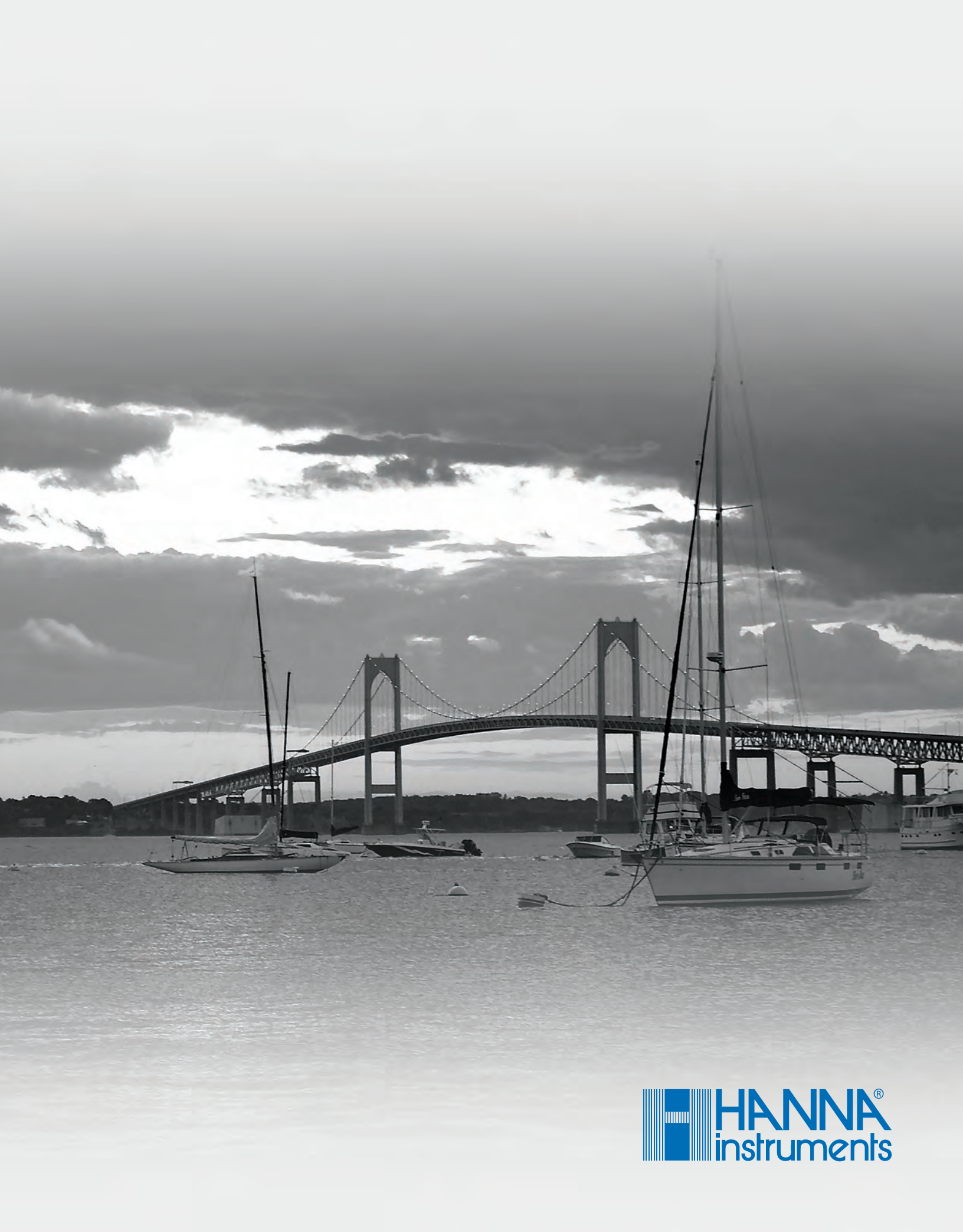


HANNA® instruments

Catalog Contents

President's Message

January 2015

Dear Valued Customer:

Hanna has long held the ideal that a company should establish a close relationship with its customers to truly provide the highest level of personal service and technical support. We make every effort possible to have offices locally available to support this ideal. Our customers can always be assured that when they pick up a phone and dial their local office that a Hanna Sales, Customer Service, or Technical Support Representative will be there to assist and provide the necessary information. There are no centralized call centers; you will always be able to speak with a local Hanna employee.

We listen to all of our customers' feedback and suggestions to improve upon existing products, understand what new products can be designed for your benefit, and most off all to strengthen our relationship with you, our valued customer. At Hanna, we believe the only way to genuinely obtain the insight into your specific needs is to create an open dialogue about your unique application.

As the largest family-owned manufacturer of analytical instrumentation in the world, we design, manufacture, supply and support all of our products to provide our customers with a level of value that our competitors struggle to contend with. Our products are manufactured in our European, state-of-the-art ISO 9001:2008 production facility and are CE compliant to EN 61326-1 and EN 61010-1 standards.

Please use this catalog as a resource for finding the right product for your application. This catalog includes the contact information of our offices around the globe so that you may get in touch with your local Hanna Representative and learn more about how we can help you.

Hanna dedicates itself to be a worldwide leader in quality, value, service, and selection. We can assure you that these fundamentals 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

Table of Contents

About Hanna

History

Hanna Instruments was founded in Padova, Italy in 1978 by Anna and Oscar Nardo and is currently headquartered in Woonsocket, Rhode Island and run by their children, Pamela and Martino Nardo. With over 60 offices in 40 countries worldwide, Hanna continues to grow to meet the demand for its products in a variety of industries. Throughout its history, Hanna has been at the forefront of technology and innovation.

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.

Manufacturing

We believe in controlling the quality of our products from their inception to delivery. For this reason, we manufacture all of the products we bring to market. To ensure consistency and quality, each of our manufacturing facilities are specialized in a product family.

To stay at the forefront of quality and innovation, we are continuously investing in new technologies and equipment as well as implementing new manufacturing techniques. As a vertically integrated manufacturer, Hanna does not subcontract any part of manufacturing. Processes such as plastic molding, glass blowing, chemical bottling and assembly are performed in one of our state of the art facilities. Hanna is an ISO 9001:2008 certified company.

Innovation

For over thirty-five 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.

In 1985, Hanna was first to introduce a pH electrode with a built in temperature sensor. This electrode soon became commonly used throughout the worldwide market. In 1990, after listening to its customers, Hanna was one of the first companies to launch a line of waterproof, portable instruments built specifically for harsh environments. The concept of giving users the possibility to check the accuracy of their digital thermometer (CAL Check™) was introduced by Hanna in 1995 and is still unique today. With technology that was first introduced by Hanna in 2000, the HI98129 and HI98130 Combo testers allowed simultaneous testing for pH and EC in a single instrument. In 2004, Hanna introduced HI98121, the worlds first combination pH and ORP tester. In late 2013, Hanna introduced edge®, a 3-in-1 benchtop/portable/wall-mount pH/EC/DO meter with a 5.5" screen, thickness of 1/2" and weight of under 9 ounces. In 2014, Hanna launched HALO™, the world's first pH electrode with Bluetooth® Smart technology and the companion Hanna Lab App.

Hanna is Technology and Innovation

Hanna Milestones

70's

1978 Hanna opens in Italy

80's

1980 World's first single-probe portable conductivity meter

1982 World's first pH controlled chemical dosing pump

1984 World's first microprocessor-based hand held pH meter

1985 World's first pH electrode with built-in temperature sensor

1986 World's first electronic pocket-sized pH tester

Opened R&D/Sales & Technical Service Office in USA

Opened Manufacturing Plant/Sales & Technical Service Office in Singapore

1987 Opened Sales & Technical Service Offices in Australia, Belgium and UK

1988 World's first pre-amplified pH electrode

Opened Manufacturing Plant in Mauritius

Opened Sales & Technical Service Offices in France, Germany, Japan and Malaysia

1989 Opened Sales & Technical Service Office in South Korea

90's

1990 World's first waterproof portable pH meter

Opened Sales & Technical Service Office in Taiwan

1991 World's first replaceable electrode pH pocket tester

Opened Sales & Technical Service Offices in Spain and South Africa

1992 World's first portable pH meter with plain-paper printer

Opened Sales & Technical Service Office in Canada

1994 Opened Sales & Technical Service Office in Argentina

1995 World's first pocket thermometer with CAL Check™

1996 Opened Sales & Technical Service Office in Indonesia

1997 World's first pH tester with double junction electrode

Opened Sales & Technical Service Office in Chile

1999 World's first pH/temperature tester with dual-level LCD

Opened Manufacturing Plant/Sales & Technical Service Office in Romania

Opened Sales & Technical Service Offices in Holland, Mexico, Poland, Portugal and Thailand

00's

2000 World's first multiparameter (pH/conductivity/temperature) pocket tester

Opened Manufacturing Plant/Sales & Technical Service Office in Hungary

Opened Sales & Technical Service Office in China

2001 Opened Sales & Technical Service Office in Greece

2002 World's first colorimeter with CAL Check™ feature

Opened Sales & Technical Service Office in Egypt

2003 World's first pH meter with CAL Check™

2004 World's first process pH meter with integrated cellular communication

World's first pH/ORP combo tester

Opened Sales & Technical Service Office in Vietnam

2005 World's first single parameter line of auto titrators for wine testing

Opened Sales & Technical Service Office in Brazil

2006 World's first single parameter automatic mini titrator

Opened Sales & Technical Service Office in India

2007 World's first conductimetric known addition alcohol analyzer for beverages

Opened Sales & Technical Service Office in Morocco

10's

2010 World's first handheld colorimeters (Checker ®HC series) to offer ease of use and high accuracy in a palm sized design

Opened Sales & Technical Service Offices in Bolivia, Cameroon Colombia, Costa Rica, Czech Republic, Guatemala and Slovakia

2011 Opened Sales & Technical Service Offices in Croatia

2012 Opened Sales & Technical Service Offices in Slovenia

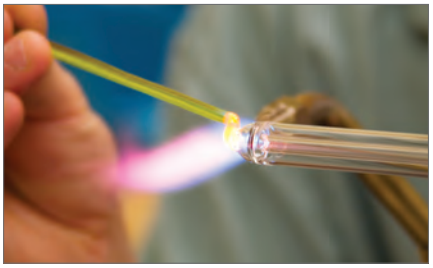
2013 World's most innovative pH, EC and DO handheld/portable/wall-mount meter....edge®

Opened Sales & Technical Service Offices in Ecuador and Switzerland

2014 World's first pH electrode with Bluetooth® Smart technology (HALO™)

Opened Sales & Technical Service Offices in Panama and UAE

About Hanna



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

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.

Certification

All Hanna products are in compliance with CE directives and our production facilities are ISO 9001:2008 certified.

Close to You

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

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.

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. There you can search for products, look up local office contacts, read the latest news from Hanna and download instruction manuals, MSDS and brochures.

Great Products Start Here

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.

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™.

Hanna also 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.

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

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 to meet the needs of customers.

Production Facilities

Our main manufacturing facility is located on a 100 acre, state of the art industrial science park in Nusfalau, Europe, with secondary sites in Woonsocket and Smithfield, Rhode Island in the United States. All of our product lines are manufactured in-house.

Hanna World Headquarters

Headquarters

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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HALO™

pH electrode with Bluetooth® Wireless Technology

HANNA® instruments

www.hannainst.com

HI11312

HALO™

3.8

The world's first pH electrode with Bluetooth® Smart technology

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. Its flexibility and ease of use will revolutionize the way pH is measured.

HALO™ features

- Refillable glass pH electrode
- Double junction reference design
- Integrated temperature sensor
  - Ensures the calibration and measurement is automatically temperature compensated, thus eliminating error
- Wide pH (0 to 13) and temperature (-5 to 80°C) range
- Clear the clutter
  - Data is wirelessly transmitted to an iPad® running the Hanna Lab App via Bluetooth® Smart technology. HALO™ provides up to 500 hours of battery life
- One button sample tagging
  - Pressing either the button on the HALO™ pH probe or the probe icon in the Hanna Lab App will tag sample data for easy reference
- Calibration is stored
  - HALO™ stores calibration information; no additional calibration is needed when switching to another iPad
- Battery condition
  - The measurement screen of the Hanna Lab App displays the name, battery life and condition of the HALO™ probe

Hanna Lab App

3.10

pH Meter Application for use with HALO™

The first app that turns an iPad® into a full-featured pH meter!

The Hanna Lab App turns an iPad® into a full-featured pH meter when used with the Hanna HALO™ pH electrode with 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 the iPad's pinch-to-zoom technology for enhanced viewing.

edge®

pH • EC • DO

HANNA® instruments

www.hannainst.com

Hanna Instruments is proud to introduce the world's most innovative pH, EC and DO meter... edge®

edge® is thin and lightweight, measuring just 1/2" (12 mm) thick and weighing less than 9 ounces (250 g). edge® has an incredibly wide viewing angle, 5.5" (14 cm) LCD and a sensitive capacitive touch keypad.

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

edge® features Hanna's exclusive pH CAL Check™ to warn you if the electrode you are using is not clean or if your buffers are contaminated during calibration. We have added Sensor Check® for pH sensors with a matching pin. Our Sensor Check™ feature warns you if the pH bulb is cracked and/or the junction of the electrode is compromised.

edge® is the culmination of Hanna's vision, design capabilities, integrated production facilities, and world class R&D teams. With edge®, Hanna has set the new standard!

Digital SMART Electrodes

The electrodes used with edge® are nearly as advanced as edge® itself. They feature a built-in microchip that stores sensor type, ID, and calibration information that is automatically retrieved by edge® once the electrode is plugged in.

Stored pH calibration information includes: calibrated buffers, date, time, offset and slope characteristics of the electrode. Conductivity calibration information includes: calibrated conductivity standards, date, time, and cell constant of the sensor. Dissolved oxygen calibration information includes: standards used for calibration, date, time, altitude and salinity correction.

These digital electrodes also feature an easy to plug in 3.5 mm connector so you never have to worry about the right angle or aligning pins.

0	0.5 (12 mm)	8.8 (250 g)	8	5.5 (14 cm)	2
footprint	inch thick	oz. weight	hours battery life	inch display	USB ports

- Sleek design
  edge® is incredibly thin and lightweight, measuring just 1/2" (12 mm) thick and weighing just 8.8 ounces (250 g).

edge® is available as kits. see the following sections for complete information:

pH Kit	EC Kit	DO Kit
3.12	6.6	7.4

www.hannainst.com

edge®

Single Parameter Meters

edge®–Innovation in a Single Parameter

edge® is thin and lightweight, measuring just 1/2" (12 mm) thick and weighing less than 9 ounces (250 g). edge® has an incredibly wide viewing angle, 5.5" (14 cm) LCD and a sensitive capacitive touch keypad.

edge® pH

3.18

edge®pH measures pH through its unique digital pH electrodes. These digital pH electrodes are auto-recognized, providing sensor type, calibration data and a serial number when connected to edge®pH by an easy to plug-in 3.5 mm connector. The versatile design of edge®pH enables it to be used as a handheld, benchtop or wall-mounted meter. edge® simplifies measurement, configuration, calibration, diagnostics, logging and transferring data directly to a computer or USB drive.

edge®pH features Hanna's exclusive CAL Check™ to warn you if the electrode you are using is not clean or if your buffers are contaminated during calibration. We have added Sensor Check™ for pH sensors with a matching pin. Our Sensor Check™ feature warns you if the pH bulb is cracked and/or the junction of the electrode is compromised.

edge® EC

6.12

edge®EC measures conductivity through its unique digital conductivity probe. The digital conductivity probe is auto-recognized, providing type, calibration data and a serial number when connected to edge®EC by an easy to plug-in 3.5mm connector. The versatile design of edge®EC enables it to be used as a handheld, benchtop or wall-mounted meter. edge®EC simplifies measurement, configuration, calibration, diagnostics, logging and transferring data directly to a computer or USB drive.

edge® DO

7.10

edge®DO measures dissolved oxygen through its unique digital dissolved oxygen electrodes. These digital dissolved oxygen electrodes are auto-recognized, providing sensor type, calibration data and a serial number when connected to edge®DO by an easy to plug-in 3.5mm connector. The versatile design of edge®DO enables it to be used as a handheld, benchtop or wall-mounted meter. edge®DO simplifies measurement, configuration, calibration, diagnostics, logging and transferring data directly to a computer or USB drive.

Research Grade Meters

6 Models to Choose from

HANNA instruments

HI5521 • HI5522

3.22

Research Grade Meters

pH/ORP/ISE and EC/TDS/Resistivity/Salinity and Temperature

Measure up to Eight Parameters

HI5521 and HI5522 are research grade benchtop instruments that feature eight measurement parameters: pH, mV (for Oxidation Reduction Potential), ISE (HI5522 only), conductivity, resistivity, TDS, salinity and temperature.

HI5221 • HI5222

3.28

Research Grade Meters

pH/ORP/ISE and Temperature

Measure up to 4 Parameters

HI5221 and HI5222 are research grade pH, mV and temperature benchtop meters. HI5222 is a dual channel meter with two independent inputs for pH, ORP and ISE probes. Each channel has it's own temperature input and supports half cells with a separate reference electrode input.

6.24

HI5321

Research Grade Conductivity/ TDS Meter with USP <645>

EC/TDS/Resistivity/Salinity and Temperature

Research Grade Conductivity Measurement

The HI5321 is a research grade EC/TDS/resistivity/salinity benchtop meter with a large, color, graphic LCD with backlight, capable of millesimal measuring resolution of conductivity with an extended range from 0.001 µS/cm to 1 S/cm.

7.12

HI5421

Research Grade Bench Meter

Dissolved Oxygen and BOD

Extensive DO Capabilities

The HI5421 is a research grade dissolved oxygen bench meter with extensive capabilities in measuring DO as well as BOD (Biological Oxygen Demand), OUR (Oxygen Uptake Rate), SOUR (Specific Oxygen Uptake Rate) and atmospheric pressure and temperature.


HANNA
6.95
pH
ATC
22.5°C
Cal points:
7.01
Log
AutoEnd
HI 98191
pH/ORP/ISE
ESC
HELP
RANGE
GLP
CAL
MODE
RCL
SETUP

HI9819x Series

Waterproof Meters

- Waterproof
  - IP67 rated waterproof, rugged enclosure
- Log-on-demand
  - Store measurement data at the press of a button
- GLP
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- AutoHold
  - Automatically holds the first stable reading on the display
- Help menu
  - On-screen context specific help is readily available at the press of a button
- Connectivity
  - PC connectivity via opto-isolated micro-USB with Hanna software

For demanding field applications

The HI9819x series are waterproof, portable meters designed for universal applications.

A backlit, graphic LCD provides easy to read resolution even in low-lit areas. A combination of dedicated and soft keys allows easy, intuitive operation in a choice of languages.

HI98190

pH/ORP

3.40

HI98191

pH/ORP/ISE

3.40

HI98192

EC/TDS/NaCl/ Resistivity

6.30

HI98193

Dissolved Oxygen

7.16

HI98194

pH/EC/DO

8.26

HI98195

pH/ORP & EC/TDS/ Salinity/Resistivity

8.30

HI98196

pH/ORP & Dissolved Oxygen

8.34

HI904

Karl Fischer Coulometric Titrator

5.24

Adaptable, High Accuracy Moisture Determination

The HI904 Karl Fischer Coulometric Titrator for moisture analysis is an extension of Hanna's highly successful titrator platform. The HI904 combines an ultra-high electrolytically generated iodine dynamic dosing system with optically-regulated magnetic stirring, sophisticated endpoint determination, and background drift correction algorithms.

The result is an extremely adaptable titrator capable of titrating with superior accuracy and precision for samples with low moisture content. The HI904 applies a pulsed DC current for titrant generation, detects the endpoint and performs all necessary calculations automatically.

The HI904 comes equipped with a solvent handling system to reduce cell conditioning time and can be connected directly to a laboratory analytical balance via RS232 serial interface.

The HI904's powerful software and intuitive menus are easily navigated on the large, color LCD display, making it simple to view results. Choose from included methods or develop a custom method for almost any application or sample type. Methods (standard or user) and reports can be transferred between titrator and PC via USB interface by using the Hanna PC software. Software updates can be performed using a USB flash drive.

Titrator, pH meter, pH electrode and magnetic stirrer in one compact unit!

Mini Titrators

5.28-5.41

for Food, Dairy, Beverage and Water Applications

Redesigned and Better than Ever

Introducing Hanna Instruments simple, fast and affordable mini automatic titrators designed for testing water, dairy, wine and fruit juice. Each mini titrator features a pre-programmed analysis method designed for its specific parameter, a high accuracy piston driven dosing system, an automatic stirrer with speed control and real time graphing with exportable data.

HI84500	Free & Total Sulfur Dioxide Mini Titrator for Wine
HI84502	Total Acidity Mini Titrator for Wine
HI84529	Acidity Mini Titrator and pH Meter for Dairy
HI84530	Total Acidity Mini Titrator and pH Meter for Water
HI84531	Total Titratable Low to High Alkalinity Mini Titrator
HI84532	Acidity Mini Titrator and pH Meter for Fruit Juices
HI84533	Formol Number Mini Titrator and pH Meter for Wine and Fruit Juices

HI921

Autosampler

5.12

Automate up to 18 Samples

Automate up to 18 samples

The HI921 Autosampler is an automated titration sample handling system designed for use with the HI902C Potentiometric Titration System. This high quality system makes the titration of multiple samples quick and easy.

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.

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 method is established, the user can then customize the automation sequence for their samples. Sample names and size can be customized or auto-filled with preset values. Once the Autosampler sequence is complete, two reports are available for review: a sequence report with 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.

- Flexible, accurate detection of the titration endpoint with HI902C potentiometric titrator
- Automation of up to 18 samples per tray
  - 16 sample tray holds 150 mL beakers
  - 18 sample tray holds 100 mL beakers
- Absolute encoder in sample tray
  - The Autosampler always knows the tray position without the need to "home" or calibrate.
- Electrode rinse feature
  - Up to 3 beakers per tray can be designated for electrode dip/spray rinses
- Automatic addition of reagents or deionized water to the sample beaker by peristaltic pump
- Included control panel for manual operation of motors and pumps
- Built-in magnetic stirrer or optional overhead propeller stirrer
- Barcode reader interface for easy sample tracking
- Built-in RFID in each tray, communicating tray serial number and type
- Optical IR beam detects presence or absence of beakers in the tray
  - Ensures the Autosampler does not proceed with titration if a beaker is missing

- Field upgradable software
- Sample trays made of chemically-resistant materials are removable, easy to clean and dishwasher safe.
- Electrode holder can accommodate 3 x 12 mm electrodes, temperature sensor, 1 aspiration tube and 5 multipurpose tubes (reagent addition, burette dosing)
- Real-time progress of the sequence and results shown on the HI902 titrator screen
- Integrated peristaltic (up to 3) or membrane pump (optional)
- Sample leveling feature
  - Automatic leveling for fast preparation of volumetric samples
- Waste removal feature
  - Aspirate completed samples into a waste container

HI99191 • HI99151 • HI99111

Application Specific pH Meters

- 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

HANNA instruments

3.52

3.54

3.56

HI99191

Portable pH Meter

for Low Ionic Strength Water

The Hanna HI99191 is a waterproof portable pH and temperature meter designed specifically for measuring the pH of drinking water.

The HI99191 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 HI99191 uses three 1.5V AAA batteries for an exceptional battery life of 1200 hours of continuous use.

HI99151

Portable pH Meter

for Beer Analysis

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.

HI99111

Portable pH Meter

for Wine Analysis

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

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.

HI98501 Checktemp®

Digital Thermometer

2.24

with 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.

HI98509 Checktemp®1

Digital Thermometer

2.25

with Stainless Steel Probe Attached to a 3.3' Silicone Cable

The 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.

HI98100

Checker®Plus pH Tester

The pH Checker®Plus series provides users with fast and accurate readings from 0 to 14 pH with a resolution of 0.01 pH. The Checker®Plus features an easy-to-read LCD and two-point calibration with automatic buffer recognition.

The HI1271 pH electrode of the Checker®Plus can be easily replaced. You only need to unscrew the electrode from the meter body and screw on a new one.

The Checker®Plus is fast, accurate and lightweight. With 1000 hours of battery life, there is no need to worry about frequent battery replacement.

Checker hc handheld colorimeter

Checker®HC Handheld Colorimeters

New Additions to One of Our Most Popular Lines

The Hanna Checker®HC bridges the gap between simple chemical test kits and professional instrumentation. Chemical test kits are not very accurate and only give 5 to 10 points resolution while professional instrumentation can cost hundreds of dollars and can be time consuming to calibrate and maintain. The Checker®HC is both accurate and affordable.

The contoured style of the Checker®HC fits in your palm and pocket perfectly, while the large LCD is easy to read. The auto shut-off feature assures the battery life will not be drained if you forget to turn it off.

HI700	Ammonia LR
HI705	Silica LR
HI707	Nitrite LR
HI708	Nitrite HR

HI715	Ammonia MR
HI716	Bromine
HI733	Ammonia HR
HI749	Chromium LR

HI758	Marine Calcium
HI761	Total Chlorine ULR
HI771	Total Chlorine UHR
HI775	Freshwater Alkalinity

HI96800

Digital Refractometer

for Refractive Index / Brix Measurement

The HI96800 refractive Index/brix digital refractometer is rugged, portable and water-resistant for measurements in the lab or field. In addition to refractive index and brix, readings can also be displayed with sucrose temperature compensation (nD_{20}).

Temperature (in °C or °F) is displayed simultaneously with the measurement on the large dual-level display along with icons for low power and other helpful messages.

Table of Contents

Hanna Checker®HC Series

Handheld Colorimeters

The Hanna Checker®HC bridges the gap between simple chemical test kits and professional instrumentation. Chemical test kits are not very accurate and only give 5 to 10 points resolution while professional instrumentation can cost hundreds of dollars and can be time consuming to calibrate and maintain. The Checker®HC is both accurate and affordable.

The contoured style of the Checker®HC fits in your palm and pocket perfectly, while the large LCD is easy to read. The auto shut-off feature assures the battery life will not be drained if you forget to turn it off.

The Checker®HC is extremely simple to use. For typical usage: first, zero the instrument with your water sample. Next, add the reagent. Last, place the vial into the Checker®HC, press the button and read the results. It's that easy.

- Easier to use and more accurate than chemical test kits
  - High accuracy
  - Large, easy-to-read digits
  - Auto shut-off
- Dedicated to a single parameter
  - Designed to work with Hanna's reagents
  - Uses 10 mL glass cuvettes
- Small size, big convenience
  - Weighing a mere 64 g (2.25 oz.), the Checker®HC easily fits in your palm or pocket
- Use for quick and accurate on-the-spot analysis
- Single-button operation: zero and measure
- Operated by a single AAA battery

The Checker®HC is very simple to use:

"Zero" the Checker®HC as required in specific procedure

Add reagent to your water sample

Place the vial into your Checker®HC

Press the button and read the results. It's that easy!

Parameter	Code	Page
Copper, Low Range, New	HI747	1.13
Copper, High Range, New	HI702	1.13
Manganese, High Range, New	HI709	1.18
Magnesium Hardness, New	HI719	1.15
Calcium Hardness, New	HI720	1.15
Chloride, New	HI753	1.8
Alkalinity, Seawater	HI755	1.4
Alkalinity, Fresh Water	HI775	1.4
Ammonia, Low Range	HI700	1.5
Ammonia, Medium Range	HI715	1.5
Ammonia, High Range	HI733	1.5
Bromine	HI716	1.6
Calcium, Marine	HI758	1.7
Chlorine, Free	HI701	1.9
Chlorine, Total	HI711	1.10
Chlorine, Total Ultra Low Range	HI761	1.10
Chlorine, Total Ultra High Range	HI771	1.10
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Chromium VI, High Range	HI723	1.11
Color of Water	HI727	1.12
Fluoride, Low Range	HI729	1.14
Fluoride, High Range	HI739	1.14
Iodine	HI718	1.16
Iron	HI721	1.17
Nickel, High Range	HI726	1.19
Nitrite, Marine Ultra Low Range	HI764	1.20
Nitrite, Low Range	HI707	1.20
Nitrite, High Range	HI708	1.20
Phosphate, Low Range	HI713	1.21
Phosphate, High Range	HI717	1.21
Phosphorus, High Range	HI706	1.22
Phosphorus, Ultra Low Range	HI736	1.22
Silica, Low Range	HI705	1.23
Silica, High Range	HI770	1.23

HI755 • HI775

Seawater and Fresh Water Alkalinity

1.4

Handheld Colorimeters

The HI755 and HI775 Checker®HC's are a simple, accurate, and cost effective ways to measure alkalinity in seawater and fresh water. Designed as a more accurate alternative to chemical test kits, these handheld colorimeters provide quick, accurate alkalinity results in four easy steps.

HI701

Free Chlorine

1.9

Handheld Colorimeter

The HI701 Checker®HC bridges the gap between simple chemical test kits and professional instrumentation. Chemical test kits are not very accurate and only give 5 to 10 points resolution while professional instrumentation can cost hundreds of dollars and can be time consuming to calibrate and maintain. The Hanna HI701 Checker®HC is accurate and affordable.

This Checker®HC portable handheld colorimeter features a resolution of 0.01 ppm and ±0.03 ppm ±3% of reading accuracy. It also uses an EPA approved DPD method.

HI727

Color of Water

1.12

Handheld Colorimeter

True color is caused by dissolved compounds in water and can be natural or artificial. Dissolved and suspended solids together cause apparent color. Color is measured in Platinum-Cobalt units (PCU). The AWWA recommends ≤ 15 PCU.

The HI727 Checker®HC is very simple to use. First, zero the instrument with deionized water. Next, prepare the sample according to the Apparent/True color measurement. Place the second vial with prepared sample into the Checker®HC, press the operational button and the HI727 Checker®HC displays the color of water in PCU.

HI755 • HI775

Seawater and Fresh Water Alkalinity

Handheld Colorimeters

- Easier to use and more accurate than chemical test kits
- Dedicated to a single parameter
- Small size, big convenience
- Ideal for
  - Saltwater aquariums (HI755)
  - Fresh water aquariums (HI775)

Alkalinity is one of the most important parameters to measure in aquariums. It helps to maintain a stable pH, an important factor for most aquatic life. In seawater, bicarbonate is the largest contributor to alkalinity and is a critical element needed for healthy corals. Corals need bicarbonate and carbonate available to form their skeletons. Without an adequate level, healthy coral growth is not possible. Since bicarbonate levels can be difficult to determine, total alkalinity is measured instead. The alkalinity of natural seawater is typically 125 ppm $CaCO_3$ (equivalent to 7 degrees of carbonate hardness, or dKH). In saltwater aquariums, typical alkalinity values can range from 125 to 200 ppm $CaCO_3$ (7 to 11.2 dKH).

The HI755 and HI775 Checker®HC's are a simple, accurate, and cost effective ways to measure alkalinity in seawater and fresh water. Designed as a more accurate alternative to chemical test kits, these handheld colorimeters provide quick, accurate alkalinity testing results in four easy steps.

Step One - Add a sample to the included cuvette(s).

Step Two - Insert sample into the Checker®HC and press the button to zero.

Step Three - Remove sample and add reagent as stated in the manual.

Step Four – Reinsert sample and press the button to measure your results.

The contoured style of these Checker®HCs fit easily in the palm of your hand or pocket and the large LCD is easy to read. The auto shut-off feature assures the battery life will not be drained if you forget to turn it off.

Specifications	HI755 (Seawater)	HI775 (Fresh water)
Range	0 to 300 ppm $CaCO_3$	0 to 500 ppm $CaCO_3$
Resolution	1 ppm	1 ppm
Accuracy @ 25°C/77°F	±5 ppm ±5% of reading	
Light Source	LED @ 610 nm	
Light Detector	silicon photocell	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Battery Type	(1) 1.5V AAA	
Auto-off	after ten minutes of non-use	
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")	
Weight	64 g (2.25 oz.)	
Method	colorimetric method. The reaction causes a distinctive range of colors from yellow to green to blue to develop	
Ordering Information	**HI755** Checker®HC is supplied with sample cuvettes with caps (2), seawater alkalinity reagent starter kit (reagents for 25 tests), syringe with tip, battery, instructions and quick start guide. **HI775** Checker®HC is supplied with sample cuvettes with caps (2), alkalinity reagent starter kit (reagents for 25 tests), syringe with tip, battery, instructions and quick start guide.	

See a list of Checker® reagents and accessories on page 1.24

HI700 • HI715 • HI733

Ammonia Low, Medium and High Range

Handheld Colorimeters

- Easier to use and more accurate than chemical test kits
- Dedicated to a single parameter
- Small size, big convenience
- Ideal for
  - Water quality
  - Aquariums
  - Environmental

The HI700, HI715, and HI733 Checker®HC's are simple, accurate, and cost effective ways to measure ranges of ammonia in fresh water. The all new HI700 Checker®HC Ammonia LR for fresh water can be used to replace the usage of of HI3824 or HI38049 fresh water test kits.

Designed as a more accurate alternative to chemical test kits, the HI700, HI715, and the HI733* provides quick, accurate results.

Step One - Add a sample to the included cuvette(s).

Step Two - Insert sample into the Checker and press the button to zero.

Step Three - Remove sample and add reagents as the manual states.

Step Four – Reinsert sample, press and hold the button for 3 seconds to start reaction timer. reading will be taken automatically and the results displayed.

* HI733 uses a different procedure

All three models use an adaptation of the ASTM Manual of Water and Environmental Technology, D1426-92, Nessler method. The reaction between ammonia and reagents causes a yellow tint in the sample.

Specifications	HI700 (LR)	HI715 (MR)	HI733 (HR)
Range	0.00 to 3.00 ppm NH_3-N	0.00 to 9.99 ppm NH_3-N	0.0 to 99.9 ppm as NH_4^+
Resolution	0.01 ppm	0.01 ppm	0.1 ppm
Accuracy @ 25°C/77°F	±0.05 ppm ±5% of reading	±0.05 ppm ±5% of reading	±1.0 ppm ±5% of reading
Light Source	LED @ 470 nm		
Light Detector	silicon photocell		
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing		
Battery Type	(1) 1.5V AAA		
Auto-off	after ten minutes of non-use		
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")		
Weight	64 g (2.25 oz.)		
Method	adaptation of the ASTM Manual of Water and Environmental Technology D1426-92, Nessler Method. The reaction between ammonia and reagents causes a yellow tint in the sample		
Ordering Information	**HI700** Checker®HC is supplied with sample cuvettes with caps (2), ammonia LR reagent starter kit (reagents for 25 tests), battery, instructions and quick start guide. **HI715** Checker®HC is supplied with sample cuvettes with caps (2), ammonia MR reagent starter kit (reagents for 25 tests), battery, instructions and quick start guide. **HI733** Checker®HC is supplied with sample cuvettes with caps (2), ammonia HR reagent starter kit (reagents for 12 tests), syringe with tip, plastic pipette, battery, instructions and quick start guide.		

See a list of Checker® reagents and accessories on page 1.24

HI716

Bromine

Handheld Colorimeter

- Easier to use and more accurate than chemical test kits
  - DPD method
  - Accuracy ±0.1 ppm ±5% of reading
  - 0.1 ppm resolution
  - Large, easy-to-read digits
  - Auto shut-off
- Dedicated to a single parameter
  - Designed to work with Hanna's powder reagents
  - Uses 10 mL glass cuvettes
- Small size, big convenience
  - Weighing a mere 64 g (2.25 oz.), the Checker®HC easily fits into the palm of your hand or pocket
  - Built- in reaction timer
  - Operated by a single AAA battery
- Ideal for
  - Water quality
  - Education
  - Swimming pools/hot tub sanitization
  - Environmental

The HI716 Checker®HC is a simple, accurate, and cost effective way to measure Bromine. Designed as a more accurate alternative to chemical test kits, the HI716 provides quick, accurate results in four easy steps.

Step One - Add a sample to the included cuvette(s).

Step Two - Insert sample into the Checker®HC and press button to zero.

Step Three - Remove sample and add reagent packet.

Step Four – Reinsert sample, press and hold the button for 3 seconds to start reaction timer. reading will be taken automatically and the results displayed.

The HI716 uses an adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, DPD method. The reaction between bromine and the reagent causes a pink tint in the sample.

Specifications	HI716
Range	0.0 to 8.0 ppm
Resolution	0.1 ppm
Accuracy @ 25°C/77°F	±0.1 ppm ±5% of reading
Light Source	LED @ 525 nm
Light Detector	silicon photocell
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Battery Type	(1) 1.5V AAA
Auto-off	after ten minutes of non-use
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")
Weight	64 g (2.25 oz.)
Method	adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, DPD method. The reaction between bromine and the reagent causes a pink tint in the sample
Ordering Information	**HI716** Checker®HC is supplied with sample cuvettes with caps (2), bromine reagent starter kit (reagents for 6 tests), battery, instructions and quick start guide.

See a list of Checker® reagents and accessories on page 1.24

HI758

Marine Calcium

Handheld Colorimeter

- Easier to use and more accurate than chemical test kits
  - Zincon method adaptation
  - ±6 % of reading
  - 1 ppm resolution
  - Large, easy-to-read digits
  - Auto shut-off
- Dedicated to a single parameter
  - Uses 10 mL glass cuvettes
- Small size, big convenience
  - Weighing a mere 64 g (2.25 oz.), the Checker®HC easily fits into the palm of your hand or pocket
  - Use for quick and accurate on-the-spot analysis
  - Single-button operation: zero and measure
  - Operated by a single AAA battery
- Ideal for
  - Aquaculture
  - Aquariums

Calcium presence in water supplies results from passage over deposits of limestone, dolomite, gypsum and gypsiferous shale. The concentration may extend from 0 to several hundred milligrams per liter, depending on its source and treatment. Calcium is necessary in plant and animal nutrition since it is an essential constituent of bones, shells and plant structures. Calcium in water as carbonate is one of the primary components of water hardness which can cause pipe or tube scaling.

The HI758 Calcium Checker®HC is extremely simple to use. First, zero with Reagent A and deionized water. Next, remove the vial and add sample and Reagent B and shake to dissolve. Reinsert into the Checker®HC and press the button to read the calcium concentration in ppm on the display.

Weighing a mere 64 g (2.25 oz.), the Checker®HC easily fits into your hand or pocket.

Specifications	HI758
Range	200 to 600 ppm
Resolution	1 ppm
Accuracy @ 25°C/77°F	±6% of reading
Light Source	LED @ 610 nm
Light Detector	silicon photocell
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Battery Type	(1) 1.5V AAA
Auto-off	after ten minutes of non-use
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")
Weight	64 g (2.25 oz.)
Method	adaptation of the Zincon method
Ordering Information	**HI758** Checker®HC is supplied with sample cuvettes with caps (2), marine calcium reagent starter kit (reagents for 25 tests), syringes with tips (25), plastic pipette, battery, instructions and quick start guide.

See a list of Checker® reagents and accessories on page 1.24

HI753

Chloride

Handheld Colorimeter

- Easier to use and more accurate than chemical test kits
- Dedicated to a single parameter
- Small size, big convenience
- Ideal for:
  - Drinking water
  - Waste water
  - Boiler and cooling towers

The HI753 Checker®HC is a simple, accurate, and cost effective way to measure chloride. Designed as a more accurate alternative to chemical test kits, the HI753 provides quick, accurate results in three easy steps.

Step One - Prepare samples according to the manual.

Step Two - Insert zero cuvette into the Checker®HC, press and hold the button for 3 seconds to start reaction timer. Meter will zero automatically.

Step Three - Remove zero cuvette and insert sample. Press the button to measure your results.

The HI753 uses an adaptation of the mercury(II) thiocyanate method.

Specifications	HI753
Range	0.0 to 20.0 ppm
Resolution	0.1 ppm
Accuracy @ 25°C/77°F	± 0.5 ppm ± 6% of reading
Light Source	LED @ 470 nm
Light Detector	silicon photocell
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Battery Type	(1) 1.5V AAA
Auto-off	after ten minutes of non-use
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")
Weight	64 g (2.25 oz.)
Method	adaptation of the mercury(II) thiocyanate method
Ordering Information	**HI753** Checker®HC is supplied with sample cuvettes with caps (2), chloride reagent starter kit (reagents for 25 tests), syringes with tips (2), battery, instructions and quick start guide.

See a list of Checker® reagents and accessories on page 1.24

HI701

Free Chlorine

Handheld Colorimeter

- Easier to use and more accurate than chemical test kits
  - EPA approved DPD method
  - ±0.03 ppm ±3% of reading accuracy
  - 0.01 ppm resolution
  - Large, easy-to-read digits
  - Auto shut off
- Dedicated to a single parameter
  - Designed to work with Hanna's powder reagents
- Small size, big convenience
  - The Checker®HC easily fits into the palm of your hand or pocket
  - Use for quick and accurate on-the-spot analysis
  - Single-button operation: zero and measure
- Ideal for:
  - Swimming pools and spas
  - Fruit and vegetable sanitation
  - Disinfection
  - Drinking water and quality control checks

The HI701 Checker®HC bridges the gap between simple chemical test kits and professional instrumentation. Chemical test kits are not very accurate and only give 5 to 10 points resolution, while professional instrumentation can cost hundreds of dollars and can be time consuming to calibrate and maintain. The Hanna HI701 Checker®HC is accurate and affordable.

This Checker®HC portable handheld colorimeter features a resolution of 0.01 ppm and ±0.03 ppm ±3% of reading accuracy. It also uses an EPA approved DPD method.

The contoured style of the Checker®HC fits in your palm and pocket perfectly and the large LCD is easy to read. The auto shut-off feature assures the battery life will not be drained if you forget to turn it off.

