluted with twice its volume of deionized or distilled water with 0.1 M sodium hydroxide to a phenolphthalein endpoint.

From:	To:	Divide By:
%l.a.	°SH	0.0225
%l.a.	°D	0.0100
%l.a.	°Th	0.0090

## Eliminate Subjectivity and Increase Efficiency

The HI84529 Mini Titrator eliminates the subjective endpoint color change detection determined by the human eye, and instead employs the sensitivity and accuracy of a pH sensor. The titration method is a potentiometric endpoint determination using a pre-determined pH value.

The titratable acidity values will vary depending on the method used. Select Low 50 to titrate a non diluted sample, or select low 20/High 20 to titrate 20 mL or 20 g samples that are diluted with twice its volume or deionized or distilled water. The HI84529 uses methods based on AOAC International and Standard Methods for the Examination of Dairy Products. Both of these methods report titratable acidity as % lactic acid, a rough conversion factor can be used to convert the results to the other available units.

The HI84529 can be customized to meet the needs of any dairy analysis lab. Samples can be titrated by weight or volume, diluted or non-diluted (low range only) and titrated to a fixed pH endpoint that can be adjusted by the user.

### Specifications

### HI84529

Titrator	Range	Low Range: %l.a.: 0.01 to 0.20; °SH: 0.4 to 8.9; °D: 1.0 to 20.0; °Th: 1.1 to 22.2 High Range: %l.a.: 0.1 to 2.0; °SH: 4.4 to 88.9; °D: 10 to 200; °Th: 11.1 to 222.2
	Resolution	Low Range: %l.a.: 0.01; °SH: 0.1; °D: 0.1; °Th: 0.1 High Range: %l.a.: 0.1; °SH: 0.1; °D: 1; °Th: 0.1
	Accuracy (@25°C/77°F)	Low Range: ± 0.01 %l.a. High Range: ± 0.1 %l.a.
	Method	acid-base titration
	Sample Size (LR 20)	20 mL or 20 g
	Sample Size (LR 50)	50 mL or 50 g
	Sample Size (HR 20)	20 mL or 20 g
	Principle	endpoint titration, adjustable (pH 8.0 - 8.7 in 0.1 increments)
	Pump Speed	10 mL/min
	Stirring Speed	800 (Low Range) / 1000 (High Range)
pH Meter	Range	-2.0 to 16.0 pH / -2.00 to 16.00 pH
	Resolution	0.1 pH / 0.01 pH
	Accuracy (@25°C/77°F)	±0.01 pH
	Calibration	one, two or three-point calibration; four available buffers (pH 4.01, 6.00, 8.30, 10.01)
	Temperature Compensation	manual or automatic
mV Meter	Range	-2000.0 to 2000.0 mV
	Resolution	0.1 mV
	Accuracy	± 1.0 mV
Temperature	Range	-20.0 to 120.0°C; -4.0 to 248.0°F; 253.2 to 393.2 K
	Resolution	0.1°C; 0.1°F; 0.1 K
	Accuracy	±0.4°C; ±0.8°F; ±0.4 K
Additional Specifications	Logging Data	up to 400 samples (200 pH/mV, 200 titration)
	Electrodes	FC260B pH electrode with 1 m (3.3') cable (included), HI5315 reference probe with 1 m (3.3') cable (included)
	Temperature Probe	HI7662-T stainless steel temperature probe with 1 m (3.3') cable (included)
	Connectivity	(1) Type-B USB for PC interface, (1) Type-A USB for storage
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Power Supply	12 VDC power adapter (included)
	Dimensions	235 x 200 x 150 mm (9.2 x 7.9 x 5.9")
	Weight	1.9 kg (6.70 oz.)
Ordering Information	<b>HI84529-01</b> (115V) and <b>HI84529-02</b> (230V) are supplied with HI84529-70 Reagent Kit for titratable acidity in dairy products, FC260B pH electrode, HI5315 reference electrode, HI7662-T temperature probe, HI7072 fill solution (30 mL), HI700640 cleaning solution for milk deposits (2 x 20 mL), capillary dropper pipette, 100 mL beakers (2), dosing pump valve, 5 mL syringe, 1 mL plastic pipette, tube set (aspiration tube with titrant bottle cap and dispensing tube with tip), stir bar, power adapter, instruction manual and quality certificate.	

# Titratable Acidity Mini Titrator and pH Meter

for Fruit Juice

- **Piston-driven pump with dynamic dosing**
  - For highly accurate, repeatable results
- **CAL Check™**
  - Alerts users to potential problems during calibration such as contaminated buffers or dirty/broken electrodes
- **Log-on-demand**
  - Log data up to 400 samples (200 for titration; 200 for pH/mV)
- **Graphic mode/exportable data**
  - Displays in-depth data on titration, which can then be stored and exported to either a USB drive or PC using the USB connection
- **Automatic stirrer speed control**
  - Maintains stirrer speed at 600 RPM regardless of viscosity of solution
- **GLP features**
  - Date, time, offset, slope and buffers used
- **Easy-to-use interface**
  - Intuitive design with large keys and easy to navigate screens
- **Help features**
  - Dedicated HELP key for content sensitive help
- **pH/mV meter**
  - Doubles as a benchtop pH meter



## An Easy-to-Use, Fast and Affordable All-in-one Solution

The HI84532 digital automatic mini titrator and pH meter is designed for measuring the concentration of titratable hydrogen ions contained in fruit juice samples by neutralization with a strong base solution to a fixed pH endpoint as according to the Official Methods of Analysis of AOAC International. This new generation of mini automatic titrator improves upon the titrant delivery system and measuring ranges for increased accuracy compared to previous models. This meter reflects Hanna's years of experience as a manufacturer of analytical instruments.

A clear and intuitive user interface allows users to easily navigate the HI84532's menus and functions. The HELP key located on the keypad aids in on-screen set-up, status and troubleshooting.

The HI84532 incorporates a precise piston dosing system, which allows for a highly accurate determination of the amount of titrant used. It is capable of dynamic dosing, making testing both faster and more accurate. Pump calibrations, performed with the provided Hanna standards, help assure the measurement accuracy.

This mini titrator is also designed to be used as a benchtop pH/mV meter. The CAL Check function not only ensures an accurate pH reading when the HI84532 is used as a pH meter but also an accurate titration since the endpoint is determined by a set pH value.

## The Importance of Titratable Acidity

Titratable acidity is an important parameter in determining fruit maturity and sour taste in citrus fruits. The maturity of fruit is one of

the most important factors to determine how well fruit will store and how it will taste. For some fruits, governmental quality standards (based on titratable acidity or the ratio of total soluble solids (°Brix) to titratable acidity) are in place to protect consumers. Immature fruit will normally have a low sugar to acid ratio as compared to mature fruit that will have a high sugar to acid ratio.