The HI701 Checker®HC is extremely simple to use. First, zero the instrument with your water sample. Next, add the reagent. Last, place the vial into the Checker®HC, press the button and read the results. It's that easy.

Specifications	HI701
Range	0.00 to 2.50 ppm
Resolution	0.01 ppm
Accuracy @ 25°C/77°F	±0.03 ppm ±3% of reading
Light Source	LED @ 525 nm
Light Detector	silicon photocell
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Battery Type	(1) 1.5V AAA
Auto-off	after two minutes of non-use
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")
Weight	64 g (2.25 oz.)
Method	adaptation of USEPA method 330.5, DPD method
Ordering Information	**HI701** Checker®HC is supplied with sample cuvettes with caps (2), free chlorine reagent starter kit (reagents for 6 tests), battery, instructions and quick start guide.

See a list of Checker® reagents and accessories on page 1.24

HI711 • HI761 •HI771

Total, Total Ultra Low Range and Ultra High Range Chlorine

Handheld Colorimeters

- Easier to use and more accurate than chemical test kits
- Dedicated to a single parameter
- Small size, big convenience
- Ideal for:
  - Swimming pools and spas
  - Fruit and vegetable sanitation/ disinfection
  - Drinking water
  - Quality control checks
  - Environmental
  - Hospitality
  - Food processing

Chlorine is the most common water disinfectant. The monitoring of chlorine is crucial in applications such as swimming pools and spas, fruit and vegetable sanitation, disinfection and drinking water. By monitoring this crucial parameter, serious health and safety risks can be avoided.

The HI711, HI761, and HI771 Checker®HC Handheld Colorimeters bridge the gap between simple chemical test kits and professional instrumentation. Chemical test kits are not very accurate and only give 5 to 10 points resolution, while professional instrumentation can cost hundreds of dollars and can be time consuming to calibrate and maintain. Hanna's Checker®HC's are an accurate and affordable alternative.

The contoured style of these Checkers fit easily in the palm of your hand or pocket and the large LCD is easy to read. The auto shut-off feature assures the battery life will not be drained if you forget to turn it off.

These Checkers®HC's are designed to be portable and easy to use, providing quick, accurate results in four easy steps.

Specifications	HI711 (Total)	HI761 (Total ULR)	HI771 (UHR)
Range	0.00 to 3.50 ppm	0 to 500 ppb	0 to 500 ppm
Resolution	0.01 ppm	1 ppb	1 ppm
Accuracy @ 25°C/77°F	±0.03 ppm ±3% of reading	±5 ppb ±5% of reading	±3 ppm ±5% of reading
Light Source	LED @ 525 nm		
Light Detector	silicon photocell		
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing		
Battery Type	(1) 1.5V AAA		
Auto-off	after two minutes of non-use	after ten minutes of non-use	
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")		
Weight	64 g (2.25 oz.)		
Method	adaptation of USEPA method 330.5, DPD method		adaptation of the Standard Methods for Water and Wastewater, 20th Edition 4500-Cl
Ordering Information	**HI711** Checker®HC is supplied with sample cuvettes with caps (2), total chlorine reagent starter kit (reagents for 6 tests), battery, instructions and quick start guide. **HI761** Checker®HC is supplied with sample cuvettes with caps (2), total chlorine ULR reagent starter kit (reagents for 6 tests), battery, instructions and quick start guide. **HI771** Checker®HC is supplied with sample cuvettes with caps (2), Chlorine UHR reagent starter kit (reagents for 6 tests), battery, instructions and quick start guide.		

See a list of Checker® reagents and accessories on page 1.24

HI723 • HI749

Chromium VI Low Range and High Range

Handheld Colorimeters

- Easier to use and more accurate than chemical test kits
- Dedicated to a single parameter
- Small size, big convenience
- Ideal for
  - Water quality
  - Environmental
  - Plating
  - Education

There are two natural forms of ionic chromium: the hexavalent Cr(VI) and the trivalent Cr(III). Cr(III) is much less toxic than Cr(VI) and seldom found in potable waters. Cr(VI), however, is toxic to humans and is found in water. Even though the toxic effects from Cr(VI) in drinking water are not well documented, it is a suspected carcinogen.

There are many industries that use chromic acid and other forms of Cr(VI) that could be a possible source of Cr(VI) pollution in either water, air, or both. One industry that can introduce Cr(VI) to water sources is the chrome-plating industry. Chromic acid is used in the electroplating process and can be present in industrial waste waters. Cr(VI) also can enter water supplies from industrial cooling towers where chromic acid is added to the water to inhibit metal corrosion.

The maximum permissible level of Cr(VI) allowed to be released into the waterways is 50 ppb. Its level in drinking water is normally much lower, and a level higher than 3 ppb is suggestive of industrial pollution.

The HI723 and HI749 Checker®HC Handheld Colorimeters are a simple, accurate, and cost effective way to measure Cr(VI).
Each model is designed for a specific range (low or high) in order to provide high levels of accuracy.

The contoured style of these Checker®HC's fit easily in the palm of your hand or pocket and the large LCD is easy to read. The auto shut-off feature assures the battery life will not be drained if you forget to turn it off.

Specifications	HI749 (LR)	HI723 (HR)
Range	0 to 300 ppb	0 to 999 ppb
Resolution	1 ppb	1 ppb
Accuracy @ 25°C/77°F	±2 ppb ±4% of reading	±5 ppb ±4% of reading
Light Source	LED @ 525 nm	
Light Detector	silicon photocell	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Battery Type	(1) 1.5V AAA	
Auto-off	after ten minutes of non-use	
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")	
Weight	64 g (2.25 oz.)	
Method	adaptaion of the ATSM, Manual of Water and Enviornmental Technology, D 1687-92, Diphenylcarbohydrazide method	
Ordering Information	**HI749** Checker®HC is supplied with sample cuvettes with caps (2), chromium LR reagent starter kit (reagents for 6 tests), battery, instructions and quick start guide. **HI723** Checker®HC is supplied with sample cuvettes with caps (2), chromium HR reagent starter kit (reagents for 6 tests), battery, instructions and quick start guide.	

See a list of Checker® reagents and accessories on page 1.24

HI727

Color of Water

Handheld Colorimeter

- Easier to use and more accurate than chemical test kits
- Dedicated to a single parameter
- Small size, big convenience
- Ideal for water quality

True color is caused by dissolved compounds in water and can be both natural or artificial. Apparent color is caused by both dissolved and suspended solids. Color is measured in Platinum-Cobalt units (PCU). The AWWA recommends ≤ 15 PCU.

The term "true color" is defined as the color of water from which turbidity has been removed. The term "apparent color" includes not only color due to substances in solution, but also color that is due to suspended matter. Apparent color is determined on the original sample without filtration or centrifugation. In some highly-colored industrial wastewaters, color is contributed principally by colloidal or suspended material. In such cases, both true color and apparent color should be determined.

To determine true color, turbidity must be removed before analysis. Methods for removing turbidity without removing color vary. Filtration yields results that are reproducible from day to day among laboratories, however, some filtration procedures may also remove some true color. Centrifugation avoids interaction of color with filter materials, but results vary with the sample nature, size, and speed of the centrifuge. When sample dilution is necessary, whether it precedes or follows turbidity removal, it can alter the measured color. Acceptable pretreatment procedures are included with each method. The pretreatment method should be stated when reporting the results.

The HI727 Checker®HC is very simple to use. First, zero the instrument with deionized water. Next, prepare the sample according to the Apparent/True color measurement. Place the second vial with prepared sample into the Checker®HC, press the operational button and the HI727 Checker® displays the color of water in PCU.

Specifications	HI727
Range	0 to 500 PCU
Resolution	5 PCU
Accuracy @ 25°C/77°F	±10 PCU ±5% of reading
Light Source	LED @ 470 nm
Light Detector	silicon photocell
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Battery Type	(1) 1.5V AAA
Auto-off	after ten minutes of non-use
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")
Weight	64 g (2.25 oz.)
Method	adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, Colorimetric Platinum Cobalt method
Ordering Information	**HI727** Checker®HC is supplied with sample cuvettes with caps (2), battery, instructions and quick start guide.

See a list of Checker® reagents and accessories on page 1.24

HI702 • HI747

Copper Low Range and High Range

Handheld Colorimeters

- Easier to use and more accurate than chemical test kits
- Dedicated to a single parameter
- Small size, big convenience
- Ideal for:
  - Water Quality
  - Education
  - Aquarium
  - Wastewater
  - Environmental

The HI702 and HI747 Checker®HC are simple, accurate, and cost effective way to measure high and low ranges of copper. Designed as a more accurate alternative to chemical test kits, the HI702 and HI747 provide quick, accurate results in four easy steps.

Step One - Add a sample to the included cuvette(s).

Step Two - Insert sample into the Checker®HC and press button to zero.

Step Three - Remove sample and add reagent packet.

Step Four - Reinsert sample, press and hold the button for 3 seconds to start reaction timer. Reading will be taken automatically and the results displayed.

The HI702 and HI747 uses an adaptation of the EPA method. The reaction between copper and the bicinchoninate reagent causes a purple tint in the sample.

Specifications	HI747 (LR)	HI702 (HR)
Range	0 to 999 ppb	0.00 to 5.00 ppm
Resolution	1 ppb	0.01 ppm
Accuracy @ 25°C/77°F	± 10 ppb ± 5% of reading	± 0.05 ppm ±5% of reading
Light Source	LED @ 575 nm	
Light Detector	silicon photocell	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Battery Type	(1) 1.5V AAA	
Auto-off	after ten minutes of non-use	
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")	
Weight	64 g (2.25 oz.)	
Method	adaptation of the EPA method. The reaction between copper and the bicinchoninate reagent causes a purple tint in the sample	
Ordering Information	**HI747** Checker®HC is supplied with sample cuvettes with caps (2), copper LR reagent starter kit (reagents for 6 tests), battery, instructions and quick start guide. **HI702** Checker®HC is supplied with sample cuvettes with caps (2), copper HR reagent starter kit (reagents for 6 tests), battery, instructions and quick start guide.	

See a list of Checker® reagents and accessories on page 1.24

HI729 • HI739

Fluoride Low Range and High Range

Handheld Colorimeters

- Easier to use and more accurate than chemical test kits
- Dedicated to a single parameter
- Small size, big convenience
- Ideal for water quality

Fluoride is one of the very few chemicals that have been shown to cause significant effects in people through drinking water. Fluoride has beneficial effects on teeth at low concentrations in drinking water, but excessive exposure to fluoride in drinking water, or in combination with exposure to fluoride from other sources, can give rise to a number of adverse effects.

A 1994 World Health Organization expert committee suggested a level of fluoride from 0.5 to 1.0 ppm, depending on climate. Bottled water typically has unknown fluoride levels, and some domestic water filters remove some or all fluoride.

Specifications	HI729 (LR)	HI739 (HR)
Range	0.00 to 2.00 ppm	0.0 to 20.0 ppm
Resolution	0.01 ppm	0.1 ppm
Accuracy* @ 25°C/77°F	±0.10 ppm ±5% of reading	±0.5 ppm ± 5% of reading
Light Source	LED @ 575 nm	
Light Detector	silicon photocell	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Battery Type	(1) 1.5V AAA	
Auto-off	after ten minutes of non-use	
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")	
Weight	64 g (2.25 oz.)	
Method	adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, SPADNS method	
Ordering Information	**HI729** Checker®HC is supplied with sample cuvettes with caps (2), fluoride LR reagent starter kit (reagents for 5 tests), syringe with tip, battery, instructions and quick start guide. **HI739** Checker®HC is supplied with sample cuvettes with caps (2), fluoride HR reagent starter kit (reagents for 12 tests), syringe with tip, plastic pipette, battery, instructions and quick start guide.	

* Excluding sample volume error

See a list of Checker® reagents and accessories on page 1.24

HI719 • HI720

Magnesium and Calcium Hardness

Handheld Colorimeters

- Easier to use and more accurate than chemical test kits
- Dedicated to a single parameter
- Small size, big convenience
- Ideal for:
  - Water purification systems
  - Heating and cooling systems
  - Drinking water
  - Wastewater

The HI719 Checker®HC is a simple, accurate, and cost effective way to measure magnesium hardness. The HI720 Checker®HC is a simple, accurate, and cost effective way to measure calcium hardness.

The HI719 uses an adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, EDTA colorimetric method. The reaction between magnesium and reagents causes a reddish-violet tint in the sample.

The HI720 uses an adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, Calmagite method. The reaction between calcium and reagents causes a reddish-violet tint in the sample.

Specifications	HI719 (Magnesium Hardness)	HI720 (Calcium Hardness)
Range	0.00 to 2.00 ppm	0.00 to 2.70 ppm
Resolution	0.01 ppm	0.01 ppm
Accuracy @ 25°C/77°F	± 0.20 ppm ± 5% of reading	± 0.20 ppm ± 5% of reading
Light Source	LED @ 525 nm	
Light Detector	Silicon photocell	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Battery Type	(1) 1.5V AAA	
Auto-off	after ten minutes of non-use	
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")	
Weight	64 g (2.25 oz.)	
Method	adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, EDTA colorimetric method. The reaction between magnesium and reagents causes a reddish-violet tint in the sample	adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, Calmagite method. The reaction between calcium and reagents causes a reddish-violet tint in the sample
Ordering Information	**HI719** Checker®HC is supplied with sample cuvettes with caps (2), magnesium hardness reagent starter kit (reagents for 25 tests), syringes with tips (2), plastic beaker, battery, instructions and quick start guide. **HI720** Checker®HC is supplied with sample cuvettes with caps (2), calcium hardness reagent starter kit (reagents for 25 tests), syringes with tips (2), plastic beaker, battery, instructions and quick start guide.	

See a list of Checker® reagents and accessories on page 1.24

HI718

Iodine

Handheld Colorimeter

- Easier to use and more accurate than chemical test kits
  - DPD method
  - ±0.1 ppm ±5% of reading accuracy
  - Large, easy-to-read digits
  - Auto shut-off
- Dedicated to a single parameter
  - Designed to work with Hanna's powder reagents
- Small size, big convenience
  - Weighing a mere 64 g (2.25 oz.), the Checker®HC easily fits into the palm of your hand or pocket
  - Use for quick and accurate on-the-spot analysis
  - Single-button operation: zero and measure
- Ideal for:
  - Swimming pools and spas
  - Industrial processes and disinfection

Iodine is sometimes used as a disinfectant for swimming pools, spas and potable water. It has also found use as a disinfectant in the poultry industry. The rapid determination of iodine is required for adequate control of this bactericide.

The Hanna Checker®HC bridges the gap between simple chemical test kits and professional instrumentation. Chemical test kits are not very accurate and only give 5 to 10 points resolution, while professional instrumentation can cost hundreds of dollars and can be time-consuming to calibrate and maintain. The HI718 Checker®HC is accurate and affordable.

The HI718 Checker®HC portable handheld colorimeter features a resolution of 0.1 ppm and accuracy of ±0.1 ppm ±5% of reading. This Checker®HC uses a modification of the DPD method used for residual chlorine.

The contoured style of this Checker®HC fits in your palm and pocket perfectly and the large LCD is easy to read. The auto shut-off feature assures the battery life will not be drained if you forget to turn it off.

Specifications	HI718
Range	0.0 to 12.5 ppm
Resolution	0.1 ppm
Accuracy @ 25°C/77°F	±0.1 ppm ±5% of reading
Light Source	LED @ 525 nm
Light Detector	silicon photocell
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Battery Type	(1) 1.5V AAA
Auto-off	after ten minutes of non-use
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")
Weight	64 g (2.25 oz.)
Method	adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, DPD method
Ordering Information	**HI718** Checker®HC is supplied with sample cuvettes with caps (2), iodine reagent starter kit (reagents for 6 tests), battery, instructions and quick start guide.

See a list of Checker® reagents and accessories on page 1.24

HI721

Iron

Handheld Colorimeter

- Easier to use and more accurate than chemical test kits
- Dedicated to a single parameter
- Small size, big convenience
- Ideal for:
  - Industrial ground and treated waters
  - Mining leachate monitoring
  - Agricultural irrigation water

About 6.3% of the earth's crust is made of iron, of which 43% is in soils. The analysis of iron is often performed to monitor ground water and irrigation waters as a gauge of corrosion from industrial settling, and as an indication of the effectiveness of treatment from mining leachate.

The Hanna HI721 Checker®HC bridges the gap between simple chemical test kits and professional instrumentation. Chemical test kits are not very accurate and only give 5 to 10 points resolution, while professional instrumentation can cost hundreds of dollars and can be time-consuming to calibrate and maintain. The HI721 Checker®HC is accurate, affordable and produces immediate results.

The new HI721 Checker®HC portable handheld colorimeter features a resolution of 0.01 ppm and ±0.04 ppm ±2% of reading accuracy. The HI721 Checker®HC uses an adaptation of EPA phenanthroline Method 315B.

The contoured style of this Checker®HC fits in your palm and pocket perfectly and the large LCD is easy to read. The auto shut-off feature assures the battery life will not be drained if you forget to turn it off.

Specifications	HI721
Range	0.00 to 5.00 ppm
Resolution	0.01 ppm
Accuracy @ 25°C/77°F	±0.04 ppm ±2% of reading
Light Source	LED @ 525 nm
Light Detector	silicon photocell
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Battery Type	(1) 1.5V AAA
Auto-off	after two minutes of non-use
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")
Weight	64 g (2.25 oz.)
Method	adaptation of the EPA Phenantroline method 315B, for natural and treated waters
Ordering Information	**HI721** Checker®HC is supplied with sample cuvettes with caps (2), iron HR reagent starter kit (reagents for 6 tests), battery, instructions and quick start guide.

See a list of Checker® reagents and accessories on page 1.24

HI709

Manganese High Range

Handheld Colorimeter

- Easier to use and more accurate than chemical test kits
- Dedicated to a single parameter
- Small size, big convenience
- Ideal for:
  - Water Quality
  - Education
  - Aquarium
  - Wastewater
  - Environmental

The HI709 Checker®HC is a simple, accurate, and cost effective way to measure high ranges of manganese. Designed as a more accurate alternative to chemical test kits, the HI709 provides quick, accurate results in four easy steps.

Step One - Add a sample to the included cuvette(s).

Step Two - Insert sample into the Checker®HC and press the button to zero.

Step Three - Remove sample and add reagent.

Step Four – Reinsert sample, press and hold the button for 3 seconds to start reaction timer. Reading will be taken automatically and the results displayed.

The HI 709 uses an adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, Periodate method. The reaction between manganese and reagents causes a pink tint in the sample.

Specifications	HI709 Manganese (HR)
Range	0.0 to 20.0 ppm
Resolution	0.1 ppm
Accuracy @ 25°C/77°F	± 0.2 ppm ± 5% of reading
Light Source	LED @ 525 nm
Light Detector	silicon photocell
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Battery Type	(1) 1.5V AAA
Auto-off	after ten minutes of non-use
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")
Weight	64 g (2.25 oz.)
Method	adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, Periodate method. The reaction between manganese and reagents causes a pink tint in the sample
Ordering Information	**HI709** Checker®HC is supplied with sample cuvettes with caps (2), manganese HR reagent starter kit (reagents for 6 tests), battery, instructions and quick start guide.

See a list of Checker® reagents and accessories on page 1.24

HI726

Nickel High Range

Handheld Colorimeter

- Easier to use and more accurate than chemical test kits
- Dedicated to a single parameter
- Small size, big convenience
- Ideal for:
  - Steel manufacturing
  - Electroplating and
  - Electronics production

Nickel is extensively used in electroplating, the manufacturing of steel, electronic devices, ceramics and colored glasses. It plays a vital role in many processes of applied sciences and fundamental sciences.

Nickel is seldom found in natural waters, but is often present in industrial wastewater as a direct by-product of metal plating baths, and as a corrosion by-product of stainless steel, nickel or cobalt alloys.

The most serious effects of nickel exposure include lung cancer and nasal sinus in people who have breathed nickel dust while working in nickel refineries or in nickel processing plants. Other lung effects including chronic bronchitis and reduced lung function have been observed in workers breathing nickel. The levels of nickel in the workplace were much higher than background levels. The International Agency for Research on Cancer (IARC) has determined that some nickel compounds are carcinogenic to humans and that metallic nickel may possibly be carcinogenic to humans. The EPA has determined that nickel refinery dust and nickel subsulfide are human carcinogens.

The HI726 Checker®HC is extremely simple to use. First, zero the instrument with your water sample. Next, add the reagent, shake gently until complete dissolution. Last, place the vial into the Checker®HC, press the button for 3 seconds. The display will show the countdown prior to the measurement. When the timer ends the meter will perform the reading and display concentration in g/L of nickel. It's that easy.

Specifications	HI726 (HR)
Range	0.00 to 7.00 g/L
Resolution	0.01 g/L
Accuracy @ 25°C/77°F	±0.10 g/L ±5% of reading
Light Source	LED @ 575 nm
Light Detector	silicon photocell
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Battery Type	(1) 1.5V AAA
Auto-off	after ten minutes of non-use
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")
Weight	64 g (2.25 oz.)
Method	adaptation of the photometric method
Ordering Information	**HI726** Checker®HC is supplied with sample cuvettes with caps (2), nickel HR reagent starter kit (reagents for 6 tests), battery, instructions and quick start guide.

See a list of Checker® reagents and accessories on page 1.24

HI764 • HI707 • HI708

Nitrite Low Range, High Range and Marine Nitrite Ultra Low Range

Handheld Colorimeters

- Easier to use and more accurate than chemical test kits
- Dedicated to a single parameter
- Small size, big convenience
- Ideal for:
  - Aquaculture
  - Aquariums
  - Education
  - Environmental
  - Water quality
  - Wastewater

Nitrification is the biological oxidation of ammonia (ammonium ion) into nitrite, followed by the oxidation of nitrite to nitrate. The first step of this two-step process is carried out in an aquarium by nitrifying bacteria. During this quick process, the ammonium levels drop while the nitrite levels increase. Since nitrite is just as harmful as ammonia, nitrite levels should be maintained at immeasurable levels. A mature biological filter should be able to keep nitrite levels low.

The HI707, HI708 and HI764 Checker®HC Handheld Colorimeters bridge the gap between simple chemical test kits and professional instrumentation. Chemical test kits are not very accurate, while professional instrumentation can cost hundreds of dollars and can be time-consuming to calibrate and maintain. Hanna Checker®HC's are accurate, affordable and easy to use.

To begin measurements, first zero the instrument with your water sample. Next, add the reagent. Last, place the vial into the Checker®HC, press and hold the button for 3 seconds to start reaction timer. reading will be taken automatically and the results displayed. It's that easy.

The contoured style of the Checker®HC fits in your palm and pocket perfectly and the large LCD is easy to read. The auto shut-off feature assures the battery life will not be drained if you forget to turn it off.

Specifications	HI764 (Marine ULR)	HI707 (LR)	HI708 (HR)
Range	0 to 200 ppb NO_2^-–N	0 to 600 ppb NO_2^-	0 to 150 ppm NO_2^-
Resolution	1 ppb	1 ppb	1 ppm
Accuracy @ 25°C/77°F	±10 ppb ±4% of reading	±20 ppb ±5% of reading	±3 ppm ±5% of reading
Light Source	LED @ 525 nm	LED @ 470 nm	LED @ 575 nm
Light Detector	silicon photocell		
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing		
Battery Type	(1) 1.5V AAA		
Auto-off	after two minutes of non-use	after ten minutes of non-use	
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")		
Weight	64 g (2.25 oz.)		
Method	adaptation of the EPA Diazotization method 354.1		adaptation of the Ferrous Sulfate method
Ordering Information	**HI764** Checker®HC is supplied with sample cuvettes with caps (2), marine nitrite ULR reagent starter kit (reagents for 6 tests), battery, instructions and quick start guide. **HI707** Checker®HC is supplied with sample cuvettes with caps (2), nitrite LR reagent starter kit (reagents for 6 tests), battery, instructions and quick start guide. **HI708** Checker®HC is supplied with sample cuvettes with caps (2), nitrite HR reagent starter kit (reagents for 6 tests), battery, instructions and quick start guide.		

See a list of Checker® reagents and accessories on page 1.24

HI713 • HI717

Phosphate

Handheld Colorimeters

- Easier to use and more accurate than chemical test kits
- Dedicated to a single parameter
- Small size, big convenience
- Ideal for:
  - Aquaculture, natural, waste, agricultural and drinking waters

Orthophosphates are found in natural waters and wastewaters. They are commonly added to drinking water as a corrosion inhibitor. The instantaneous analysis of orthophosphates by colorimetric determination provides rapid results using a standard analysis technique.

The Hanna HI713 and HI717 Checker®HC bridges the gap between simple chemical test kits and professional instrumentation. Chemical test kits are not very accurate and only give only some points resolution, while professional instrumentation can cost hundreds of dollars and can be time-consuming to calibrate and maintain. The Hanna HI713 and HI717 Checker®HC's are accurate and affordable.

The HI713 Checker®HC portable handheld colorimeter features a resolution of 0.01 ppm and ±0.04 ppm ±4% of reading accuracy. The HI713 Checker®HC uses an adaptation of the Ascorbic Acid method.

The HI717 Checker®HC portable handheld colorimeter features a resolution of 0.1 ppm and ±1.0 ppm ±5% of reading accuracy. The HI717 Checker®HC uses an adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, Amino Acid method.

Specifications	HI713 (LR)	HI717 (HR)
Range	0.00 to 2.50 ppm	0.0 to 30.0 ppm
Resolution	0.01 ppm	0.1 ppm
Accuracy @ 25°C/77°F	±0.04 ppm ±4% of reading	±1.0 ppm ±5% of reading
Light Source	LED @ 525 nm	
Light Detector	silicon photocell	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Battery Type	(1) 1.5V AAA	
Auto-off	after two minutes of non-use	after ten minutes of non-use
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")	
Weight	64 g (2.25 oz.)	
Method	adaptation of the Ascorbic Acid method	adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, Amino Acid method
Ordering Information	**HI713** Checker®HC is supplied with sample cuvettes with caps (2), phosphate LR reagent starter kit (reagents for 6 tests), battery, instructions and quick start guide. **HI717** Checker®HC is supplied with sample cuvettes with caps (2), phosphate HR reagent starter kit (reagents for 20 tests), battery, instructions and quick start guide.	

See a list of Checker® reagents and accessories on page 1.24

HI736 • HI706

Phosphorus

Handheld Colorimeters

- Easier to use and more accurate than chemical test kits
- Dedicated to a single parameter
- Small size, big convenience
- Ideal for aquaculture

Plants, algae and phytoplankton require phosphorus for nourishment and utilize phosphorous as a component of cell tissue. When organic matter such as plant tissue, dead fish, algae, or uneaten food breaks down aerobically (with oxygen), phosphate is produced, This results in rapid oxygen depletion of aquarium water, which in turn suffocates aquatic life and compounds the problem.

Phosphorus concentration in water is monitored because it causes corrosion when present in levels too high.

Both the Hanna HI736 and HI706 Checker®HC's bridge the gap between simple chemical test kits and professional instrumentation. The Hanna HI736 (for marine applications) and HI706 (for fresh water applications) are both accurate and affordable.

The HI736 Checker®HC portable handheld colorimeter features a resolution of 1 ppb and ±5 ppb ±5% of reading accuracy and uses an adaptation of the Ascorbic Acid.

SPECIFICATIONS	HI736 (Marine ULR)	HI706 (HR)
Range	0 to 200 ppb	0.0 to 15.0 ppm
Resolution	1 ppb	0.1 ppm
Accuracy @ 25°C/77°F	±5 ppb ±5% of reading	±0.3 ppm ±5% of reading
Light Source	LED @ 525 nm	
Light Detector	silicon photocell	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Battery Type	(1) 1.5V AAA	
Auto-off	after two minutes of non-use	after ten minutes of non-use
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")	
Weight	64 g (2.25 oz.)	
Method	adaptation of the Ascorbic Acid method	adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, Amino Acid method
ORDERING INFORMATION	**HI736** Checker®HC is supplied with sample cuvettes with caps (2), marine phosphorus ULR reagent starter kit (reagents for 6 tests), battery, instructions and quick start guide. **HI706** Checker®HC is supplied with sample cuvettes with caps (2), phosphorus HR reagent starter kit (reagents for 20 tests), battery, instructions and quick start guide.	

See a list of Checker® reagents and accessories on page 1.24

HI770 • HI705

Silica High Range and Low Range

Handheld Colorimeter

- Easier to use and more accurate than chemical test kits
- Dedicated to a single parameter
- Small size, big convenience
- Ideal for:
  - Aquaculture, water quality
  - Environmental, water treatment

Silica is the name given to silicon dioxide, SiO_2. Silicon (Si), is the most abundant element in the Earth's crust, 28% of it by weight. Silicon is never found free form in nature. In crystallized form it is only reactive under conditions of extremely high temperatures. Water and water vapor have little influence upon silicon solubility, because a protective surface layer of silicon dioxide is rapidly formed. Silicon binds with other elements to form various species of silica and silicate. The concentration of the soluble silica molecules are important to aquaculture because they influence (and limit) the growth of diatoms.

In most waters, the predominant form of dissolved silica is monosilicic acid, which incorporates two water molecules.

The HI705 and HI770 Checker®HC Handheld Colorimeters are a simple, accurate, and cost effective way to measure silica. Each model is designed for a specific range (low or high) in order to provide high levels of accuracy.

The contoured style of these Checkers®HC fit easily in the palm of your hand or pocket and the large LCD is easy to read. The auto shut-off feature assures the battery life will not be drained if you forget to turn it off.

SPECIFICATIONS	HI770 (HR)	HI705 (LR)
Range	0 to 200 ppm	0 .00 to 2.00 ppm
Resolution	1 ppm	0.1 ppm
Accuracy @ 25°C/77°F	±2 ppm ±5% of reading	±0.03 ppm ±5% of reading
Light Source	LED @ 470 nm	LED @ 610 nm
Light Detector	silicon photocell	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Battery Type	(1) 1.5V AAA	
Auto-off	after ten minutes of non-use	
Dimensions	81.5 x 61 x 37.5 mm (3.2 x 2.4 x 1.5")	
Weight	64 g (2.25 oz.)	
Method	adaptation of the USEPA method 370.1 for drinking, surface and saline waters and Standard Method 4500-SiO_2 C for domestic and industrial waters	adaptation of the ASTM D859, heteropoly blue method
ORDERING INFORMATION	**HI770** Checker®HC is supplied with sample cuvettes with caps (2), silica HR reagent starter kit (reagents for 6 tests), battery, instructions and quick start guide. **HI705** Checker®HC is supplied with sample cuvettes with caps (2), silica LR reagent starter kit (reagents for 12 tests), battery, instructions and quick start guide.	

See a list of Checker® reagents and accessories on page 1.24

Checker® Reagents and Calibration Check Sets

Meter Code	Parameter	Chemical Method	Reagent Code	Calibration Checking Set	# of Tests
HI700	Ammonia LR	Nessler*	**HI700-25**	**HI700-11**	25
HI701	Chlorine, Free	DPD*	**HI701-25**	**HI701-11**	25
HI702	Copper HR	Bicinchoninate*	**HI702-25**	**HI702-11**	25
HI705	Silica LR	Heteropoly Blue*	**HI705-25**	**HI705-11**	25
HI706	Phosphorus HR	Amino Acid*	**HI706-25**	**HI706-11**	40
HI707	Nitrite LR	Diazotization*	**HI707-25**	**HI707-11**	25
HI708	Nitrite HR	Ferrous Sulfate*	**HI708-25**	**HI708-11**	25
HI709	Manganese HR	Periodate*	**HI709-25**	**HI709-11**	25
HI711	Chlorine, Total	DPD*	**HI711-25**	**HI711-11**	25
HI713	Phosphate LR	Ascorbic Acid*	**HI713-25**	**HI713-11**	25
HI715	Ammonia MR	Nessler*	**HI715-25**	**HI715-11**	25
HI716	Bromine	DPD*	**HI716-25**	**HI716-11**	25
HI717	Phosphate HR	Amino Acid*	**HI717-25**	**HI717-11**	40
HI718	Iodine	DPD*	**HI718-25**	**HI718-11**	25
HI719	Magnesium Hardness	EDTA*	**HI719-25**	**HI719-11**	25
HI720	Calcium Hardness	Calmagite*	**HI720-25**	**HI720-11**	25
HI721	Iron HR	Phenantroline*	**HI721-25**	**HI721-11**	25
HI723	Chromium VI HR	Diphenylcarbohydrazide*	**HI723-25**	**HI723-11**	25
HI726	Nickel HR	Photometric*	**HI726-25**	**HI726-11**	25
HI727	Color of Water	Colorimetric Platinum Cobalt*	–	**HI727-11**	–
HI729	Fluoride LR	SPADNS*	**HI729-26**	**HI729-11**	20
HI733	Ammonia HR	Nessler*	**HI733-25**	**HI733-11**	24
HI736	Phosphorus, Marine ULR	Ascorbic Acid*	**HI736-25**	**HI736-11**	25
HI739	Fluoride HR	SPADNS*	**HI739-26**	**HI739-11**	30
HI747	Copper LR	Bicinchoninate*	**HI747-25**	**HI747-11**	25
HI749	Chromium LR	Diphenylcarbohydrazide*	**HI749-25**	**HI749-11**	25
HI753	Chloride	Mercury(II) Thiocyanate	**HI753-25**	**HI753-11**	25
HI755	Alkalinity, Marine	Colorimetric	**HI755-26**	**HI755-11**	25
HI758	Calcium, Marine	Zincon*	**HI758-26**	**HI758-11**	25
HI761	Chlorine, Total ULR	DPD*	**HI761-25**	**HI761-11**	25
HI764	Nitrite, Marine ULR	Diazotization*	**HI764-25**	**HI764-11**	25
HI770	Silica HR	USEPA 370.1*/Std. Mtd. 4500-SiO_2C*	**HI770-25**	**HI770-11**	25
HI771	Chlorine, Total UHR	4500-Cl*	**HI771-25**	**HI771-11**	25
HI775	Alkalinity	Colorimetric	**HI775-26**	**HI775-26**	25

*adaptation

Checker® Accessories

Code	Description
HI731318	cuvette cleaning cloth (4)
HI731321	glass cuvettes (4)
HI731225	cuvette cap for Checker®HC (4)
HI93703-50	cuvette cleaning solution
HI740226	5 mL graduated syringe
HI740157P	plastic refilling pipette (20)
HI740144P	pipette tip (6)
HI740143	1 mL graduated syringe (6)
HI740036P	100 mL plastic beaker (10)
HI70436M	deionized water (230 mL)
HI70436	deionized water (1G)

Tips for an accurate measurement

It is important that the sample does not contain any debris.

Whenever the cuvette is placed into the measurement cell, it must be dry outside and completely free of fingerprints, oil or dirt. Wipe it thoroughly with HI731318 or a lint-free cloth prior to insertion.

Shaking the cuvette can generate bubbles, causing higher readings. To obtain accurate measurements, remove such bubbles by swirling or by gently tapping the cuvette.

Do not let the reacted sample stand for too long after reagent is added, or accuracy will be lost.

After the reading, it is important to discard the sample immediately , otherwise the glass might become permanently stained.

Hanna Chemical Test Kits

Single or Combination Kits

Hanna test kits are a simple way to perform an accurate chemical analysis. The wide variety of single parameter test kits presented in this section includes colorimetric, checker disc, titration and turbidimetric methods.

Quick and easy to use, Hanna colorimetric chemical test kits are the ideal solution for water analysis of many chemical parameters. The kits are equipped with a transparent container which has the color scale right next to the sample being tested. This makes the color comparison process simple and error free. The reagents are either liquid or powder, depending on the parameter to be measured.

Hanna Checker® Disc test kits use the technology of colorimetric kits to provide greater accuracy and resolution. The Checker® Disc is a color comparison wheel shaded from dark to light in proportion to the concentration of the chemical parameter being tested. The user just needs to put both the blank and the reacted cuvettes inside the Checker® Disc. By turning the wheel, the user can then visually find the concentration that best equals the reacted sample. This technique enhances resolution and accuracy.

Titration test kits are easy to use without any loss of resolution and accuracy. To determine the concentration of the chemical parameter, these kits utilize a titration technique which consists of counting the number of drops of titrant necessary to cause a color change in the sample. Dropper bottles make titration extremely quick and easy without compromising accuracy. The endpoint can be determined with enhanced accuracy and simplicity.

Hanna test kits are supplied ready to use, complete with all the necessary accessories. They are designed to help you to work better, faster and safer. All Hanna chemical test kits use color-coded dropper bottles which are easy to recognize during analysis.

With some kits, a plastic beaker is provided featuring a ported cap to prevent spills and waste.

Every kit is manufactured according to the highest quality standards and a Safety Data Sheet (SDS) is available for each product, online.

Designed for Specific Applications

Hanna combination chemical test kits are tailor made

- Olive Oil Acidity
- Acid Mining
- Agriculture
- Alkalinity – Acidity
- Boiler Feedwater
- Cooling Systems and Boilers
- Education
- Environmental Testing
- Swimming Pools
- Water Quality

for specific applications:

Includes all you need

Hanna test kits include all the necessary reagents and accessories for their specific application.

Ideal for field measurements

Multiparameter test kits from Hanna are equipped with a hard carrying case helps to keep your equipment neat, organized and easy to carry around in the field. Our carrying cases are rugged, built to last, and easily refilled with replacement reagents as needed.

One more advantage: Hanna's exclusive pHep® for pH measurements

For those kits that offer pH measurements, Hanna has included the exclusive pHep® electronic tester so that your pH analysis will always be quick and reliable. Traditional pH test strips have limited accuracy and do not cover the entire pH range. Due to the pHep®'s long life, high accuracy and extended range, these problems are avoided.

Comprehensive Instructions

Every chemical test kit is supplied with a comprehensive, easy-to-understand instruction manual. The manuals guide you through the analysis step-by-step, making it easy for even non-technical personnel to perform tests.

HI3897

Olive Oil Acidity Test Kit

1.32

Now there is an easy, affordable and accurate way to determine the purity, quality, classification and freshness of your olive oil.

Acidity, expressed as percent oleic acid, is the most fundamental measurement of olive oil.

The quality of olive oil is directly related to the degree of breakdown of the fatty acids in the oil. As the bound fatty acids break down, free fatty acids are formed, which increase the % acidity of the oil.

HI3814

Environmental Monitoring Test Kit

1.46

The six most important parameters in environmental applications can be monitored with this combination chemical test kit. They include: acidity, alkalinity, carbon dioxide, dissolved oxygen, hardness and pH.

This kit is ideal not only for professionals, but also for students of environmental sciences, since it offers great performance and ease of use.

HI3896

Hanna Soil Test Kit

1.43

The chemical composition of soil includes pH and chemical elements. Soil analysis is necessary for better management of fertilization by knowing the fertilizer residue in relation to crop and tillage. You can select the most suitable plant based on the soil composition. Testing the soil during each crop cycle and comparing the results with plant growth can be a useful information for subsequent cultivations. An analysis can also highlight shortages and help the understanding of the causes of an abnormal growth. By using the Hanna Soil test, it is possible to measure pH and the most important elements for plant growth: nitrogen (N), phosphorus (P) and potassium (K).

HI3887

Quick-Check Swimming Pool Test Kit

1.47

Free Chlorine and pH

Hanna's Quick-check test kits combine two basic parameters in swimming pool monitoring. This kit is ideal for performing routine pH and chlorine testing.

Chlorine is commonly used in swimming pool water for it's disinfectant properties. For chlorine to work effectively, pH should be monitored as it affects the activity of the disinfecting agents.

Chlorine tests are colorimetric (color comparison).

HI3896BP

Backpack Lab™ Soil Quality Educational Test Kit

1.50

Hanna introduces a kit specifically assembled for the educator and environmental science student. Using the popular Hanna Agricultural Combination Test Kit (HI3895 and HI3896) as its foundation, the Soil Quality Education Test Kit is designed to provide a complete lesson plan for teachers. Teachers are able to introduce students to important chemical tests for evaluating soil quality and fertility, and relate these measurements to the principles of plant metabolism. Tied together by an extensive teacher's guide, this kit includes in-depth background information about each parameter, classroom activities designed to introduce students to each parameter and field-testing procedures.

HI3899BP

Backpack Lab™ Marine Science Educational Test Kit

1.51

Backpack Lab™ is designed with all the necessary components in one place, reducing the chance of misplacing an item. Ideal for transporting, this durable backpack is great to take to the field for accurate on-site measurements.

This kit is designed to provide a complete unit for teachers to introduce students to important marine science topics. The teacher's guide provides detailed background information for marine science lessons and activities that can be adapted to various grade levels. Field tests are included to complement classroom lessons. All materials fit easily into the supplied backpack for easy transport.

Single Parameter Test Kits

	Parameter	Method	Range	# of Tests	Code	Page
Acidity	Acidity (as % Oleic acid)	titration	0.00 - 1.00 % acidity	6	HI3897	1.32
	Acidity (as $CaCO_3$) Methyl/Orange and Total	titration	0-100 mg/L (ppm); 0-500 mg/L (ppm)	110 avg.	HI3820	1.34
Alkalinity	Alkalinity (as $CaCO_3$) Phenolphthalein and Total	titration	0-100 mg/L (ppm); 0-300 mg/L (ppm)	110 avg.	HI3811	1.34
Ammonia	Ammonia (as NH_3–N) (Fresh Water)	colorimetric	0.0-2.5 mg/L (ppm)	25 avg.	HI3824	1.34
	Ammonia (as NH_3–N) (Saltwater)	colorimetric	0.0-2.5 mg/L (ppm)	25 avg.	HI3826	1.34
Boron	Boron	titration	0.0-5.0 mg/L (ppm)	100	HI38074	1.35
Bromine	Bromine	colorimetric	0.0-3.0 mg/L (ppm)	60 avg.	HI3830	1.35
Carbon Dioxide	Carbon Dioxide	titration	0.0-10.0 mg/L (ppm); 0.0-50.0 mg/L (ppm); 0-100 mg/L (ppm)	110 avg.	HI3818	1.35
Chloride	Chloride (as Cl^-)	titration	0-100 mg/L (ppm); 0-1000 mg/L (ppm)	110 avg.	HI3815	1.35
Chlorine	Chlorine Free	colorimetric	0.0-2.0 mg/L (ppm)	50 avg.	HI3829F	1.36
		colorimetric	0.0-2.5 mg/L (ppm)	50 avg.	HI3831F	1.36
		checker disc	0.0-3.5 mg/L (ppm)	100	HI3875	1.36
		checker disc	0.00-0.70 mg/L (ppm); 0.0-3.5 mg/L (ppm)	200	HI38018	1.36
	Chlorine Free & Total	checker disc	0.00-0.70 mg/L (ppm); 0.0-3.5 mg/L (ppm)	200	HI38017	1.36
		checker disc	0.00-0.70 mg/L (ppm); 0.0-3.5 mg/L (ppm); 0.0-10.0 mg/L (ppm)	200	HI38020	1.36
	Chlorine Total	colorimetric	0.0-2.5 mg/L (ppm)	50 avg.	HI3831T	1.36
		titration	10-200 mg/L (ppm)	100	HI38023	1.36
Chromium	Chromium (as CrVI)	colorimetric	0.0-1.0 mg/L (ppm)	100 avg.	HI3846	1.37
Copper	Copper	colorimetric	0.0-2.5 mg/L (ppm)	100	HI3847	1.37
Formaldehyde	Formaldehyde	titration	0-1%; 0-10%	110 avg.	HI3838	1.37
Glycol	Glycol	visual	Present/Absent	25	HI3859	1.37
Hardness	Hardness (as $CaCO_3$) Total	titration	0.0-30.0 mg/L (ppm); 0-300 mg/L (ppm)	100 avg.	HI3812	1.38
		titration	0-150 mg/L (ppm)	50 avg.	HI3840	1.38
		titration	40-500 mg/L (ppm)	50 avg.	HI3841	1.38
		titration	400-3000 mg/L (ppm)	50 avg.	HI3842	1.38
		titration	0-30 gpg	100	HI38033	1.38
Hydrogen Peroxide	Hydrogen Peroxide	titration	0.00-2.00 mg/L; 0.0-10.0 mg/L	100 avg.	HI3844	1.38
Hypochlorite	Hypochlorite (as Cl_2)	titration	50-150 g/L (ppt)	100 avg.	HI3843	1.39
Iron	Iron	colorimetric	0-5 mg/L (ppm)	50 avg.	HI3834	1.39
		checker disc	0.00-1.00 mg/L (ppm)	100	HI38039	1.39
		checker disc	0.0-5.0 mg/L (ppm)	100	HI38040	1.39
		checker disc	0.0-10.0 mg/L (ppm)	100	HI38041	1.39
Nitrate	Nitrate (as NO_3^-–N)	colorimetric	0-50 mg/L (ppm)	100	HI3874	1.40
	Nitrate (as NO_3^-–N) (Irrigation Water and Soil)	checker disc	water: 0-50 mg/L (ppm); soil: 0-60 mg/L (ppm)	100 100	HI38050	1.40

	Parameter	Method	Range	# of Tests	Code	Page
Oxygen, Dissolved	Oxygen, Dissolved	titration	0.0-10.0 mg/L (ppm)	110 avg.	HI3810	1.41
Ozone	Ozone	checker disc	0.0-2.3 mg/L (ppm)	100	HI38054	1.41
Phosphate	Phosphate (PO_4^{3-})	colorimetric	0-5 mg/L (ppm)	50	HI3833	1.41
		checker disc	0.00-1.00 mg/L (ppm); 0.0-5.0 mg/L (ppm); 0-50 mg/L (ppm)	100	HI38061	1.41
Salinity	Salinity	titration	0.0-40.0 g/kg (ppt)	110 avg.	HI3835	1.42
Silica, HR	Silica as (SiO_2)	checker disc	0-40 mg/L (ppm); 0-800 mg/L (ppm)	100	HI38067	1.42
Sulfate	Sulfate (as SO_4^{2-})	turbidimetric	20-100 mg/L (ppm)	100	HI38000	1.42
		titration	100-1000 mg/L (ppm); 1000-10000 mg/L (ppm)	200	HI38001	1.42
Sulfite	Sulfite (as Na_2SO_3)	titration	0.0-20.0 mg/L (ppm); 0-200 mg/L (ppm)	110 avg.	HI3822	1.42

HI38050 Nitrate Checker® Disc Test Kit

Multiparameter Test Kits

	Parameter	Method	Range	# of Tests	Page
HI3895 Agriculture Test Kit, Basic	Nitrogen	colorimetric	traces, low, medium, high	10	1.43
	Phosphorus	colorimetric	traces, low, medium, high	10	
	pH	colorimetric	4 to 9 pH	10	
	Potassium	turbidimetric	traces, low, medium, high	10	
HI3896 Agriculture Test Kit, Professional	Nitrogen	colorimetric	traces, low, medium, high	25	1.43
	Phosphorus	colorimetric	traces, low, medium, high	25	
	pH	colorimetric	4 to 9 pH	25	
	Potassium	turbidimetric	traces, low, medium, high	25	
HI3827 Boiler and Feedwater Test Kit	Alkalinity (as $CaCO_3$)	titration	0-100 mg/L (ppm); 0-300 mg/L (ppm)	110 avg.	1.44
	Chloride (as Cl^-)	titration	0-100 mg/L (ppm); 0-1000 mg/L (ppm)	110 avg.	
	Hardness (as $CaCO_3$)	titration	0.0-30.0 mg/L (ppm); 0-300 mg/L (ppm)	100 avg.	
	Phosphate	colorimetric	0-5 mg/L (ppm)	50	
	pH	electronic pH tester	0.0-14.0 pH	life of the meter	
	Sulfite (as Na_2SO_3)	titration	0.0-20.0 mg/L (ppm); 0-200 mg/L (ppm)	110 avg.	
HI3821 Cooling and Boiler Combination Test Kit	Alkalinity (as $CaCO_3$)	titration	0-100 mg/L (ppm); 0-300 mg/L (ppm)	110 avg.	1.45
	Chloride (as Cl^-)	titration	0-100 mg/L (ppm); 0-1000 mg/L (ppm)	110 avg.	
	Hardness (as $CaCO_3$)	titration	0.0-30.0 mg/L (ppm); 0-300 mg/L (ppm)	100 avg.	
	Phosphate	colorimetric	0-5 mg/L (ppm)	50 avg.	
	Oxygen, Dissolved	titration	0.0-10.0 mg/L (ppm)	110 avg.	
	Sulfite (as Na_2SO_3)	titration	0.0-20.0 mg/L (ppm); 0-200 mg/L (ppm)	110 avg.	
HI3814 Environmental Monitoring Test Kit	Acidity (as $CaCO_3$)	titration	0-100 mg/L (ppm); 0-500 mg/L (ppm)	110 avg.	1.46
	Alkalinity (as $CaCO_3$)	titration	0-100 mg/L (ppm); 0-300 mg/L (ppm)	110 avg.	
	Carbon Dioxide	titration	0.0-10.0 mg/L (ppm); 0.0-50.0 mg/L (ppm); 0-100 mg/L (ppm)	110 avg.	
	Hardness (as $CaCO_3$)	titration	0.0-30.0 mg/L (ppm); 0-300 mg/L (ppm)	100 avg.	
	Oxygen, Dissolved	titration	0.0-10.0 mg/L (ppm)	110 avg.	
	pH	electronic pH tester	0.0-14.0 pH	life of the meter	
HI3887 Quick-check Swimming Pool Test Kit	Free Chlorine	colorimetric	0-2.5 mg/L (ppm)	50 avg.	1.47
	pH	colorimetric	6.0-8.5 pH	100 avg.	
HI3817 Water Quality Test Kit	Alkalinity (as $CaCO_3$)	titration	0-100 mg/L (ppm); 0-300 mg/L (ppm)	110 avg.	1.48
	Chloride (as Cl^-)	titration	0-100 mg/L (ppm); 0-1000 mg/L (ppm)	110 avg.	
	Hardness (as $CaCO_3$)	titration	0.0-30.0 mg/L (ppm); 0-300 mg/L (ppm)	100 avg.	
	Iron	colorimetric	0-5 mg/L (ppm)	50	
	pH	electronic pH tester	0.0-14.0 pH	life of the meter	
	Sulfite (as Na_2SO_3)	titration	0.0-20.0 mg/L (ppm); 0-200 mg/L (ppm)	110 avg.	

Backpack Lab™ Multiparameter Test Kits

	Parameter	Method	Range	# of Tests	Page
HI3817BP Backpack Lab™ Water Quality Educational Test Kit	Acidity ($CaCO_3$)	titration	0-100 mg/L (ppm); 0-500 mg/L (ppm)	110	1.49
	Alkalinity ($CaCO_3$) Phenolphthalein & Total	titration	0-100 mg/L (ppm); 0-300 mg/L (ppm)	110	
	Carbon Dioxide	titration	0.0-10.0 mg/L (ppm); 0.0-50.0 mg/L (ppm) 0-100 mg/L (ppm)	110	
	Oxygen, Dissolved	titration	0.0-10.0 mg/L (ppm)	110	
	Hardness ($CaCO_3$)	titration	0.0-30.0 mg/L (ppm); 0-300 mg/L (ppm)	100	
	Nitrate (NO_3^-–N)	colorimetric	0-50 mg/L (ppm)	100	
	Phosphate	colorimetric	0-5 mg/L (ppm)	50	
	pH	Hanna electronic Combo tester	-2 to 16 pH	life of meter	
	EC	Hanna electronic Combo tester	0-3999 µS/cm	life of meter	
	TDS	Hanna electronic Combo tester	0-2000 ppm	life of meter	
	Temperature	Hanna electronic Combo tester	-5-60.0°C	life of meter	
	Turbidity	secchi disc	-	-	
HI3896BP Backpack Lab™ Soil Quality Educational Test Kit	Nitrogen	colorimetric	traces, low, medium, high	50	1.50
	Phosphorus	colorimetric	traces, low, medium, high	50	
	Potassium	turbidimetric	traces, low, medium, high	50	
	pH	colorimetric	4 to 9 pH (1 pH increments)	50	
		Hanna electronic Combo tester	-2 to 16 pH	life of meter	
	EC	Hanna electronic Combo tester	0 to 3999 µS/cm	life of meter	
	TDS	Hanna electronic Combo tester	0 to 2000 ppm	life of meter	
	Temperature	Hanna electronic Combo tester	-50.0 to 220°C	life of meter	
HI3899BP Backpack Lab™ Marine Science Educational Test Kit	Acidity ($CaCO_3$)	titration	0-100 mg/L (ppm); 0-500 mg/L (ppm)	110 avg.	1.51
	Alkalinity ($CaCO_3$) Phenolphthalein & Total	titration	0-100 mg/L (ppm); 0-300 mg/L (ppm)	110 avg.	
	Ammonia (as NH_3–N)	colorimetric	0.0-2.5 mg/L (ppm)	25 avg.	
	Carbon Dioxide (CO_2)	titration	0.0-10.0 mg/L (ppm); 0.0-50.0 mg/L (ppm)	110 avg.	
	Oxygen, Dissolved	titration	0.0-10.0 mg/L (ppm)	110 avg.	
	Nitrite	colorimetric	0.0-1.0 mg/L (ppm)	100	
	Nitrate (NO_3^-–N)	colorimetric	0-50 mg/L (ppm)	100	
	Phosphate (PO_4^{3-})	colorimetric	0-5 mg/L (ppm)	50	
	Salinity	titration	0.0-40.0 g/kg	110 avg.	
	pH	Hanna electronic Combo tester	-2 to 16 pH	life of meter	
	EC	Hanna electronic Combo tester	0-3999 µS/cm	life of meter	
	TDS	Hanna electronic Combo tester	0-2000 ppm	life of meter	
	Temperature	Hanna electronic Combo tester	-5-60.0°C	life of meter	
	Turbidity	secchi disc	-	-	

HI3897

Olive Oil Acidity Test Kit

Now there is an easy, affordable and accurate way to determine the quality, classification and freshness of your olive oil.

Acidity (as % oleic acid) is the most fundamental measurement of olive oil. It is the primary indicator of olive oil purity and freshness.

The quality of olive oil is directly related to the degree of breakdown of the fatty acids in the oil. As the bound fatty acids break down, free fatty acids are formed, which increase the % acidity of the oil. Acidity, is a measure of the free fatty acid present in the oil, which is directly related to its purity.

The quality of olive oil can be adversely affected during either maturation or by environmental conditions. Mishandling, processing and bruising during harvesting can also contribute to a breakdown of fatty acids and an increase in free acidity. Improper and/or long-term storage can cause olive oil to break down and become rancid. Regular acidity testing is the best way to ensure and maintain quality and freshness.

Normally, testing acidity is a complicated process requiring the use of various chemicals in a laboratory environment. Hanna has simplified this process in an easy-to-understand test kit that can be used by almost anyone to produce quick and accurate results.

Studies have shown that the quality of olive oil has a direct impact on its health benefits. Extra Virgin Olive Oil contains higher levels of antioxidants, particularly phenols and vitamin E (because it is less processed). Antioxidants can help prevent oxidation damage to body tissue caused by free radicals. Studies have also shown that the oxidation of LDL (bad) cholesterol is associated with the hardening of arteries that can lead to heart disease.

With the HI3897 test kit, it is possible to easily and accurately test the quality of olive oil at various stages of processing and storage to monitor and maintain the highest quality.

Acidity, defined as percent oleic acid, is a parameter that indicates olive oil freshness. A high acidity value indicates the oil quality has diminished and is at risk of becoming rancid.

Acidity is used to discriminate an extra virgin olive oil from all other olive oils. According to the CEE 2568/91 regulation, olive oil is considered extra virgin when its acidity level is below 1%. A low acidity value also indicates a natural extraction process occurred soon after olive harvesting.

The HI3897 kit utilizes a titration method where the endpoint is visually determined when the color changes from yellow-green to pink.

The HI180 is a compact and lightweight magnetic stirrer which incorporates electronic controls that allow the user to regulate the speed with precision. In addition to speed control, Hanna's Speedsafe™ system will assure that the maximum speed is never exceeded.

Chemical Parameters

Olive Storage Period (between harvesting and extraction)	within 48 hours	2 to 4 days	over 4 days
Acidity (as % oleic acid)	0.3	0.4	0.5

Sensory Quality of Olive Oil

The sensory analysis of virgin olive oil is based on a panel test, developed by the International Olive Oil Council. The rating is awarded on the basis of a scale of points running from 0, which indicates that the oil has extreme defects, to 9, which indicates that the oil has no defects at all. See the following chart for sensory ratings of each grade of olive oil.

- Extra Virgin Oil >6.5
- Virgin >5.5
- Ordinary Virgin >3.5
- Virgin Lampante <3.5

Specifications	HI3897
Range	0.00 to 1.00 % acidity
Smallest Increment	0.01 mL = 0.01%
Method	titration
Sample Size	4.6 mL or 4 g
Number of Tests	6
Dimensions (kit)	112 x 390 x 318 mm (4.4 x 15.4 x 12.5")

Specifications	HI180 Magnetic Stirrer (included)
Maximum Stirring Capacity	1 L (0.26 g)
Speed Range	100 rpm min.; 1000 rpm max
Installation Category	II
Cover Material	ABS plastic
Environment	0 to 50°C (32 to 122°F) 95% RH max
Dimensions	dia. 137 mm x 51 mm (h) (5.39 x 2")
Weight	640 g (1.4 lbs.)
Ordering Information	**HI3897** is supplied with 6 ready-to-use bottles of organic solvent, HI180I/MB magnetic stirrer, calibrated syringe for oil dosing, calibrated syringe for titrant dosing with tip, titrant (20 mL bottle), rugged carrying case and instructions.

In accordance with the European Community (EC) reg. CEE2568/91 quality classification of olive oil based on acidity (expressed as percent oleic acid) is as follows:

- Extra Virgin Olive Oil: Acidity ≤ 1%
  - "Perfect flavor and odor", with a maximum acidity, expressed as oleic acid, of 1 g/100 g
- Virgin Olive Oil: Acidity 1 - 2%
  - "Perfect flavor and odor", with a maximum acidity, expressed as oleic acid, of 2 g/100 g
- Ordinary Virgin Olive Oil: Acidity 2 - 3.3% (tolerance of 10%)
  - "Good flavor and odor", with a maximum acidity, expressed as oleic acid, of 3.3 g/100 g
- Virgin Lampante Olive Oil: + 3.3%. Not fit for human consumption
  - "Off flavor and odor", with a maximum acidity, expressed as oleic acid, > 3.3 g/100 g

Additional Technical Information:

Olive oil is a complex compound made of fatty acids, vitamins, volatile components, water soluble components and microscopic bits of olive. The three primary fatty acids (triglycerides) are oleic, linoleic, and linolenic.

- Palmitic Acid (16:0) = 7.5 - 20%
- Oleic Acid (18:1) = 55 - 85% olive oil composition
- Linoleic Acid (18:2) = 3.5 - 21.00% olive oil composition
- Linolenic Acid (18:3) = 0.0 - 1.5% olive oil composition

Oleic acid makes up 55to 85% of olive oil. Oleic acid is the most abundant fatty acid found in nature.

Studies show that high concentrations of oleic acid can lower blood levels of total and LDL (bad) cholesterol, reducing the long term risk of heart disease.

Olive Oil Acid Composition

- Palmitic Acid (16:0) = 7.5 - 20%
- Palmitoleic Acid (16:1) = 0.3 - 3.5%
- Stearic Acid (18:0) = 0.5 - 5.0%
- Oleic Acid (18:1) = 55.0 - 83.0 %
- Linoleic Acid (18:2) = 3.5 - 21.0%
- Linolenic Acid (18:3) = 0.0 - 1.5%
- Others = 1.5 - 3.2%

HI3820

Acidity Test Kit

With the use of diluted sodium hydroxide as the titrant and bromphenol blue or phenolphthalein indicators, the acidity can be determined. Methyl orange acidity is carried out by titrating with sodium hydroxide until the solution turns from yellow to green/blue (pH endpoint about 4.5). The total acidity is determined by titrating to an endpoint pH of 8.3, using phenolphthalein as an indicator. This is known as phenolphthalein acidity.

HI3820 Acidity

HI3811

Alkalinity Test Kit

Alkalinity can be measured as phenolpthalein alkalinity and total alkalinity. Phenolpthalein alkalinity is determined by neutralizing the sample to a pH of 8.3 using a dilute hydrochloric acid solution, and a phenolpthalein indicator. Total alkalinity is determined by titrating the sample to a pH of 4.5, bromocresol green.

HI3811 Alkalinity Phenolphthalein and Total

Ammonia Test Kits

HI3824
for Fresh Water

The Nessler reagent reacts with ammonia, under strong alkaline conditions, to form a yellow colored complex.

HI3826
for Seawater

The ammonia as nitrogen is determined by a colorimetric method. The Nessler reagent reacts with ammonia, under strong alkaline conditions, to form a yellow-colored complex. Reagent 1 for seawater inhibits precipitation of calcium and magnesium ions due to the presence of the alkaline Nessler reagent. The color intensity of the solution determines the ammonia concentration.

Method	Range	Smallest Increment	Chemical Method	# Tests
HI3820	**Acidity (as $CaCO_3$*)**			
titration	0-100 mg/L (ppm) 0-500 mg/L (ppm)	1 mg/L (ppm) 5 mg/L (ppm)	methyl-orange/ phenolphthalein	110 avg.
HI3811	**Alkalinity (as $CaCO_3$*)**			
titration	0-100 mg/L (ppm) 0-300 mg/L (ppm)	1 mg/L (ppm) 3 mg/L (ppm)	phenolphthalein/ bromphenol blue	110 avg.
HI3824	**Ammonia (as NH_3–N) in fresh water**			
colorimetric	0.0-2.5 mg/L (ppm)	0.5 mg/L (ppm)	Nessler	25 avg.
HI3826	**Ammonia (as NH_3–N) in salt water**			
colorimetric	0.0-2.5 mg/L (ppm)	0.5 mg/L (ppm)	Nessler	25 avg.

Ordering Information

HI3820 test kit comes with 10 mL dechlorinating reagent, 10 mL bromophenol blue indicator, 10 mL phenolpthalein indicator, 120 mL acidity titrant, 10 mL calibrated vessel, 50 mL calibrated vessel, and calibrated syringe with tip.

HI3811 test kit comes with 10 mL phenolpthalein indicator, 10 mL bromophenol blue indicator, 120 mL alkalinity titrant, 10 mL calibrated vessel, 50 mL calibrated vessel, and calibrated syringe with tip.

HI3824 test kit comes with 20 mL plastic beaker, color comparison cube, 20 mL ammonia reagent 1 (for fresh water) and 20 mL Nessler reagent.

HI3826 test kit comes with 20 mL plastic beaker, color comparison cube, 20 mL ammonia reagent 1 (for seawater) and 20 mL Nessler reagent.

* 1 gpg = 17 ppm $CaCO_3$

See a list of chemical test kit reagents beginning on page 1.52

HI3818 Carbon Dioxide

Method	Range	Smallest Increment	Chemical Method	# Tests
HI38074	**Boron**			
titration	0.0-5.0 mg/L (ppm)	0.2 mg/L (ppm)	boric acid	100
HI3830	**Bromine (as Br_2)**			
colorimetric	0.0-3.0 mg/L (ppm)	0.6 mg/L (ppm)	DPD	60 avg.
HI3818	**Carbon Dioxide (as CO_2)**			
titration	0.0-10.0 mg/L (ppm) 0.0-50.0 mg/L (ppm) 0-100 mg/L (ppm)	0.1 mg/L (ppm) 0.5 mg/L (ppm) 1 mg/L (ppm)	phenolphthalein	110 avg.
HI3815	**Chloride (as Cl^-)**			
titration	0-100 mg/L (ppm) 0-1000 mg/L (ppm)	1 mg/L (ppm) 10 mg/L (ppm)	mercuric nitrate	110 avg.

Ordering Information

HI38074 test kit comes with reagent for 100 tests, HI98103 Checker pocket pH meter, pH 4.01 (1 sachet), pH 7.01 (1 sachet), screwdriver, 120 mL bottle with cap, 50 mL calibrated vessel, and 1 mL plastic pipettes (2).

HI3830 test kit comes with 30 mL reagent 1, 20 mL reagent 2, color comparison cube, and plastic vessel.

HI3818 test kit comes with 10 mL phenolphthalein indicator, 120 mL carbon dioxide reagent, 10 mL calibrated vessel, 50 mL calibrated vessel and calibrated syringe with tip.

HI3815 test kit comes with 15 mL diphenylcarbazone indicator, 30 mL nitric acid solution, 120 mL mercuric nitrate solution, 50 mL calibrated vessel, 10 mL calibrated vessel, calibrated syringe with tip.

* 1 gpg = 17 ppm $CaCO_3$

See a list of chemical test kit reagents beginning on page 1.52

HI38074
Boron Test Kit

The HI38074 test kit can determine boron concentration in irrigation waters by direct titration of boric acid.

HI3830
Bromine Test Kit

The Hanna portable bromine test kit determines the bromine level in water with efficiency. The first step involves pH adjustment of the sample to pH 6.3 by adding pH buffer. The second step consists of adding the second reagent, an indicator solution which contains DPD (N, N-diethyl-p-phenylenediamine), the DPD is immediately oxidized by bromine producing a reddish color. The color intensity of the solution determines the bromine concentration.

HI3818
Carbon Dioxide Test Kit

Carbon dioxide (as carbonic acid) in the water sample is neutralized with a dilute sodium-hydroxide solution to a pH of 8.3 using a phenolphthalein indicator. This process converts carbonic acid to sodium bicarbonate:

$CO_2+H_2O \rightarrow H_2CO_3+NaOH \rightarrow NaHCO_3+H_2O$

The color change from clear to pink determines the end point of this titration.

HI3815
Chloride Test Kit

The pH is lowered to approximately 3 by the addition of nitric acid. Mercuric ions react with chloride ions to form mercuric chloride; when excess mercuric ions are present, they complex with diphenylcarbazone to form a purple solution. The color change from yellow to purple determines the endpoint of this titration.

Free Chlorine Test Kits

HI3829F
With Color Cube

HI3831F
With Color Cube

HI3875
Medium Range with Checker® Disc

HI38018
Low and Medium Range with Checker® Disc

Free & Total Chlorine Test Kits

HI38017
Low and Medium Range with Checker® Disc

HI38020
Low, Medium and High Range with Checker® Disc

Total Chlorine Test Kits

HI3831T
with Color Cube

HI38023
Extended Range

HI38017 Free & Total Chlorine

3831T Chlorine

Code	Method	Range	Smallest Increment	Chemical Method	# Tests
Chlorine (as Cl_2) Free					
HI3829F	colorimetric	0.0-2.0 mg/L (ppm)	0.5 mg/L (ppm)	DPD	50 avg.
HI3831F	colorimetric	0.0-2.5 mg/L (ppm)	0.5 mg/L (ppm)	DPD	50 avg.
HI3875	checker disc	0.0-3.5 mg/L (ppm)	0.1 mg/L (ppm)	DPD	100
HI38018	checker disc	0.00-0.70 mg/L (ppm) 0.0-3.5 mg/L (ppm)	0.02 mg/L (ppm) 0.1 mg/L (ppm)	DPD	200
Chlorine (as Cl_2) Free & Total					
HI38017	checker disc	0.00-0.70 mg/L (ppm) 0.0-3.5 mg/L (ppm)	0.02 mg/L (ppm) 0.1 mg/L (ppm)	DPD	200
HI38020	checker disc	0.00-0.70 mg/L (ppm) 0.0-3.5 mg/L (ppm) 0.0-10.0 mg/L (ppm)	0.02 mg/L (ppm) 0.1 mg/L (ppm) 0.5 mg/L (ppm)	DPD	200
Chlorine (as Cl_2) Total					
HI3831T	colorimetric	0.0-2.5 mg/L (ppm)	0.5 mg/L (ppm)	DPD	50
HI38023	titration	10-200 mg/L (ppm)	10 mg/L (ppm)	iodometric	100

Ordering Information

HI3829F test kit comes with color comparison cube, 20 mL reagent 1 and 15 mL reagent 2

HI3831F test kit comes with color comparison cube, 20 mL reagent 1 and 15 mL reagent 2.

HI3875 test kit comes with HI93701-0 free Cl reagent (100 packets), 500 mL deionized water, checker disc, glass vials with caps (2) and 3 mL plastic pipette.

HI38018 test kit comes with HI93701-0 free chlorine reagent (200 packets), demineralizer bottle with cap for 12 L, checker disc, glass vials with caps (2) and 3 mL plastic pipettes.

HI38017 and **HI38020** test kits come with HI93701-0 free chlorine reagent (100 packets), HI93711-0 total chlorine reagent (100 packets), demineralizer bottle with filter cap for 12 L, checker disc, glass vials with caps (2) and 3 mL plastic pipettes

HI3831T test kits comes with color comparison cube, 20 mL chlorine reagent 1, 15 mL chlorine reagent 2 and 15 mL chlorine reagent 3

HI38023 test kit comes with 30 mL potassium iodide solution, sulfamic reagent (100 packets), 25 mL starch indicator, 100 mL thiosulfate reagent, 50 mL calibrated vessel, 1 mL syringe with tip, 1 mL plastic pipette and spoon.

See a list of chemical test kit reagents beginning on page 1.52

HI3859 Glycol Yes/No Test Kit

HI3856 Copper

Method	Range	Smallest Increment	Chemical Method	# Tests
HI3846	**Chromium (as CrVI)**			
colorimetric	0.0-1.0 mg/L (ppm)	0.2 mg/L (ppm)	diphenylcarbohydrazide	100 avg.
HI3847	**Copper**			
colorimetric	0.0-2.5 mg/L (ppm)	0.5 mg/L (ppm)	bicinchoninic acid	100
HI3838	**Formaldehyde (as CH_2O)**			
titration	0.00-1.00% 0.0-10.0%	0-1% 0-10%	Alizarin Yellow R	110 avg.
HI3859	**Glycol**			
visual	present/absent	–	oxidation of glycolic group	25

Ordering Information

HI3846 test kit comes with HI3846-0 reagent (100 packets) and color comparison cube.

HI3847 test kit comes with HI3847-0 reagent (100 packets) and color comparison cube.

HI3838 test kit comes with 15 mL Alizarin Yellow R indicator, 30 g sodium sulfite, 120 mL titrant solution, plastic spoon, plastic bottle, 10 mL calibrated vessel, filter cartridge, calibrated titration syringe with tip and plungers

HI3859 test kit comes with 125 mL glycol reagent A, 25 packets glycol reagent B, 25 packets glycol reagent C, 25 mL glycol standard 0.025%, 3 mL plastic pipette, 1 mL plastic pipettes (25), 10 mL glass vials with caps (2) and brush.

See a list of chemical test kit reagents beginning on page 1.52

HI3846
Chromium Test Kit

Chromium VI reacts with diphenylcarbohydrazide to form a purple complex in an acidic buffered condition. The amount of color developed is proportional to the concentration of chromium present in the aqueous sample.

HI3847
Copper Test Kit

Copper is an essential trace element in the human diet and a factor in plant metabolism.

Corrosion of copper alloys in pipe fittings may introduce excess quantities of copper into water supplies.

Copper salts react with bicinchoninate reagent to form a purple complex in a neutral buffered condition. The amount of color developed is directly proportional to the concentration of copper present in the aqueous sample.

HI3838
Formaldehyde Test Kit

Formaldehyde concentration is determined by a simple acid titration. The formaldehyde, in the aqueous sample, reacts with sodium sulfite to form an alkaline product. This product is then titrated to an Alizarin Yellow R endpoint, using a prestandardized hydrochloric acid solution.

HI3859
Glycol Yes/No Test Kit

Use the HI3859 glycol standard 0.025% included in the kit to easily recognize a positive result in the form of an intense purple color. Ethylene glycol and other glycols are determined by a two-step reaction:

Step One: Glycol is oxidized to two carbonyl groups under acidic conditions.

Step Two: The carbonyl groups react with the indicator to give a highly colored solution.

Total Hardness Test Kits

The hardness level as mg/L (ppm) calcium carbonate is determined by an EDTA (ethylene-diamine-tetraacetic acid) titration.

HI3812

HI3840
Low Range

HI3841
Medium Range

HI3842
High Range

HI38033
0-30 gpg range

HI3812 Hardness

HI3844

Hydrogen Peroxide Test Kit

The Hanna test kit can quickly and easily determine concentration in water up to 10 ppm of hydrogen peroxide. This method is not affected by stabilizers that can be added to commercial hydrogen peroxide solutions. Hydrogen peroxide concentration is determined by a titrimetric method. It reacts with iodide in acid solution, the amount of iodine generated is equivalent to the hydrogen peroxide in the sample. The liberated iodine is then titrated with standard sodium thiosulfate solution.

Method	Range	Smallest Increment	Chemical Method	# Tests
HI3812	**Hardness (as $CaCO_3$*) Total**			
titration	0.0-30.0 mg/L (ppm) 0-300 mg/L (ppm)	0.3 mg/L (ppm) 3 mg/L (ppm)	EDTA	100
HI3840	**Hardness (as $CaCO_3$*) Total**			
titration	0-150 mg/L (ppm)	5 mg/L (ppm)	EDTA	50 avg.
HI3841	**Hardness (as $CaCO_3$*) Total**			
titration	40-500 mg/L (ppm)	20 mg/L (ppm)	EDTA	50 avg.
HI3842	**Hardness (as $CaCO_3$*) Total**			
titration	400-3000 mg/L (ppm)	100 mg/L (ppm)	EDTA	50 avg.
HI38033	**Hardness (as $CaCO_3$*) Total**			
titration	0-30 gpg	1 gpg	EDTA	100
HI3844	**Hydrogen Peroxide (as H_2O_2)**			
titration	0.00-2.00 mg/L (ppm) 0.0-10.0 mg/L (ppm)	0.25 mg/L (ppm) 1.0 mg/L (ppm)	iodometric	100 avg.

Ordering Information

HI3812 test kit comes with 30 mL hardness buffer, 10 mL calmagite indicator, 120 mL EDTA solution, 20 mL plastic beaker with cap, 50 mL plastic beaker with cap and 1 mL syringe with tip.

HI3840 test kit comes with 30 mL hardness LR reagent and 50 mL calibrated vessel.

HI3841 test kit comes with 30 mL hardness MR reagent and 50 mL calibrated vessel.

HI3842 test kit comes with 30 mL hardness HR reagent and 50 mL calibrated vessel.

HI38033 test kit comes with 30 mL buffer solution, 10 mL calmagite indicator, 75 mL EDTA solution (2), 20 mL plastic beaker with cap and 1 mL plastic pipette.

HI3844 test kit comes with 100 mL hydrogen peroxide reagent A, 17 g hydrogen peroxide reagent B, 30 mL hydrogen peroxide reagent C, 25 mL hydrogen peroxide reagent D, graduated plastic test tube with cap, 50 mL calibrated plastic vessel, 3 mL plastic pipette, 1 mL plastic pipette and plastic spoon.

* 1 gpg = 17 ppm $CaCO_3$

See a list of chemical test kit reagents beginning on page 1.52

HI3834 Iron

HI3843

Bleach Test Kit

An iodometric titration method is used in this test kit. The hypochlorite solution is treated with potassium iodide and strongly acidified with acid:

$(OCl)^- + 2H^+ + 2I^- \rightarrow Cl^- + I_2 + H_2O$

The amount of iodine generated is equivalent to the chlorine in the sample. The concentration of iodine is then calculated by titration of thiosulfate ions that reduce the iodine back to iodide ions:

$I_2 + 2(S_2O_3)^{2-} \rightarrow 2I^- + (S_4O_6)^{2-}$

Iron Test Kits

Iron can exist as ferrous (Fe^{2+}) or ferric (Fe^{3+}) ions. The Hanna test kit determines total iron levels in water via a colorimetric method. First, all ferric ions are reduced by sodium sulfite to ferrous ions. Phenanthroline complexes with ferrous ion to form an orange-colored solution. The color intensity of the solution determines the iron concentration.

HI3834
Medium Range with Color Cube

HI38039
Low Range with Checker® Disc

HI38040
Medium Range with Checker® Disc

HI38041
High Range with Checker® Disc

Method	Range	Smallest Increment	Chemical Method	# Tests
HI3843	**Hypochlorite (as Cl_2)**			
titration	50-150 g/L (ppt)	5 g/L (ppt)	iodometric	100 avg.
HI3834	**Iron (Fe^{2+} & Fe^{3+})**			
colorimetric	0-5 mg/L (ppm)	1 mg/L (ppm)	phenanthroline	50
HI38039	**Iron (Fe^{2+} & Fe^{3+})**			
checker disc	0.00-1.00 mg/L (ppm)	0.02 mg/L (ppm)	phenanthroline	100
HI38040	**Iron (Fe^{2+} & Fe^{3+})**			
checker disc	0.0-5.0 mg/L (ppm)	0.1 mg/L (ppm)	phenanthroline	100
HI38041	**Iron (Fe^{2+} & Fe^{3+})**			
checker disc	0.0-10.0 mg/L (ppm)	0.2 mg/L (ppm)	phenanthroline	100

Ordering Information

HI3843 test kit comes with 30 mL potassium iodide solution, 100 packets bleach reagent B, 60 mL bleach reagent C (2), 125 mL glass Erlenmeyer flask and 1 mL plastic pipettes (25).

HI3834 test kit comes with 50 packets iron reagent, color comparison cube and 20 mL plastic vessel.

HI38039 and **HI38040** test kits come with 100 packets iron reagent, checker disc, glass vials with caps (2) and 3 mL plastic pipette.

HI38041 test kit comes with 100 packets iron reagent, 500 mL deionized water, checker disc, glass vials with caps (2), 3 mL plastic pipettes and long plastic pipette.

See a list of chemical test kit reagents beginning on page 1.52

Nitrate Test Kits

HI3874

Nitrate is found in low quantities in domestic wastewater, but can reach higher concentration (up to 30 mg/L as nitrogen) in the outflow of nitrifying biological treatment plants. Excessive amounts can contribute to methaemoglobinemia: infant death and adult illness. In order to prevent this, a 10 mg/L limit (as nitrogen) has been imposed on drinking water.

HI38050
for Soil and Irrigation Water

The Hanna HI38050 nitrate test kit for soil and irrigation water makes it possible to determine the need for nitrogen fertilization. It also obtains the best crop response and avoids over-fertilization.

Nitrate is reduced to nitrite in the presence of cadmium. The nitrite thus produced reacts with the reagent to yield an orange compound. The amount of color developed is proportional to the concentration of nitrate present in the aqueous sample.

The Hanna nitrate-nitrogen test can be performed the whole year round, but testing is particularly recommended during spring and late spring, when rainfall and temperature-related bursts of microbiological activity often have great influence on the availability of nitrate-nitrogen.

HI38050 Nitrate Checker® Disc Test Kit

HI3873 Nitrite

Nitrite Test Kits

HI3873

The HI3873 Hanna test kit determines the nitrite concentration in water via color comparison cube. Nitrites react with chromotropic acid reagent to form a pink tint in the sample. The amount of color developed is proportional to the concentration of nitrite present in the aqueous sample.

Method	Range	Smallest Increment	Chemical Method	# Tests
HI3874	**Nitrate (as NO_3^-–N)**			
colorimetric	0-50 mg/L (ppm)	10 mg/L (ppm)	cadmium reduction	100
HI38050	**Nitrate (as NO_3^-–N) in irrigation water and soil**			
checker disc	water: 0-50 mg/L (ppm) soil: 0-60 mg/L (ppm)	water: 1 mg/L (ppm) soil: 2 mg/L (ppm)	cadmium reduction	100 100
HI3873	**Nitrite (as NO_2^-–N)**			
colorimetric	0.0-1.0 mg/L (ppm)	0.2 mg/L (ppm)	chromotropic acid	100

Ordering Information

HI3874 test kit comes with 100 packets nitrate reagent, glass cuvette and color comparison cube.

HI38050 test kit comes with 200 packets nitrogen reagent, checker disc, glass vials with caps (2), 10 g calcium sulfate, demineralizer bottle with filter cap for 12 L, soil sieve, 50 mL plastic test tube with screw cap, large funnel, 100 paper filter discs, brush, 50 mL calibrated vessels (2), 2 g sample cup, 3 mL plastic pipette and spoons (2).

HI3873 test kit comes with 100 packets nitrite reagent, glass cuvette and color comparison cube.

See a list of chemical test kit reagents beginning on page 1.52

HI3810 Dissolved Oxygen

HI3833 Phosphate

Method	Range	Smallest Increment	Chemical Method	# Tests
HI3810	**Oxygen, Dissolved**			
titration	0.0-10.0 mg/L (ppm)	0.1 mg/L (ppm)	modified Winkler	110 avg.
HI38054	**Ozone**			
checker disc	0.0-2.3 mg/L (ppm)	0.1 mg/L (ppm)	DPD	100
HI3833	**Phosphate (as PO_4^{3-})**			
colorimetric	0-5 mg/L (ppm)	1 mg/L (ppm)	ascorbic acid	50
HI38061	**Phosphate (as PO_4^{3-})**			
checker disc	0.00-1.00 mg/L (ppm) 0.0-5.0 mg/L (ppm) 0-50 mg/L (ppm)	0.02 mg/L (ppm) 0.1 mg/L (ppm) 1 mg/L (ppm)	ascorbic acid	100

Ordering Information

HI3810 test kit comes with 30 mL manganous sulfate solution, 30 mL alkali-azide reagent, 60 mL sulfuric acid solution (2), 10 mL starch indicator, 120 mL titrant solution, glass bottle with stopper, 10 mL calibrated vessel and calibrated syringe with tip.

HI38054 test kit comes with 100 packets ozone reagent, 500 mL deionized water, checker disc, glass vials with caps (2) and 3 mL plastic pipette.

HI3833 test kit comes with 20 mL plastic beaker, color comparison cube and 50 packets phosphate reagent.

HI38061 test kit comes with 100 packets phosphate reagent, 500 mL deionized water, checker disc, glass vials with caps (2), 3 mL plastic pipette and long plastic pipette.

See a list of chemical test kit reagents beginning on page 1.52

HI3810

Dissolved Oxygen Test Kit

The Hanna dissolved oxygen portable test kit can determine the oxygen concentration in water quickly and easily. A modified Winkler method is used. Manganous ions react with oxygen in the presence of potassium hydroxide to form a manganese oxide precipitate. When acid is added, manganese oxide oxidizes the iodide to iodine. The amount of iodine generated is equivalent to the oxygen in the sample, the concentration of iodine is calculated by titration of thiosulfate ions that reduce the iodine back to iodide ions.

HI38054

Ozone Test Kit

The Hanna test kit for ozone determines the ozone concentration in water via Checker® disc. The reaction between ozone and the reagent causes a pink tint in the sample which is proportional to the ozone concentration.

Phosphate Test Kits

The orthosphosphate level in mg/L (or ppm) is determined by a colorimetric method. Ammonium molybdate and potassium antimonyl tartrate react in an acidic medium with orthophosphate to form a phosphomolybdate complex; this complex is reduced to intensely colored molybdenum blue by ascorbic acid. The color intensity of the solution determines the phosphate concentration. The Hanna Phosphate Test Kit will only determine orthophosphate levels.