The HI84532 measures the concentration of titratable acids contained in fruit juice samples by neutralization with a strong base solution to a fixed pH. This value includes all the substances of an acidic nature in the fruit juice including: free hydrogen ions, organic acids and acid salts. Titratable acidity is expressed as g/100 mL of the predominant acid. The predominant acids in fruit depend on the type of fruit being tested and include citric acid, tartaric acid, and malic acid.

## On-screen Features

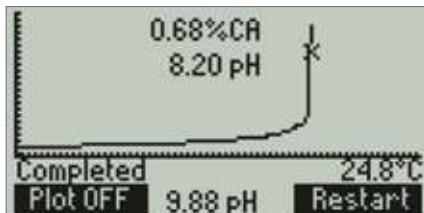


Last Electrode Calibration	
Date: 2012/05/31	8.20
Time: 05:13:04 PM	7.01
Cal Expire: 3 Days	4.01
Offset: 1.4mV	
Slope: 102.9%	
Electrode Condition: 100%	

Meter setup	
Conc. unit	%CA
Meas. Range	Low
Calib. Timeout	Disable
pH Resolution	0.1
	High

### CAL Check™

CAL Check is a Hanna exclusive process for checking the condition of pH electrodes for accurate measurements



### GLP

The GLP feature records electrode and pump calibration data to help keep measurements accurate and reliable.

Record number: 1	
2012/05/31	04:55:01 PM
< 0.10%CA	25.6°C
0610890.txt file	
Plot	Export

### Setup screens

The LCD features an easy to use setup screen.

### Titrate LR

Prepare the sample. Add stir bar to beaker. Attach the electrode holder. Insert electrodes and dosing tip.

Continue Stop

### Titration curve displayed on screen

The HI84532 offers real time graphing of the titration curve on the LCD.

### Log and recall data

The HI84532 can log up to 400 samples (200 for titration; 200 for pH/mV) and recall or export data to a USB drive or PC.

### Tutorial and help screens

Accessing the tutorial menu provides helpful information during calibration and titration.

### Specifications

Titration	Titratable Acidity Range	Low Range (5 mL sample): g/100 mL as citric acid: 0.10 to 2.00% CA; g/100 mL as tartaric acid: 0.11 to 2.35% TA; g/100 mL as malic acid: 0.10 to 2.09% MA High Range (5 mL sample): g/100 mL as citric acid: 1.00 to 10.00% CA; g/100 mL as tartaric acid: 1.17 to 11.72% TA; g/100 mL as malic acid: 1.05 to 10.47% MA
	Titratable Acidity Resolution	0.01%
	Accuracy (@25°C/77°F)	± 0.02% CA or 3% of reading whichever is greater
	Titration Method	acid-base titration
	Principle	endpoint titration: 8.1 pH
	Pump Speed	10 mL/min
	Stirring Speed	600 rpm
pH Meter	Range	-2.0 to 16.0 pH / -2.00 to 16.00 pH
	Resolution	0.1 pH / 0.01 pH
	Accuracy (@25°C/77°F)	± 0.01 pH
	Calibration	one, two or three-point calibration; four available buffers (4.01, 7.01, 8.20, 10.01)
	Temperature Compensation	manual or automatic
mV Meter	Range	-2000.0 to 2000.0 mV
	Resolution	0.1 mV
	Accuracy	± 1.0 mV
Temperature	Range	-20.0 to 120.0°C; -4.0 to 248.0°F; 253.2 to 393.2 K
	Resolution	0.1°C; 0.1°F; 0.1 K
	Accuracy (@25°C/77°F)	± 0.4°C; ± 0.8°F; ± 0.4 K
Additional Specifications	Logging Data	up to 400 samples (200 pH/mV, 200 titration)
	Electrode	HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable
	Temperature Probe	HI7662-T stainless steel temperature probe with 1 m (3.3') cable (included)
	Connectivity	(1) Type-B USB for PC interface, (1) Type-A USB for storage
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Power Supply	12 VDC power adapter (included)
	Dimensions	235 x 200 x 150 mm (9.2 x 7.9 x 5.9")
	Weight	1.9 kg (6.7 oz.)
Ordering Information	HI84532-01 (115V) and HI84532-02 (230V) are supplied with HI84532-70 reagent Kit for titratable acidity in fruit juice, HI1131B pH electrode, HI7662-T temperature probe, HI7082 electrode fill solution (30 mL), 100 mL beakers (2), 20 mL beaker, tube set (aspiration tube with titrant bottle cap and dispensing tube with tip), dosing pump valve, 5 mL syringe, 1 mL plastic pipette, stir bar, power adapter, instruction manual and quality certificate.	

# Formol Number Mini Titrator and pH Meter

for Wines and Fruit Juices

- **Piston driven pump with dynamic dosing**
  - For highly accurate, repeatable results
- **CAL Check™**
  - Alerts users to potential problems during calibration such as contaminated buffers or dirty/broken pH electrode
- **Log-on-demand**
  - Log data up to 400 samples (200 for titration; 200 for pH/mV)
- **Graphic mode/exportable data**
  - Displays in-depth data on titration, which can then be stored and exported to either a USB drive or PC using the USB connection
- **Automatic stirrer speed control**
  - Maintains stirrer speed at 600 RPM regardless of viscosity of solution
- **GLP features**
  - Date, time, offset, slope and buffers used
- **Easy-to-use interface**
  - Intuitive design with large keys and easy to navigate screens
- **Help features**
  - Dedicated HELP key for content sensitive help
- **pH/mV meter**
  - Doubles as a benchtop pH meter



## An Easy-to-Use, Fast and Affordable All-in-one Solution

The HI84533 is an easy to use, fast and affordable mini automatic titrator designed for the rapid and accurate determination of formol number in wines or fruit juices. This new generation of mini automatic titrator improves upon the titrant delivery system and measuring ranges for increased accuracy compared to previous models. This meter reflects Hanna's years of experience as a manufacturer of analytical instruments.

The HI84533 incorporates a precise piston dosing system which allows for a highly accurate determination of the amount of titrant used. It is also capable of dynamic dosing, making testing both faster and more accurate. A pump calibration performed with the supplied Hanna standard help assure the accuracy of the measurement.

This mini titrator includes a user adjustable programmed analysis method designed for formol number analysis. It employs a powerful and effective algorithm to analyze the pH response to determine the exact pH endpoint, then uses this algorithm to perform the necessary calculations.

This mini titrator is also designed to be used as a benchtop pH/mV meter. The CAL Check function not only ensures an accurate pH reading when the HI84533 is used as a pH meter but also an accurate titration since the endpoint is determined by a set pH value.

## Why Formol Number is an Important Determination

The content of amino-acids and other nitrogen compounds in fruit juices and wines is expressed as total assimilable nitrogen and is determined by the formol method using an acid-base titration. The formol number (also known as formol index) is a parameter used for evaluation of the quality of fruit juices and wines.