HI3833
with Color Cube

HI38061
with Checker® Disc

HI3835
Salinity Test Kit

Silica Test Kit

HI38067
High Range

Determination of silica concentration is an adaptation of the ASTM D859 method of the heteropoly blue method. The reaction between silica and reagents causes a blue tint in the sample which is proportional to the silica concentration.

Sulfate Test Kits

HI38000

The procedure for determining sulfate is a modification of the barium sulfate turbidimetric method.

Sulfate is precipitated as barium sulfate by reaction with barium chloride in acidic medium. The turbidity is proportional to the concentration of sulfate:
$(SO_4)^{2-} + Ba^{2+} \rightarrow BaSO_4$

HI38001
Low and High Range

The procedure for determining sulfate is a modification of the Determination of Sulfate by Sulfonazo III. Sulfate is determined via a titrimetric method. The reaction endpoint is indicated by the change in color of the solution from violet to blue.

HI3822
Sulfite Test Kit

The method used is an iodometric method. Iodide ions react with iodate ions in the presence of sulfuric acid to form iodine.

The sulfite present in the water sample then reduces the iodine back to iodide.

An excess of iodate ions will generate additional iodine, which will form a blue complex with starch. This color change determines the endpoint of this titration.

HI3822 Sulfite

Method	Range	Smallest Increment	Chemical Method	# Tests
HI3835	**Salinity**			
titration	0.0-40.0 g/kg (ppt)		mercuric nitrate	110 avg.
HI38067	**Silica (as SiO_2)**			
checker disc	0-40 mg/L (ppm) 0-800 mg/L (ppm)	1 mg/L (ppm) 40 mg/L (ppm)	colorimetric	100
HI38000	**Sulfate (as SO_4^{2-})**			
turbidimetric	20-30 mg/L (ppm) 30-100 mg/L (ppm)	5 mg/L (ppm) 10 mg/L (ppm)	barium chloride	100
HI38001	**Sulfate (as SO_4^{2-})**			
titration	100-1000 mg/L (ppm) 1000-10000 mg/L (ppm)	10 mg/L (ppm) 100 mg/L (ppm)	barium chloride	200
HI3822	**Sulfite (as Na_2SO_3)**			
titration	0.0-20.0 mg/L (ppm) 0-200 mg/L (ppm)	0.2 mg/L (ppm) 2 mg/L (ppm)	iodometric	110 avg.

Ordering Information

HI3835 test kit comes with 15 mL diphenylcarbazone indicator, 30 mL nitric acid solution, 120 mL titrant solution, plastic vial with cap and 1 mL calibrated syringe with tip.

HI38067 test kit comes with 25 mL silica reagent A, 100 packets silica reagent B, 100 packets silica reagent C, demineralizer bottle with filter cap for 12 L, checker disc, glass vials with caps (2), 3 mL plastic pipette and 1 mL syringe with tip.

HI38000 test kit comes with 100 packets sulfate reagent A, 53 g sulfate reagent B, 10 mL complexing agent, 50 mL glass test tube, 50 mL plastic vessel, 3 mL plastic pipette and spoon.

HI38001 test kit comes with 100 packets sulfate reagent A (2 sets), 100 mL LR sulfate reagent B, 100 mL HR sulfate reagent B, 10 mL sulfate reagent C, 20 mL complexing agent, 30 mL sulfate solution, 50 mL plastic vessels (2) and 1 mL syringes (2).

HI3822 test kit comes with 30 mL sulfamic acid solution, 30 mL EDTA reagent, 15 mL sulfuric acid solution, 10 mL starch indicator, 120 mL titrant solution, 20 mL calibrated vessel, 50 mL calibrated vessel and calibrated syringe with tip.

See a list of chemical test kit reagents beginning on page 1.52

HI3896 Soil Test Kit

HI3895
Quick Soil Test Kit

Hanna's quick soil test kit provides growers with an economical way to quickly test pH as well as the three basic elements needed for a healthier plant: nitrogen (N), phosphorus (P) and potassium (K).

HI3896
Hanna Soil Test Kit

The chemical composition of soil includes pH and chemical elements. Soil analysis is necessary for better management of fertilization and to know the residues of fertilizers in relation to the crop, tillage and the most suitable plant choice for soil composition. An analysis can highlight shortages and help the understanding of the causes of an abnormal growth. By using the Hanna soil test, it is possible to measure pH and the most important elements for plant growth: nitrogen (N), phosphorus (P) and potassium (K).

Testing the soil during each crop cycle and comparing the results with plant growth can be a useful information for subsequent cultivations.

Parameter	Method	Range	Smallest Increment	Chemical Method	# Tests
HI3895 Agriculture Test Kit, Basic					
Nitrogen	colorimetric	traces, low, medium, high	–	Ned	10
Phosphorus	colorimetric	traces, low, medium, high	–	ascorbic acid	10
pH	colorimetric	4 to 9 pH	1 pH	pH indicator	10
Potassium	turbidimetric	traces, low, medium, high	–	tetraphenyl-borate	10
HI3896 Agriculture Test Kit, Professional					
Nitrogen	colorimetric	traces, low, medium, high	–	Ned	25
Phosphorus	colorimetric	traces, low, medium, high	–	ascorbic acid	25
pH	colorimetric	4 to 9 pH	1 pH	pH indicator	25
Potassium	turbidimetric	traces, low, medium, high	–	tetraphenyl-borate	25

Ordering Information

HI3895 test kit includes 40 powder packets (10 each for pH, N, P & K), 1 mL plastic pipette, test tubes (4), color cards (4) and one graduated card.

HI3896 test kit includes 120 mL extraction solution (2), 70 mL pH indicator, 75 powder packets (25 each for N,P & K), 1 mL pipettes (3), test tubes (5), test tube stand, spoon, brush, color cards (4), graduated card and handbook.

See a list of chemical test kit reagents beginning on page 1.52

You can conveniently replace reagents separately as they run out (see Reagents section). The number of pH tests has no limitations other than the life of the instrument itself.

HI3827

Boiler & Feedwater Test Kits

For boiler and feedwater industries, all tests are performed by titration except for pH. pH is obtained with Hanna's pHep®, pH electronic tester, which guarantees greater accuracy and a longer life than traditional litmus paper.

This kit is equipped with all the necessary reagents and equipment to perform over 100 tests for each parameter, with the exception of phosphate, which includes reagents for 50 tests. All reagents can be purchased individually as they run out (please see our reagents section). All tests are easy to perform with step-by-step instructions.

This kit is supplied with a rugged portable carrying case for orderly transportation.

Parameter	Method	Range	Smallest Increment	Chemical Method	# Tests
HI3827 Boiler Test Kit					
Alkalinity (as $CaCO_3$)	titration	0-100 mg/L (ppm) 0-300 mg/L (ppm)	1 mg/L (ppm) 3 mg/L (ppm)	phenolphthalein/ bromphenol blue	110 avg.
Chloride (as Cl^-)	titration	0-100 mg/L (ppm) 0-1000 mg/L (ppm)	1 mg/L (ppm) 10 mg/L (ppm)	mercuric nitrate	110 avg.
Hardness (as $CaCO_3$)	titration	0.0-30.0 mg/L (ppm) 0-300 mg/L (ppm)	0.3 mg/L (ppm) 3 mg/L (ppm)	EDTA	100 avg.
Phosphate (as PO_4^{3-})	colorimetric	0-5 mg/L (ppm)	1 mg/L (ppm)	ascorbic acid	50
pH	electronic pH tester	0.0-14.0 pH	0.1 pH	–	life of the meter
Sulfite (as Na_2SO_3)	titration	0.0-20.0 mg/L (ppm) 0-200 mg/L (ppm)	0.2 mg/L (ppm) 2 mg/L (ppm)	iodometric	110 avg.
Dimensions	440 x 330 x 100 mm (17.3 x 13.0 x 3.9")				
Ordering Information	**HI3827** test kit includes all of the necessary reagents and accessories to perform over 100 tests for every parameter, with the exception of iron and phosphate, which include reagents for 50 tests each, hard carrying cases and instructions.				

See a list of chemical test kit reagents beginning on page 1.52

HI3821

Cooling and Boiler Test Kit

Boilers can be complicated systems to maintain. It seems easy enough that water heats to steam, and that steam provides power. For such a seemingly simplistic operation, care and maintenance can be anything but simple. Proper boiler treatment can prevent or correct a multitude of hazardous and costly situations.

Corrosion can occur in many key areas of a boiler. It can shorten the life of a boiler, or at the very least, increase the costs associated with maintaining a boiler. Corrosion can form in feed water heaters, deaerators, superheater tubes and economizers, among other places. Corrosion is commonly caused by the presence of dissolved gases and low pH.

Corrosion can be debilitating to boiler operation, but it is preventable. In order to effectively prevent or control corrosion, a boiler treatment regimen should include the maintenance of pH levels as well as alkalinity. Together with proper operation, the right boiler treatment chemicals can ward off dangerous corrosion in the critical components of a boiler.

This guarantees the maximum efficiency of the system and prevents costly damage that can occur as a result of corrosion to metal parts.

Hanna's HI3821 combination test kit includes all the necessary reagents to test these parameters. The kit allows you to perform over 100 tests for each parameter, with the exception of phosphate, which includes reagents for 50 tests. All reagent bottles are numerically labeled for ease of operation and to avoid mistakes.

HI3821 Cooling and Boiler Combination Test Kit

Parameter	Method	Range	Smallest Increment	Chemical Method	# Tests
Alkalinity (as $CaCO_3$)	titration	0-100 mg/L (ppm) 0-300 mg/L (ppm)	1 mg/L (ppm) 3 mg/L (ppm)	phenolphthalein/ bromphenol blue	110 avg.
Chloride	titration	0-100 mg/L (ppm) 0-1000 mg/L (ppm)	1 mg/L (ppm) 10 mg/L (ppm)	mercuric nitrate	110 avg.
Hardness (as $CaCO_3$)	titration	0.0-30.0 mg/L (ppm) 0-300 mg/L (ppm)	0.3 mg/L (ppm) 3 mg/L (ppm)	EDTA	100 avg.
Phosphate	colorimetric	0-5 mg/L (ppm)	1 mg/L (ppm)	ascorbic acid	50 avg.
Oxygen, Dissolved	titration	0.0-10.0 mg/L (ppm)	0.1 mg/L (ppm)	modified Winkler	110 avg.
Sulfite (as Na_2SO_3)	titration	0.0-20.0 mg/L (ppm) 0-200 mg/L (ppm)	0.2 mg/L (ppm) 2 mg/L (ppm)	iodometric	110 avg.
Dimensions	440 x 330 x 100 mm (17.3 x 13.0 x 3.9")				
Ordering Information	**HI3821** test kit includes all of the necessary reagents and accessories to perform over 100 tests for every parameter, with the exception of phosphate, which includes reagents for 50 tests, hard carrying case and instructions.				

See a list of chemical test kit reagents beginning on page 1.52

HI3814

Environmental Monitoring Test Kit

Ideal for Professionals and Students

The six most important parameters in environmental applications can be monitored with this combination chemical test kit. They include: acidity, alkalinity, carbon dioxide, dissolved oxygen, hardness and pH.

This kit is ideal not only for professionals, but also for students of environmental sciences, since it offers great performance and ease of use.

The HI3814 is equipped with all the accessories and reagents to perform over 100 tests for each parameter.

The pHep®, our popular pH electronic tester, is included for your convenience. This small and easy to use pH meter will provide more accurate and reliable pH readings than conventional litmus paper. The pHep® also has the added benefit of introducing students to the use of a pH meter.

The kit is supplied complete with a step-by-step instruction manual and a hard carrying case to easily perform tests in the field.

Reagents can be replenished individually by parameter as they run out (please see our reagents section).

Parameter	Method	Range	Smallest Increment	Chemical Method	# Tests
HI3814 Environmental Monitoring Test Kit					
Acidity (as $CaCO_3$)	titration	0-100 mg/L (ppm) 0-500 mg/L (ppm)	1 mg/L (ppm) 5 mg/L (ppm)	methyl-orange/ phenolphthalein	110 avg.
Alkalinity (as $CaCO_3$)	titration	0-100 mg/L (ppm) 0-300 mg/L (ppm)	1 mg/L (ppm) 3 mg/L (ppm)	phenolphthalein/ bromphenol blue	110 avg.
Carbon Dioxide	titration	0.0-10.0 mg/L (ppm) 0.0-50.0 mg/L (ppm) 0-100 mg/L (ppm)	0.1 mg/L (ppm) 0.5 mg/L (ppm) 1 mg/L (ppm)	phenolphthalein	110 avg.
Hardness (as $CaCO_3$)	titration	0.0-30.0 mg/L (ppm) 0-300 mg/L (ppm)	0.3 mg/L (ppm) 3 mg/L (ppm)	EDTA	100 avg.
Oxygen, Dissolved	titration	0.0-10.0 mg/L (ppm)	0.1 mg/L (ppm)	modified Winkler	110 avg.
pH	electronic pH tester	0.0-14.0 pH	0.1 pH	–	life of the meter
Dimensions	440 x 330 x 100 mm (17.3 x 13.0 x 3.9")				
Ordering Information	**HI3814** test kit includes all of the necessary reagents and accessories to perform over 100 tests for every parameter, electronic pH tester, hard carrying case and instructions.				

See a list of chemical test kit reagents beginning on page 1.52

HI3887

Quick-Check Swimming Pool Test Kit

Free Chlorine and pH

Swimming pool water requires daily tests for chlorine and pH. Hanna's Quick-check test kits combine these two basic parameters in swimming pool monitoring.

Chlorine is commonly used in swimming pool water for it's disinfectant properties.

pH should be monitored to ensure proper activity of the disinfecting agents.

This kit is ideal for performing routine pH and chlorine testing.

Chlorine and pH tests are colorimetric (color comparison).

Parameter	Method	Range	Smallest Increment	Chemical Method	# Tests
HI3887 Quick-Check Swimming Pool Test Kit					
Free Chlorine	colorimetric	0-2.5 mg/L (ppm)	0.5 mg/L (ppm)	DPD	50 avg.
pH	colorimetric	6.0-8.5 pH	0.5 pH	pH indicator	100 avg.
Ordering Information	**HI3887** test kit includes color comparison cubes (2), 20 mL reagent 1, 12 mL reagent 2, 25 mL pH reagent and instructions.				

See a list of chemical test kit reagents beginning on page 1.52

HI3817

Water Quality Test Kit

Accurate and Reliable Water Quality Tests

Monitor the most important chemical parameters in water: alkalinity, chloride, hardness, iron, pH and sulfite with this combination test kit.

The kit has all the reagents needed to perform over 100 tests for each parameter, with the exception of iron, which includes reagents for 50 tests. Reagents may also be purchased individually as they run out (please see our reagent section for a complete listing).

pH measurements are performed with our electronic pHep® pH tester which guarantees more accurate and repeatable readings than litmus paper.

The chemical reagents to perform each test are provided in numerically labeled bottles and are easy to identify.

The kit is supplied with a convenient hard carrying case designed with field applications in mind. It will also keep your test kit neat and organized.

The Hanna HI3817 combination test kit offers all the necessary equipment for accurate and reliable water quality testing.

Parameter	Method	Range	Smallest Increment	Chemical Method	# Tests
HI3817 Water Quality Test Kit					
Alkalinity (as $CaCO_3$)	titration	0-100 mg/L (ppm) 0-300 mg/L (ppm)	1 mg/L (ppm) 3 mg/L (ppm)	phenolphthalein/ bromphenol blue	110 avg.
Chloride	titration	0-100 mg/L (ppm) 0-1000 mg/L (ppm)	1 mg/L (ppm) 10 mg/L (ppm)	mercuric nitrate	110 avg.
Hardness (as $CaCO_3$)	titration	0.0-30.0 mg/L (ppm) 0-300 mg/L (ppm)	0.3 mg/L (ppm) 3 mg/L (ppm)	EDTA	100 avg.
Iron	colorimetric	0-5 mg/L (ppm)	1 mg/L (ppm)	phenanthroline	50
pH	electronic pH tester	0.0-14.0 pH	0.1 pH	–	life of the meter
Sulfite (as Na_2SO_3)	titration	0.0-20.0 mg/L (ppm) 0-200 mg/L (ppm)	0.2 mg/L (ppm) 2 mg/L (ppm)	iodometric	110 avg.
Dimensions	440 x 330 x 100 mm (17.3 x 13.0 x 3.9")				
Ordering Information	**HI3817** test kit includes all of the necessary reagents and accessories to perform over 100 tests for every parameter, with the exception of iron, which include reagents for 50 tests, electronic pH tester, hard carrying case and instructions.				

See a list of chemical test kit reagents beginning on page 1.52

backpacklab.com

Test kits can be replaced individually

HI3817BP

Backpack Lab™ Water Quality Educational Test Kit

Backpack Lab™ Water Quality Educational Test Kit Includes:

- 110 tests each for acidity and alkalinity, 100 tests for carbon dioxide, dissolved oxygen, hardness, nitrate and phosphate
- Hanna's HI98129 Combo pH/EC/TDS/temperature tester
- Secchi disk for turbidity
- Backpack carrying case which holds all components of the kit
- Teacher's manual with a curriculum that meets National Science Teachers Association Standards
- Parameter summary in PDF and PowerPoint format (on included CD)
- Laminated, laboratory instruction cards with step-by-step field test procedures
- Reproducible lab activity worksheets with instructions, goals, hypothesis, and testing procedure results/observations (on included CD)
- A glossary of key terms in PDF format (on included CD)

Hanna offers a series of test kits specifically designed for educators and environmental science students. These portable kits contain well-constructed lessons and activities, and will allow the teacher to get the most out of their classroom time.

Backpack Lab™ is designed with all the necessary components in one place, reducing the chance of misplacing an item. Ideal for transporting, take this durable backpack to the field for on-site measurements.

The lesson plan and components are tied together by a comprehensive teacher's manual that includes information about each parameter, classroom activities designed to introduce students to each parameter, and detailed field-testing procedures. Hanna chemical test kits and pocket testers provide teachers with a valuable tool in helping students assess the water quality of streams, rivers and lakes.

Parameter	Reorder Code	Method	Range	Chemical Method	# Tests
HI3817BP Backpack Lab™ Water Quality Educational Test Kit					
Acidity ($CaCO_3$)	HI3820	titration	0-100 mg/L (ppm) 0-500 mg/L (ppm)	methyl-orange phenolphthalein	110 avg.
Alkalinity ($CaCO_3$) Phenolphthalein & Total	HI3811	titration	0-100 mg/L (ppm) 0-300 mg/L (ppm)	phenolphthalein/ bromphenol blue	110 avg.
Carbon Dioxide	HI3818	titration	0.0-10.0 mg/L (ppm) 0.0-50.0 mg/L (ppm) 0-100 mg/L (ppm)	phenolphthalein	110 avg.
Oxygen, Dissolved	HI3810	titration	0.0-10.0 mg/L (ppm)	modified Winkler	110 avg.
Hardness ($CaCO_3$)	HI3812	titration	0.0-30.0 mg/L (ppm) 0-300 mg/L (ppm)	EDTA	100 avg.
Nitrate (NO_3^-–N)	HI3874	colorimetric	0-50 mg/L (ppm)	cadmium reduction	100
Phosphate	HI3833	colorimetric	0-5 mg/L (ppm)	ascorbic acid	50

Ordering Information

HI3817BP Backpack Lab includes HI98129 Combo pH/EC/TDS/temperature tester, acidity test kit, alkalinity test kit, carbon dioxide test kit, dissolved oxygen test kit, hardness test kit, nitrate test kit, phosphate test kit, set of 10 field test procedures, teacher's resource CD, teacher's guide and backpack.

See a list of chemical test kit reagents beginning on page 1.52

Backpack Lab™ contents subject to change

HI3896BP

Backpack Lab™ Soil Quality Educational Test Kit

backpacklab.com

Backpack Lab™ Soil Quality Educational Test Kit Includes:

- Agriculture combination test kit for testing nitrogen, phosphorus, potassium (N,P,K) with enough materials for 50 tests of each parameter
- Hanna's HI98129 Combo pH/EC/TDS/temperature tester
- Hanna's HI145 digital thermometer
- Backpack carrying case which holds all components of the kit
- Teacher's manual with a curriculum that meets National Science Teachers Association Standards
- Parameter summary in PDF and PowerPoint format (on included CD)
- Laminated, laboratory instruction cards with step-by-step field test procedures
- Reproducible lab activity worksheets with instructions, goals, hypothesis and testing procedure results/observations (on included CD)
- A glossary of key terms in PDF format (on included CD)

Test kits can be replaced individually

Hanna introduces a kit specifically assembled for the educator and environmental science student. Using the popular Hanna Agricultural Combination Test Kit (HI3896) as its foundation, the Soil Quality Education Test Kit is designed to provide a complete lesson plan for teachers. Teachers are able to introduce students to important chemical tests for evaluating soil quality and fertility, and relate these measurements to the principles of plant metabolism. Tied together by an extensive teacher's guide, this kit includes in-depth background information about each parameter, classroom activities designed to introduce students to each parameter and field-testing procedures.

The Hanna Agricultural Combination Test Kit addresses important issues related to soil quality and modern agriculture practices. Real-world examples help students understand the relevance of macronutrients and other parameters in everyday life. This kit introduces the student to all major soil quality topics, and is presented in an easy-to-use format that makes lessons accessible, understandable and memorable.

Parameter	Reorder Code	Method	Range	Chemical Method	# Tests
HI3896BP Backpack Lab™ Soil Quality Educational Test Kit					
Nitrogen	HI3896	colorimetric	traces, low, medium, high	Ned	50
Phosphorus	HI3896	colorimetric	traces, low, medium, high	ascorbic acid	50
Potassium	HI3896	turbidimetric	traces, low, medium, high	tetraphenylborate	50
pH	HI3896	colorimetric	4 to 9 pH (1 pH increments)	pH indicators	50
Ordering Information	**HI3896BP** Backpack Lab test kit includes agriculture test kit pro, HI98129 Combo pH/EC/TDS/temperature tester, HI145 digital thermometer, set of 6 field test procedures, teacher's resource CD, teacher's guide and backpack				

Backpack Lab™ contents subject to change

See a list of chemical test kit reagents beginning on page 1.52

backpacklab.com

HI3899BP

Backpack Lab™ Marine Science Educational Test Kit

Test kits can be replaced individually

Backpack Lab™ Includes:

- 110 tests each for acidity and alkalinity, 100 tests for ammonia, carbon dioxide, dissolved oxygen, hardness, nitrate, nitrogen, phosphate and salinity
- Hanna's HI98129 Combo pH/EC/TDS/temperature tester
- Hydrometer for salinity
- Secchi disk for turbidity
- Backpack-style carrying case which holds all components of the kit
- Teacher's manual with a curriculum that meets National Science Teachers Association Standards
- Parameter summary in PDF and PowerPoint format (on included CD)
- Laminated, laboratory instruction cards with step-by-step field-test procedures
- Reproducible lab activity worksheets with instructions, goals, hypothesis, and testing procedure results/observations (on included CD)
- A glossary of key terms in PDF format (on included CD)

Backpack Lab™ is designed with all the necessary components in one place, reducing the chance of misplacing an item. Ideal for transporting, take this durable backpack to the field for on-site measurements.

This kit is designed to provide a complete unit for teachers to introduce students to important marine science topics. The teacher's guide provides detailed background information for marine science lessons and activities that can be adapted to various grade levels. Field tests are included to complement classroom lessons. All materials fit easily into the supplied backpack for convenient transport.

Parameter	Reorder Code	Method	Range	Chemical Method	# Tests
HI3899BP Backpack Lab™ Marine Science Educational Test Kit					
Acidity ($CaCO_3$)	HI3820	titration	0-100 mg/L (ppm) 0-500 mg/L (ppm)	methyl-orange phenolphthalein	110 avg.
Alkalinity ($CaCO_3$) Phenolphthalein & Total	HI3811	titration	0-100 mg/L (ppm) 0-300 mg/L (ppm)	phenolphthalein/ bromphenol blue	110 avg.
Ammonia (as NH_3–N) in saltwater	HI3826	colorimetric	0.0-2.5 mg/L (ppm)	Nessler	25 avg.
Carbon Dioxide	HI3818	titration	0.0-10.0 mg/L (ppm) 0.0-50.0 mg/L (ppm) 0-100 mg/L (ppm)	phenolphthalein	110 avg.
Oxygen, Dissolved	HI3810	titration	0.0-10.0 mg/L (ppm)	modified Winkler	110 avg.
Nitrite	HI3873	colorimetric	0.0-1.0 mg/L (ppm)	chromotropic acid	100
Nitrate (NO_3^-–N)	HI3873	colorimetric	0-50 mg/L (ppm)	cadmium reduction	100
Phosphate	HI3833	colorimetric	0-5 mg/L (ppm)	ascorbic acid	50
Salinity	HI3835	titration	0.0-40.0 g/kg	mercuric nitrate	110 avg.

Ordering Information

HI3899BP Backpack Lab includes acidity test kit, alkalinity test kit, carbon dioxide test kit, ammonia test kit, dissolved oxygen test kit, nitrate test kit, nitrite test kit, phosphate test kit, salinity test kit, secchi disc, hydrometer, HI98129 Combo pH/EC/TDS/temperature tester, set of 6 field test procedures, teacher's resource CD, teacher's guide and backpack.

See a list of chemical test kit reagents beginning on page 1.52

Backpack Lab™ contents subject to change

Chemical Test Kit Reagents

CTK Code	Test Kit Parameter	Chemical Method	Reagent Code	# Tests
HI3810	Dissolved Oxygen	Winkler	**HI3810-100**	110 avg.
HI3811	Alkalinity (as $CaCO_3$)	phenolphthalein/bromphenol blue	**HI3811-100**	110 avg.
HI3812	Hardness, total (as $CaCO_3$)	EDTA titration	**HI3812-100**	100 avg.
HI3814	Dissolved Oxygen	Winkler	**HI3810-100**	110 avg.
	Alkalinity (as $CaCO_3$)	phenolphthalein/bromphenol blue	**HI3811-100**	110 avg.
	Hardness, Total (as $CaCO_3$)	EDTA titration	**HI3812-100**	100 avg.
	Carbon Dioxide	phenolphthalein titration	**HI3818-100**	110 avg.
	Acidity (as $CaCO_3$)	methyl-orange/phenolphthalein	**HI3820-100**	110 avg.
HI3815	Chloride	mercuric nitrate titration	**HI3815-100**	110 avg.
HI3817	Alkalinity (as $CaCO_3$)	phenolphthalein/bromphenol blue	**HI3811-100**	110 avg.
	Hardness, total (as $CaCO_3$)	EDTA titration	**HI3812-100**	100 avg.
	Chloride	mercuric nitrate titration	**HI3815-100**	110 avg.
	Sulfite (as Na_2SO_3)	titration	**HI3822-100**	110 avg.
	Iron	phenanthroline	**HI3834-050**	50 avg.
	Buffer solution	–	**HI70004P**	25
	Buffer solution	–	**HI70007P**	25
	Buffer solution	–	**HI70010P**	25
HI3817BP	Dissolved Oxygen	Winkler	**HI3810-100**	110 avg.
	Alkalinity (as $CaCO_3$)	phenolphthalein/bromphenol blue	**HI3811-100**	110 avg.
	Hardness, total (as $CaCO_3$)	EDTA titration	**HI3812-100**	100 avg.
	Carbon Dioxide	phenolphthalein titration	**HI3818-100**	110
	Acidity (as $CaCO_3$)	methyl orange/phenolphthalein	**HI3820-100**	110
	Phosphate	ascorbic acid	**HI3833-050**	50
	Nitrate (as NO_3^-–N)	cadmium reduction	**HI3874-100**	100
	Buffer solution	–	**HI70004P**	25
	Buffer solution	–	**HI70007P**	25
	Buffer solution	–	**HI70010P**	25
	EC Calibration Standard	–	**HI70031P**	25
	EC Calibration Standard	–	**HI7033M**	1 bottle (230 mL)
HI3818	Carbon Dioxide	phenolphthalein titration	**HI3818-100**	110 avg.
HI3820	Acidity (as $CaCO_3$)	methyl orange/phenolphthalein	**HI3820-100**	110 avg.
HI3821	Alkalinity (as $CaCO_3$)	phenolphthalein/bromphenol blue	**HI3811-100**	110 avg.
	Chloride	mercuric nitrate titration	**HI3815-100**	110 avg.
	Hardness, total (as $CaCO_3$)	EDTA titration	**HI3812-100**	100 avg.
	Dissolved Oxygen	Winkler	**HI3810-100**	110 avg.
	Phosphate	ascorbic acid	**HI3833-050**	50
	Sulfite (as Na_2SO_3)	titration	**HI3822-100**	110 avg.
HI3822	Sulfite (as Na_2SO_3)	titration	**HI3822-100**	110 avg.
HI3824	Ammonia (fresh water) (as NH_3–N)	Nessler colorimetric	**HI3824-025**	25 avg.
HI3826	Ammonia (seawater) (as NH_3–N)	Nessler colorimetric	**HI3826-025**	25 avg.
HI3827	Alkalinity (as $CaCO_3$)	acid titration	**HI3811-100**	110 avg.
	Hardness, total (as $CaCO_3$)	EDTA titration	**HI3812-100**	100 avg.
	Chloride	mercuric nitrate titration	**HI3815-100**	110 avg.
	Sulfite (as Na_2SO_3)	titration	**HI3822-100**	110 avg.
	Phosphate	ascorbic acid	**HI3833-050**	50
	Buffer solution	–	**HI70004P**	25
	Buffer solution	–	**HI70007P**	25
HI3830	Bromine	DPD colorimetric	**HI3830-060**	60 avg.

Chemical Test Kit Reagents

CTK Code	Test Kit Parameter	Chemical Method	Reagent Code	# Tests
HI3831F	Chlorine, free	DPD colorimetric	**HI3831F-050**	50 avg
HI3831T	Chlorine, total	DPD colorimetric	**HI3831T-050**	50 avg
HI3833	Phosphate	ascorbic acid	**HI3833-050**	50
HI3838	Formaldehyde	acid titration	**HI3838-100**	110 avg
HI3840	Hardness LR (as $CaCO_3$)	EDTA titration	**HI3840-050**	50 avg
HI3841	Hardness MR (as $CaCO_3$)	EDTA titration	**HI3841-050**	50 avg
HI3842	Hardness HR (as $CaCO_3$)	EDTA titration	**HI3842-050**	50 avg
HI3843	Hypochlorite (bleach)	iodometric	**HI3843-100**	100 avg
HI3844	Hydrogen Peroxide	iodometric	**HI3844-100**	100 avg
HI3846	Chromium VI	diphenylcarbohydrazide	**HI3846-100**	100 avg
HI3847	Copper	bicinchoninate	**HI3847-100**	100
HI3859	Glycol	oxidation	**HI3859-025**	25
HI3873	Nitrite (as NO_2^-–N)	chromotropic acid	**HI3873-100**	100
HI3874	Nitrate (as NO_3^-–N)	cadmium reduction	**HI3874-100**	100
HI3875	Chlorine, free	DPD colorimetric	**HI3875-100**	100
HI3887	Chlorine, free	DPD colorimetric	**HI3831F-050**	50 avg
	pH	colorimetric	**HI3881-010**	100 avg
HI3895	Nitrogen	Ned	**HI3895-010**	10
	Phosphorus	ascorbic acid	**HI3895-010**	10
	Potassium	tetraphenylborate	**HI3895-010**	10
	pH	pH indicators	**HI3895-010**	10
HI3896	Nitrogen	Ned	**HI3896-025**	25
	Phosphorus	ascorbic acid	**HI3896-025**	25
	Potassium	tetraphenylborate	**HI3896-025**	25
	pH	pH indicators	**HI3896-025**	25
HI3896BP	Nitrogen	Ned	**HI3896-025**	25
	Phosphorus	ascorbic acid	**HI3896-025**	25
	Potassium	tetraphenylborate	**HI3896-025**	25
	pH	pH indicators	**HI3896-025**	25
	Buffer solution	–	**HI70004P**	25
	Buffer solution	–	**HI70007P**	25
	Buffer solution	–	**HI70010P**	25
	EC Calibration Standard	–	**HI70031P**	25
	EC Calibration Standard	–	**HI7033M**	1 bottle (230 mL)
HI3897	Acidity, olive oil	titration with hydroxide	**HI3897-010**	10
HI3899BP	Dissolved Oxygen	Winkler	**HI3810-100**	110 avg
	Alkalinity (as $CaCO_3$)	phenolphthalein/bromphenol blue	**HI3811-100**	110 avg.
	Carbon Dioxide	phenolphthalein titration	**HI3818-100**	110 avg
	Acidity (as $CaCO_3$)	methyl-orange/phenolphthalein	**HI3820-100**	110 avg
	Ammonia, Seawater (as NH_3–N)	Nessler colorimetric	**HI3826-025**	25 avg
	Phosphate	ascorbic acid	**HI3833-050**	50
	Salinity	mercuric nitrate titration	**HI3835-100**	110 avg
	Nitrite (as NO_2^-–N)	chromotropic acid	**HI3873-100**	100
	Nitrate (as NO_3^-–N)	cadmium reduction	**HI3874-100**	100
	Buffer solution	–	**HI70004P**	25
	Buffer solution	–	**HI70007P**	25
	Buffer solution	–	**HI70010P**	25
	EC Calibration Standard	–	**HI70031P**	25
	EC Calibration Standard	–	**HI7033M**	1 bottle (230 mL)

Chemical Test Kit Reagents

CTK Code	Test Kit Parameter	Chemical Method	Reagent Code	# Tests
HI38000	Sulfate	barium chloride	**HI38000-10**	100
HI38001	Sulfate LR/HR	barium chloride	**HI38001-10**	100
HI38017	Chlorine, free and total	DPD colorimetric	**HI38017-200**	200
HI38018	Chlorine, free	DPD colorimetric	**HI38018-200**	200
HI38020	Chlorine, free and total	DPD colorimetric	**HI38020-200**	200
HI38023	Chlorine, total, extended range	iodometric	**HI38023-100**	100
HI38033	Hardness, total (as $CaCO_3$)	EDTA titration	**HI38033-100**	100
HI38039	Iron LR	phenanthroline colorimetric	**HI38039-100**	100
HI38040	Iron MR	phenanthroline colorimetric	**HI38040-100**	100
HI38041	Iron HR	phenanthroline colorimetric	**HI38041-100**	100
HI38050	Nitrate (soil + irrigation) (as NO_3^-–N)	cadmium reduction	**HI38050-200**	200
HI38054	Ozone	DPD	**HI38054-100**	100
HI38061	Phosphate	ascorbic acid	**HI38061-100**	100
HI38067	Silica HR (as SiO_2)	heteropoly blue	**HI38067-100**	100
HI38074	Boron	boric acid	**HI38074-100**	100

Table of Contents

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 maintainence 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 in 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.

RH Measuring Tester

Relative humidity testers from Hanna use the thin film polymer capacitance sensing method, assuring a quick and accurate reading. Readings are converted directly in RH units, meaning there is no need for estimating, charts, thermometers or complicated calculations.

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. The multiparameter models allow the user to monitor up to three different parameters with one indicator.

Each monitor has been designed to meet 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 functions freeze the readings on 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 with large backlit LCDs to give users instantaneous readings of multiple parameters with the utmost clarity. Monitors are provided with automatic calibration, automatic buffer selection and automatic temperature compensation (ATC) features.

Hanna's wall-mounted monitors are very easy to install and work with a 12 V 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 (β) 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, enhancing the control and maintenance of water.

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

HI98129 • HI98130
pH/Conductivity/TDS Testers

2.8

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.

HI98100
Checker®Plus pH Tester

2.13

The pH Checker®Plus series provides users with fast and accurate readings from 0 to 14 pH with a resolution of 0.01 pH. The Checker®Plus features an easy-to-read LCD and two-point calibration with automatic buffer recognition.

The HI1271 pH electrode of the Checker®Plus can be easily replaced. You only need to unscrew the electrode from the meter body and screw on a new one.

The Checker®Plus is fast, accurate, lightweight and with 1000 hours of battery life, there is no need to worry about frequent battery replacement.

HI98331
Soil Test™ Direct Soil EC Tester

2.19

The HI98331 Soil Test™ is a pocket tester specifically designed to directly measure soil conductivity and temperature. With a temperature sensor in the penetration probe, measurements are automatically temperature-compensated.

The conductivity range can be calibrated at one point and is designed to be performed in a standardized solution.

HI98501 Checktemp®
Digital Thermometer

2.24

The Checktemp® delivers high accuracy temperature measurements over a wide temperature range without worrying about 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.

HI98509 Checktemp®1
Digital Thermometer
with Stainless Steel Probe Attached to a 3.3' Silicone Cable

2.25

The 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 to HACCP requirements. The sharp-tip penetration probe easily lances semi-solid products such as fruits, vegetables, and cheeses. This probe can also handle liquid, air and measurements in 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.

HI147
Checkfridge™ Remote Sensor Thermometer

2.40

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 in the real vs theoretical temperatures. With the HI147, there is no need to waste time preparing and ice bath for making these tests. It's 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.

Comparison Guide

Code	pH Range	EC Range	TDS Range	ORP Range	Relative Humidity Range	Salinity Range	Temperature Range(s)	0.01 pH Resolution	Automatic Calibration	Automatic EC Calibration	pH Calibration Points	EC/TDS Calibration Points	pH Buffer Sets	ATC	Waterproof	Replaceable Electrode/Probe	Cloth Extendable Junction	HOLD Function	BEPS	Auto-off	Page
Multiparameter																					
HI98129	•	•	•				°C/°F	•	•	•	2	1	2	•	•	•	•	•	•	•	2.8
HI98130	•	•	•				°C/°F	•	•	•	2	1	2	•	•	•	•	•	•	•	2.8
pH/ORP																					
HI98127	•						°C/°F		•		2		2	•	•	•	•	•	•	•	2.10
HI98128	•						°C/°F	•	•		2		2	•	•	•	•	•	•	•	2.10
HI98111	•							•			2			•		•					2.11
HI98112	•							•			2			•		•					2.11
HI98113	•						°C	•			2			•		•					2.11
HI98106	•										1						•				2.12
HI98107	•										2						•				2.12
HI98108	•										2			•			•				2.12
HI98100	•							•			2					•				•	2.13
HI98103	•							•			2					•					2.14
HI99104	•							•			2					•					2.15
HI98120				•			°C/°F								•	•		•	•	•	2.16
HI98121	•			•			°C/°F	•			2		2	•	•	•	•	•	•	•	2.16
HI98201				•																	2.17
EC/TDS																					
HI98311		•	•				°C/°F			•		1		•	•	•		•	•	•	2.18
HI98312		•	•				°C/°F			•		1		•	•	•		•	•	•	2.18
HI98331		•					°C					1		•		•					2.19
HI98301			•									1		•							2.20
HI98302			•									1		•							2.20
HI98303		•										1		•							2.20
HI98304		•										1		•							2.20
Primo			•						•			1		•						•	2.21
Primo 2			•				°C		•			1		•						•	2.21
Primo 5		•							•			1		•						•	2.21
HI98203						•						1									2.22
HI98202						•						1									2.23
HI98308		•										1				•					2.23
HI98309		•																			2.23

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	12 VDC Power Supply	Battery Power	Visual Alarm	Auto-off	Page
Temperature																				
HI98501					°C/°F							•								2.24
HI98509					°C/°F							•								2.25
HI151-00					°C							•							•	2.26
HI151-01					°F							•							•	2.26
HI145-00					°C							•								2.27
HI145-01					°F							•								2.27
HI145-20					°C							•								2.28
HI145-30					°F							•								2.28
HI98517					°C															2.28
Monitors																				
HI991404	•	•	•		°C/°F	2	2	•	•	•	•		•	•	•	•				2.29
HI991405	•	•	•		°C/°F	2	2	•	•	•	•		•	•	•	•				2.29
HI981504/5	•		•		°C/°F	2					•				•	•				2.30
HI981504/7	•		•		°C/°F	2					•				•	•				2.30
HI981404N	•		•			2					•					•				2.31
HI981405N	•	•				2				•						•				2.31
HI991401	•				°C/°F	2	2	•	•				•	•	•	•				2.32
HI981401N	•					2										•				2.33
HI981402	•					2										•		•		2.34
HI993301		•	•		°C/°F			•		•	•		•	•	•	•				2.35
HI993302		•	•		°C/°F			•		•	•		•	•	•	•				2.35
HI983302N		•								•						•				2.36
HI983307		•								•						•		•		2.37
HI983308			•								•					•		•		2.37
HI983304		•								•						•		•		2.38
HI146-00					°C												•			2.39
HI147-00					°C												•			2.40
HI147-01					°F												•			2.40

HI98129 • HI98130

pH/EC/TDS Testers

- Waterproof
  - Waterproof and designed to float
- ATC
  - Automatic Temperature Compensation
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- HOLD feature
  - HOLD button to freeze readings on the display
- Two-point calibration
  - Automatic one or two-point pH calibration

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 (β).

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.

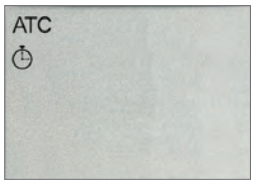
- Replaceable pH electrode cartridge
  - The Combo features an easy-to-replace pH electrode. The sturdy, snap-in connector means there are no pins to bend or break.

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

LCD Display Features

- 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 (β) 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	0.00 to 14.00 pH
	Resolution	0.01 pH	0.01 pH
	Accuracy	±0.05 pH	±0.05 pH
Conductivity	Range	0 to 3999 µS/cm	0.00 to 20.00 mS/cm
	Resolution	1 µS/cm	0.01 mS/cm
	Accuracy	±2% F.S.	±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	±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	EC/TDS Calibration	automatic, one point at 1413 µS/cm or 1382 mg/L (ppm)	automatic, one point at 12.88 mS/cm or 6.44 g/L (ppt)
	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 β 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.

For a list of our pH calibration and electrode solutions, see section 3;
for EC and TDS solutions, see section 6

HI98127 (pHep®4)
HI98128 (pHep®5)

pH 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

The pHep®4 and pHep®5 testers are for users that require the greatest accuracy while staying economical. The pHep®4 has a 0.1 pH resolution and pHep®5 reads up to 0.01 pH.

Both models have BEPS, which prevents taking a reading due to low battery as well as user-selectable automatic shut-off, a replaceable pH electrode cartridge, stability indicator and automatic calibration.

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

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

- 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		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.	

For a list of our pH calibration and electrode solutions, see section 3

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	1.00 to 13.00 pH; 0.0 to 70.0°C
	Resolution	0.01 pH	0.01 pH	0.01 pH; 0.1°C
	Accuracy (@25°C/77°F)	±0.01 pH	±0.01 pH	±0.01 pH; ±1°C
Additional Specifications	Electrode	HI1280	HI1290	HI1295
	Calibration	manual, two-point	manual, two-point	manual, two-point
	Temperature Compensation	automatic, 0 to 70°C (32 to 150°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")	265 x 29 x 15 mm (10.4 x 1.1 x 0.6")
	Weight	70 g (2.5 oz.)		

Ordering Information

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.

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.

For a list of our pH calibration and electrode solutions, see section 3

HI98106 Champ®
HI98107 pHep®
HI98108 pHep®+

pHep pH Tester

- Renewable junction
- Easy one or two-point manual calibration
- 700 hour battery life
- Simple to use
- Economical

The pHep® revolutionized the pH industry by providing non-technical personnel with a simple, inexpensive solution to accurate pH measurement.

The HI98107 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 clogs with use over time and a typical tester would normally have to be thrown away once the junction becomes contaminated. the HI98107 junction is 2 cm long and when dirty, can be pulled out to expose a fresh section to effectively renew the pHep's life.

Calibration is performed manually at one or two points with a trimmer located on the side of the tester.

With a battery life of 700 hours of continuous use, the pHep® will provide years of testing before the batteries need to be replaced.

Specifications		HI98106 (Champ®)	HI98107 (pHep®)	HI98108 (pHep®+)
pH	Range	0.0 to 14.0 pH	0.0 to 14.0 pH	0.0 to 14.0 pH
	Resolution	0.1 pH	0.1 pH	0.1 pH
	Accuracy (@25°C/77°F)	±0.2 pH	±0.1 pH	±0.1 pH
Additional Specifications	Calibration	manual, one-point	manual, two-point	manual, two-point
	Temperature Compensation	–	–	automatic from 0 to 50°C
	Battery Type / Life	1.5V (4) / approximately 800 hours of continuous use	1.5V (4) / approximately 700 hours of continuous use	1.5V (4) / approximately 200 hours of continuous use
	Environment	0 to 50°C (32 to 122°F); RH max 95%	0 to 50°C (32 to 122°F); RH max 95%	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")	175 x 41 x 23 mm (6.9 x 1.6 x 0.9")	175 x 41 x 23 mm (6.9 x 1.6 x 0.9")
	Weight	78 g (2.7 oz.)	95 g (3.4 oz.)	95 g (3.4 oz.)
Ordering Information	**HI98106** (Champ®), **HI98107** (pHep®), **HI98108** (pHep®+) are supplied with protective cap, calibration screwdriver, batteries and instructions.			

For a list of our pH calibration and electrode solutions, see section 3

HI98100

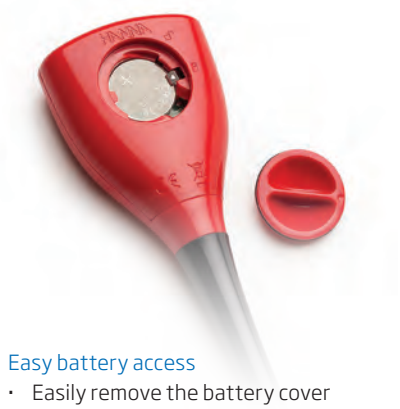
Checker®Plus pH Tester

- High accuracy with 0.01 pH resolution
- Two-point calibration with automatic buffer recognition
- 1000 hours of battery life
- HI1271 small diameter probe fits easily into a test tube

The pH Checker®Plus series provides users with fast and accurate readings from 0 to 14 pH with a resolution of 0.01 pH. The Checker®Plus features an easy-to-read LCD and two-point calibration with automatic buffer recognition.

The HI1271 pH electrode of the Checker®Plus can be easily replaced. You only need to unscrew the electrode from the meter body and screw on a new one.

The Checker®Plus is fast, accurate and lightweight. With 1000 hours of battery life, there is no need to worry about frequent battery replacement.



- Easy battery access
  - Easily remove the battery cover to replace the battery
- Save battery life with auto-off
  - With the auto-off feature, the Checker®Plus shuts off after 8 minutes

Specifications		HI98100 Checker®Plus
pH	Range	0.00 to 14.00 pH
	Resolution	0.01 pH
	Accuracy (@25°C/77°F)	±0.2 pH
Additional Specifications	Calibration	automatic, two-point
	Electrode	HI1271 (included)
	Battery Type / Life	CR2032 Li-ion / approximately 1000 hours of continuous use
	Auto-off	8 minutes
	Environment	0 to 50°C (32 to 122°F); RH 95% max
	Dimensions	71 x 50 x 21 mm (2.8 x 2.0 x .77") (excluding probe)
	Weight	50 g (1.8 oz.)
Ordering Information	**HI98100** (Checker®Plus) is supplied with pH electrode, battery and instructions.	

For a list of our pH calibration and electrode solutions, see section 3

HI98103

Checker® pH Tester

- High accuracy with 0.01 pH resolution
- Two-point manual calibration
- Usable with virtually any electrode that has the same connector
- 3000 hours of battery life
- HI1270 small diameter probe fits easily into a test tube

The pH Checker® series supplies users with fast and accurate readings from 0 to 14 pH with a resolution of 0.01 pH. This compact tester features an easy-to-read LCD and simple to perform two-point calibration.

The pH electrode of the Checker® can be easily replaced. You only need to unscrew the electrode from the meter body and screw on a new one.

The Checker® is fast, accurate and lightweight. With 3000 hours of battery life, you no longer have to worry about frequent battery replacement.

Specifications		HI98103 Checker®
pH	Range	0.00 to 14.00 pH
	Resolution	0.01 pH
	Accuracy (@25°C/77°F)	±0.2 pH
Additional Specifications	Calibration	manual, two-point
	Electrode	HI1270 (included)
	Battery Type / Life	1.5V (2) / approximately 3000 hours of continuous use
	Environment	0 to 50°C (32 to 122°F); RH max 95%
	Dimensions	66 x 50 x 25 mm (2.6 x 2.0 x 1.0") - excluding probe
	Weight	50 g (1.8 oz.) - excluding probe
Ordering Information	**HI98103** (Checker®) is supplied with HI1270 pH electrode, batteries and instructions.	

For a list of our pH calibration and electrode solutions, see section 3

HI99104

Education pH Tester

The HI99104 is an ideal pocket tester for educational purposes. Designed with a 0.01 pH resolution and two-point manual calibration through easy-to-reach trimmers, it immediately displays pH variations to reflect the smallest change in the sample.

Unlike conventional testers, the HI99104 has a long and slim stem, ideal for measurements in small samples or test tubes.

The HI99104 is supplied with a rugged, plastic body electrode with a screw connector that allows for quick and easy electrode replacement. Additionally, its low power demand allows for 1000 hours of battery life with common 1.5V batteries.

Specifications		HI99104
pH	Range	0.00 to 14.00 pH
	Resolution	0.01 pH
	Accuracy (@25°C/77°F)	±0.2 pH
Additional Specifications	Calibration	manual, two point
	pH Electrode	HI1270 (included)
	Battery Type / Life	1.5V (2) / approximately 1000 hours of continuous use
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Dimensions	200 x 28 x 20 mm (7.9 x 1.1 x 0.8")
	Weight	46 g (1.6 oz.)
Ordering Information	**HI99104** is supplied with HI 1270T pH electrode, batteries and instructions.	

For a list of our pH calibration and electrode solutions, see section 3

HI98120 • HI98121

pH/ORP and 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	± 1000 mV
	Resolution	1 mV	1 mV
	Accuracy	±2 mV	±2 mV
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	ORP Calibration	factory calibrated	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)	HI73127 replaceable pH electrode (included); fixed ORP sensor
	Battery Type / Life	1.5V (4) / approximately 250 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 / Weight	163 x 40 x 26 mm (6.4 x 1.6 x 1.0") / 100 g (3.5 oz.)	
Ordering Information	**HI98120** (ORP) is supplied with HI73120 ORP electrode, HI73128 electrode removal tool, batteries and instructions. **HI98121** (ORP/pH) is supplied with HI73127 pH electrode, HI73128 electrode removal tool, batteries and instructions.		

For a list of our pH and ORP calibration and electrode solutions, see section 3

HI98201

ORP Tester

Oxidation-reduction (ORP) is a process by which a chemical species 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.

The HI98201 is ideal for swimming pools and spas because 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.

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 (meter only)	175 x 41 x 23 mm (6.9 x 1.6 x 0.9")
	Weight (meter only)	95 g (3.4 oz.)
Ordering Information	**HI98201** (ORP) is supplied with protective cap, batteries and instructions	

For a list of our pH and ORP calibration and electrode solutions, see section 3

HI98311 • HI98312

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 β, 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 µS/cm	0.00 to 20.00 mS/cm
	Resolution	1 µS/cm	0.01 mS/cm
	Accuracy	±2% F.S.	±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	±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 µS/cm or 1382 mg/L (ppm)	automatic, one point at 12.88 mS/cm or 6.44 g/L (ppt)
	TDS Conversion Factor	adjustable from 0.45 to 1.00	
	Temperature Compensation	automatic, with β 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.	

For a list of our EC and TDS solutions, see section 6

HI98331

Soil Test™ Direct Soil EC Tester

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

The HI98331 Soil Test™ is a pocket tester designed to directly measure soil conductivity and temperature. With a temperature sensor in the penetration probe, measurements are automatically temperature-compensated.

The conductivity range can be calibrated at one point and is designed to be performed in a standardized solution.

- Replaceable 122 mm (4.5") penetration probe

Specifications		HI98331 Soil Test™
EC	Range	0.00 to 4.00 mS/cm (dS/m)*
	Resolution	0.01 mS/cm
	Accuracy	±0.05 mS/cm (0.00 to 2.00 mS/cm), ±0.30 mS/cm (2.00 to 4.00 mS/cm)
Temperature	Range	0.0 to 50.0°C
	Resolution	0.1°C
	Accuracy	±1°C
Additional Specifications	Calibration	manual, one point
	Probe	HI73331 122 mm (4.5") penetration (included)
	Temperature Compensation	automatic, temperature coefficient (β) fixed 2% / °C
	Environment	0 to 50°C (32 to 122°F); RH max 100%
	Battery Type	1.5V (4)
	Dimensions (without probe)	163 x 40 x 26 mm (6.4 x 1.6 x 1.0")
	Weight	100 g (3.5 oz.)
Ordering Information	**HI98331** (Soil Test™) is supplied with HI73331 penetration conductivity probe, calibration screwdriver, batteries and instructions.	

* The meter gives indicative readings with lower accuracy between 4 mS/cm and 10 mS/cm (mS/cm=ds/cm).

For a list of our EC solutions, see section 6

DiST®: HI98301 • HI98302 HI98303 • HI98304

EC and TDS Testers

- Automatic temperature compensation (ATC)
- One-point calibration

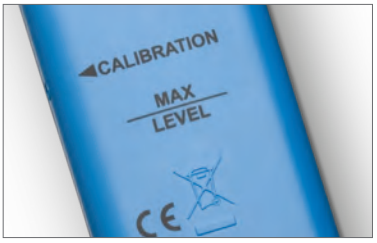
The DiST® family are rugged and reliable pocket-sized testers that offer quick and accurate readings of conductivity or TDS.

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 adjust the trimmer on the side of the tester.

- Exposed temperature sensor
  - These testers feature exposed temperature sensors for faster response times.



- Guides
  - The max level guide lets you know how deep to submerse the probe.

Specifications		HI98301 (DiST® 1)	HI98302 (DiST® 2)	HI98303 (DiST® 3)	HI98304 (DiST® 4)
TDS	Range	1999 mg/L (ppm)	10.00 g/L (ppt)	–	–
	Resolution	1 mg/L (ppm)	0.01 g/L (ppt)	–	–
	Accuracy (@25°C/77°F)	±2% F.S.	±2% F.S.	–	–
EC	Range	–	–	1999 µS/cm	19.99 mS/cm
	Resolution	–	–	1 µS/cm	0.01 mS/cm
	Accuracy (@25°C/77°F)	–	–	±2% F.S.	±2% F.S.
Additional Specifications	TDS Factor	0.65 / 0.5	0.5	–	–
	Calibration Solution	HI70442: 1500 ppm HI70032: 1382 ppm	HI70038: 6.44 ppt	HI70031: 1413 mS/cm	HI70039: 5.00 mS/cm HI70030: 12.88 mS/cm
	Calibration	manual, one point	manual, one point	manual, one point	manual, one point
	Temperature Compensation	automatic from 0 to 50°C (32 to 122°F)			
	Battery Type / Life	1.5V (4) / approx. 200 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		**HI98301** (DiST®1), **HI98302** (DiST®2), **HI98303** (DiST®3) and **HI98304** (DiST®4) are supplied with protective cap, screwdriver, batteries and instructions.			

For a list of our EC and TDS solutions, see section 6

Primo

EC/TDS Testers

- 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.

Temperature is compensated automatically to ensure the readings are consistent to the standard or reference temperature.

Operating and maintenance has never been easier. Primo uses a single button at the top of the meter. Press it once and the meter is powered and ready for use. Press and hold the button for a few seconds and Primo automatically enters calibration mode. Simply open a sachet of calibration solution, dip the probe in, and within seconds the meter automatically recognizes the calibration solution.

Specifications		Primo	Primo 2	Primo 5
TDS	Range	0 to 1999 mg/L (ppm)	0 to 1999 mg/L (ppm); 0.0 to 60.0°C	–
	Resolution	1 mg/L (ppm)	1 mg/L (ppm); 0.1°C	–
	Accuracy (@25°C/77°F)	±2% F.S.	±2% F.S.; ±0.5°C	–
EC	Range	–	–	0 to 1999 µS/cm
	Resolution	–	–	1 µS/cm
	Accuracy (@25°C/77°F)	–	–	±2% F.S.
Additional Specifications	Calibration	automatic, at 1382 mg/L (ppm)	automatic, at 1382 mg/L (ppm)	automatic, at 1413 µS/cm
	Probe Connection	direct	direct	direct
	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")	180 x 50 x 25 mm (7.1 x 2.0 x 1.0")
	Weight	50 g (1.8 oz.)	50 g (1.8 oz.)	50 g (1.8 oz.)
	Temperature Compensation	automatic from 0 to 60°C (32 to 140°F), β=2%/°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**, **Primo 2** and **Primo 5** are supplied with batteries and instructions.		

For a list of our EC and TDS solutions, see section 6

HI98203 SALINTEST

Salt Content Meter

- Replaceable sodium ion selective electrode
- Easy to handle
- Quick calibration

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 form of salt in seawater is sodium chloride (NaCl). The SALINTEST can help you accurately monitor the concentration of sodium chloride in aquaculture systems to ensure fish populations remain healthy.

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.

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.	

For a list of solutions, see our conductivity section 6 and ISE section 4

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 (µS) 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 µS/cm	0.000 to 1.999 µS/cm
	Resolution	0.1 µS/cm	0.001 µS/cm
	Accuracy	±2% F.S.	±2% F.S.
Additional Specifications	Calibration	manual, one point	factory calibrated
	Temperature Compensation	automatic from 0 to 50°C (32 to 122°F) with β=2%/°C typical	–
	Battery Type / Life	1.5V (4) / approximately 250 hours of continuous use	1.5V (4) / approximately 120 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.	

HI98501 Checktemp®

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

- 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

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	**HI98501** (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.

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.	

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

The 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

HI151

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 (no CAL Check™) **HI151-01** (Checktemp®4 F) is supplied complete with battery and instructions (no CAL Check™)	

HI145-20 (°C) – HI145-30 (°F):
Stainless steel probe 300 x dia 5 mm

HI145-00 (°C) – HI145-01 (°F):
Stainless steel probe 125 x dia 5 mm

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 it's 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. **HI145-00** with 125 mm probe, **HI145-01** with 125 mm probe, **HI145-20** with 300 mm probe; **HI145-30** 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.

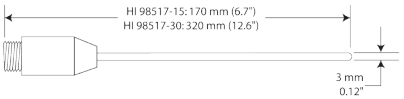
4 probes available:

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.)
Ordering Information	**HI98517** (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	0.0 to 14.0 pH
	Resolution	0.1 pH	0.1 pH
	Accuracy	±0.1 pH	±0.1 pH
EC	Range	0 to 3999 µS/cm	0.00 to 20.00 mS/cm
	Resolution	1 µS/cm	0.01 mS/cm
	Accuracy	±2% F.S.	±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	±2% F.S.	±2% F.S.
Temperature	Range	0.0 to 60.0°C / 32.0 to 122.0°F	0.0 to 60.0°C / 32.0 to 122.0°F
	Resolution	0.1°C (o 0.1°F)	0.1°C (0.1°F)
	Accuracy	±0.5°C (±1°F)	±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	automatic, one-point at 12.88 mS/cm or 6.44 g/L (ppt)
	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^{12} 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

HI991404-01 (115V) and **HI991404-02** (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.

HI991405-01 (115V) and **HI991405-02** (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.

For a list of our pH calibration and electrode solutions, see section 3;
for EC and TDS solutions, see section 6

HI981504/5 • HI981504/7

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.

Specifications		HI981504/5 • HI981504/7
pH	Range	0.0 to 14.0
	Resolution	0.1
	Accuracy	±0.2
TDS	Range	0 to 1990 ppm
	Resolution	10 ppm
	Accuracy	±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	±0.3°C or ±0.5°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.)
Ordering Information		**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.

For a list of our pH calibration and electrode solutions, see section 3;
for TDS solutions, see section 6

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		**HI981404N-01** (115V) and **HI981404N-02** (230V) are supplied complete with HI1286 pH electrode, HI7634 TDS probe, HI1283 grounding bar, calibration solutions, screwdriver for calibration, 12 VDC adapter and instructions. **HI981405N-01** (115V) and **HI981405N-02** (230V) are supplied complete with HI1286 pH electrode, HI7632 EC probe, HI1283 grounding bar, calibration solutions, screwdriver for calibration, 12 VDC adapter and instructions.	

For a list of our pH calibration and electrode solutions, see section 3;
for EC and TDS solutions, see section 6

HI991401

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	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^{12} 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** (115V) and **HI991401-02** (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.

For a list of our pH calibration and electrode solutions, see section 3

HI981401N

pH Monitor

- Two-point calibration
- Water-resistant

The pH monitor HI981401N has been designed to meet the grower's need for equipment suited to the environments found in agricultural and hydroponics applications. The housing is water resistant and features a molded eye which allows installation right above the sample to be monitored.

Measurements are highly accurate and can be verified with two-point calibration. With a 12 VDC power supply included with the meter, low battery failures are never an issue. The electrode is interchangeable and the connector is well protected behind a waterproof sleeve. The meter is supplied with a stainless steel probe, preventing potential grounding problems and ensuring extended electrode life.

The gel-filled 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 such as 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^{12} 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	**HI981401N-01** (115V) and **HI981401N-02** (230V) are supplied with HI1286 pH electrode, HI 1283 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.

For a list of our pH calibration and electrode solutions, see section 3

HI981402

pH Monitor

- Waterproof
- LED indicators

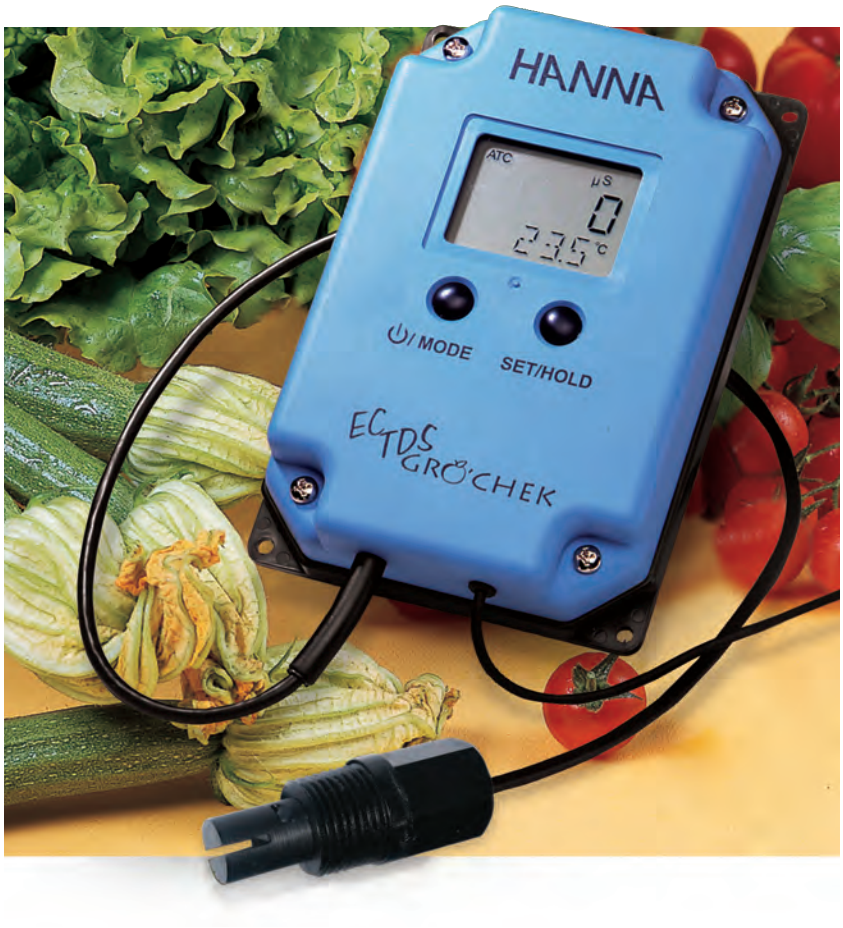
The HI981402 is a water-resistant pH meter with a built-in digital LCD. The meter is supplied with the HI1286 double junction, plastic bodied, gel-filled combination pH electrode with a flexible 2 m (6.6') cable. The electrode also has a unique clog-resistant PTFE junction that enhances both probe life 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 ±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 (pH Pronto)
Range	0.0 to 14.0 pH
Resolution	0.1 pH
Accuracy (@25°C/77°F)	±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 ±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** (115V) and **HI981402-02** (230V) is supplied with HI1286 pH electrode, calibration screwdriver, 12 VDC power adapter and instructions.

For a list of our pH calibration and electrode solutions, see section 3



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 (β) are user-adjustable for application-specific measurements.

Specifications		HI993301	HI993302
EC	Range	0 to 3999 µS/cm	0.00 to 20.00 mS/cm
	Resolution	1 µS/cm	0.01 mS/cm
	Accuracy	±2% F.S.	±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	±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	EC/TDS Calibration	automatic, one point at 1413 µS/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 β adjustable from 0.0 to 2.4%/°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

HI993301-01 (115V) and **HI993301-02** (230V) is supplied with HI7630 conductivity probe, HI70031 1413 µS/cm calibration solution sachet, 12 VDC adapter and Instructions.

HI993302-01 (115V) and **HI993302-02** (230V) is supplied with HI7630 conductivity probe, HI70030 12.88 mS/cm calibration solution sachet, 12 VDC adapter and Instructions.

For a list of our EC and TDS solutions, see section 6

HI983302N

EC Meter

- Water-resistant
- Automatic Temperature Compensation (ATC)

The HI983302N has been engineered with a host of features suited for the aggressive environments commonly found in agricultural applications. Housings and cable connections have been sealed against vapor and humidity.

The HI983302N is supplied with a probe specifically made for horticulture and hydroponics applications. The easy-to-clean probe compensates for temperature variations automatically and provides stable readings.

The 12 VDC power supply included with the meter eliminates low battery failures.

Specifications	HI983302N
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	**HI983302N-01** (115V) and **HI983302N-02** (230V) is supplied with HI7632 probe, 12 VDC adapter, 1413 mS/cm calibration solution (20 mL), calibration screwdriver and instructions.

For a list of our EC and TDS solutions, see section 6

HI983307 • HI983308

EC/TDS Meters

- Automatic Temperature Compensation (ATC)
- Water-resistant

These water-resistant EC and TDS meters are the result of customer requests for accurate, affordable process monitoring with low maintenance.

Each meter is supplied with a direct two-pin probe and 2 m (6.6') cable with a ½" 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 β 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. These EC and TDS monitors 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	HI983308
EC	Range	0.00 to 9.99 mS/cm	–
	Resolution	0.01 mS/cm	–
	Accuracy (@25°C/77°F)	±2% F. S.	–
TDS	Range	–	0.00 to 9.99 g/L (ppt)
	Resolution	–	0.01 g/L (ppt)
	Accuracy (@25°C/77°F)	–	±2% F. S.
Additional Specifications	Calibration	manual, one-point, through trimmer	manual, one-point, through trimmer
	Calibration Solution	HI70039	HI70038
	Temperature Compensation	automatic, 5 to 50°C (41 to 122°F) with β=2%	automatic, 5 to 50°C (41 to 122°F) with β=2%
	TDS Factor	–	0.5
	Setpoint	0.70 to 3.50 mS/cm	0.70 to 3.50 g/L (ppt)
	Alarm	red LED blinks when measured value differs from set point more than:	
		±0.20 mS/cm	±0.20 g/L (ppt)
	Probe (included)	HI7632/2	HI7632/2
		all probes are provided with 2 m (6.6') cable and ½" 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), **HI983307-02** (230V), **HI983308-01** (115V) and **HI983308-02** (230V) are supplied with HI7632/2 EC/TDS probe, calibration screwdriver, 12 VDC adapter and instructions.	

For a list of our EC and TDS solutions, see section 6

HI983304

Conductivity Meters 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 µS/cm.

This meter is supplied with an HI7631/2 direct two-pin probe with 2 m (6.6') cable and a ½" 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 µS/cm over the setpoint.

Specifications	HI983304
Range	0.00 to 19.99 µS/cm
Resolution	0.01 µS/cm
Accuracy (@25°C/77°F)	±2% F. S.
Calibration	manual, one point, through trimmer
Temperature Compensation	automatic, 5 to 50°C (41 to 122°F) with β=2.4%/°C
Setpoint	1.00 to 5.00 µS/cm
Alarm	red LED blinks when measured value differs from the setpoint more than 1.00 µS/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.

For a list of our EC solutions, see section 6

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 ±0.3°C (±0.5°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
Range	-50.0 to 150.0°C
Resolution	0.1°C
Accuracy	±0.3°C (-20 to 90°C) ±0.5°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**, and **HI146-99** are supplied with stainless steel temperature probe, battery and instructions.

HI147

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 and 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	HI73311
Description	pH electrode	ORP electrode	EC/TDS electrode	pH electrode	EC/TDS electrode
Reference	single, Ag/AgCl	single, Ag/AgCl		single, Ag/AgCl	
Junction / Flow Rate	cloth	cloth		open	
Electrolyte	gel	gel		viscolene	
Max Pressure	0.1 bar	0.1 bar		0.1 bar	
Range	pH: 0 to 14	ORP: ±2000 mV		pH: 0 to 13	
Recommended Operating Temp.	-5 to 50°C (23 to 122°F)	-5 to 50°C (23 to 122°F)	-5 to 50°C (23 to 122°F)	0 to 50°C (32 to 122°F)	-5 to 50°C (23 to 122°F)
Tip /Shape	spheric (dia: 5.0 mm)	platinum pin		spheric (dia: 3.0 mm)	conic
Temperature Sensor	no	no	no	no	no
Amplifier	no	no	no	no	no
Body Material	polypropylene	polypropylene	polypropylene	polypropylene	polypropylene, stainless steel
Cable	no	no	no	no	no
Recommended Use	general purpose, field applications	general purpose, field applications	general purpose, field applications	general purpose, field applications	agriculture, soil, field applications
Connection	pin	pin	pin	screw cap	3.5 mm jack

Replacement Electrodes

CODE	HI1280	HI1290	HI1295	HI1286	HI1293D
Description	pH electrode	pH electrode	pH electrode	pH electrode	pH electrode
Reference	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	PTFE	PTFE
Electrolyte	gel	gel	gel	polymer	polymer
Max Pressure	0.1 bar	0.1 bar	2 bar	3 bar	3 bar
Range	pH: 0 to 13	pH: 0 to 13	pH: 0 to 13	pH: 0 to 13	pH: 0 to 13
Recommended Operating Temp.	0 to 70°C (32 to 158°F)	0 to 70°C (32 to 158°F)	0 to 70°C (32 to 158°F)	0 to 80°C (32 to 176°F)	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: 7.5 mm)	spheric (dia: 7.5 mm)
Temperature Sensor	yes	yes	yes	no	no
Amplifier	yes	yes	yes	no	yes
Body Material	polypropylene	polypropylene	polypropylene	PEI	PEI
Cable	no	no	no	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	general purpose, water treatment, agriculture	hydroponics, greenhouses
Connection	multi-pin	multi-pin	multi-pin	BNC	DIN

Table of Contents

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 or...
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. Manually adjust 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 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. It is important that the measurement process determination be stable and accurate.

With Hanna's CAL Check™ technology, the offset of the electrode can be evaluated using one point calibration. Offset is generally determined using a 7.01 pH buffer, however, using CAL Check™ allows the offset to be based on any calibration point.

The acceptable range for offset is ±30 mV although 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 added 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 use 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.

The graphic LCD that many Hanna meters include improves the user experience with features such as tutorials, contextual help, multi-language support and icons and messages to guide the user through operation and calibration.

Comparison Guides

HALO™ and Hanna Lab App

	pH Range	0.001 pH Resolution	Five-point pH Calibration	Calibration Buffers	GLP features	iPad Compatible	Bluetooth® Wireless Technology	Hanna Lab App Required	Data Logging	Battery Life	Page
HI11312	0.00-13.00	•	•	up to 7	•	•	•	yes (page 3.10)	•	500 hours	3.8

edge® pH • EC • DO Kit and Single Parameter

	pH Measurement	EC/TDS Measurement	DO Measurement	pH CAL Check™	0.001 pH Resolution	Five-point pH Calibration	Two Custom pH Buffers	GLP Features	Capacitive Touch Buttons	Data Logging	8 Hour Battery Life	PC Connectivity	Benchtop, Portable & Wall-Mount	3.5 mm probe input	Page
Kit Versions (all kit edge® versions have the capability to measure pH, EC and DO with compatible electrodes)															
edge® with pH Kit	•	*	*	•	•	•	•	•	•	•	•	•	•	•	3.12
edge® with EC Kit	*	•	*	*	*	*	*	•	•	•	•	•	•	•	3.12
edge® with DO Kit	*	*	•	*	*	*	*	•	•	•	•	•	•	•	3.12
Single Parameter (edge® single parameter versions have single parameter capability only)															
edge®pH	•			•	•	•	•	•	•	•	•	•	•	•	3.18

* With optional edge® compatible probe

HI5000
Research Grade pH Benchtop Meters

	Two Channels	ISE Measurement	EC/TDS Measurement	CAL Check™	0.001 pH Resolution	Five-point pH Calibration	Five Custom pH Buffers	GLP Features	Real Time Graphing	Data Logging	Incremental Methods	PC Connectivity	Fully Customizable	Page
HI5522	•	•	•	•	•	•	•	•	•	•	•	•	•	3.22
HI5521	•		•	•	•	•	•	•	•	•		•	•	3.22
HI5222	•	•		•	•	•	•	•	•	•	•	•	•	3.28
HI5221				•	•	•	•	•	•	•		•	•	3.28

HI3000

Laboratory Grade pH Benchtop Meters

	Two Channels	ISE Measurement	EC/TDS Measurement	CAL Check™	0.001 pH Resolution	Five-point pH Calibration	TwoCustom pH Buffers	GLP Features	Log-on-demand (samples)	Auto-End	PC Connectivity	Page
HI3512	•	•	•	•	•	•	•	•	400	•	•	3.30
HI3222	•	•		•	•	•	•	•	400	•	•	3.32
HI3221		•		•	•	•	•	•	300	•	•	3.32
HI3220				•	•	•	•	•	200	•	•	3.32

Other 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
HI2550	•		•	•	•	•	•	•	•	•					3.34
HI122	•	•	•		•	•	•	•		•		•			3.36
HI2211	•		•	•											3.37
HI2210			•	•											3.37
HI2209	•												•		3.38
HI22091													•	•	3.38
HI208			•	•							•				3.39
HI207			•	•											3.39

Waterproof Portable Meters

	ISE Measurement	mV Measurement	Temperature Measurement	0.001 pH Resolution	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	•	•	•	•	•	•	•	•	3.40
HI98191	•	•	•	•	•	•	•	200	•	•	•	•	•	•	•	•	3.40

Portable Meters

	ISE Measurement	mV Measurement	Temperature Measurement	0.001 pH Resolution	CAL Check™	Automatic Calibration	Automatic Temperature Compensation	Log on Demand (records)	Five-point pH Calibration	Custom Buffers	BEPS	Waterproof	GLP Features	PC Connectivity	Auto-end	Backlit LCD	Page
HI9126		•	•	•	•	•	•			•	•	•				•	3.43
HI9125		•	•			•	•				•	•					3.44
HI9124			•			•	•				•	•					3.44

Application Specific Portable Meters

	pH Sensor Check™	mV Measurement	pH-mV Measurement	Temperature Measurement	BEPS	Automatic Temperature Compensation	Two-Point pH Calibration	Waterproof	General Purpose	Soil Measurement	Plating Baths	Boiler & Cooling Towers	Leather & Paper	Food & Dairy	Low Ionic Strength Water	Beer Analysis	Wine Analysis	Meat Measurement	pH of Skin	Page
HI99121				•	•	•	•	•		•										3.46
HI99131				•	•	•	•	•			•									3.47
HI99141				•	•	•	•	•				•								3.48
HI99171				•	•	•	•	•					•							3.49
HI99161				•	•	•	•	•						•						3.50
HI99163				•	•	•	•	•										•		3.51
HI99191				•	•	•	•	•							•					3.52
HI99151				•	•	•	•	•								•				3.54
HI99111				•	•	•	•	•									•			3.56
HI99181				•	•	•	•	•											•	3.58

Other Portable Meters

	pH Sensor Check™	mV Measurement	pH-mV Measurement	Temperature Measurement	BEPS	Automatic Calibration	Automatic Temperature Compensation	HOLD Function	Two-Point pH Calibration	Waterproof	Low Battery Indicator	Pre-amplified pH Electrode	Auto-off	Page
HI991003	•	•	•	•	•	•	•	•	•	•	•			3.45
HI991002		•		•	•	•	•	•	•	•	•			3.45
HI991001				•	•	•	•	•	•	•	•			3.45
HI8424		•		•		•	•	•	•		•		•	3.59
HI8314		•		•			•		•		•	•		3.60
HI83141		•		•			•		•		•			3.60
HI8014		•							•					3.61
HI8010									•					3.61
HI8427		•									•			3.62
HI931001		•												3.62

HI11312

HALO™

The world's first pH electrode with Bluetooth® Smart technology

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. Its flexibility and ease of use will revolutionize the way pH is measured.

iPad not included.

Does not include electrode holder, beaker and magnetic stirrer.

HALO™ features

- Refillable glass pH electrode
- Double junction reference design
- Integrated temperature sensor
  - Ensures the calibration and measurement is automatically temperature compensated, thus eliminating error
- Wide pH (0-13) and temperature (-5 to 80°C) range
- Clear the clutter
  - Data is wirelessly transmitted to an iPad® running the Hanna Lab App via Bluetooth® Smart technology. HALO™ provides up to 500 hours of battery life
- One button sample tagging
  - Pressing either the button on the HALO™ pH probe or the probe icon in the Hanna Lab App will tag sample data for easy reference
- Calibration is stored
  - HALO™ stores calibration information; no additional calibration is needed when switching to another iPad
- Battery condition
  - The measurement screen of the Hanna Lab App displays the name, battery life and condition of the HALO™ probe

One press connect

Easily connect to the Hanna Lab App* at the press of a button via Bluetooth® wireless technology (10 m range (33')).

*Required for use. See the Hanna Lab App on the next page.

Status indicator

Visible from a distance, the LED halo light indicates the probe is active and transmitting.

Easy to replace battery

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

HI11312 HALO™ Specifications

Reference	double, Ag/AgCl
Junction	ceramic
Electrolyte	3.5M KCl
Range	0.00 to 13.00 pH ±420 mV -5.0 to 80.0°C (23.0 to 176.0°F)
Tip Shape	spheric
Outer Diameter (glass)	12 mm
Overall Length	195 mm
Environment	0.0 to 50.0°C (32.0 to 122.0°F), electronic module is not waterproof
Solution Temperature	-5.0 to 80.0°C (23.0 to 176.0°F)
Temperature Sensor	integrated
Body material	glass
Connection	Bluetooth® Smart (Bluetooth 4.0), 10 m (33') range
Battery Type / Life	CR2032 3V lithium ion / approximately 500 hours
Ordering Information	**HI11312 (HALO™)** is supplied with storage solution, storage cap, pH 7.01 buffer solution sachets (2), pH 4.01 buffer solution sachets (2), electrode cleaning solution sachets (2), HI7082 fill solution (30 mL), pipette for fill solution, battery, quality certificate and instruction sheet.

Hanna Lab App

pH Meter Application for use with HALO™

The first app that turns an iPad® into a full-featured pH meter!

- Connects to HALO™ via Bluetooth® 4.0
- Up to five-point pH calibration with seven standard pH buffers available
- Calibration reminder
  - Alerts you when HALO™ needs calibration
- Real-time data
  - Displays pH and temperature updated every second
- 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. The graph axes may be expanded using the iPad's pinch and zoom technology for enhanced viewing
- Measurement alarms
  - Alerts you if the measurement threshold is exceeded
- One button sample tagging
  - Pressing either the probe icon in the Hanna Lab App or button on the HALO™ pH probe will tag sample data for easy reference
- Data-logging with custom annotations
  - Saved log files may be annotated with measurement specific information
  - Data is autosaved every hour
- Four ways to save and share data:
  - All data since last autosave
  - Annotations only
  - All data within a timed interval
  - Annotations only within a timed interval
- Share data via email in CSV (comma-separated values) format
- Help and tutorials:
  - Demo probe mode to help explore features of the Hanna Lab App
  - General app information
  - General HALO™ information
  - pH tutorial
  - Maintenance tutorial
  - Contact information

Hanna Lab App features

The Hanna Lab App turns an iPad® into a full-featured pH meter when used with the Hanna HALO™ pH electrode with 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 the iPad's pinch-to-zoom technology for enhanced viewing.

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.

Readings are automatically saved to a history file every hour, limited only by the available memory on the iPad. Readings in specific time intervals can also be saved. Saved log files may be annotated with measurement specific information and also shared via email in CSV format.

The Hanna Lab App incorporates a probe calibration using up to five pH buffers that are automatically recognized and temperature corrected to 25.0°C during calibration.

Connecting a HALO™ probe to the Hanna Lab App is simple. Tap the Bluetooth® icon in the top-right corner to view all available HALO™ probes then press the button on your HALO™ probe. The blue halo on the probe will start blinking indicating that it is in discovery mode. Select the newly discovered HALO™ probe from the list of available probes. If a previously associated probe is discoverable when the app is opened, it will connect to that probe automatically.

Settings

Tap the gear icon in the top-right corner of the measurement screen to access the Probe Settings menu for the following options:

- Measurement
  - Measurement mode: pH or mV
  - Measurement resolution
  - Temperature compensation: automatic or manual
  - Temperature units
- Display
  - Good Laboratory Practice (GLP): on screen calibration data
  - View: basic, table or graph
  - Graph display: pH (mV) and/or temperature
  - Stability criteria
- Calibration
  - Perform calibration
  - Calibration buffers: Hanna or NIST
  - Calibration reminder
- Logging
  - Save
  - Share
- Alarms
  - pH (mV) and temperature

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, 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	Hanna Lab App works with iPad 3rd generation or newer (including iPad mini) with Bluetooth® 4.0 technology and iOS 7.1 or newer
Download Information	Download on the App Store

*HALO™ required for measurement use. ** Limits will be reduced to actual probe/sensor limits.

Easily accessible help menu

Clear and concise calibration screens

HALO™ continuously logs measurements and lets you retrieve the data you want, when you need it

Share data complete with custom annotations via email

edge®

pH • EC • DO

Hanna Instruments is proud to introduce the world's most innovative pH, EC and DO meter... edge®

edge® is thin and lightweight, measuring just 1/2" (12 mm) thick and weighing less than 9 ounces (250 g). edge® has an incredibly wide viewing angle, 5.5" (14 cm) LCD and a sensitive capacitive touch keypad.

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

edge® features Hanna's exclusive pH CAL Check™ to warn you if the electrode you are using is not clean or if your buffers are contaminated during calibration. We have added Sensor Check™ for pH sensors with a matching pin. Our Sensor Check™ feature warns you if the pH bulb is cracked and/or the junction of the electrode is compromised.

edge® is the culmination of Hanna's vision, design capabilities, integrated production facilities, and world class R&D teams. With edge®, Hanna has set the new standard!

edge® Technical Features

- 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 charging edge® when the cradle is not available.