In wines, the concentration of alpha amino acid in grapes change as a function of maturity and crop load (yield to vine size ratio). The concentration increases with fruit

### The HI84533 has two operating options:

1. pH measurement using the meter in pH mode
2. Formol number determination by titration of wines and fruit juice samples with sodium hydroxide solution to an 8.2 pH endpoint

maturity and decreases with crop load. In the fermentation of wine, there is a minimum amount of amino acid and other nitrogen compounds (eg: 150-200 mg/L of yeast assimilable nitrogen) that has to be present in the must/juice. Too low of an amount will result in a stuck fermentation in which there is not enough nitrogen for the yeast to thrive. Because of the importance of nitrogen in

fermentation, it is desirable to determine the nitrogen concentration before fermentation.

In fruit juices, the formol nitrogen number is one of the basic parameters measured to determine quality. Depending on the type of fruit, the number can increase or decrease with maturity. In orange and grapefruit juice, lower values are observed when the fruit is

not suitably mature or there has been frost damage. In pineapple juice, a low number could be indicative of over-dilution with water or a disproportionate amount of the core was used. To determine the adulteration of fruit juices, the formol number, along with the chromatography characterization of amino acids, can be used.

## On-screen Features

<b>Last Electrode Calibration</b>	
Date: 2012/05/31	8.20
Time: 05:13:04 PM	7.01
Cal Expire: 3 Days	4.01
Offset: 1.4mV	
Slope: 102.9%	
Electrode Condition: 100%	

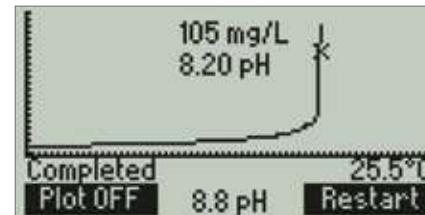
### GLP

The GLP feature records electrode and pump calibration data to help keep measurements accurate and reliable.

<b>Record number: 2</b>	
2013/03/13	15:09:08
111.5mg/L	25.5°C
3781134.txt file	
Plot	Export

### Log and recall data

The HI84533 can log up to 400 samples (200 for titration results; 200 for mV/pH) and recall or export data to a USB drive or PC.



### Titration curve displayed on screen

The HI84533 offers real time graphing of the titration curve on the LCD.

## Specifications

	<b>HI84533</b>	
Titrator	Range (as N)	Low Range: 2.14 to 28.57 meq/L; 0.21 to 2.85 meq%; 30.0 to 400.0 mg/L High Range: 21.7 to 71.4 meq/L; 2.14 to 7.14 meq%; 300 to 1000 mg/L
	Resolution	Low Range: 0.01 meq/L; 0.01 meq%; 0.1 mg/L High Range: 0.1 meq/L; 0.01 meq%; 1 mg/L
	Accuracy (@25°C/77°F)	±0.1 mg/L or 3% of reading, whichever is greater
	Sample Volume	Low Range: 10 mL High Range: 5 mL
	Method	acid-base titration
	Principle	endpoint titration, adjustable (pH 8.0 - 8.5 in 0.1 increments)
	Pump Speed	10 mL/min
	Stirring Speed	600 rpm
	Range	-2.0 to 16.0 pH / -2.00 to 16.00 pH
pH Meter	Resolution	0.1 pH / 0.01 pH
	Accuracy (@25°C/77°F)	±0.01 pH
	Calibration	one, two, or three-point calibration; 4 available buffers (4.01; 7.01; 8.20; 10.01)
	Temperature Compensation	manual or automatic
mV Meter	Range	-2000.0 to 2000.0 mV
	Resolution	0.1 mV
	Accuracy	±1.0 mV
Temperature	Range	-20.0 to 120.0°C; -4.0 to 248.0°F; 253.2 to 393.2 K
	Resolution	0.1°C; 0.1°F; 0.1 K
	Accuracy	±0.4°C; ±0.8°F; ±0.4 K
Additional Specifications	Logging Data	up to 400 samples (200 pH/mV, 200 titration)
	pH Electrode	HI1131B glass body, refillable, with BNC connector and 1 m (3.3') cable (included)
	Temperature Probe	HI7662-T stainless steel temperature probe with 1 m (3.3') cable (included)
	Connectivity	(1) Type-B USB for PC interface, (1) Type-A USB for storage
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Power Supply	12 VDC adapter (included)
	Dimensions	235 x 200 x 150 mm (9.2 x 7.9 x 5.9")
	Weight	1.9 kg (67.0 oz.)
Ordering Information	<b>HI84533-01</b> (115V) and <b>HI84533-02</b> (230V) are supplied with HI84533-70 reagent kit for formol number in wine and fruit juices, HI1131B pH electrode, HI7662-T temperature probe, HI7082 electrode fill solution (30 mL), 100 mL beakers (2), tube set (aspiration tube with titrant bottle cap and dispensing tube with tip), dosing pump valve, 5 mL syringe (2), 2000 µL automatic pipette (1) with plastic tips (2), plastic pipette (1 mL), HI731319 stir bar, electrode cleaning solution sachets for wine deposits (2), electrode cleaning solution sachets for wine stains (2), power adapter, instruction manual and quality certificate.	

# Sulfur Dioxide Mini Titrator

for Wine Analysis

- Piston driven pump with dynamic dosing**
  - For highly accurate, repeatable results
- Log-on-demand**
  - Log data up to 400 samples (200 for titration; 200 for ORP/mV)
- Graphic mode/exportable data**
  - Displays in-depth data on titration, which can then be stored and exported to either a USB drive or PC using the USB connection
- Automatic stirrer speed control**
  - Maintains stirrer speed at 700 RPM regardless of viscosity of solution
- GLP features**
  - Date, time, offset, slope and buffers used
- Easy-to-use interface**
  - User intuitive design with large keys and easy to navigate screens
- HELP features**
  - Dedicated HELP key for content sensitive help
- mV meter**



## An Easy-to-Use, Fast and Affordable All-in-one Solution

The HI84500 is an easy to use, fast and affordable automatic mini titrator designed for testing free or total sulfur dioxide ( $\text{SO}_2$ ) levels in wine. It includes a pre-programmed analysis method and uses a powerful algorithm in order to determine when the titration reaction has reached completion. The HI84500 incorporates a precision dosing pump which allows for a highly accurate determination of the amount of titrant used. Pump calibrations, performed with the provided Hanna standards, help assure the measurement accuracy. The HI84500 also features a new low range measurement and can also be used as a mV meter for direct ORP measurements.

This new generation of mini automatic titrator improves upon the titrant delivery system and measuring ranges for increased accuracy compared to previous models. This meter reflects Hanna's years of experience as a manufacturer of analytical instruments.