- Clear, full text readout

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

- Data logging

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

- GLP

Data from the last calibration you perform is stored in the sensor including the electrode's offset, slope, date, time and standards. When any sensor (pH, EC, or DO) is connected to edge®, GLP data is automatically transferred.

- Basic mode

You can use edge® in basic mode–ideal for routine measurements by offering a simplified screen and features.

- CAL Check™ (edge® pH measurement only)

edge® features Hanna's exclusive CAL Check™ technology to warn you if the electrode bulb is not clean or if the buffers are contaminated during calibration.

Accepts pH, EC and DO edge® compatible probes

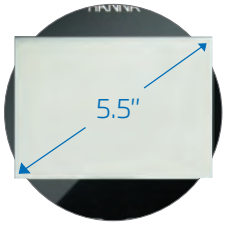
edge® Design Features

- Cradle and electrode holder

edge® is equipped with a benchtop cradle that features an adjustable swivel electrode holder which can charge and hold edge® securely in place at the optimum viewing angle.

- Capacitive touch keypad

edge® features a capacitive touch keypad that gives a distinctive, modern look. Since the keypad is part of the screen, your buttons can never get clogged with sample residue. For faster scrolling, simply hold down the arrow keys.



- 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 edge® and charge its batteries.

- 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 SMART electrodes are automatically recognized.

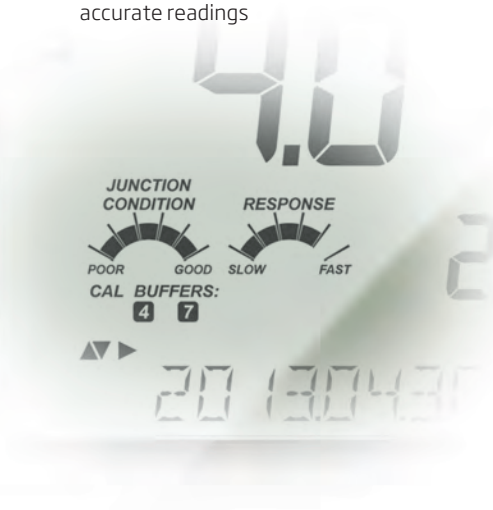
- Sleek design

edge® is incredibly thin and lightweight, measuring just 1/2" (12 mm) thick and weighing just 8.8 ounces (250 g).

edge pH Parameter and CAL Check™ Features

pH

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



CAL Check™

The edge® includes powerful algorithms to alert the user of potential problems during the pH calibration process. These indicators include when to clean the electrode, check the buffer, the response time, and the overall condition of the electrode.

WRONG BUFFER–Displayed when the difference between the pH reading and the value of the selected buffer is too great.

WRONG OLD POINTS INCONSISTENCY–Displayed if the new calibration differs significantly from the last value of that sensor in that buffer.

CLEAN ELECTRODE–This message indicates poor electrode performance (offset out of accepted window, or slope under the accepted lower limit).

CHECK ELECTRODE CHECK BUFFER–Displayed when electrode slope exceeds the highest accepted slope limit.

BAD ELECTRODE–Displayed if the cleaning procedure performed as a result of the previous two messages is unsuccessful.

WRONG BUFFER TEMPERATURE–Displayed if the temperature of the buffer is outside the defined buffer temperature range.

CONTAMINATED BUFFER–Displayed when the buffer could be contaminated.

Broken Temperature Sensor–If the temperature sensor should malfunction or break at any time, a temperature of "25.0°C" will blink on the second LCD line and the message **BROKEN TEMPERATURE SENSOR** will appear after leaving calibration.

Response and condition gauges appear on the display for 24 hours after an electrode calibration. These five segment displays provide a visual image of the overall condition of the pH probe based on offset and slope characteristics and speed of response based upon how long it took to stabilize in buffers during calibration.

edge EC and DO Parameter Features

Conductivity

- Four-ring platinum probe
  - Covers all ranges from 0.00 µS/cm to 500 mS/cm (absolute EC)
- Accuracy
  - ± 1% of the reading ± (0.05 µS/cm or 1 digit, whichever is greater)
- Calibration
  - Offset (0 µS/cm) and cell factor calibration
  - Choice of five standards
- Auto-ranging or manual range selection
- EC, TDS and salinity reading modes
- Temperature compensation
  - Automatic
  - NoTC (absolute)
- GLP data
  - Records date, time, offset and cell constant value (K)
- Adjustable EC to TDS conversion factor
- Adjustable temperature correction coefficient

Dissolved Oxygen

- Clark type polarographic probe with easy-to-replace membrane cap
  - Covers all ranges from 0.00 to 45.00 mg/L (ppm); 0.0 to 300% air saturation
- Accuracy
  - ±1.5% full scale
- One or two-point calibration (HI7040); 0% (solution) and 100% (air)
- Automatic Temperature Compensation from 0 to 50 °C
- Altitude compensation from -500 to 4000 m (-1640 to 13,123')
- Salinity compensation 0 to 40 g/L
- GLP data
  - Records date, time, calibration standards, altitude value and salinity value

- Portable field unit
  - edge® is ideal for field use due to its lightweight, large screen and thin design. It can be easily slipped into a backpack or messenger bag.
- Wall mount cradle
  - The included wall mount cradle makes it easy to conserve space on the benchtop and can charge edge® with the AC adapter. 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.

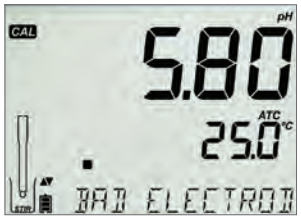
edge® Electrodes

Digital SMART Electrodes

The electrodes used with edge® are nearly as advanced as edge® itself. They feature a built-in microchip that stores sensor type, ID, and calibration information that is automatically retrieved by edge® once the electrode is plugged in.

Stored pH calibration information includes: calibrated buffers, date, time, offset and slope characteristics of the electrode. Conductivity calibration information includes: calibrated conductivity standards, date, time, and cell constant of the sensor. Dissolved oxygen calibration information includes: standards used for calibration, date, time, altitude and salinity correction.

These digital electrodes also feature an easy to plug in 3.5 mm connector so you never have to worry about the right angle or aligning pins.



Sensor Check™ (HI12301 and HI11311 only)

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

pH Electrodes

HI11310

Single ceramic, double junction, glass body, refillable pH electrode with temperature sensor

Recommended for laboratory and general purpose

Sensor Check™

HI11311

Single ceramic, double junction, glass body, refillable pH electrode with temperature sensor and matching pin

Recommended for laboratory and general purpose

HI12300

Single ceramic, double junction, gel filled, PEI body, pH electrode with temperature sensor

Recommended for field applications

Sensor Check™

HI12301

Single ceramic, double junction, gel filled, PEI body, pH electrode with temperature sensor and matching pin

Recommended for field applications

HI10530

Triple ceramic, double junction, glass body, refillable pH electrode with conical tip and temperature sensor

Recommended for fats and creams, and soil samples

HI10430

Triple ceramic, double junction, glass body, refillable pH electrode with temperature sensor

Recommended for paints, solvents, strong acids and bases, high conductivity samples, and Tris buffer

HI10480

Double reference, open junction, Clogging Prevention System (CPS), glass body pH electrode with temperature sensor

Recommended for wine analysis

FC2320

Double reference, open junction, viscolene electrolyte, PVDF body pH electrode with conical tip and temperature sensor

Recommended for meat applications

FC2100

Double reference, open junction, viscolene electrolyte, glass body pH electrode with conical tip and temperature sensor

Recommended for dairy analysis

FC2020

Double reference, open junction, viscolene electrolyte, PVDF body pH electrode with conical tip and temperature sensor

Recommended for dairy analysis

Conductivity Probe

HI763100

Conductivity probe with temperature sensor

Recommended for general purpose

Dissolved Oxygen Electrode

HI764080

Dissolved oxygen electrode with temperature sensor

Recommended for general purpose

- Simply connect each probe via the 3.5 mm jack, digital SMART Electrodes are automatically recognized

Specifications		edge®		
pH (using pH kit)	Range	basic mode: -2.00 to 16.00 pH; ±1000.0 mV for pH standard mode: -2.00 to 16.00 pH; -2.000 to 16.000 pH; ±1000.0 mV for pH		
	Resolution	0.01 pH; 0.001 pH; 0.1 mV		
	Accuracy (@25°C/77°F)	±0.01 pH; ±0.002 pH; ±0.2 mV		
	Calibration	Automatic, up to three points (five points†) calibration, 5 standard (7 standard†) buffers available (1.68†, 4.01 or 3.00, 6.86, 7.01, 9.18, 10.01, 12.45†) and two custom buffers†		
	Temperature Compensation*	automatic, -5.0 to 100.0°C (23.0 to 212.0°F) (using integral temperature sensor)		
	Electrode Diagnostics	standard mode: probe condition, response time and out of calibration range		
EC (using EC kit)	Range	EC	TDS	Salinity†
		0.00 to 29.99 µS/cm; 30.0 to 299.9 µS/cm; 300 to 2999 µS/cm; 30.0 to 200.0 mS/cm; up to 500.0 mS/cm (absolute EC)**	0.00 to 14.99 mg/L (ppm); 15.0 to 149.9 mg/L (ppm); 150 to 1499 mg/L (ppm); 1.50 to 14.99 g/L; 15.0 to 100.0 g/L; up to 400.0 g/L (absolute TDS)**, with 0.80 conversion factor	0.0 to 400.0 % NaCl; 2.00 to 42.00 PSU; 0.0 to 80.0 g/L
	Resolution	0.01 µS/cm; 0.1 µS/cm; 1 µS/cm; 0.01 mS/cm; 0.1 mS/cm	0.01 ppm; 0.1 ppm; 1 ppm; 0.01 g/L; 0.1 g/L (0.80 TDS factor)	0.1 % NaCl; 0.01 PSU; 0.01 g/L
	Accuracy (@25°C/77°F)	±1% of reading ±(0.5 µS or 1 digit, whichever is greater)	±1% of reading ±(0.03 ppm or 1 digit, whichever is greater)	±1% of reading
	Calibration	single cell factor calibration; six standards available: 84 µS/cm, 1413 µS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, 118.8 mS/cm, one point offset: 0.00 µS/cm	through EC calibration	one-point with HI7037 100% NaCl sea water standard
	Conductivity Temperature Coefficient	0.00 to 6.00%/°C (for EC and TDS only), default value is 1.90%/°C		
	Temperature Compensation*	automatic -5.0 to 100.0°C (23.0 to 212.0°F); NoTC – none, absolute conductivity.		
	TDS Factor	0.40 to 0.80 (default value is 0.50)		
DO (using DO kit)	Range	0.00 to 45.00 ppm (mg/L); 0.0 to 300.0 % saturation		
	Resolution	0.01 ppm (mg/L); 0.1 % saturation		
	Accuracy	± 1.5% of reading ±1 digit		
	Calibration	one or two-point at 0% (HI7040 solution) and 100% (in air)		
	Temperature Compensation*	0 to 50°C; 32.0 to 122.0°F		
	Salinity Compensation	0 to 40 g/L (with 1 g/L resolution)		
	Altitude Compensation	-500 to 4000 m (with 100 m resolution)		
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		
Additional Specifications	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	one USB port for storage; one micro USB port for charging and PC connectivity		
	pH Electrode (included in pH kit)	HI11310 digital glass body pH electrode with 1/8"(3.5mm) connector and 1 m (3.3') cable		
	EC Electrode (included in EC kit)	HI763100 digital four-ring conductivity probe with 1/8"(3.5mm) connector and 1 m (3.3') cable		
	DO Electrode (included in DO kit)	HI764080 digital dissolved oxygen electrode with 1/8"(3.5mm) connector and 1 m (3.3') cable		
	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

edge® is available in 3 kit configurations: pH, EC and DO

All kits Include: edge®, benchtop docking station with electrode holder, wall-mount cradle, USB cable, 5 VDC power adapter, quality certificate and instruction manual.

HI2020-01 (115V) and **HI2020-02** (230V) pH kit also includes: HI11310 glass body, refillable pH electrode with temperature sensor, pH 4 buffer solution sachets (2), pH 7 buffer solution sachets (2), pH 10 buffer solution sachets (2) and electrode cleaning solution sachets (2).

HI2030-01 (115V) and **HI2030-02** (230V) EC kit also includes: HI763100 EC probe, 1413 µS/cm conductivity standard sachets (3) and 12880 µS/cm conductivity standard sachets (3).

HI2040-01 (115V) and **HI2040-02** (230V) DO kit also includes: HI764080 dissolved oxygen electrode, HI7041S refill electrolyte solution, DO membrane caps (2) and o-rings (2).

All probes on the opposite page are interchangeable with edge® and can be ordered separately.

edge® compatible electrodes begin on page 3.91; pH solutions begin on page 3.100; DO solutions begin on page 7.21; EC and TDS solutions begin on page 6.42

* temperature limits will be reduced to actual probe/sensor limits
** with temperature compensation function disabled
† standard mode only

edge® pH

edge®pH–Innovation in a Single Parameter

edge®pH is thin and lightweight, measuring just 1/2" (12 mm) thick and weighing less than 9 ounces (250 g). edge® has an incredibly wide viewing angle, 5.5" (14 cm) LCD and a sensitive capacitive touch keypad.

edge®pH measures pH through its unique digital pH electrodes. These digital pH electrodes are auto-recognized, providing sensor type, calibration data and a serial number when connected to edge®pH by an easy to plug-in 3.5 mm connector. The versatile design of edge®pH enables it to be used as a handheld, benchtop or wall-mounted meter. edge® simplifies measurement, configuration, calibration, diagnostics, logging and transferring data directly to a computer or USB drive.

edge®pH features Hanna's exclusive CAL Check™ to warn you if the electrode you are using is not clean or if your buffers are contaminated during calibration. We have added Sensor Check™ for pH sensors with a matching pin. Our Sensor Check™ feature warns you if the pH bulb is cracked and/or the junction of the electrode is compromised.

edge®pH Technical Features

- Two USB ports

edge®pH includes one standard USB for exporting data to a flash drive. edge®pH also includes one micro USB port for exporting files to your computer as well as charging edge® 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 electrode's offset, slope, date, time and buffer/standards. When a compatible pH sensor is connected to edge®pH, GLP data is automatically transferred.

- Basic mode

You can use edge®pH in Basic Mode–ideal for routine measurements for a simplified screen and features.

- CAL Check™

edge®pH features Hanna's exclusive CAL Check™ technology to warn you if the electrode bulb is not clean or if the buffers are contaminated during calibration.

Accepts edge®pH compatible pH probes

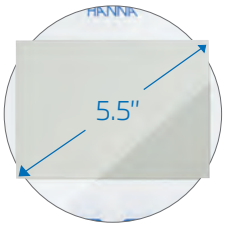
edge®pH Design Features

- Cradle and electrode holder

edge®pH is supplied with a benchtop cradle with an adjustable swivel electrode holder to charge and hold edge®pH securely in place at the optimum viewing angle.

- Capacitive touch keypad

edge®pH features a capacitive touch keypad that gives a distinctive, modern look. Since the keypad is part of the screen, your buttons can never get clogged with sample residue. For faster scrolling, simply hold down the arrow keys.

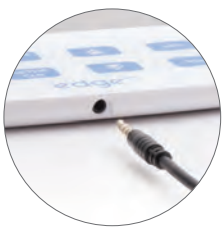


- Easy to read LCD

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 LCD's 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 edge®pH and charge its batteries.



- 3.5 mm probe input

Plugging an electrode in has never been simpler; no alignments or broken pins, just connect the 3.5 mm plug and begin. Digital SMART 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).

edge®pH Parameter and CAL Check™ Features

pH

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

CAL Check™

The edge® includes powerful algorithms to alert the user of potential problems during the pH calibration process. These indicators include when to clean the electrode, check the buffer, the response time, and the overall condition of the electrode.

WRONG BUFFER–Displayed when the difference between the pH reading and the value of the selected buffer is too great.

WRONG OLD POINTS INCONSISTENCY–Displayed if the new calibration differs significantly from the last value of that sensor in that buffer.

CLEAN ELECTRODE–This message indicates poor electrode performance (offset out of accepted window, or slope under the accepted lower limit).

CHECK ELECTRODE CHECK BUFFER–Displayed when electrode slope exceeds the highest accepted slope limit.

BAD ELECTRODE–Displayed if the cleaning procedure performed as a result of the previous two messages is unsuccessful.

WRONG BUFFER TEMPERATURE–Displayed if the temperature of the buffer is outside the defined buffer temperature range.

CONTAMINATED BUFFER–Displayed when the buffer could be contaminated.

Broken Temperature Sensor–If the temperature sensor should malfunction or break at any time, a temperature of "25.0°C" will blink on the second LCD line and the message **BROKEN TEMPERATURE SENSOR** will appear after leaving calibration.

Response and condition gauges appear on the display for 24 hours after an electrode calibration. These five segment displays provide a visual image of the overall condition of the pH probe based on offset and slope characteristics and speed of response based upon how long it took to stabilize in buffers during calibration.

Digital SMART Electrodes

The electrodes used with edge®pH are nearly as advanced as the edge® itself. They feature a built-in microchip that stores sensor type, ID, and calibration information that is automatically retrieved by edge®pH once the electrode is plugged in.

These digital electrodes also feature an easy to plug in 3.5 mm connector so you never have to worry about the right angle or aligning pins.

pH Electrodes

See edge®pH compatible pH electrodes on page 3.16 and starting on page 3.91.

ORP Probes

HI36180

Single ceramic, double junction, glass body, refillable ORP probe with temperature sensor

Recommended for laboratory and general purpose

HI36200

Single ceramic, single junction, gel filed, PEI body, ORP probe with temperature sensor

Recommended for field applications

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
	Calibration	Automatic, up to three points (five points†) calibration, 5 standard (7 standard†) buffers available (1.68†, 4.01 or 3.00, 6.86, 7.01, 9.18, 10.01, 12.45†) and two custom buffers†
	Temperature Compensation*	automatic, -5.0 to 100.0°C (23.0 to 212.0°F) (using 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
ORP	Range	±2000 mV
	Resolution	0.1 mV
	Accuracy (@25°C/77°F)	±0.2 mV (±999.9 mV); ±1 mV (±2000 mV)
	Calibration	one-point calibration
Temperature	Range*	-20.0 to 120.0°C; -4.0 to 248.0°F
	Resolution	0.1°C; 0.1°F
	Accuracy	±0.5°C; ±0.9°F
Additional Specifications	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
	Electrode	HI11310 digital glass body pH electrode with 1/8"(3.5 mm) connector and 1 m (3.3') cable
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Power Supply	5 VDC adapter (included)
	Dimensions	202 x 140 x 12 mm (7.9" x 5.5" x 0.5")
	Weight	250 g (8.82 oz.)
Ordering Information		**HI2002-01** (115V) and **HI2002-02** (230V) edge®pH includes: HI11310 pH electrode, pH 4 buffer solution sachets (2), 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 certificate and instruction manual.

- Portable field unit
  - edge®pH is ideal for field use due to its light weight, large screen and thin design. It can be slipped into a backpack or messenger bag. Up to 8 hours of battery life when used as a portable device.

- Wall mount cradle
  - The included wall mount cradle makes it easy to conserve space on the benchtop and can charge edge®pH with the AC adapter. 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.

edge®pH compatible electrodes begin on page 3.91; solutions begin on page 3.100

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

HI5521 • HI5522

Research Grade Meters

pH/ORP/ISE and EC/TDS/Resistivity/Salinity and Temperature

Measure up to Eight Parameters

HI5521 and HI5522 are research grade benchtop instruments that feature eight measurement parameters: pH, mV (for Oxidation Reduction Potential), ISE (HI5522 only), conductivity, resistivity, TDS, salinity and temperature.

These instruments incorporate dual channels with a separate temperature input and support external reference electrodes required by half-cell pH and ISE sensors.

Up to four conductivity calibration points can be used to increase measurement accuracy. One fixed-point salinity calibration can be performed on the percent scale only. Three methods for calculating seawater salinity are supported: practical scale, natural sea water scale and percent scale.

The HI5522 features up to a five-point standard ISE calibration using standard or custom solutions. Users can select their ISE electrode parameters with the standard configuration profile or create their own and store it in a profile that can be recalled.

- Capacitive touch keypad
- Clear user interface
- CAL Check™ for pH
  - Alerts users of calibration status
- Five-point calibration (HI5522)
  - Five point pH and ISE calibration
- Logging
  - Large log memory with different logging methods
- Specific Applications
  - EC specific applications: USP <645> method, salinity in seawater, TDS
  - ISE Specific Applications: incremental methods
- Multiple input channels
  - pH/ORP/(ISE, HI5522) and EC/TDS/Resistivity/Salinity
- On-screen help
  - Users can consult the on-screen help from any mode simply by pressing the HELP key.

Highly Customizable

The display is customizable and capable of displaying two channels at the same time, showing the measurements in various modes: basic measurement with or without GLP information, graph or logging data. The display colors are also selectable.

Up to 10 profiles (5 for each channel) can be saved and recalled for both instruments, eliminating the need to reconfigure each time a different electrode is used. User definable configurations can include: temperature compensation modes, isopotential points for pH and ISE (HI5522 only), measurement units of ISE concentrations, ISE electrode type (HI5522 only), and temperature units.

User-friendly Features

These instruments offer multi-language support and contextual help is available through a dedicated help key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through all measurement and calibration procedures to ensure readings are taken correctly.

CAL Check™ for pH

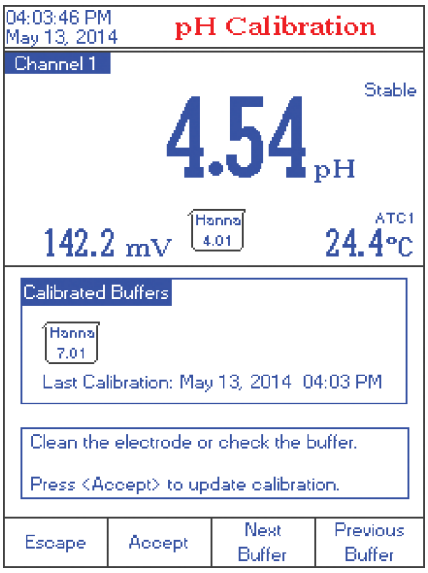
Hanna's pH CAL Check™ ensures accurate readings every time by alerting users of potential problems during the calibration process. The CAL Check™ system eliminates erroneous readings due to dirty or faulty pH electrodes or contaminated pH buffer solutions. After the guided calibration process, electrode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

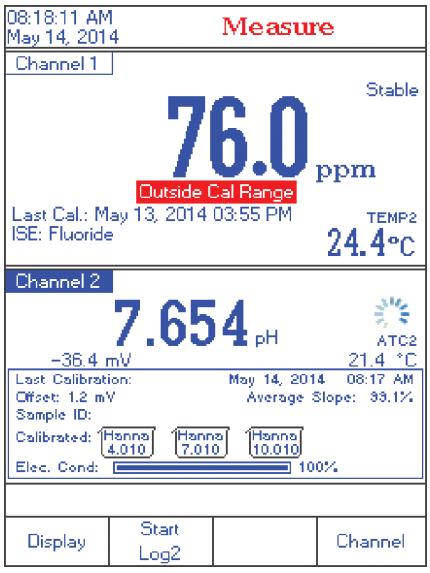
pH and EC Features

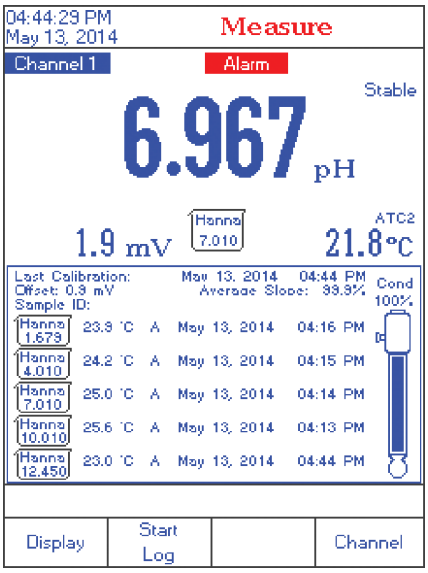
pH CAL Check™

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 (HI5522)

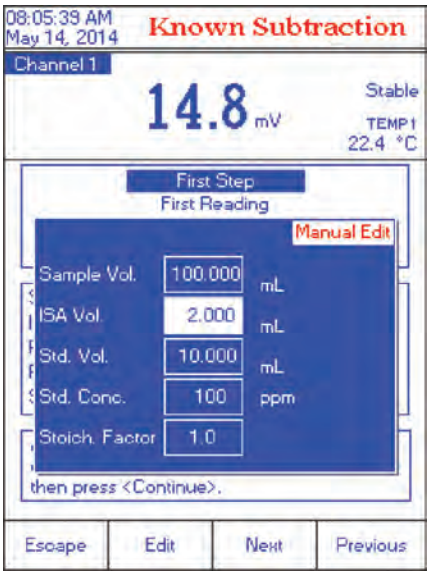
ISE Incremental Methods

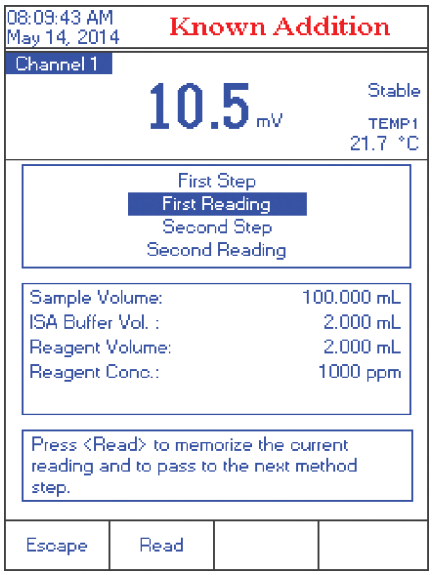
Ion concentration determinations with ISEs can be made faster and easier using the streamlined incremental methods.

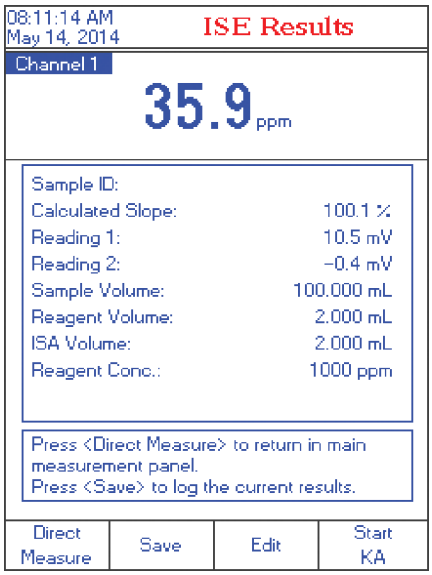
Incremental methods involve adding a standard to a sample or sample to a standard and detecting the mV change that occurs due to the addition, and this difference determines the concentration. Historically the user would use mathematical equations to determine the ion concentration of the sample; the HI5522, sample concentrations are calculated automatically and then logged into an ISE method report; up to 200 reports can be saved for future recall. The entire process can be repeated on multiple samples without reentering sets of parameters. Reports can be printed using HI92000 PC software.

Incremental method techniques can reduce errors from variables such as temperature, viscosity, pH or ionic strength. The electrodes remain immersed throughout the process, thus reducing measurement time as well as eliminating sample carry over and its associated errors.

Known Addition, Known Subtraction, Analyte Addition, and Analyte Subtraction methods are standard method choices provided by the HI5522.







First Step

The first step in performing an incremental method analysis is to enter the required parameters including sample, ISA and standard volumes, as well as standard concentration and stoichiometric factor.

When repeating the analysis on another sample, the parameters do not need to be reentered.

Sequence of Readings

Once the variables are entered, the user is guided step-by-step through the measurement process.

The initial mV measurement is made before the addition; next is the addition, followed by the second mV measurement.

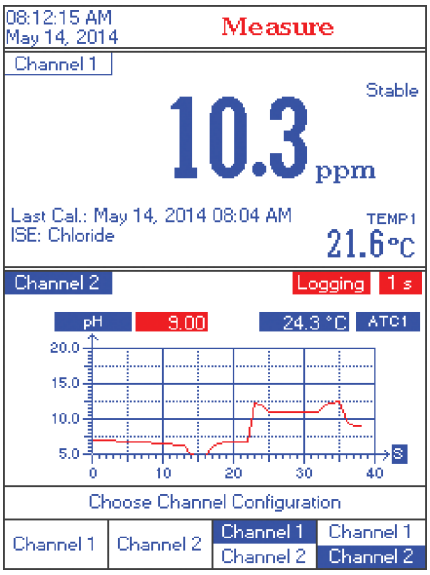
Results

The results are automatically calculated and shown together with all the parameters used.

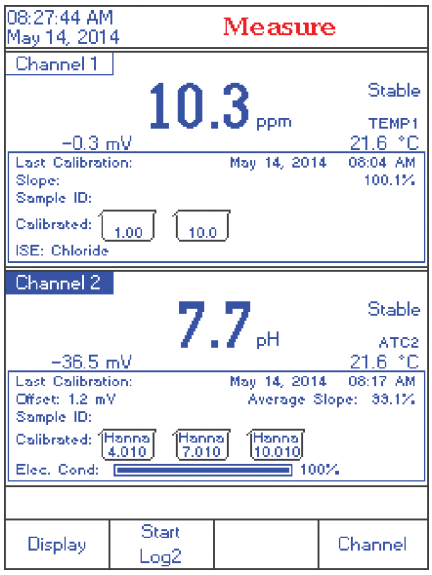
At this time, results can be saved into an ISE Methods Report and printed using using the HI92000 PC software. If necessary, the user can edit the parameters without having to redo the entire analysis. Multiple sample analysis is enabled without having to reenter set-up data.

- Low Profile
  - These intruments feature a low profile with an ideal viewing angle

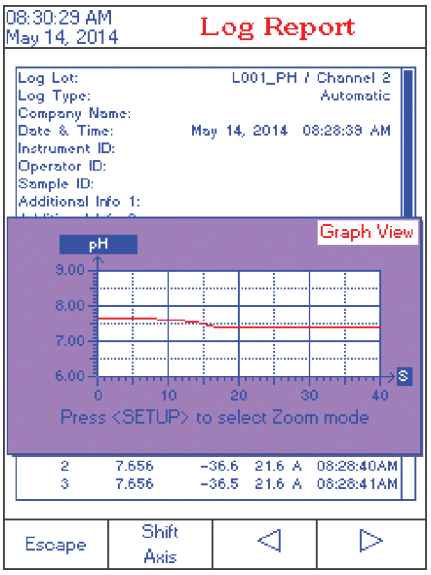
Additional Features by Screen (depending on model)



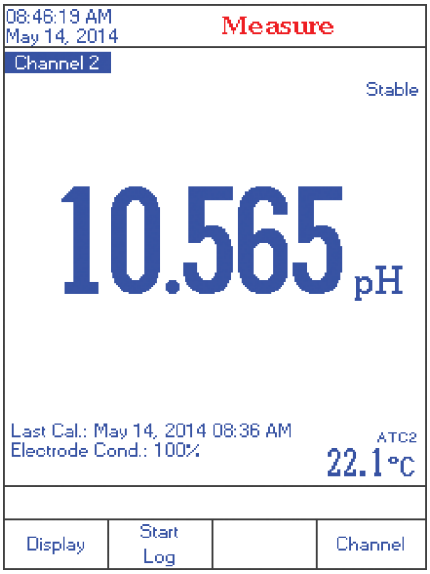
Channel Configuration



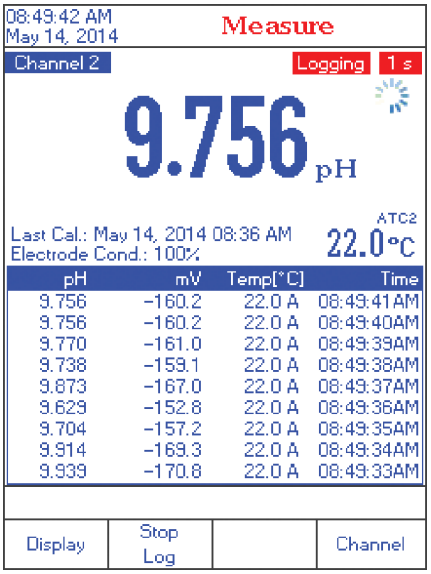
Good Laboratory Practices



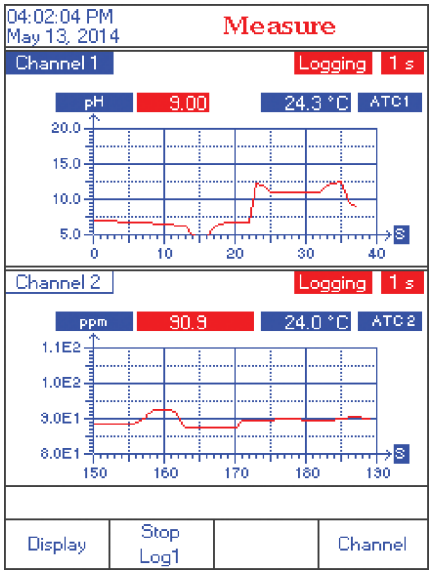
Log Recall



Simple Readout Available



Real-Time Logging



Simultaneous Dual-Channel Graphing

Dual Channels

The two measurement channels of the HI5522 and HI5521 are galvanically isolated to eliminate noise and instability.

In ISE mode (HI5522), these instruments provide the user with a choice of several incremental methods. Communication is via opto-isolated USB and RS232 ports.

Specifications		HI5521	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, 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	±2000 mV
	Resolution	0.1 mV	0.1 mV
	Accuracy	±0.2 mV ±1 LSD	±0.2 mV ±1 LSD
ISE	Range	–	1×10^{-7} to 9.99M concentration
	Resolution	–	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 5 user defined standards
Temperature**	Range	-20.0 to 120°C; -4.0 to 248.0°F; 253.15 to 393.15K	-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	0.1°C; 0.1°F; 0.1K
	Accuracy	±0.2°C ; ±0.4°F; ±0.2K (without probe)	±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)	±1% of reading (±0.01 µS/cm)
	Cell Constant	0.0500 to 200.00	0.0500 to 200.00
	Cell Type	4 cells	4 cells
	Calibration	automatic standard recognition, user standard single point / multi-point calibration	automatic standard recognition, user standard single point / multi-point calibration
	Calibration Reminder	yes	yes
	Temperature Coefficient	0.00 to 10.00 %/°C	0.00 to 10.00 %/°C
	Temperature Compensation	disabled, linear and non-linear (natural water)	disabled, linear and non-linear (natural water)
	Reference Temperature	5.0 to 30.0°C	5.0 to 30.0°C
	Profiles	up to 10, 5 each channel	up to 10, 5 each channel
	USP Compliant	yes	yes
TDS	Range	0.000 to 9.999 ppm; 10.00 to 99.99 ppm; 100.0 to 999.9 ppm; 1.000 to 9.999 ppt; 10.00 to 99.99 ppt; 100.0 to 400.0 ppt actual TDS* (with 1.00 factor)	
	Resolution	0.001 ppm; 0.01 ppm; 0.1 ppm; 0.001 ppt; 0.01 ppt; 0.1 ppt	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)	±1% of reading (±0.01 ppm)
Resistivity	Range	1.0 to 99.9 Ω•cm; 100 to 999 Ω•cm; 1.00 to 9.99 kΩ•cm; 10.0 to 99.9 kΩ•cm; 100 to 999 kΩ•cm; 1.00 to 9.99 MΩ•cm; 10.0 to 100.0 MΩ•cm	
	Resolution	0.1 Ω•cm; 1 Ω•cm; 0.01 kΩ•cm; 0.1 kΩ•cm; 1 kΩ•cm; 0.01 MΩ•cm; 0.1 MΩ•cm	
	Accuracy	±2% of reading (±1 Ω•cm)	±2% of reading (±1 Ω•cm)
Salinity	Range	practical scale: 0.00 to 42.00 psu; natural sea water scale: 0.00 to 80.00 ppt; percent scale: 0.0 to 400.0% NaCl	
	Resolution	0.01 for practical scale/natural sea water scale; 0.1% for percent scale	
	Accuracy	±1% of reading	±1% of reading
	Calibration	percent scale–one-point (with HI7037 standard)	percent scale–one-point (with HI7037 standard)
Additional Specifications	pH Electrode	HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included)	
	EC Probe	HI76312 platinum, four-ring EC/TDS probe with and 1 m (3.3') cable (included)	
	Temperature Probe	HI7662-T stainless steel temperature probe with 1 m (3.3') cable (included)	
	Input Channel(s)	1 pH/ORP + 1 EC	1 pH/ORP/ISE + 1 EC
	GLP	cell constant, reference temperature/coefficient, calibration points, calibration time stamp, probe offset for conductivity	
	Logging	**record :** 100,000 data point storage/channel, up to 100 lots with max. 50,000 records/lot; **interval:** settable between 1 second and max log time of 180 minutes; **type:** automatic, manual, AutoHOLD; **additional:** 200 records USP; 200 records incremental methods (HI5522)	
	Display	color graphic LCD with on-screen help, graphing, and custom color configuration	
	PC Connection	USB	
	Power Supply	12 VDC adapter (included)	
	Environment	0 to 50°C (32 to 122°F; 273 to 323K) RH max 95% non-condensing	
	Dimensions / Weight	160 x 231 x 94 mm (6.3 x 9.1 x 3.7") / 1.2 kg (2.64 lbs.)	
Ordering Information		**HI5521-01** (115V), **HI5521-02** (230V), **HI5522-01** (115V) and **HI5522-02** (230V) are supplied with HI76312 EC/TDS probe, HI1131B pH electrode, HI7662-T temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachet (2), HI7082 3.5M KCL electrolyte solution (30 mL), HI76404N electrode holder, 12 VDC adapter and instructions.	

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100; ISE electrodes and solutions begin on page 4.22; EC , TDS and salinity solutions begin on page 6.42

(*) Absolute conductivity (or TDS) is the conductivity (or TDS) value without temperature compensation.
(**) Reduced to actual probe limits

HI5221 • HI5222

Research Grade Meters

pH/ORP/ISE and Temperature

- Capacitive touch keypad
- Clean user interface
- CAL Check™
  - Alerts users of calibration status
- Five-point calibration
  - Five-point pH and ISE (HI5222 only) calibration
- Logging
  - Large log memory with different logging methods
- Provided methods (HI5222)
  - ISE incremental methods
- Multiple input channels
  - (HI5222) pH/ORP/ISE and temperature
- On-screen help
  - Users can consult the on-screen help from any mode simply by pressing the HELP key.

Measure up to 4 Parameters

HI5221 and HI5222 are research grade pH, mV and temperature benchtop meters. HI5222 is a dual channel meter with two independent inputs for pH, ORP and ISE probes. Each channel has it's own temperature input and supports half-cells with a separate reference electrode input.

User-friendly features

These instruments offer multi-language support and 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 measurement and calibration procedures to ensure they are performed properly.

Highly Customizable

The user interface of both instruments is customizable and the HI5222 is capable of displaying two channels simultaneously. These meters are capable of showing the measurements in various modes: basic measurement with or without GLP information, real-time graphing at either channel and logging data.

Up to 10 profiles can be saved and recalled for both instruments. A profile is a user-definable configuration that can include: mode, standards, isopotential point, measurement units of ISE and ISE electrode type (HI5222 only), temperature units and resolution reading mode. Recalling a pre-defined profile can save time when changing the meter to a different measurement.

CAL Check™

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

Choice of Calibration

Automatic, semiautomatic and manual pH calibration is available for up to five points, with eight standard (1.68, 3.00, 4.01, 6.86, 7.01, 9.18, 10.01 and 12.45) and five custom buffers. The out of calibration range and calibration expiration features alert the user in the event the measurement is far from the calibration point or when the meter is due for recalibration. Proper, scheduled calibrations are crucial for accurate and repeatable measurements.

HI5222 also features ISE calibration up to five points, with standard solutions and up to five custom solutions, with or without temperature compensation. From the on-screen list, users can select the ISE electrode being used along with the standard configuration profile or create a custom version.

Data Logging

Three selectable logging modes are available: automatic, manual and AutoHold logging. Automatic and manual logs up to 100 lots, 50,000 records max/lot; 100,000 data points per channel, and up to 100 ISE methods reports (HI5222 only). Automatic logging features the option to save data according to sampling period and interval. GLP information is stored with each lot recorded. GLP information includes complete data about user calibration of each parameter and identification information for the instrument, user, and company. Data can be transferred to a PC via USB and HI92000 software (optional).