## Why Free & Total Sulfur Dioxide is Important

Winemakers add sulfur dioxide to wine in order to inhibit bacteria and wild yeast growth and to serve as an antioxidant to prevent browning. When  $\text{SO}_2$  is added to wine, a portion of it becomes immediately bound while a remaining portion is unbound  $\text{SO}_2$ . The portion that is unbound is also called free  $\text{SO}_2$ ; it is responsible for protecting the wine.

The bound and free  $\text{SO}_2$  together are referred to as total  $\text{SO}_2$ . The relationship between the amount of  $\text{SO}_2$  added and the amount of free  $\text{SO}_2$  is complex. This relationship is governed by the total amount of  $\text{SO}_2$  in the wine and the ability of compounds (e.g. sugars, aldehydes, ketonic acid, quinones, anthocyanin) in the wine to bind  $\text{SO}_2$ .

The exact relationship between free and bound  $\text{SO}_2$  will vary from wine to wine. The amount of free  $\text{SO}_2$  depends on how much is added, how much was present before the addition, and how much was immediately

bound. Free  $\text{SO}_2$  exists in two forms: bisulfite ( $\text{HSO}_3^-$ ) is the predominant form but is relatively ineffective and molecular  $\text{SO}_2$  is the minor form and is responsible for protecting the wine. The amount of molecular  $\text{SO}_2$  available in wine is depended on the amount of free  $\text{SO}_2$  present and the pH. Typically 0.8 ppm of molecular  $\text{SO}_2$  provides adequate protection against bacteria growth and oxidation. In order to obtain this value for a wine sample that has a pH of 3.2 you would need 22 ppm of free  $\text{SO}_2$ ; if the pH was at 3.5 you would need double the amount, 44 ppm of free  $\text{SO}_2$ .

Molecular  $\text{SO}_2$  can be detected by human senses at about 2.0 ppm. This level is needed for maximum protection of wine. Higher levels are needed for sweet and most notable, botrytised wine. The HI84500 can be used to test for free and total  $\text{SO}_2$  in all wines, including red, which are difficult to test using traditional methods associated with a distinctive color change to determine the endpoint.

## Application-specific ORP Electrode

The HI84500 is supplied with the HI3148B ORP electrode featuring CPS™ technology to prevent the clogging of the reference junction. Conventional electrodes may clog quickly in biological samples such as wine. By design, the HI3148B ORP electrode utilizes a ground glass/PTFE sleeve junction which controls a steady, predictable flow of electrolyte solution, keeping the junction open. The hydrophobic properties of PTFE repels wetness and coatings.

## On-screen Features



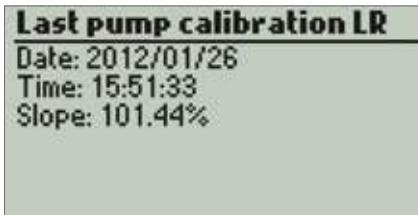
### Titration curve displayed on screen

The HI84500 offers real time graphing of the titration curve on the LCD.



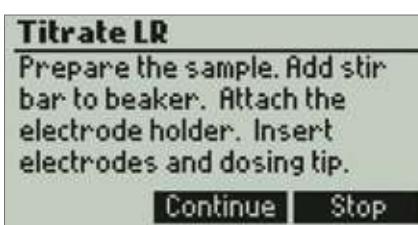
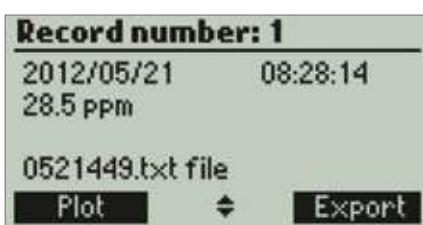
### ORP

During ORP measurements, the stirrer icon will be displayed when the stirrer is on



### GLP

Records pump calibration data to ensure measurements are accurate and reliable.



### Log and recall data

Log up to 400 samples (200 for titration results; 200 for ORP/mV) and recall or export data to a USB stick or PC.

### Procedure warnings

Users are warned if there is an error in procedures such as the titration exceeded the maximum volume of titrant.

### Tutorial and help screens

Accessing the tutorial menu provides helpful information during calibration and titration.

## Specifications

	HI84500	
Titrator	Range	Low Range: 1.0 to 40.0 ppm of SO <sub>2</sub> High Range: 30 to 400 ppm of SO <sub>2</sub>
	Resolution	Low Range: 0.1 ppm High Range: 1 ppm
	Accuracy (@25°C/77°F)	Low Range: ±0.5 ppm or 3% of reading, whichever is greater High Range: ±1 ppm or 3% of reading, whichever is greater
	Sample Volume	50 mL
	Method	Ripper method
	Principle	equivalence point redox titration
	Pump speed	10 mL/min
	Stirring Speed	700 rpm
ORP Meter	Range	-2000.0 to 2000.0 mV
	Resolution	0.1 mV
	Accuracy (@25°C/77°F)	±1 mV
Additional Specifications	Logging Data	up to 400 samples (200 ORP/mV, 200 titration)
	Electrode	HI3148B glass body ORP electrode with BNC connector and 1 m (3.3') cable (included)
	Connectivity	(1) Type-B USB for PC interface, (1) Type-A USB for storage
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Power Supply	12 VDC adapter (included)
	Dimensions	235 x 200 x 150 mm (9.2 x 7.9 x 5.9")
	Weight	1.9 kg (6.7 oz.)
	HI84500-01 (115V) and HI84500-02 (230V) are supplied with HI3148B ORP electrode, HI7082 electrode fill solution (30 mL), HI84500-70 reagent kit for SO <sub>2</sub> determination (consisting of: 1 bottle HI84500-50 (230 mL) low range titrant, 1 bottle HI84500-51 high range titrant (230mL), 1 bottle HI84500-55 pump calibration standard (120 mL), 1 bottle HI84500-60 acid reagent (230 mL), 1 bottle HI84500-61 alkaline reagent (120 mL) and HI84500-62 stabilizer packets (100 packets)), 100 mL beakers (2), 20 mL beakers (2), scissors, dosing pump valve, 5 mL syringe, 1 mL plastic pipette, tube set (aspiration tube with titrant bottle cap and dispensing tube with tip), stir bar, electrode cleaning solution sachets for wine deposits (2), electrode cleaning solution sachets for wine stains (2), power adapter, instruction manual and quality certificate.	
Ordering Information		

# Total Acidity Mini Titrator and pH Meter

for Wine Analysis

- **Piston driven pump with dynamic dosing**
  - For highly accurate, repeatable results
- **CAL Check™**
  - Alerts users to potential problems during calibration such as contaminated buffers or dirty/broken pH electrode
- **Log-on-demand**
  - Log data up to 400 samples (200 for titration; 200 for pH/mV)
- **Graphic mode/exportable data**
  - Displays in-depth data on titration, which can then be stored and exported to either a USB drive or PC using the USB connection
- **Automatic stirrer speed control**
  - Maintains stirrer speed at 600 RPM regardless of viscosity of solution
- **GLP features**
  - Date, time, offset, slope and buffers used
- **Easy-to-use interface**
  - User intuitive design with large keys and easy to navigate screens
- **Help features**
  - Dedicated HELP key for content sensitive help
- **pH/mV meter**
  - Doubles as a benchtop pH meter



## An Easy-to-Use, All-in-one Solution

The HI84502 is an easy to use, fast and affordable automatic mini titrator designed for testing total acidity levels in wine. It includes a pre-programmed analysis method and uses a powerful algorithm in order to determine when the titration reaction has reached completion. The results are displayed in g/L as tartaric acid. The HI84502 incorporates a precision piston driven dosing pump which allows for a highly accurate determination of the amount of titrant used. Pump calibrations performed with the provided Hanna standards assure the accuracy of measurements.

This mini titrator is also designed to be used as a benchtop pH/mV meter. As a pH meter, it has many features of a professional grade benchtop including automatic calibration up to three points with four available buffers, a 0.01 pH resolution, accuracy of  $\pm 0.01$  pH, automatic temperature compensation and comprehensive GLP data.

The GLP data includes date, time, offset, slope, and buffers used for calibration.

Accuracy is always ensured with Hanna's unique CAL Check feature, which analyzes the response of the electrode during the calibration process. Based on electrode response in the buffer, indicators are displayed on screen to alert the user of potential problems during calibration. These indicators include Buffer Contaminated, Electrode Dirty/Broken, and overall probe condition. The CAL Check function not only ensures an accurate pH reading when the HI84502 is used as a pH meter but also an accurate titration since the endpoint is determined by a set pH value.

## The Significance of Titratable Total Acidity

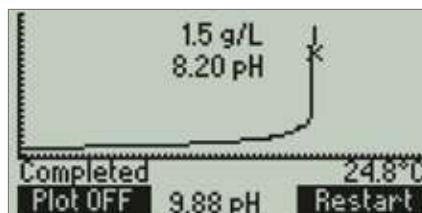
Acids occur naturally during the growing of grapes and as part of the fermentation process. Wines show lower levels of acid when there is a hot growing season or when the grapes come from warmer regions. In the proper proportion, acids are a desirable trait and give the wine character. The three predominant acids in wine are tartaric, malic and citric. Tartaric acid is the principal acid in grapes and is a component that promotes a crisp flavor and graceful aging in wine. A

moderate amount of a wine's acid comes from malic acid, which contributes to fruitiness. A small amount of titratable acidity comes from citric acid. Wine also contains trace amounts of other acids; the least desirable acid in wine is acetic acid, which, when present in more than a nominal amount, gives wine a sour or vinegary aspect.

Total acidity, also called titratable acidity, is the sum of the fixed and volatile acids. In the United States the total acidity is usually expressed in terms of tartaric acid, even though the other acids are measured.

Total acidity directly affects the color and flavor of wine and, depending on the style of the wine, is sought in a perfect balance with the sweet and bitter sensations of other components. Too much acidity makes wine tart and sharp; too little makes wines flat, flabby and uninteresting. Proper acidity in wine is what makes it refreshing and an ideal accompaniment to food. The proper acid level of a wine varies, with sweeter wines generally requiring somewhat higher levels to retain the proper balance.

## On-screen Features



### CAL Check™

A Hanna exclusive process for checking the condition of electrodes which helps keep measurements accurate.

### Titration Curve Displayed On Screen

The HI84502 offers real time graphing of the titration curve on the LCD.

### Log and Recall Data

Log up to 400 samples (200 for titration results; 200 for mV/pH) and recall or export data to a USB stick or PC.

### Specifications

#### HI84502

Titrator	Range	Low Range: 0.1 to 5.0 g/L (ppt) of tartaric acid High Range: 4.0 to 25.0 g/L (ppt) of tartaric acid
	Resolution	0.1 g/L (ppt)
	Accuracy (@25°C/77°F)	±0.1 g/L or 3 % of reading, whichever is greater
	Method	acid-base titration
	Sample Volume	Low Range: 10 mL High Range: 2 mL
	Principle	endpoint titration: 7.00 pH or 8.20 pH
	Pump speed	10 mL/min
	Stirring Speed	600 rpm
pH	Range	-2.0 to 16.0 pH; -2.00 to 16.00 pH
	Resolution	0.1 pH / 0.01 pH
	Accuracy (@25°C/77°F)	±0.01 pH
	Calibration	one, two or three-point calibration, four available buffers (4.01, 7.01, 8.20, 10.01)
	Temperature Compensation	manual or automatic
mV Meter	Range	-2000.0 to 2000.0 mV
	Resolution	0.1 mV
	Accuracy (@25°C/77°F)	±1.0 mV
Temperature	Range	-20.0 to 120.0°C; -4.0 to 248.0°F; 253.2 to 393.2 K
	Resolution	0.1°C; 0.1°F; 0.1 K
	Accuracy (@25°C/77°F)	±0.4°C; ±0.8°F; ±0.4 K
Additional Specifications	Logging Data	up to 400 samples (200 pH/mV, 200 titration)
	pH Electrode	HI1048B glass body pH electrode with BNC connector and 1 m (3.3') cable (included)
	Temperature Probe	HI7662-T stainless steel temperature probe with 1 m (3.3') cable (included)
	Connectivity	(1) Type-B USB for PC interface, (1) Type-A USB for storage
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Power Supply	12 VDC adapter (included)
	Dimensions	235 x 200 x 150 mm (9.2 x 7.9 x 5.9")
	Weight	1.9 kg (6.70 oz.)
Ordering Information	HI84502-01 (115V) and HI84502-02 (230V) are supplied with HI1048B pH electrode, HI7662-T temperature probe, HI7082 electrode fill Solution (30 mL), HI84502-70 reagent kit (consisting of: 1 bottle HI84502-50 (230 mL) titration solution and HI84502-55 (120 mL) pump calibration standard (1 bottle)), (2) 100 mL beakers, dosing pump valve, 2000 µL automatic pipette (1) with plastic tips (2), 5 mL syringe, 1 mL plastic pipette, tube set (aspiration tube with titrant bottle cap and dispensing tube with tip), stir bar, electrode cleaning solution sachets for wine deposits (2), electrode cleaning solution sachets for wine stains (2), power adapter, instruction manual and quality certificate.	