Specifications		**HI5221**	**HI5222**
pH	Range	-2.0 to 20.0 pH; -2.00 to 20.00; -2.000 to 20.000 pH	-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	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	±0.1 pH; ±0.01 pH; ±0.002 pH ±1 LSD	±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	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	automatic or manual from -20.0 to 120.0°C/ -4.0 to 248.0°/253.15 to 393.15K
mV	Range	±2000 mV	±2000 mV
	Resolution	0.1 mV	0.1 mV
	Accuracy	±0.2 mV ±1 LSD	±0.2 mV ±1 LSD
	Relative mV Offset Range	±2000 mV	±2000 mV
Temperature*	Range	-20.0 to 120°C; -4.0 to 248.0°F; 253.15 to 393.15K	-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	0.1°C; 0.1°F; 0.1K
	Accuracy	±0.2°C; ±0.4°F; ±0.2K	±0.2°C; ±0.4°F; ±0.2K
ISE	Range	–	1 x 10^{-6} to 9.99 x 10^{10} concentration
	Resolution	–	1; 0.1; 0.01; 0.001 concentration
	Accuracy	–	±0.5% (monovalent ions); ±1% (divalent ions)
	Calibration	–	automatic, up to five point calibration, five fixed standard solutions available (0.1, 1, 10, 100, 1000 ppm), and five user defined standards
Additional Specifications	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)	
	Input Channel(s)	1 pH/ORP	2 pH/ORP/ISE
	GLP	calibration points, calibration time stamp, probe offset, slope, date, time and buffers/standards used	
	Logging	**record :** 100,000 data point storage/channel, 100 lots with 50,000 records/lot; **interval:** settable between 1 second and 180 minutes max log time; **type:** automatic, manual, AutoHOLD	
	Display	color graphic LCD with on-screen help, graphing, and custom color configuration	
	PC Connection	USB and RS232	
	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), **HI5221-02** (230V), **HI5222-01** (115V) and **HI5222-02** (230V) are supplied with HI1131B pH electrode, HI7662-T temperature probe, HI76404N electrode holder, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachet (2), HI7082 3.5M KCL electrolyte solution (30 mL), 12 VDC adapter and instructions.	

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100; ISE electrodes and solutions begin on page 4.22

(*) Reduced to actual probe limits

HI3512

Multiparameter Meter

pH/ORP/ISE and EC/TDS/Resistivity/Salinity and Temperature

- CAL Check™ for pH
  - Alerts users of calibration status
- Calibration points
  - Up to five-point pH calibration and up to two-point EC calibration
- Logging
  - Automatic logging up to 600 records and log on demand up to 400 samples
- Connectivity
  - PC connectivity via opto-isolated USB
- GLP features
  - Meets Good Laboratory Practices

Two Channels, Eight Parameters

The HI3512 is a dual-channel benchtop meter with a graphic LCD designed to provide accurate laboratory results. Channel 1 features pH/ORP/ISE and temperature measurement capability while channel 2 features conductivity, TDS, salinity or resistivity measurements and temperature capability.

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.

Calibration

The pH channel offers up to five point pH calibration with seven standard buffers and up to two custom buffers.

A five point ISE calibration selected from up to six calibration standards make this instrument very useful for a large range of ion concentrations.

The EC channel permits a two-point calibration selected from seven Hanna standards. The EC channel supports autoranging, manual ranging and lock of the user selected range as well as temperature compensation selection, temperature reference selection and temperature coefficient selection.

Total dissolved Solids (TDS) factor is user-adjustable and can be set between 0.40 and 1.00.

pH and EC channels also provide "out of calibration range" warnings and a "calibration timeout" message to remind the user when a new calibration is necessary.

Messages on the graphic LCD offer directions for easy and accurate calibration for both channels, as well as diagnostics to alert the user when calibration or measurement issues are detected.

Additional Features

Other features of the HI3512 include log-on-demand of up to 400 samples, automatic logging interval with log on stability of up to 600 records, AutoHold to freeze the first stable reading on the LCD display, GLP to view the last calibration data for pH, rel mV, ISE, EC or salinity and a PC interface via USB.

Specifications		HI3512
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	±0.01 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 two custom buffers
	Temperature Compensation	automatic or manual from -20.0 to 120.0 °C (-4.0 to 248.0 °F)
mV	Range	±2000.0 mV
	Resolution	0.1 mV
	Accuracy	±0.2 mV
ISE	Range	1.00 E^{-7} to 9.99 E^{10} concentration (user selectable units)
	Resolution	3 digits
	Accuracy	±0.5% of reading (monovalent ions); ±1% of reading (divalent ions)
	Calibration	up to five-point calibration points 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	±0.2°C (±0.4°F) (excluding probe error)
EC	Range	0 µS/cm to 400 mS/cm (shows values up to 1000 mS/cm absolute conductivity); 0.001 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 999.9 mS/cm; 1000 mS/cm (autoranging)
	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; 1 mS/cm
	Accuracy	±1% of reading (±0.01 µS/cm or 1 digit whichever is greater) excluding probe error
	Calibration	automatic up to two points with seven Hanna standards (0.00 µS/cm, 84.0 µS/cm, 1.413 mS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, 111.8 mS/cm)
	Cell constant	0.010 to 10.000
	Temperature Compensation	NoTC, MTC, ATC
	Reference Temperature	15, 20, 25°C
	Temperature Coefficient	0.00 to 10.00 %/°C (for EC and TDS only; default value is 1.90%/°C)
TDS	Range	0.000 to 9.999 ppm; 10.00 to 99.99 ppm; 100.0 to 999.9 ppm; 1.000 to 9.999 g/L; 10.00 to 99.99 g/L; 100.0 to 400.0 g/L (autoranging)
	Resolution	0.001 ppm; 0.01 ppm; 0.1 ppm; 0.001 g/L; 0.01 g/L; 0.1 g/L
	Accuracy	±1% of reading (±0.05 ppm or 1 digit whichever greater) excluding probe error
	Factor	0.40 to 1.00
Resistivity	Range	1.0 to 99.9 Ω•cm; 100 to 999 KΩ•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 (autoranging)
	Resolution	0.1 Ω•cm; 1 Ω•cm; 0.01 KΩ•cm; 0.1 Ω•cm; 1 Ω•cm; 0.01 MΩ•cm; 0.1 Ω•cm
	Accuracy	±1% of reading (±10 Ω•cm or 1 digit whichever greater) excluding probe error
Salinity	Range	0.0 to 400.0% NaCl
	Resolution	0.1% NaCl
	Accuracy	±1% of reading excluding probe error
	NaCl Calibration	one-point with HI7037 standard (optional)
Additional Specifications	pH Electrode	HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included)
	Temperature probe	HI7662-T temperature probe with 1 m (3.3') cable (included)
	EC Probe	HI76310 platinum four-ring EC/TDS probe with 1 m (3.3') cable (included)
	Relative mV Offset Range	±2000 mV
	Slope Calibration	from 80 to 110%
	Temperature Source	automatic from sensor inside the probe; manual entry
	Log-on-demand	400 samples
	Interval Logging	5, 10, 30 seconds; 1, 2, 5, 10, 15, 30, 60, 120, 180 minutes, AutoEnd (max 600 samples)
	PC connection	opto-isolated USB
	Input Impedance	10^{12} ohms
	Power Supply	12 VDC adapter (included)
	Environment	0 to 50 °C (32 to 122 °F) RH max 55% non-condensing
	Dimensions / Weight	235 x 207 x 110 mm (9.2 x 8.14 x 4.33") / 1.8 kg (4 lbs.)
Ordering Information		**HI3512-01** (115V) and **HI3512-02** (230V) is supplied with HI76310 EC/TDS probe, HI1131B pH electrode, HI7662-T temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachet (2), HI7082 3.5M KCl electrolyte solution (30 mL), HI76404N electrode holder, 12 VDC adapter and instructions.

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100; ISE electrodes and solutions begin on page 4.22; EC , TDS and salinity solutions begin on page 6.42

(*) Reduced to actual sensor limits

HI3220 • HI3221 • HI3222

pH Benchtop Meters

pH/mV/ISE and Temperature

- CAL Check™
  - Alerts users of calibration status
- GLP features
  - Meets Good Laboratory Practices
- Logging
  - Stability, interval and log-on-demand
- Connectivity
  - PC connectivity via opto-isolatedUSB
- Input channels
  - One (HI3220 & HI3221) or two (HI3222) input channels

Up to 4 Parameters, Single and Dual Channel

Hanna's HI3220, HI3221 and HI3222 professional benchtop meters with a graphic LCD are designed to provide accurate laboratory results. Both the HI3220 and HI3221 are equipped with one input channel while the HI3222 is equipped with two input channels. Having these two channels eliminates the need for swapping probes and recalibrating.

User-friendly features

HI3222, HI3221 and HI3220 feature an interactive user support interface that assists you before, during and after measurement. On-screen tutorials guide users through set-up, calibration and measurement while context sensitive help on any screen is available at the push of a button. The help screen includes language specific assistance for menu parameters, calibration, logging, contact and accessory information for your instrument.

CAL Check™

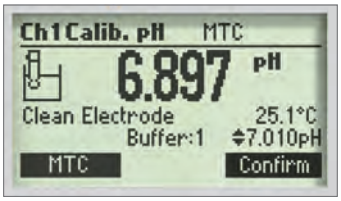
These instruments feature Hanna's exclusive CAL Check™, a diagnostics system that ensures accurate pH readings every time. By alerting users of potential problems during the calibration process, the CAL Check™ system eliminates erroneous readings due to dirty or faulty pH electrodes or contaminated pH buffer solutions. Throughout the calibration process, users are guided step-by-step by the on-screen tutorial. After calibration, the probe condition is evaluated and an indicator is displayed informing the user of the overall pH electrode status.

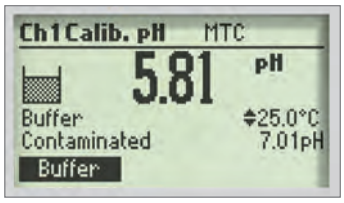
Calibration

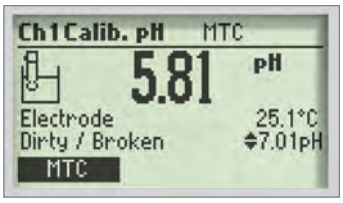
These instruments feature up to five point pH calibration with a choice of five custom buffers and seven standard buffers.

The HI3221 permits a two-point ISE calibration with a choice of six standard solutions while the HI3222 permits up to a five-point ISE calibration.

CAL Check™ Features







- Calibration
  - pH calibration features detailed CAL Check™ messages. Users are guided through the calibration procedure with step-by-step on-screen instructions.

Specifications		HI3220	HI3221	HI3222
pH	Range	-2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH	-2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH	-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	0.1 pH; 0.01 pH; 0.001 pH	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	±0.01 pH; ±0.002 pH	±0.01 pH; ±0.002 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	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	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	manual or automatic from -20.0 to 120.0°C (-4.0 to 248.0°F)	manual or automatic from -20.0 to 120.0°C (-4.0 to 248.0°F)	manual or automatic from -20.0 to 120.0°C (-4.0 to 248.0°F)
mV	Range	±2000 mV	±2000 mV	±2000 mV
	Resolution	0.1 mV	0.1 mV	0.1 mV
	Accuracy	±0.2 mV	±0.2 mV	±0.2 mV
	Rel mV Offset Range	±2000 mV	±2000 mV	±2000 mV
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)	-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)	0.1°C (0.1°F)
	Accuracy	±0.2°C (±0.4°F) (excluding probe error)	±0.2°C (±0.4°F) (excluding probe error)	±0.2°C (±0.4°F) (excluding probe error)
ISE	Range	–	1.00 E^{-3} to 1.00 E^{5} ppm	1.00 E^{-7} to 9.99 E^{10} concentration (choice of units)
	Resolution	–	3 digits	3 digits
	Accuracy	–	±0.5% of reading (monovalent ions), ±1% of reading (divalent ions)	±0.5% of reading (monovalent ions), ±1% of reading (divalent ions)
	Calibration	–	up to two point calibration, six standard solutions (0.1, 1, 10, 100, 1000, 10000 ppm)	up to five point calibration, six standard solutions (in units selected)
Additional Specifications	pH Electrode	HI1131B pH electrode with glass body, BNC connector and 1 m (3.3') cable (included)		
	Temperature Probe	HI7662-T temperature probe, stainless steel with 1 m (3.3') cable (included)		
	Slope calibration	from 80 to 110%		
	Log-on-demand	HI3220: 200 samples; HI3221: 300 samples; HI3222: 400 samples		
	Interval Logging	5, 10, 30 seconds; 1, 2, 5, 10, 15, 30, 60, 120, 180 minutes (max 600 samples)		
	PC connection	opto-isolated USB		
	Input Impedance	10^{12} Ohms		
	Power Supply	12 VDC adapter (included)		
	Environment	0 to 50°C (32 to 122°F) RH max 55% non-condensing		
	Dimensions	235 x 207 x 110 mm (9.2 x 8.14 x 4.33")		
	Weight	1.8 kg (4 lbs.)		
Ordering Information		**HI3220-01** (115V), **HI3220-02** (230V), **HI3221-01** (115V), **HI3221-02** (230V), **HI3222-01** (115V) and **HI3222-02** (230V) are supplied with HI1131B pH electrode, HI7662-T temperature probe, HI76404N electrode holder, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachet (2), HI7082 3.5M KCL electrolyte solution (30 mL), 12 VDC adapter and instructions.		

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100; ISE electrodes and solutions begin on page 4.22

(*) Reduced to actual sensor limits

HI2550

Multiparameter Meter

pH/ORP/ISE/EC/TDS/Salinity

- Five Point Calibration
  - Up to five point pH calibration
- Hold Feature
  - Hold button to freeze readings on the display
- ATC
  - Automatic temperature compensation for pH and EC
- Connectivity
  - PC interface via USB
- Multiple input channels
  - Two input channels: pH/ORP/ISE and EC/TDS/Resistivity/Salinity

Dual-Channel, with Up to Seven Parameters

HI2550 is a dual-channel instrument that measures up to seven parameters. With this single laboratory bench meter you can measure pH, ORP or ISE, conductivity (EC), TDS or salinity, and temperature.

Utilizing an external temperature probe, pH readings are automatically compensated for temperature. To ensure a higher level of precision, pH calibrations can use up to five calibration points, chosen from the seven available memorized buffers.

This instrument can take measurements using ORP electrodes (pH channel input), due to its capability to measure mV with a resolution up to 0.1 mV, as well as ISE electrodes on the mV scale (pH channel input).

EC measurements can be compensated relative to a selected reference temperature. The EC calibration mode allows you to chose from among six recognized conductivity standards and perform a single-point calibration. The most suitable EC and TDS range for your application is automatically selected. The HI2550 also includes the ability to set and lock the range manually.

Good Laboratory Practice

This instrument provides GLP capabilities that allow for the storage and retrieval of all data regarding pH, ORP, EC and salinity calibration and sample measurement as well as data regarding the maintenance and status of the electrode.

Data Logging

With a built-in logging function, measurements are stored in non-volatile memory, and can be transferred to a PC through the USB port. Users can manually log up to 200 records and interval log up to 500 records.

Specifications		HI2550
pH**	Range	-2.0 to 16.0 pH; -2.00 to 16.00 pH; -2.000 to 16.000 pH
	Resolution	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	± 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 two custom buffers
	Temperature Compensation	automatic or manual from: -20.0 to 120.0 °C
	Input Impedance	10^{12} ohms
ISE and ORP	Range	±999.9 mV; ±2000 mV
	Resolution	0.1 mV (±1000.0 mV); 1 mV (± 2000 mV)
	Accuracy	± 0.2 mV (±999.9 mV); ± 1 mV (±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 (excluding probe error)
EC	Range	0.00 to 29.99 µS/cm; 30.0 to 299.9 µS/cm; 300 to 2999 µS/cm; 3.00 to 29.99 mS/cm; 30.0 to 200.0 mS/cm; up to 500.0 mS/cm actual* conductivity
	Resolution	0.01 µS/cm; 0.1 µS/cm; 1 µS/cm; 0.01 mS/cm; 0.1 mS/cm
	Accuracy	± 1 % reading (±0.05 µS/cm or 1 digit, whichever is greater)
	Calibration	one point slope calibration; six buffers available: 84.0, 1413 µS/cm; 5.00, 12.88, 80.0, 111.8 mS/cm; one point offset: 0.00 µS/cm
	Temperature Compensation	automatic or manual from -20.0 to 120.0 °C, or disabled
	Temperature Coefficient	0.00 to 6.00 %/°C (for EC and TDS only; default value is 1.90 %/°C
TDS	Range	0.00 to 14.99 ppm; 15.0 to 149.9 ppm; 150 to 1499 ppm; 1.50 to 14.99 g/L; 15.0 to 100.0 g/L; up to 400.0 g/L actual* TDS (with 0.80 factor)
	Resolution	0.01 ppm; 0.1 ppm; 1 ppm; 0.01 g/L; 0.1 g/L
	Accuracy	±1% of reading (±0.03 ppm or 1 digit, whichever is greater)
	TDS Factor	0.40 to 0.80 (default value is 0.50)
Salinity	Range	0.0 to 400.0% NaCl
	Resolution	0.1% NaCl
	Accuracy	±1% of reading (excluding probe error)
	Calibration	one point with HI7037 standard (optional)
Additional Specifications	pH Electrode	HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included)
	EC Probe	HI76310 platinum four-ring EC/TDS probe and 1 m (3.3') cable (included)
	Temperature Probe	HI7662 temperature probe with 1 m (3.3') cable (included)
	Relative mV Offset Range	±2000 mV
	PC Connectivity	opto-isolated USB
	Log-on-demand	200 samples
	Interval Logging	500 records; 5, 10, 30 sec and 1, 2, 5, 10, 15, 30, 60, 120, 180 min stability logging
	Power Supply	12 VDC (included)
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Dimensions	235 x 222 x 109 mm (9.2 x 8.7 x 4.3")
	Weight	1.3 Kg (2.9 lb); kit with holder 2.1 Kg (4.6 lb.)
Ordering Information		**HI2550-01** (115V) and **HI2550-02** (230V) are supplied with HI1131B pH electrode, HI76310 EC/TDS probe, 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), 12 VDC adapter and instruction manual.

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100; ISE electrodes and solutions begin on page 4.22; EC , TDS and salinity solutions begin on page 6.42

(*) Uncompensated conductivity (or TDS) is the conductivity (or TDS) value without temperature compensation.

(**) Reduced to actual sensor limits

HI122

pH Benchtop Meter

with Built-in Printer

- CAL Check™
  - Alerts users of calibration status
- Five-point calibration
  - Five pH calibration points using standard or custom buffers
- Logging
  - Automatic data logging of 1000 records and log-on-demand
- GLP features
  - Meets Good Laboratory Practices
- Direct printing
  - Built-in impact printer

On-board printing and CAL Check™ in One Instrument

HI122 benchtop instrument features a built-in printer and CAL Check™. CAL Check™ monitors electrode response time and condition, and provides enhanced diagnostic messages during calibration.

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, log-on-demand or internal logging modes. This model also allows users to print detailed information in four languages for specific help screens and instrument set-up.

Logging

Users can log-on-demand up to 50 samples and automatically log data up to 1000 points with flexible starting and stopping criteria.

GLP Capabilities

HI122 provides GLP capabilities that allow for the retrieval of all data regarding pH, mV, EC and salinity calibration as well as data regarding the maintenance and status of the electrode.

Calibration

This meter uses Hanna's "P" series of electrodes. Calibration can be performed up to five points using the standard seven buffers, or by using two custom buffer values. The buffer(s) used during calibration are displayed on the LCD even when in measurement mode.

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

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100

HI2210 • HI2211

pH Benchtop Meters

pH/mV and Temperature

- Automatic temperature compensation (ATC)
- Two-Point Calibration
- Simple to operate
- Calibration expiration reminder
- 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 and provide a calibration expiration reminder.

Specifications		HI2210	HI2211
pH	Range	-2.00 to 16.00 pH	-2.00 to 16.00 pH
	Resolution	0.01 pH	0.01 pH
	Accuracy	±0.01 pH	±0.01 pH
	pH Calibration	automatic, one or two-point with five memorized buffer values (pH 4.01, 6.86, 7.01, 9.18, 10.01)	
	Temperature Compensation	automatic 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	-9.9 to 120.0°C (14.2 to 248.0°F)	
	Resolution	0.1°C	0.1°C
	Accuracy	±0.4 °C	±0.4 °C
Additional Specifications	pH Electrode	HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included)	
	Temperature Probe	HI7662 stainless steel temperature probe with 1 m (3.3') cable (included)	
	Input Impedance	10^{12} Ohm	
	Power Supply	12 VDC adapter (included)	
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
	Dimensions / Weight	240 x 187 x 74mm (9.4 x 7.1 x 2.9")	
Ordering Information	**HI2210-01** (115V), **HI2210-02** (230V), **HI2211-01** (115V) and **HI2211-02** (230V) are supplied with HI1131B pH electrode, HI7662 temperature probe, HI76404N electrode holder, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI7082 3.5M KCL electrolyte solution (30 mL), HI700601 cleaning solution sachet, 12 VDC adapter and instructions.		

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100

HI2209 • HI22091

pH Benchtop Meters

with Manual Temperature Compensation and Analog Output

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

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

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100

HI207 • HI208

pH Meters

for Education

- Built-in 500 rpm magnetic stirrer (HI208)
- Automatic temperature compensation (ATC)
- Two-point calibration
- Built-in beaker and electrode holder

With features such as a built-in beaker holder, beaker-top electrode holder and rugged, two-in-one pH and temperature sensor, the HI207 and HI208 are meters designed to meet busy classroom environments.

These instruments also feature an extended pH range, dual-level LCD with icons for stability and buffer recognition, a built-in magnetic stirrer (HI208 only), automatic pH calibration, and temperature display in either Celsius or Fahrenheit. In addition the HI207 and HI208 feature automatic temperature compensation so that all readings are automatically compensated for temperature variations.

In the classroom, these compact units reduce clutter and utilize a minimal amount of space on the desktop. Switch to battery power and the instrument can be taken outside the classroom for field studies. When lab time is over, the instruments are easily cleaned and can be stored out of the way–right away.

Specifications		HI207 • HI208
pH	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	automatic, one or two point with two sets of memorized buffer values (pH 4.01, 7.01, 10.01 or 4.01, 6.86, 9.18)
	Temperature Compensation	automatic from -5.0 to 105.0°C (23.0 to 221.0°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 (up to 60°C); ±1°C (outside) ±1°F (up to 140°F); ±2°F (outside)
Additional Specifications	pH Electrode	HI1291D PEI body pH electrode with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)
	Battery Type / Life	9V / approximately 200 hours of continuous use (without stirrer)
	Power Supply	12 VDC adapter (included)
	Environment	0 to 50°C (32 to 122°F); RH max 95%
	Dimensions / Weight	192 x 104 x 134 mm (7.6 x 4.5 x x5.3") / 420 g (14.8 oz.)
Ordering Information	**HI207-01** (115V), **HI207-02** (230V), **HI208-01** (115V) and **HI208-02** (230V) are supplied with HI1291D pH electrode, HI740035 pH electrode holder and plastic beaker, rubber O-ring, magnetic stir bar (HI208 only), HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, 12 VDC adapter, battery and instructions.	

pH solutions begin on page 3.100

HI98190 • HI98191

Professional Waterproof Meters

pH/ORP and pH/ORP/ISE

- Waterproof
  - IP67 rated waterproof, rugged enclosure
- ISE measurement units (HI98191 only)
  - Extensive choice of units to display readings (ppm, ppt, g/L, µg/L, mg/L, M, mol/L, mmol/L, %, w/v, user)
- 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
- Log-on-demand
  - Store measurement data at the press of a button
- GLP
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- AutoHold
  - Automatically holds the first stable reading on the display
- Calibration timeout
  - Alerts when calibration is due at a specified interval
- Help menu
  - On-screen context specific help is readily available at the press of a button
- Clear display
  - Dot matrix display with multifunction virtual keys
- Intuitive keypad
  - Most of the available options such as GLP information, help, range, calibration and backlight have a dedicated button
- Connectivity
  - PC connectivity via opto-isolated micro-USB with HI92000 software
- Approximately 200 hour battery life
  - Powered by (4) 1.5V AA batteries

Quick Connect Probe

(HI98190 only)

For Universal Applications

HI98190 and HI98191 are IP67 rated waterproof meters designed for universal applications. HI98190 measures pH/ORP and temperature while HI98191 also includes ISE measurements.

Exchange out the pH probe for an ORP probe to obtain mV readings in the ±2000 mV range. HI98191 adds direct ion concentration readings for ISEs with a choice of units for calibration and display.

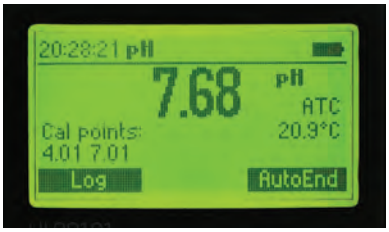
Quick Connect Probe

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. The HI98191 is supplied with the HI72911B titanium bodied pH/temperature electrode with BNC and RCA connectors.

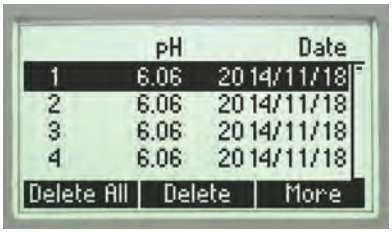
ISE Sensors and Calibration

HI98191 has 17 different standard ISE sensors pre-programmed in the meter. Selecting the appropriate sensor will automatically update the ion charge for slope calibration and can be calibrated up to five points with the choice of seven standards and five custom standards (choice of units). This meter allows an extensive choice of measurement units (ppm, ppt, g/L, ppb, µg/L, mg/mL, M, mol/L, mmol/L, % w/v, user) and has an expanded measuring range of 1.00×10^{-7} to 9.99×10^{10}.

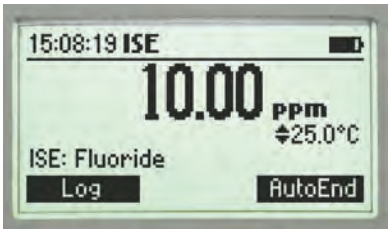
On-screen Features



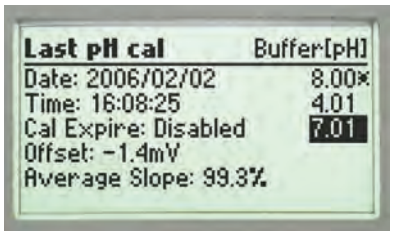
- Backlit LCD
  - Press the backlight button to view the display in low-light conditions



- Log-on-demand
  - Store measurement data at the press of a button. Data can be viewed on-screen or transferred to a PC.

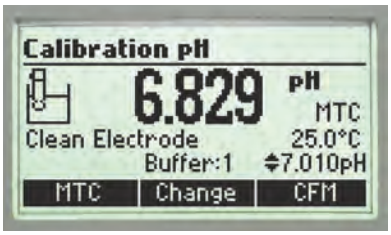


- ISE measurements
  - The HI98191 includes ISE measurements when used with our wide selection of ISE electrodes or a custom version



- GLP data
  - 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

- 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



- Calibration
  - pH calibration features detailed CAL Check™ messages. Users are guided through the calibration procedure with step-by-step on-screen instructions

pH Calibration

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

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.

Data Logging

The log-on-demand feature allows users to store up to 200 samples (HI98190) or 300 samples (HI98191) that can be later transferred to a PC with the HI920015 USB cable and HI92000 software.

GLP and On-Screen Help

Comprehensive GLP data is directly accessible by pressing the GLP key; the contextual help menu can be accessed to obtain on-screen information and assistance at the touch of a button.

- Calibrate right in the case with custom beaker holders
  - Our custom carrying case features beaker holders for calibration out in the field.

HI98190 shown in HI720190 rugged carrying case with custom thermoformed insert (included)

HI98191 shown in HI720191 rugged carrying case with custom thermoformed insert (included)

- 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.

Specifications		HI98190	HI98191
pH*	Range	-2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH	-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	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	±0.1 pH; ±0.01 pH; ±0.002 pH	±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	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)	automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F)
mV*	Range	±2000 mV	±2000 mV
	Resolution	0.1 mV	0.1 mV
	Accuracy	±0.2 mV	±0.2 mV
	Relative mV Offset Range	±2000 mV	±2000 mV
ISE	Range	–	from 1.00 E^{-7} to 9.99 E^{10} concentration
	Resolution	–	3 digits 0.01; 0.1; 1; 10 concentration
	Accuracy	–	±0.5% of reading (monovalent ions), ±1% of reading (divalent ions)
	Calibration	–	up to five point calibration, seven standard solutions available
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	±0.4°C (±0.8°F) (excluding probe error)	±0.4°C (±0.8°F) (excluding probe error)
Additional Specifications	pH Probe	HI98190: HI12963 titanium body, pH electrode with internal temperature sensor, quick DIN connector and 1 m (3.3' cable) HI98191: 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	200 samples (100 each pH/mV range)	300 samples (100 each pH/mV/ISE range)
	PC Connection	opto-isolated USB with HI92000 software and micro USB cable	
	Input Impedance	10^{12} Ω	
	Battery Type / Life	1.5V AA batteries (4) / approximately 200 hours of continuous use without backlight (50 hours with backlight)	
	Auto-off	user selectable: 5, 10, 30, 60 min, disabled	
	Environment	0 to 50°C (32 to 122°F); RH 100% IP67	
	Dimensions / Weight	185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.)	
Ordering Information		**HI98190** and **HI98191** are supplied with HI12963 pH electrode (HI98190), HI72911B pH electrode (HI98191), HI 7662 temperature Probe (HI 98191) HI7004M pH 4.01 buffer solution (230 mL), HI7007M pH 7.01 buffer solution (230 mL), electrode general cleaning solution sachet (2), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), instruction manual, quick start guide, quality certificate and HI 720190 (HI98190) or HI720191 (HI98191) rugged carrying case with custom thermoformed insert.	

* Limits will be reduced to actual sensor limits

pH and ORP solutions begin on page 3.100; ISE solutions begin on page 4.22

HI9126

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 and reference junction of the electrode every time the instrument is calibrated. In the event of a dirty pH electrode, CAL Check™ warns users that maintenance may be needed.

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

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

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

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

* Limits will be reduced to actual sensor limits

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100

HI9124 • HI9125

Portable pH/mV Meters

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

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

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

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

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

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

* Limits will be reduced to actual sensor limits

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100

HI991001 • HI991002 • HI991003

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 HI 991001 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	-2.00 to 16.00 pH
	Resolution	0.01 pH	0.01 pH	0.01 pH
	Accuracy	±0.02 pH	±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	±1999 mV
	Resolution	–	1 mV	1 mV
	Accuracy	–	±2 mV	±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.		
	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.)		
Ordering Information		**HI991001** 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. **HI991002** and **HI991003** 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

pH and ORP solutions begin on page 3.100

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.

- Soil preparation solution
  - For higher degrees of accuracy, or for stony ground where the electrode may be damaged, use the included HI7051M soil preparation solution

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

HI710023 Orange

HI710024 Blue

* Limits will be reduced to actual sensor limits

Specifications		HI99121
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	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.

pH solutions begin on page 3.100

HI99131

Portable pH Meter

for Plating Baths

- 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.

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°C (up to 60°C), ±1.0°C (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.	

pH solutions begin on page 3.100

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

HI710023 Orange

HI710024 Blue

* 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.

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

HI710023 Orange

HI710024 Blue

* Limits will be reduced to actual sensor limits

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%
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)
Ordering Information		**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.

pH solutions begin on page 3.100

HI99171

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.

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.

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

HI710023 Orange

HI710024 Blue

* Limits will be reduced to actual sensor limits

pH solutions begin on page 3.100

HI99161

Portable pH Meter

for Food and Dairy

- 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 dairy 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 prevents the typical problems of clogging in viscous liquids such as milk or condiments.

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

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

HI710023 Orange

HI710024 Blue

* Limits will be reduced to actual sensor limits

Specifications		HI99161
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	FC202D Glass 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.

pH solutions begin on page 3.100

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

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.	

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

HI710023 Orange

HI710024 Blue

* Limits will be reduced to actual sensor limits

pH solutions begin on page 3.100

HI99191

Portable pH Meter

for Low Ionic Strength 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 HI99191 is a waterproof portable pH and temperature meter designed specifically for measuring the pH of drinking water.

The HI99191 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 HI99191 uses three 1.5V AAA batteries for an exceptional battery life of 1200 hours of continuous use.

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.

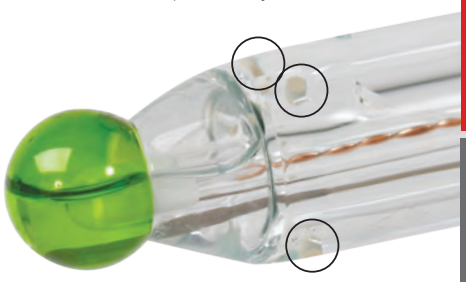
Most drinking water plants use surface water (lakes, rivers, and streams) or groundwater as their point source. Surface water is typically lower in mineral content, which results in lower EC/TDS readings. Groundwater that has percolated through limestone, dolomite or gypsum will have a relatively higher 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 HI99191 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		HI99191
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	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	**HI99191** is supplied with FC215D pH and temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700642 electrode cleaning solution sachets (2), HI7082 3.5 KCl filling solution, batteries, instructions and hard carrying case.	

pH solutions begin on page 3.100

Triple ceramic junction



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 HI99191 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 µL/hour of electrolyte to flow. The FC215D has three ceramic junctions providing for 40 to 50 µL/hour of electrolyte to flow. This increased flow provides a greater continuity between the reference electrode and the indicating electrode, making it suitable for water of low ionic strength. To optimize the flow from the electrode, the refill cap should be unscrewed; this allows for positive head pressure to be created, allowing for the electrolyte to flow more easily into the sample.

* Limits will be reduced to actual sensor limits

HI99151

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.

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 Affects 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	±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	FC214D 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	**HI99151** is supplied with FC214D 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

pH solutions begin on page 3.100

HI99111

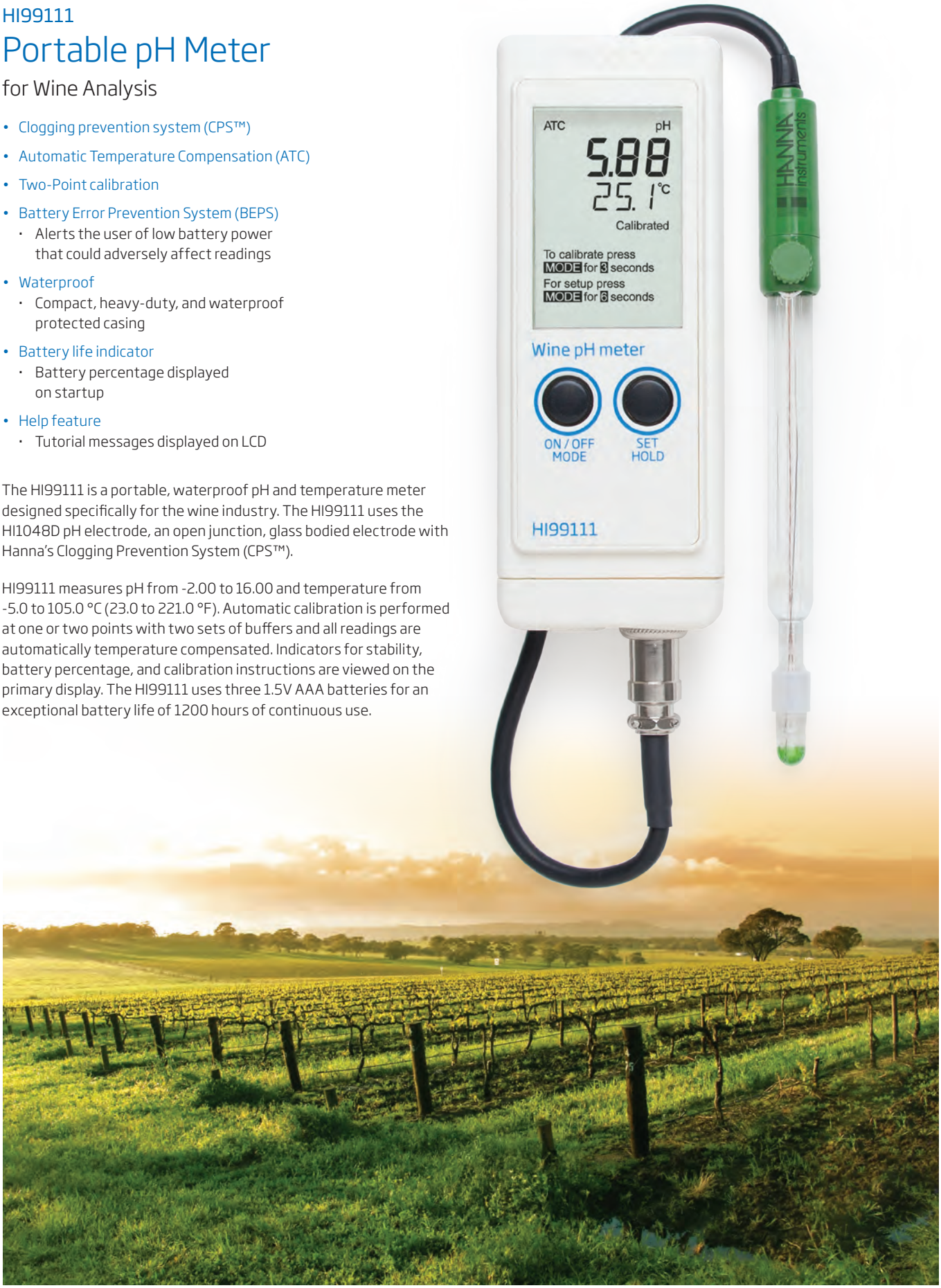
Portable pH Meter

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 pH electrode, an open junction, glass bodied electrode with Hanna's Clogging Prevention System (CPS™).

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.



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 bacterias growth and fermentation.

Specifications		**HI99111**
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	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	**HI99111** is supplied with HI1048D 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.	

pH solutions begin on page 3.100

HI1048D pH electrode

- Open junction design
- 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 HI1048D has an open junction providing direct contact with the solution to be measured, making it difficult to clog and an excellent choice for wine and must testing.

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.

* 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.

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

HI710023 Orange

HI710024 Blue

* Limits will be reduced to actual sensor limits

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		**HI99181** 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.

pH solutions begin on page 3.100

HI8424

General Purpose pH/mV Meter

- Automatic Temperature Compensation (ATC)
- Waterproof
  - Compact, heavy-duty, and waterproof protected casing
- Two-Point calibration
  - Easy manual one or two-point calibration
- Hold
  - HOLD function
- Battery indicator
  - Low battery indicator

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

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

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

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

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100

* Limits will be reduced to actual sensor limits

HI83141 • HI8314

Analog pH/mV Meters

- Automatic Temperature Compensation (ATC)
- Two-Point Calibration
- Waterproof
  - Compact, heavy-duty, and waterproof protected casing
- Battery Indicator
  - Low battery indicator

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 °C, 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 meters 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	0.0 to 100.0°C
	Resolution	0.1°C	0.1°C
	Accuracy	±0.4°C	±0.4°C
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	
	Input Impedance	10^{12} Ohm	
	Battery Type / Life	9V / approximately 100 hours of continuous use	
	Environment	0 to 50°C (32 to 122°F); RH max 100%	
	Dimensions	145 x 80 x 36 mm (5.7 x 3.1 x 1.4")	
	Weight	230 g (8.1 oz.)	
Ordering Information		**HI83141** is supplied with HI1230B pH electrode and HI7669AW temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachets (2), calibration screwdriver, battery, protective case and instructions. **HI8314** is supplied with HI 1217D 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

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100

HI8010 • HI8014

Educational pH Meters

- Automatic Temperature Compensation (ATC)
- Two-Point Calibration

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

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

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

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

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

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100

* Limits will be reduced to actual sensor limits

HI8427 • HI931001

pH/mV Precision Simulators

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

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

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

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

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

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

* Limits will be reduced to actual sensor limits

pH Electrodes

Designed and Manufactured by Hanna

At the Forefront of Electrode Technology

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

In 1981, Hanna developed it's 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:

$$\mathbf{Eobs = Ec + ln(10)(RT / nF)(log[a_{H^+}])}$$

Eobs = Observed potential (sum of reference and liquid junction potentials)
Ec = Reference potential including other stable and fixed potentials
$\mathbf{a_{H^+}}$ = The hydrogen ion activity
T = Temperature in Kelvin (C° + 273.15)
n = Valence of the ion measured (1)
F = Faraday's constant (9.6485 x 10^4)
R = Gas constant (8.31432J / 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 Electrodes

Designed and Manufactured by Hanna

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.

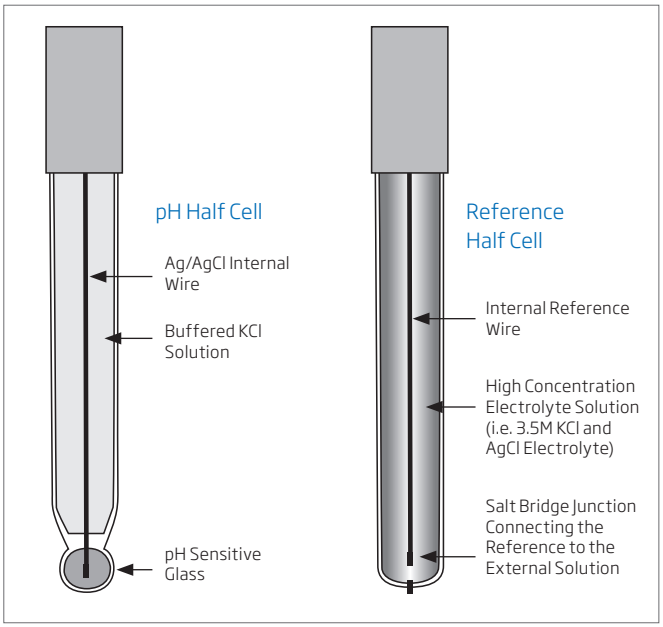
Thermometer or Temperature Probe

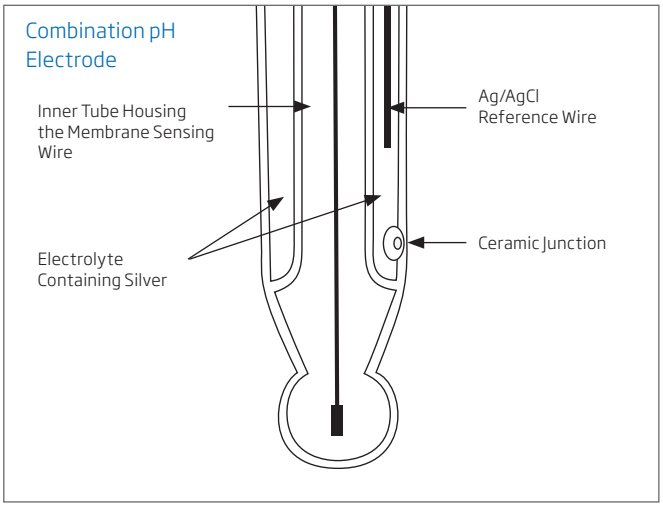
A temperature measurement is desired during calibration and measurement to make adjustments to the Nernst slope factor. An auxiliary or built-in temperature probe ensures both calibration and measurement are automatically temperature compensated, thus eliminating error.