HI70401	potassium hydrogen phthalate, 20 g
HI70402	tartaric acid, 20 g
HI70403	sodium thiosulfate pentahydrate, 20 g
HI70404	potassium iodide powder packets, 100 packets
HI70405	glucose/fructose, 20 g
HI70406	sodium chloride, 20 g
HI70407	potassium iodate, 20 g
HI70408	oxalic acid, 20 g
HI70409	potassium permanganate, 20 g
HI70422	silver nitrate (0.1 M), 1L
HI70423	sodium hydroxide solution (0.11 N), 1 L
HI70424	amino-propanol buffer, 25 mL
HI70425	sulfuric acid solution (16%), 500 mL
HI70426	glyoxal solution (40%), 100 mL
HI70427	nitric acid solution (1.5 M), 500 mL
HI70428	sodium hydroxide solution (0.25N), 1L
HI70429	silver nitrate solution (0.05 M), 1L
HI70432	hydrogen peroxide solution (3%), 25 mL
HI70433	stabilized iodine solution (0.01 N), 1L
HI70434	phosphoric acid (85%), 500 mL
HI70435	sodium hydroxide solution (5 M), 500 mL
HI70436	deionized water, 1G
HI70437	potassium iodide concentrated (30%) solution, 500 mL
HI70438	tris buffer set, 1L
HI70439	sodium thiosulfate solution (0.1 M), 1 L
HI70440	iodine stabilized solution (0.02 N), 1L

HI70441	iodine stabilized solution (0.04 N), 1 L
HI70443	sulfuric acid solution (10%), 500 mL
HI70444	sulfuric acid solution (25%), 500 mL
HI70445	nitric acid solution (1 M), 500 mL
HI70446	Fehling solution A, 500 mL
HI70447	Fehling solution B, 500 mL
HI70448	silver nitrate solution (0.02 M), 1L
HI70449	EDTA solution (0.02 M), 1 L
HI70453	hydrochloric acid solution (0.02 N), 1 L
HI70454	sodium hydroxide solution (0.02 N), 1 L
HI70455	sodium hydroxide solution (0.01 N), 1 L
HI70456	sodium hydroxide solution (0.1 N), 1 L
HI70457	sodium hydroxide solution (1 N), 1 L
HI70458	sulfuric acid solution (0.01 M), 1 L
HI70459	sulfuric acid solution (0.05 M), 1 L
HI70462	hydrochloric acid solution (0.01 N), 1L
HI70463	hydrochloric acid solution (0.1 N), 1 L
HI70464	hydrochloric acid solution (1 N), 1 L
HI70465	hydrogen peroxide solution (30%), 25 mL
HI70466	phenylarsine oxide (PAO) solution (0.00564N), 500 mL
HI70467	pH 4.18 acetate buffer, 230 mL
HI70468	potassium iodide, 35g
HI70469	iodine solution (0.00188N), 230 mL (4)
HI70471	phenylarsine oxide (PAO) solution (0.000564N), 500 mL
HI70472	pH 7.15 phosphate buffer solution, 230 mL

# Meter Accessories and Reagents



## HI902C and HI901 Automatic Titration System Accessories

Code	Description
<b>HI900100</b>	dosing pump
<b>HI900150</b>	50 mL burette assembly (includes syringe, aspiration, and dispensing tubes)
<b>HI900125</b>	25 mL burette assembly (includes syringe, aspiration, and dispensing tubes)
<b>HI900110</b>	10 mL burette assembly (includes syringe, aspiration, and dispensing tubes)
<b>HI900105</b>	5 mL burette assembly (includes syringe, aspiration, and dispensing tubes)
<b>HI900250</b>	50 mL burette syringe
<b>HI900225</b>	25 mL burette syringe
<b>HI900210</b>	10 mL burette syringe
<b>HI900205</b>	5 mL burette syringe
<b>HI900260</b>	3-way valve (includes 3 gaskets and 2 screws)
<b>HI900270</b>	aspiration tube set with fitting (includes blue protection tube, gasket, and tube lock)
<b>HI900280</b>	dispensing tube set with fitting (includes standard dispensing tip, blue protection tube, gasket, and tube lock)
<b>HI900270S</b>	aspiration tube set with 316 stainless steel fitting (includes blue protection tube, gasket, and tube lock)
<b>HI900280S</b>	dispensing tube set with 316 stainless steel fitting (includes standard dispensing tip, blue protection tube, gasket, and tube lock)
<b>HI900301</b>	overhead stirrer assembly (includes overhead stirrer and 3 propellers)
<b>HI900302</b>	replacement propellers (3)
<b>HI900303</b>	PVDF replacement propellers (3) for organic solvents
<b>HI900304</b>	Replacement shearing type polycarbonate propeller (1) for HI901 and HI902 overhead stirrer
<b>HI900310</b>	overhead electrode holder (includes overhead stirrer without electronics or propeller)
<b>HI900320</b>	stirrer stand
<b>HI7662-T</b>	temperature probe
<b>HI900942</b>	tool for burette cap removal
<b>HI900946</b>	power adapter 120VAC to 24VDC
<b>HI900947</b>	power adapter 220VAC to 24VDC
<b>HI920013</b>	USB cable (HI902C only)
<b>HI900805</b>	HI902C1/HI902C2 Design, Installation, Operation, and Performance Qualification (DQ/IQ/OQ/PQ) Documentation



## HI921 Autosampler Accessories

Code	Description
<b>HI920-11660</b>	single row with RFID, 16 beaker position, 60mm dia.
<b>HI920-060</b>	120 mL plastic beakers that fit HI920-11660 (20)
<b>HI920-11853</b>	single row with RFID, 18 beaker position, 53mm dia.
<b>HI920-053</b>	100 mL plastic beakers that fit HI920-11853 (20)
<b>HI920-301</b>	overhead stirrer
<b>HI920-101</b>	peristaltic pump with dispensing tubing
<b>HI920-102</b>	peristaltic pump with aspiration tubing
<b>HI920-201</b>	peristaltic pump replacement cap and rotor
<b>HI920-202</b>	peristaltic pump complete tubing set with plastic dispensing tube
<b>HI920-203</b>	peristaltic pump complete tubing set with stainless-steel aspiration tube
<b>HI920-205</b>	peristaltic pump roller tube (3) with fittings and grease - general purpose
<b>HI920-204</b>	peristaltic pump roller tube (3) with fittings and grease - increased chemical resistance
<b>HI920-290</b>	5m TYGON tube
<b>HI920-280S</b>	1.5m dispensing tube set with 316 stainless steel fitting for burette to autosampler
<b>HI920-304</b>	Replacement shearing type polycarbonate propeller (1) for HI921 overhead stirrer
<b>HI920-280</b>	1.5m Burette/Autosampler titrant dispensing tube
<b>HI920-302</b>	replacement propellers (3)
<b>HI920-303</b>	high chemical resistance replacement propellers (3)
<b>HI920-310</b>	three electrode holder
<b>HI920-900</b>	USB memory stick
<b>HI920-921</b>	control panel for HI921
<b>HI920-930</b>	titrator/autosampler communication cable
<b>HI920-931</b>	BNC extension cable (1m)
<b>HI920-932</b>	reference extension cable (1m)
<b>HI920-960</b>	tray locking screw
<b>HI7662-A</b>	autosampler temperature sensor w/1.5m cable
<b>HI731319</b>	25 mm x 7 mm stir bars (10)

## Meter Accessories and Reagents



**HI903 KF Volumetric Titrator  
Accessories**

Code	Description
<b>HI76320</b>	dual platinum pin KF electrode with BNC connector
<b>HI900100</b>	titrant dosing pump
<b>HI900520</b>	beaker assembly (beaker, dispensing tip, fittings, o-rings, top, holder, stirrer, solvent port plug)
<b>HI900505</b>	5 mL burette assembly (syringe, aspiration, and dispensing tubes)
<b>HI900205</b>	5 mL burette syringe
<b>HI900260</b>	3-way valve (3 gaskets and 3 screws)
<b>HI900522</b>	KF beaker (glass only)
<b>HI900523</b>	dispensing tip (2)
<b>HI900527</b>	septum (5)
<b>HI900528</b>	solvent port plugs (2)
<b>HI900530</b>	titrant bottle top assembly
<b>HI900531</b>	solvent/waste bottle top assembly
<b>HI900532</b>	desiccant cartridge for KF beaker or titrant bottle top
<b>HI900533</b>	desiccant cartridge for solvent or waste bottle top
<b>HI900534</b>	waste bottle
<b>HI900180</b>	solvent-handling pump
<b>HI900535</b>	tubing for solvent/waste handling
<b>HI900536</b>	tubing for solvent-handling pump
<b>HI900540</b>	O-ring set
<b>HI900570</b>	aspiration tube set with fitting (PTFE titrant tubing, blue protection and tube lock)
<b>HI900580</b>	dispensing tube set with fitting (PTFE titrant tubing)
<b>HI900570S</b>	aspiration tube set with 316 stainless steel fitting (PTFE titrant tubing, blue protection and tube lock)
<b>HI900580S</b>	dispensing tube set with 316 stainless steel fitting (PTFE titrant tubing)
<b>HI900942</b>	tool for burette cap removal
<b>HI920013</b>	USB cable for PC connection
<b>HI900806</b>	HI903 Design, Installation, Operation, and Performance Qualification (DQ/IQ/OQ/PQ) Documentation



**HI904 KF Coulometric Titrator  
Accessories**

Code	Description
<b>HI900561</b>	titration vessel (glass only)
<b>HI76330</b>	detector electrode
<b>HI900511</b>	generator electrode with diaphragm
<b>HI900512</b>	generator electrode without diaphragm
<b>HI900180</b>	solvent handling pump
<b>HI900181</b>	reagent adapter holder assembly
<b>HI900182</b>	reagent adapter holder (glass only)
<b>HI900560</b>	titration vessel assembly
<b>HI900568</b>	reagent exchange adapter
<b>HI900537</b>	bottle top assembly (with molecular sieves)
<b>HI900538</b>	desiccant cartridge for reagent/waste bottles (with molecular sieve)
<b>HI900535</b>	tubing set for reagent/waste handling (2)
<b>HI900536</b>	tubing for solvent handling pump (2)
<b>HI900566</b>	open-top GL18 cap
<b>HI900563</b>	glass stopper, standard taper 19
<b>HI900564</b>	desiccant cartridge for generator electrode
<b>HI900542</b>	O-ring set
<b>HI900534</b>	waste bottle
<b>HI900551</b>	molecular sieves, 150 g
<b>HI900940</b>	calibration key
<b>HI900946</b>	power adapter 120VAC to 24VDC
<b>HI900567</b>	septum kit (5)
<b>HI900543</b>	glass joint grease
<b>HI900931</b>	generator cable
<b>HI920013</b>	USB Cable for PC Connection
<b>HI900807</b>	HI904/HI904D Design, Installation, Operation, and Performance Qualification (DQ/IQ/OQ/PQ) Documentation

# Meter Accessories and Reagents



## HI84530 Total Titratable Acidity Mini Titrator and pH Meter Reagents and Accessories

Reagent Code	Description
HI84530-50	titrant solution for low range, 120 mL
HI84530-51	titrant solution for high range, 120 mL
HI84530-55	pump calibration standard, 230 mL
HI84530-60	hydrogen peroxide, 30 mL
HI7004M	pH 4.01 buffer, 230 mL
HI7007M	pH 7.01 buffer, 230 mL
HI70083M	pH 8.30 buffer, 230 mL
HI7010M	pH 10.01 buffer, 230 mL
HI70300M	storage solution, 230 mL
HI7082	pH electrode filling solution, 3.5M KCl, 30 mL (4)
HI7061M	general purpose electrode cleaning solution, 230 mL

Accessory Code	Description
HI70500	tube set with cap for titrant bottle, tip and valve
HI731319	stir bar, 25 x 7 mm (10)
HI740036P	100 mL beaker (10)
HI740236	5 mL syringe for mini titrator
HI920013	PC connection cable
HI1131B	replacement pH electrode
HI7662-T	replacement temperature probe

## HI84531 Titratable Alkalinity Mini Titrator and pH Meter Reagents and Accessories

Reagent Code	Description
HI84531-50	titrant solution for low range, 120 mL
HI84531-51	titrant solution for high range, 120 mL
HI84531-55	pump calibration standard, 230 mL
HI7004M	pH 4.01 buffer, 230 mL
HI7007M	pH 7.01 buffer, 230 mL
HI70083M	pH 8.30 buffer, 230 mL
HI7010M	pH 10.01 buffer, 230 mL
HI70300M	storage solution, 230 mL
HI7082	pH electrode filling solution, 3.5M KCl, 30 mL (4)
HI7061M	general purpose electrode cleaning solution, 230 mL

Accessory Code	Description
HI740236	5 mL syringe for mini titrator
HI70500	tube set with cap for titrant bottle, tip and valve
HI731319	stir bar, 25 x 7 mm (10)
HI740036P	100 mL beaker (10)
HI920013	PC connection cable
HI1131B	replacement pH electrode
HI7662-T	replacement temperature probe

## Meter Accessories and Reagents



**HI84529 Titratable Acidity Mini Titrator and pH Meter Reagents and Accessories**

Reagent Code	Description
<b>HI84529-50</b>	titrant solution for low range 20, 120 mL
<b>HI84529-51</b>	titrant solution for high range 20, 120 mL
<b>HI84529-52</b>	titrant solution for low range 50, 120 mL
<b>HI84529-55</b>	pump calibration standard, 230 mL
<b>HI7004M</b>	pH 4.01 buffer, 230 mL
<b>HI70060M</b>	pH 6.00 buffer, 230 mL
<b>HI70083M</b>	pH 8.30 buffer, 230 mL
<b>HI7010M</b>	pH 10.01 buffer, 230 mL
<b>HI70300M</b>	storage solution, 230 mL
<b>HI70640M</b>	cleaning solution for milk deposits, 230 mL
<b>HI70641M</b>	cleaning and disinfection solution for dairy products, 230 mL
<b>HI7072</b>	reference half-cell filling solution, 1M KNO <sub>3</sub> , 30 mL (4)

Accessory Code	Description
<b>HI70500</b>	tube set with cap for titrant bottle, tip and valve
<b>HI731319</b>	stir bar, 25 x 7 mm (10)
<b>HI740036P</b>	100 mL beaker (10)
<b>HI740037P</b>	20 mL beaker (10)
<b>HI740236</b>	5 mL syringe for mini titrator
<b>HI920013</b>	PC connection cable
<b>FC260B</b>	replacement pH half-cell electrode for dairy
<b>HI5315</b>	replacement reference half-cell electrode
<b>HI7662-T</b>	replacement temperature probe



**HI84532 Titratable Acidity Mini Titrator and pH Meter Reagents and Accessories**

Reagent Code	Description
<b>HI84532-50</b>	titrant solution for low range, 120 mL
<b>HI84532-51</b>	titrant solution for high range, 120 mL
<b>HI84532-55</b>	pump calibration standard, 230 mL
<b>HI7004M</b>	pH 4.01 buffer, 230 mL
<b>HI7007M</b>	pH 7.01 buffer, 230 mL
<b>HI70082M</b>	pH 8.20 buffer, 230 mL
<b>HI7010M</b>	pH 10.01 buffer, 230 mL
<b>HI70300M</b>	storage solution, 230 mL
<b>HI7061M</b>	general purpose cleaning solution, 230 mL
<b>HI7082</b>	pH electrode filling solution, 3.5M KCl, 30 mL (4)

Accessory Code	Description
<b>HI731342</b>	automatic pipette (2000 µL)
<b>HI731352</b>	tips for 2000 µL automatic pipette (4)
<b>HI70500</b>	tube set with cap for titrant bottle, tip and valve
<b>HI731319</b>	stir bar, 25 x 7 mm (10)
<b>HI740036P</b>	100 mL beaker (10)
<b>HI740037P</b>	20 mL beaker (10)
<b>HI740236</b>	5 mL syringe for mini titrator
<b>HI920013</b>	PC connection cable
<b>HI1131B</b>	replacement pH electrode
<b>HI7662-T</b>	replacement temperature probe

# Meter Accessories and Reagents



**HI84533 Formol Number Mini Titrator and pH Meter Reagents and Accessories**

Reagent Code	Description
<b>HI84533-50</b>	titrant solution, 230 mL
<b>HI84533-55</b>	pump calibration standard, 120 mL
<b>HI84533-60</b>	hydrogen peroxide reagent, 30 mL
<b>HI84533-61</b>	formol base reagent, 230 mL
<b>HI84533-62</b>	pH adjustment reagent, 30 mL
<b>HI7004M</b>	pH 4.01 buffer, 230 mL
<b>HI7007M</b>	pH 7.01 buffer, 230 mL
<b>HI70082M</b>	pH 8.20 buffer, 230 mL
<b>HI7010M</b>	pH 10.01 buffer, 230 mL
<b>HI70300M</b>	storage solution, 230 mL
<b>HI70635M</b>	cleaning solution for wine deposits, 230 mL
<b>HI70636M</b>	cleaning solution for wine stains, 230 mL
<b>HI7082</b>	pH electrode filling solution, 3.5M KCl, 30 mL (4)
Accessory Code	Description
<b>HI70500</b>	tube set with cap for titrant bottle, tip and valve
<b>HI731319</b>	stir bar, 25 x 7 mm (10)
<b>HI740036P</b>	100 mL beaker (10)
<b>HI740236</b>	5 mL syringe for mini titrator
<b>HI920013</b>	PC connection cable
<b>HI1131B</b>	replacement pH electrode
<b>HI7662-T</b>	replacement temperature probe



**HI84500 Sulfur Dioxide Mini Titrator for Wine Analysis Reagents and Accessories**

Reagent Code	Description
<b>HI84500-50</b>	titrant solution for low range, 230 mL
<b>HI84500-51</b>	titrant solution for high range, 230 mL
<b>HI84500-55</b>	pump calibration standard, 120 mL
<b>HI84500-60</b>	acid reagent, 230 mL
<b>HI84500-61</b>	alkaline reagent (Total SO <sub>2</sub> ), 120 mL
<b>HI84500-62</b>	stabilizer powder packets (100)
<b>HI7082</b>	pH electrode filling solution, 3.5M KCl, 30 mL (4)
<b>HI7021M</b>	ORP test solution @ 240 mV (@25°C), 230 mL
<b>HI7092M</b>	oxidizing pretreatment solution, 230 mL
<b>HI70635M</b>	cleaning solution for wine deposits, 230 mL
<b>HI70636M</b>	cleaning solution for wine stains, 230 mL
<b>HI70300M</b>	storage solution, 230 mL
Accessory Code	Description
<b>HI70500</b>	tube set with cap for titrant bottle, dosing tip and valve
<b>HI731319</b>	stir bar, 25 x 7 mm (10)
<b>HI740036P</b>	100 mL beaker (10)
<b>HI740037P</b>	20 mL beaker (10)
<b>HI740236</b>	5 mL syringe for mini titrator
<b>HI920013</b>	PC connection cable
<b>HI3148B</b>	ORP electrode for wine

## Meter Accessories and Reagents



### HI84502 Total Acidity Mini Titrator and pH Meter for Wine Analysis Reagents and Accessories

Reagent Code	Description
HI84502-50	titrant solution, 230 mL
HI84502-55	pump calibration standard, 120 mL
HI7004M	pH 4.01 buffer, 230 mL
HI7007M	pH 7.01 buffer, 230 mL
HI70082M	pH 8.20 buffer, 230 mL
HI7010M	pH 10.01 buffer, 230 mL
HI70300M	storage solution, 230 mL
HI70635M	cleaning solution for wine deposits, 230 mL
HI70636M	cleaning solution for wine stains, 230 mL
HI7082	pH electrode filling solution, 3.5M KCl, 30 mL (4)

Accessory Code	Description
HI70500	tube set with cap for titrant bottle, tip and valve
HI731352	tips for 2000 $\mu$ L automatic pipette (4)
HI731342	automatic pipette 2000 $\mu$ L
HI731319	stir bar, 25 x 7 mm (10)
HI740036P	100 mL beaker (10)
HI740236	5 mL syringe for mini titrator
HI920013	PC connection cable
HI1048B	replacement pH electrode for wine
HI7662-T	replacement temperature probe