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.

pH Electrodes

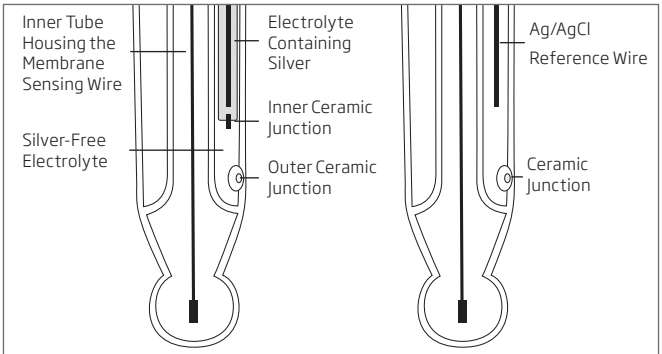
Designed & Manufactured by Hanna

Single Junction vs. Double Junction

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

Hanna's double junction system, as the name implies, has two junctions, only one of which is in contact with the sample as shown in the figure below Under adverse conditions, the same tendency of sample ingress is 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.



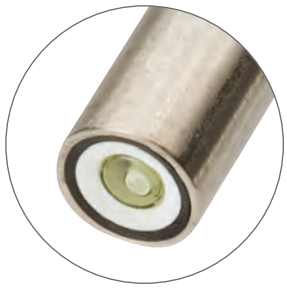
Types of Junctions:

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.

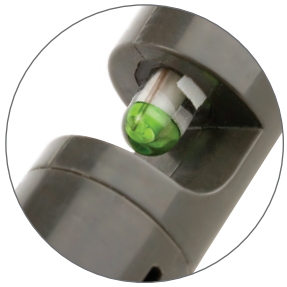
Porous PTFE (Polytetrafluoroethylene)

Porous PTFE is a hydrophobic material that is available with different porosities. Because of its chemical 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 an uncontaminated, fresh surface.

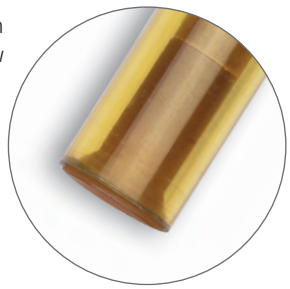


Open Junction

This type of junction is often found in reference half-cells 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.

pH Electrodes

Designed and Manufactured by Hanna

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 4 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

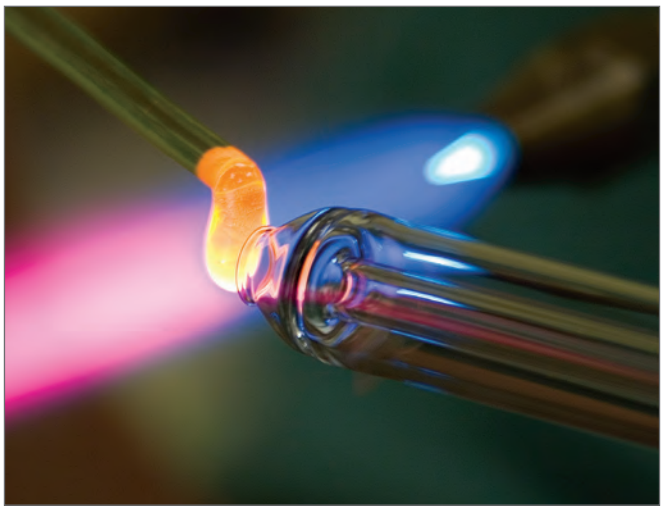
Hanna's general purpose (GP) hydrogen sensitive glass provides the best response over the entire pH range and can be used for a wide range of applications. Great results are obtained with a sphere geometry with a diameter of 9.5 mm (0.37"), achieving a system with 100 MΩ impedance. The GP glass is also 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.

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

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

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


Spherical


Conical


Flat

pH Electrodes

Designed and Manufactured by Hanna

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 sea water. 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.

Water Conductivity and pH Measurement

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

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

Alkaline Error

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

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

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

Alkaline Error with 0.1 M Sodium

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

Alkaline Error with 1.0 M Sodium

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

pH Electrodes

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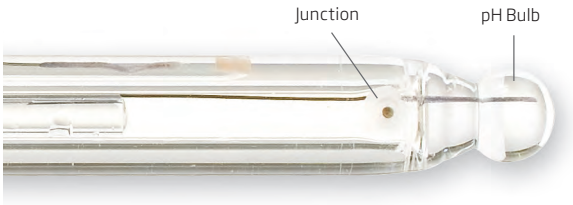
Calibration

pH Electrode Preparation Procedure

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

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

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



Rinse Electrode with Purified Water

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

Use Fresh pH Buffer for Calibration

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

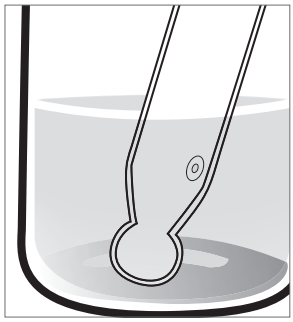
It is important to note that pH buffers at higher values (i.e. pH 10.01) are less stable than lower values, this is due to atmospheric CO_2 diffusing into the buffer, forming carbonic acid. If the buffer is old, the actual value might be less than stated on the bottle, resulting a low slope.

Open Reference Fill Cap on Refillable Electrodes

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

Submerse Electrode Past Junction

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

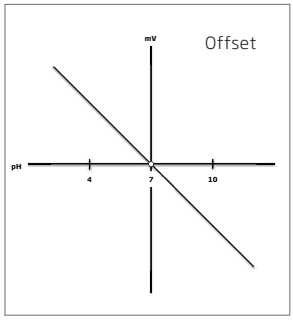


Use a Magnetic Stirrer

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

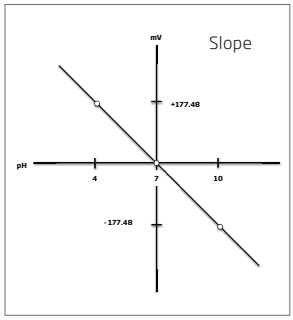
One-point Calibration

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



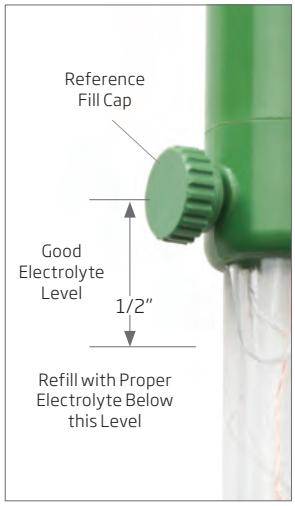
Multiple-point Calibration

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



Electrode Fill Solutions

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



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

Maintenance and Storage

General Maintenance Tips

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

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

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

How to calculate offset and slope

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

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

Step 1 measure mV of pH 7.01 buffer and record value
Step 2 measure mV value of pH 4.01 buffer and record value
Step 3 calculate the absolute mV difference (pH 4.01 value – pH 7.01 value)

Examples:

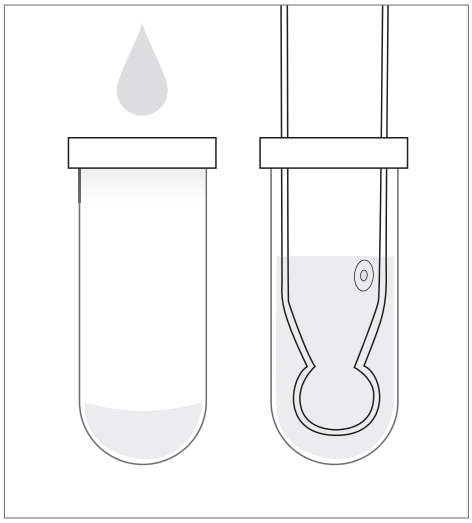
Electrode 1 pH 7.01 = -15 mV
pH 4.01 = +160 mV
Absolute mV difference is +160 mV – (+15 mV) = +175 mV

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

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

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

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



Electrode Storage Solutions

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

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

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

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

pH Electrodes

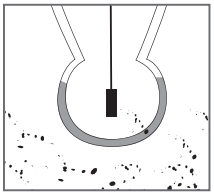
Designed and Manufactured by Hanna

Electrode Cleaning

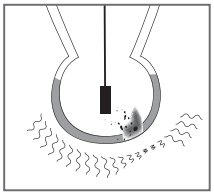
Cleaning Procedure

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

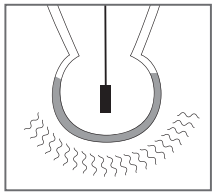
Calibrating a meter with a dirty electrode will result in inaccurate readings. If the mV offset continues to deviate with a properly cleaned electrode, it is a good indication that the electrode may need to be replaced.



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



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



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

General Cleaning

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

Protein Coating

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

Inorganic Soak

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

Oil and Grease Rinse

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

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

Troubleshooting

Drifting/Erratic Readings

Potential problems include:

Build up on glass electrode – Clean electrode

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

If the junction is constantly clogging due to measuring in semi solids or viscous samples, use a pH electrode that has an open junction design or cloth junction. 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 ±30 mV; if outside of this range, try cleaning the electrode. Slope (difference in mV from pH 7.0 to pH 4.0) must be greater than 150 mV (85%). If the slope is less than 85% then use fresh buffers, change fill solution, and clean electrode. If the slope cannot be increased to an acceptable value, replace electrode.

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

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

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	1-2 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:

pH Electrodes

Designed and Manufactured by Hanna

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

In this equation, where T is the temperature (°C) of the sample, mV is the ORP (mV) reading, and pH is the pH value of the sample.

The rH scale is not used in the instruments available on the market. A direct mV reading from the electrode is preferred, within the ±2000 mV range, without compensation/correlation with the pH/temperature value.

ORP Applications

ORP measurements are based on the potential difference measured between the platinum or gold electrode and a reference electrode. The identical reference system utilized for the pH electrode (Ag/AgCl) is also used for redox measurements.

Redox electrodes are used to monitor many chemical processes particularly those involving reversible reactions. Common applications include the following:

Industrial Wastewater Treatment

The redox systems used in water treatment are the reduction of chromates and oxidation of cyanides. Waste hexavalent chromium is reduced to trivalent chromium by the addition of sodium bisulfite or sulphur dioxide. In the case of cyanide, chlorine or sodium hypochlorite is used to oxidize the cyanide, followed by the hydrolysis of cyanate to ammonia and carbon dioxide.

Water Sanitation

ORP measurements are being increasingly used as an effective measure of the sanitizing activity in pool, spa and potable water. The kill time of E. coli bacteria in water depends on the ORP value. ORP is a reliable indicator of bacteriological water quality. Water having an ORP value equal to or higher than 650 mV are well within accepted sanitization levels for pool and spa waters.

Electrode Feature Guide: A Quick Glance

CAL Check™ System

When used in tandem with a Hanna CAL Check™ meter, our CAL Check™ equipped electrodes allow users to be informed if they have performed a proper calibration. In the event of a dirty or broken electrode or contaminated buffer solution, the system alerts the user to either check the electrode, replace the buffer solution, or both. The system also reminds users when the instrument should be recalibrated.

Smart Electrodes

With models that feature our SMART circuitry, an exclusive microchip embedded inside the electrode retains the calibration data and assigns an identity code to the host unit. As soon as the electrode is connected to a pH meter in the SMART series, it is recognized and its characteristics retrieved. The meter then uses the accessed calibration data as a reference for future measurements. Once each SMART electrode is calibrated, these electrodes can be used in succession without requiring new calibration. Hanna's SMART electrodes help eliminate errors and save time when working with more than one electrode.

Pre-amplified Electrodes

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/PTFE sleeve junction which controls a steady, predictable flow of fill solution, thus keeping the junction open. The hydrophobic property of PTFE sleeve repels wetness and coatings.

Sensor Check™ for edge® meters

When used with Hanna's electrodes equipped with a matching pin, edge® constantly checks the impedance of the pH measuring electrode to notify the user, in real-time, in the event of glass breakage. During calibration, Sensor Check™ also verifies the state of the junction.

Titanium Casings

Our electrodes that feature titanium bodies offer durability and shielding that is required in many industrial applications.

pH Electrode Application Guides

Abbreviation Guide

Spheric (S)
Conic (C)
Flat (F)
Glass (G)
Plastic (P)
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
Acids, Strong	HI1043B/P	S	G		•		•				•		•				0.1	3.77
	HI10430*	S	G		•		•				•		•		•	•	0.1	3.91
Alkaline, Strong	HI2111B (half-cell) + HI5311	S	P/G		•		•				•						0.1	3.94, 3.95
Aquariums	HI1332B/P	S	P		•		•				•		•				0.1	3.83
Bases, Strong	HI1043B/P	S	G		•		•				•		•				0.1	3.77
	HI10430*	S	G		•		•				•		•		•	•	0.1	3.91
Beer	HI1131B/P/D	S	G	•			•					•	•				0.1	3.78
	HI11310*	S	G		•		•				•		•		•	•	0.1	3.91
	HI11311*	S	G		•		•				•		•		•	•	0.1	3.91
	FC214D	S	M	•		•				•					•	•	3	3.86
Biotechnology (< 100 µl)	HI1083B/P	S	G	•				•	•								0.1	3.77
Boilers and Cooling Towers	HI72911D	F	M		•		PTFE				Polymer				•	•	3	3.90
Cheese	FC100B	S	P		•		•				•		•				0.1	3.84
	FC240B	C	M	•				•	•								0.1	3.85
Chemicals	HI1332B/P/D	S	P		•		•				•		•				0.1	3.83
Conductivity, Low	HI1053B/P	C	G		•		•					•	•				0.1	3.77
	HI10530*	C	G		•		•				•		•		•	•	0.1	3.91
Conductivity, High	HI1043B/P	S	G		•		•				•		•				0.1	3.77
	HI10430*	S	G		•		•				•		•		•	•	0.1	3.91
Creams	FC210B	C	G		•			•	•								0.1	3.84
	FC220B	S	G	•			•					•					0.1	3.84
	FC911B	S	P		•		•				•		•			•	0.1	3.86
Dairy Products	HI2031B	C	G	•			•					•	•				0.1	3.80
	FC200B/S	C	P	•				•	•								0.1	3.84
	FC240B	C	M	•				•	•								0.1	3.85
	FC201D, FC202D	C	P	•				•	•					•	•	•	0.1	3.86
	FC2100*	C	G		•			•	•						•	•	0.1	3.92
	FC2020*	C	P		•			•	•						•	•	0.1	3.92
Emulsions	HI1053B/P	C	G	•			•					•	•				0.1	3.77
	HI10530*	C	G		•		•				•		•		•	•	0.1	3.91
	HI1612D	C	G	•			•					•	•		•	•	0.1	3.82
	HI1413B	F	G	•				•	•								0.1	3.88
	HI1414D	F	G	•				•	•						•	•	0.1	3.88
Fats and Creams	HI1053B/P	C	G	•			•					•	•				0.1	3.77
	HI10530*	C	G		•		•				•		•		•	•	0.1	3.91
Flasks	HI1331B	S	G	•			•					•	•				0.1	3.78
Fluoride, Samples with	HI1143B	S	G		•		•				•		•				0.1	3.78
Food Industry (General Use)	FC100B	S	P		•		•				•		•				0.1	3.84
	FC911B	S	P		•		•				•		•			•	0.1	3.86
Food, Semi-solid	FC201D, FC202D	C	P	•				•	•					•	•	•	0.1	3.86
	FC200B/S/D	C	P	•				•	•								0.1	3.84

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*edge® specific electrode

pH Electrode Application Guides

Abbreviation Guide

Spheric (S)
Conic (C)
Flat (F)

Glass (G)
Plastic (P)

Application	Recommended Electrodes	Tip Shape	Body Material	Single Reference	Double Reference	Cloth Junction	Ceramic Junction	Open Junction	Viscolene Electrolyte	Gel Electrolyte	KCl 3.5M Electrolyte	KCl 3.5M + AgCl Electrolyte	Refillable	SMART	Temperature Sensor	Amplifier	Pressure (Bar)	Page
Fruits	FC200B/S/D	C	P	•				•	•								0.1	3.84
	FC230B	C	P	•				•	•								0.1	3.85
	FC202D	C	P	•				•	•						•	•	0.1	3.86
Fruit Juices, Organic	FC220B	S	G	•			•					•	•				0.1	3.84
	FC911B	S	P		•		•				•		•			•	0.1	3.86
Frozen, Semi	FC230B	C	P	•				•	•								0.1	3.85
Ham and Sausages	FC200B/S/D	C	P	•				•	•								0.1	3.84
	FC202D	C	P	•				•	•						•	•	0.1	3.86
	FC230B	C	P	•				•	•								0.1	3.85
Horticulture and Nurseries	HI1053B/P	C	G	•			•				•		•				0.1	3.77
	HI1292D	C	G	•			•					•	•		•	•	0.1	3.88
Humidity, High	FC911B	S	P		•		•				•		•			•	0.1	3.86
Hydrocarbons	HI1043B/P	S	G		•		•				•		•				0.1	3.77
	HI10430*	S	G		•		•				•		•		•	•	0.1	3.91
Laboratory (General Use)	HI1131B/P/D	S	G		•		•					•	•				0.1	3.78
	HI1230B/D	S	P		•		•			•							2	3.79
	HI1217D	S	P	•			•			•					•	•	2	3.81
	HI1610D	S	G	•			•					•	•		•	•	0.1	3.82
	HI1332B/P/D	S	P		•		•				•		•				0.1	3.83
	HI11310*	S	G		•		•				•		•		•	•	0.1	3.91
	HI11311*	S	G		•		•				•		•		•	•	0.1	3.91
	HI12300*	S	P		•		•			•					•	•	2	3.93
	HI12301*	S	P		•		•			•					•	•	2	3.93
	HI1291D	S	P	•			•			•					•	•	2	3.81
Leather	HI1413B	F	G	•				•	•								0.1	3.88
	HI1414D	F	G	•				•	•						•	•	0.1	3.88
Meats	FC230B	C	P	•				•	•								0.1	3.85
	FC400B	C	P		•			•	•								0.1	3.85
	FC231D, FC232D	C	P	•				•	•					•	•	•	0.1	3.86/3.87
	FC201D, FC202D	C	P	•				•	•					•	•	•	0.1	3.86
	FC2320*	C	P		•			•	•						•	•	0.1	3.92
Milk and Yogurt	FC200B/S	C	P	•				•	•								0.1	3.84
	FC210B	C	G		•			•	•								0.1	3.84
	FC201D, FC202D	C	P	•				•	•					•	•	•	0.1	3.86
	FC2100*	C	G		•			•	•						•	•	0.1	3.92
	FC2020*	C	P		•			•	•						•	•	0.1	3.92
Monitoring, Continuous	HI1135B	S	G		•		•				•		•				3	3.78
	HI1611D	S	G	•			•			•					•	•	2	3.82
NMR Tubes	HI1093B	S	G	•				•	•								0.1	3.77
Paints	HI1043B/P	S	G		•		•				•		•				0.1	3.77

*edge® specific electrode

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pH Electrode Application Guides

Abbreviation Guide

Spheric (S)
Conic (C)
Flat (F)

Glass (G)
Plastic (P)
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
Paper	HI1413B	F	G	•				•	•								0.1	3.88
	HI1414D	F	G	•				•	•						•	•	0.1	3.88
Photographic Chemicals	HI1230B/D	S	P		•		•			•								3.79
Plating Baths	HI62911D	F	M		•	PTFE					Polymer				•	•	3	3.90
Quality Control	HI1332B/P/D	S	P		•		•				•		•				0.1	3.83
Sauces	FC220B	S	G	•			•					•	•				0.1	3.84
	FC911B	S	P		•		•				•		•			•	0.1	3.86
Seawater	HI1043B/P	S	G		•		•				•		•				0.1	3.77
	HI10430*	S	G		•		•				•		•		•	•	0.1	3.91
Semi-solid Products	HI1053B/P	C	G		•		•				•		•				0.1	3.77
	HI10530*	C	G		•		•				•		•		•	•	0.1	3.91
	HI1612D	C	G	•			•					•	•		•	•	0.1	3.82
	FC200B/S/D	C	P	•				•	•								0.1	3.84
	FC201D, FC202D	C	P	•				•	•					•	•	•	0.1	3.86
	HI2031B	C	G	•			•					•	•				0.1	3.80
Skin, Scalp	HI1413B	F	G	•				•	•								0.1	3.88
	HI1414D/50	F	G	•				•	•						•	•	0.1	3.88
Soil, Direct	HI1292D	C	G	•			•					•	•		•	•	0.1	3.88
Soil Samples	HI1053B/P	C	G		•		•				•		•				0.1	3.77
	HI10530*	C	G		•		•				•		•		•		0.1	3.91
	HI1230B/D	S	P		•		•			•							2	3.79
	HI1292D	C	G	•			•					•	•		•	•	0.1	3.88
Solvents	HI1043B/P	S	G		•		•				•		•				0.1	3.77
	HI10430*	S	G		•		•				•		•		•	•	0.1	3.91
Surface Measurements	HI1413B	F	G	•				•	•								0.1	3.88
	HI1414D	F	G	•				•	•						•	•	0.1	3.88
Swimming Pools	HI1297D	C	M	•		•				•					•	•	3	3.89
Tris Buffer	HI1043B/P	S	G		•		•				•		•				0.1	3.77
	HI10430*	S	G		•		•				•		•		•	•	0.1	3.91
	HI1144B/D	S	G	•			•				•		•				0.1	3.79
	HI1343B	S	P	•			•				•						0.1	3.80
Vials and Test Tubes	HI1330B/D	S	G	•			•				•		•				0.1	3.80
Wastewater	HI1296D	S	M	•		•				•					•	•	3	3.89
	HI1297D	C	M	•		•				•					•	•	3	3.89
Water, High Purity	HI1053B/P	C	G		•		•				•		•				0.1	3.77
Water, Municipal	HI1297D	C	M	•		•				•					•	•	3	3.89
Water, Potable	HI1053B/P	C	G		•		•				•		•				0.1	3.77
	HI10530*	C	G		•		•				•		•		•		0.1	3.91
	FC215D	C	G	•			•					•	•		•	•	0.1	3.89
Water Treatment	HI1297D	C	M	•		•				•					•	•	3	3.89
Wine and Must	HI1048B/P/D	S	G		•			•			•		•		•	•	0.1	3.85
	HI10480*	S	G		•			•			•		•		•	•	0.1	3.92

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*edge® specific electrode

ORP Electrode Application Guides

Abbreviation Guide

Platinum (Pt) — Glass (G)
Gold (Gl) — Plastic (P)

Application	Recommended Electrodes	Sensor	Body Material	Single Reference	Double Reference	Cloth Junction	Ceramic Junction	Open Junction	Gel Electrolyte	KCl 3.5M Electrolyte	KCl 3.5M + AgCl Electrolyte	Refillable	SMART	Temperature Sensor	Amplifier	Pressure (Bar)	Page
Laboratory (General Use)	HI3131B/P	Pt	G	•			•				•	•				0.1	3.81
	HI3618D	Pt	G	•			•				•	•		•	•	0.1	3.81
	HI36180*	Pt	G		•		•				•	•	•	•	•	0.1	3.93
	HI36200*	Pt	P	•			•		•				•	•	•	2	3.93
Oxidants	HI4430B	Gl	P	•			•		•							2	3.83
Ozone	HI4430B	Gl	P	•			•		•							2	3.83
Quality Control	HI3230B	Pt	P	•			•		•							2	3.83
Titrations, ORP	HI3131B/P	Pt	G	•			•				•	•				0.1	3.81
Water, Municipal	HI3230B	Pt	P	•			•		•							2	3.83
Wine	HI3148B	Pt	G		•			•		•		•				0.1	3.87

*edge® specific electrode

Half-Cell and Reference Electrode Application Guides

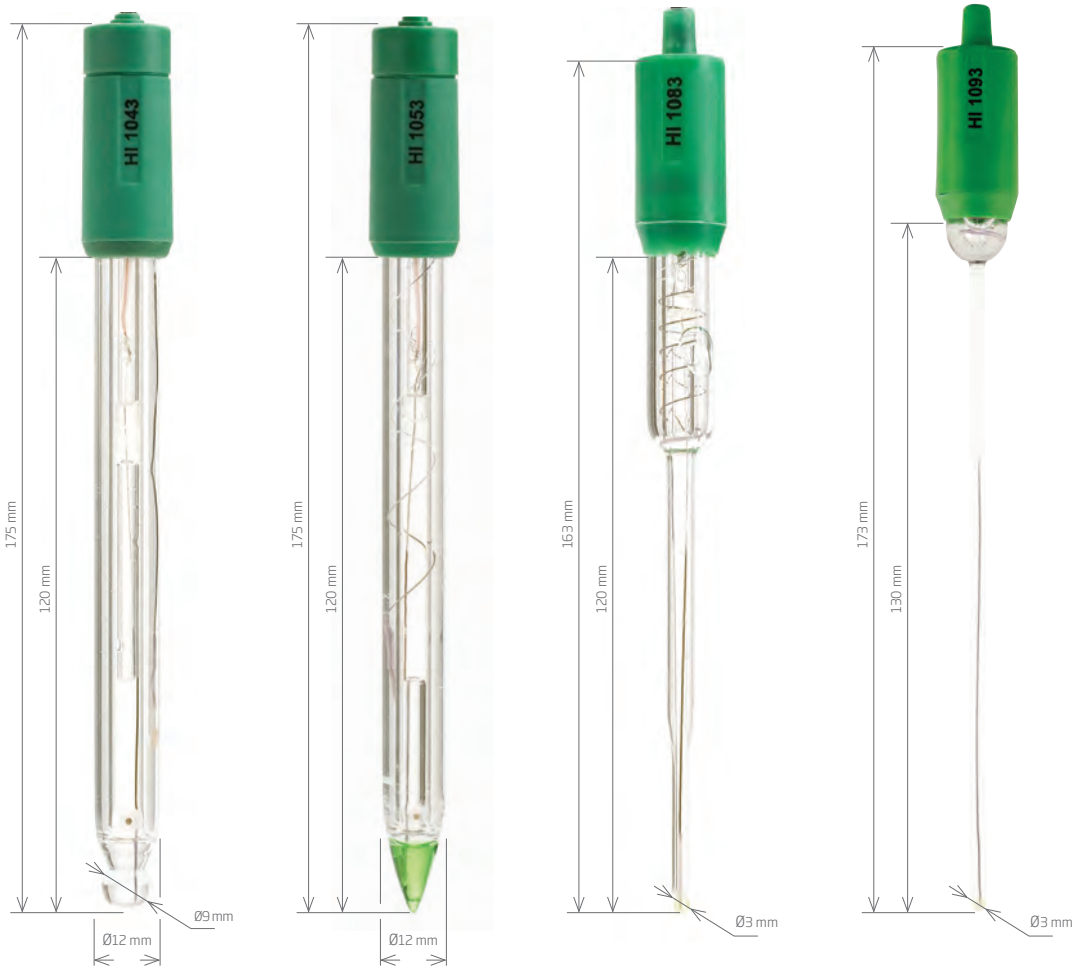
Abbreviation Guide

Spheric (S) — Glass (G)
Cylindric (C) — Plastic (P)
Platinum (Pt)
Gold (Gl)

Application	Recommended Electrodes	pH Half Cell	ORP Half Cell	Reference	Tip Shape	Body Material	Single Reference	Double Reference	PTFE Sleeve Junction	Ceramic Junction	KCl 3.5M Electrolyte	Pressure (Bar)	Page
	HI5315			•		P		•					3.96
	HI5313			•		P	•			•		0.1	3.96
Laboratory (General Use)	HI2111B	•			S	G							3.94
	HI2112B	•			S	P							3.94
	HI3133B		•		Pt	G							3.94
	HI5412			•		G	•			•	•	0.1	3.95
	HI5311			•		G		•		•	•	0.1	3.95
Milk	FC260B	•			S	G							3.94
Remote Filling	HI5314			•		G		•		•	•	3	3.95
	HI5414			•		G	•			•	•	3	3.95
Strong Alkaline Solutions	HI2111B	•			S	G							3.94
Suspended Solids	HI5413			•		G	•		•		•	0.1	3.95
	HI5312			•		G		•	•		•	0.1	3.96
	HI5313			•		P	•			•		0.1	3.96
Titration, Argentometric	HI5110B		•		C	G							3.94
Titrations, General	HI5412			•		G	•			•	•	0.1	3.95
	HI5311			•		G		•		•	•	0.1	3.95
	HI5312			•		G		•	•		•	0.1	3.96
	HI5313			•		P	•			•		0.1	3.96
Titration, Potentiometric	HI3133B		•		Pt	G							3.94
Wide Temperature Range	HI5311			•		G		•		•	•	0.1	3.95

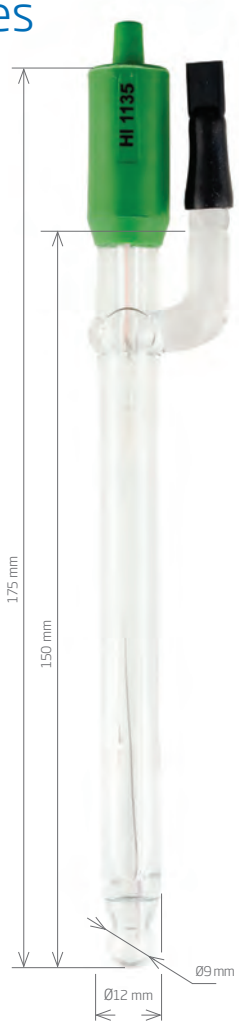
Unsure about which electrode to choose? Give your local Hanna office a call for assistance.

Combination Electrodes



Code	HI1043[ ]	HI1053[ ]	HI1083[ ]	HI1093B
Description	refillable, combination pH electrode w/ double junction	refillable, combination pH electrode w/ conical tip	combination pH electrode w/micro bulb for small samples	combination pH electrode w/ extended length and micro bulb
Reference	double, Ag/AgCl	double, Ag/AgCl	single, Ag/AgCl	single, Ag/AgCl
Junction / Flow Rate	ceramic, single / 15-20 µL/h	ceramic, triple / 40-50 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 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 100°C (23 to 212°F) - LT	0 to 50°C (32 to 122°F) - GP	0 to 50°C (32 to 122°F) - GP
Tip /Shape	spheric (dia: 9.5 mm)	conic (12 x 12 mm)	spheric (dia: 3 mm)	spheric (dia: 3 mm)
Temperature Sensor	no	no	no	no
Amplifier	no	no	no	no
Body Material	glass – HT	glass – LT	glass – GP	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, soil samples, potable water, semi-solid products, low conductivity solutions, emulsions	biotechnology, samples < 100 µL	NMR tubes
Connection	**HI1043B** BNC **HI1043P** BNC + pin*	**HI1053B** BNC **HI1053P** BNC + pin*	**HI1083B** BNC **HI1083P** BNC + pin*	**HI1093B** BNC
	* For pH meters with CAL Check™ system	* For pH meters with CAL Check™ system	* For pH meters with CAL Check™ system	

Combination Electrodes



Code	HI1131[ ]	HI1135B	HI1143[ ]	HI1331B
Description	refillable, combination pH electrode	refillable, combination pH electrode w/ side arm construction and fast flow rate	refillable, combination pH electrode for fluoride applications	combination pH electrode
Reference	double, Ag/AgCl	double, Ag/AgCl	double, Ag/AgCl	single, Ag/AgCl
Junction / Flow Rate	ceramic, single / 15-20 µL/h	ceramic, double / 30-40 µL/h	ceramic, single / 15-20 µL/h	ceramic, single / 15-20 µL/h
Electrolyte	KCl 3.5M	KCl 3.5M	KCl 3.5M	KCl 3.5M + AgCl
Max Pressure	0.1 bar	3 bar with back pressure	0.1 bar	0.1 bar
Range	pH: 0 to 13	pH: 0 to 14	pH: 0 to 10	pH: 0 to 13
Recommended Operating Temp.	0 to 100°C (32 to 212°F) – HT	0 to 100°C (32 to 212°F) – HT	-5 to 60°C (23 to 140°F) – HF	0 to 70°C (32 to 158°F) – GP
Tip /Shape	spheric (dia: 9.5 mm)	spheric (dia: 9.5 mm)	spheric (dia: 9.5 mm)	spheric (dia: 7.5 mm)
Temperature Sensor	no	no	no	no
Amplifier	no	no	no	no
Body Material	glass	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	laboratory general purpose, beer	continuous monitoring with remote filling	samples with fluoride (max 2 g/L @ pH 2 and temperature < 60°C)	specific for flasks
Connection	**HI1131B** BNC **HI1131P** BNC + pin* **HI1131D** DIN	**HI1135B** BNC	**HI1143B** BNC **HI1143D** DIN	**HI1331B** BNC

* For pH meters with CAL Check™ system

Combination Electrodes

Code	HI1230[ ]	HI1144[ ]
Description	combination pH electrode	refillable, combination pH electrode with calomel references
Reference	double, Ag/AgCl	single, Hg/Hg_2Cl_2
Junction / Flow Rate	ceramic, single / 15-20 µL/h	ceramic / 15-20 µL/h
Electrolyte	gel	KCl 3.5M
Max Pressure	2 bar	0.1 bar
Range	pH: 0 to 13	pH: 0 to 14
Recommended Operating Temp.	0 to 70°C (32 to 158°F) – HT	0 to 60°C (32 to 140°F) – HT
Tip /Shape	spheric (dia: 7.5 mm)	spheric (dia: 9.5 mm)
Temperature Sensor	no	no
Amplifier	no	no
Body Material	PEI	glass
Cable	coaxial; 1 m (3.3')	coaxial; 1 m (3.3')
Recommended Use	field applications	tris buffer
Connection	**HI1230B** BNC **HI1230D** DIN	**HI1144B** BNC **HI1144D** DIN

Tips for the Most Accurate Measurements

Keep Electrode Hydrated

Ideally, pH electrodes should be kept in a storage solution when not in use. Placing the electrode in a small glass filled with storage solution is suitable. An option for pocket meters is to place a small piece of sponge into the meter's cap and pour storage solution into the cap to wet the sponge. Pouring off any excess solution beforehand, the cap can then be placed on the meter.

If a storage solution is not available the next best option is to use pH 4.01 buffer (pH 7.01 is also suitable to a lesser extent).

Clean Electrodes Before Use

Clean the junction of your electrodes once a day or at least once a week to prevent junction clogging and to maintain accuracy. Immerse the electrode in the proper cleaning solution for at least 15 to 20 minutes. Hanna offers a wide range of cleaning solutions for general purpose and specific applications.

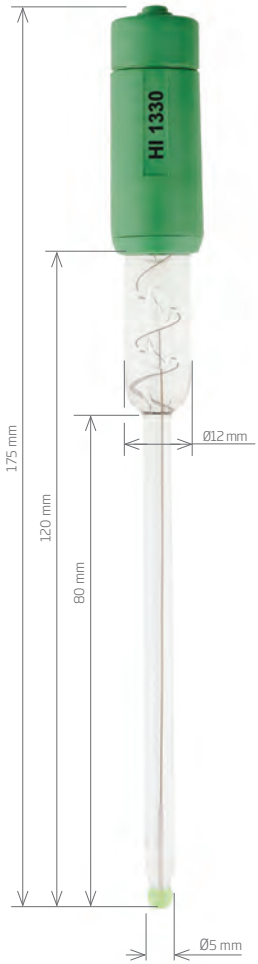
Replace Electrodes Once a Year

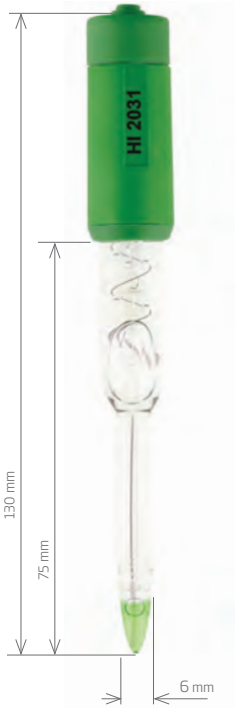
If your electrode takes too long to stabilize a reading, or readings fluctuate wildly, it is most likely time to replace the electrode. The typical life span of any pH electrode is from 6 months to 1.5 years.

Additional Tips

- Calibration and storage solutions should be changed regularly (i.e. monthly)
- Calibrate the meter often if a high degree of accuracy is required.
- Remember that the calibration is as only as good the buffer being used (i.e. old or contaminated buffer may not have the same value on the label).
- 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.

Combination Electrodes





Code	HI1330[ ]	HI1343[ ]	HI2031[ ]
Description	combination pH electrode	combination pH electrode	refillable, conical tip combination pH electrode
Reference	single, Ag/AgCl	single, Hg/Hg_2Cl_2	single, 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 + AgCl	KCl 3.5M	KCl 3.5M + AgCl
Max Pressure	0.1 bar	0.1 bar	0.1 bar
Range	pH: 0 to 12	pH: 0 to 14	pH: 0 to 12
Recommended Operating Temp.	-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: 5 mm)	spheric (dia: 7.5 mm)	conic (6 x 10 mm)
Temperature Sensor	no	no	no
Amplifier	no	no	no
Body Material	glass	PEI	glass
Cable	coaxial; 1 m (3.3')	coaxial; 1 m (3.3')	coaxial; 1 m (3.3')
Recommended Use	specific for vials and test tubes	specific for Tris buffer	dairy and semi-solid products
Connection	**HI1330B** BNC **HI1330D** DIN	**HI1343B** BNC **HI1343D** DIN	**HI2031B** BNC **HI2031D** DIN

Special pH and ORP Electrodes

Code	HI3131[ ]	HI3618D	HI1217D	HI1291D
Description	refillable combination ORP electrode	ORP combination electrode	pH electrode	pH electrode
Reference	single, Ag/AgCl	single, Ag/AgCl	single, Ag/AgCl	single, Ag/AgCl
Junction / Flow Rate	ceramic, single / 15-20 µL/h	ceramic, single / 15-20 µL/h	ceramic, single	ceramic, single
Electrolyte	KCl 3.5M + AgCl	KCl 3.5M + AgCl	gel	gel
Max Pressure	0.1 bar	0.1 bar	2 bar	2 bar
Range	ORP: ±2000 mV	ORP: ±2000 mV	pH: 0 to 13	pH: 0 to 12
Recommended Operating Temp.	-5 to 70°C (23 to 158°F)	-5 to 70°C (23 to 158°F)	0 to 70°C (32 to 158°F) - GP	0 to 70°C (32 to 158°F) - GP
Tip /Shape	platinum pin	platinum pin	spheric (dia: 5.0 mm)	spheric (dia: 5.0 mm)
Temperature Sensor	no	yes	yes	yes
Amplifier	no	yes	yes	yes
Body Material	glass	glass	PEI	PEI
Cable	coaxial; 1 m (3.3')	5-pole; 1 m (3.3')	coaxial; 1 m (3.3')	coaxial; 1 m (3.3')
Recommended Use	laboratory general use, ORP titrations	laboratory	general purpose	general purpose, education, laboratory
Connection	**HI3131B** BNC **HI3131P** BNC + pin* **HI3131D** DIN	**HI3618D** DIN**	**HI1217D** DIN**	**HI1291D** DIN †

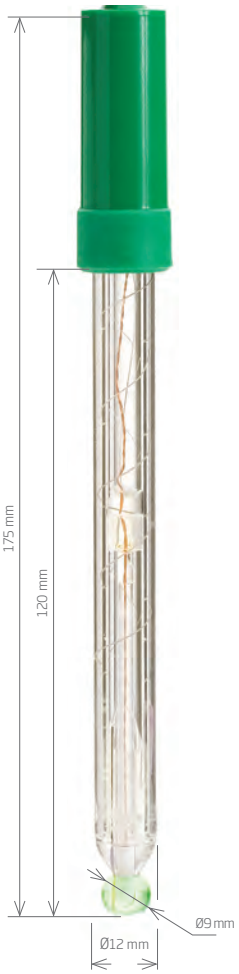
* For pH meters with CAL Check™ system

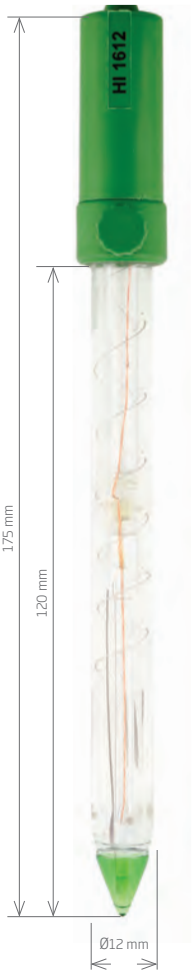
** Recommended for use with HI8314 pH meter

** Recommended for use with HI8314 pH meter

† Recommended for use with HI207 and HI208 pH meters

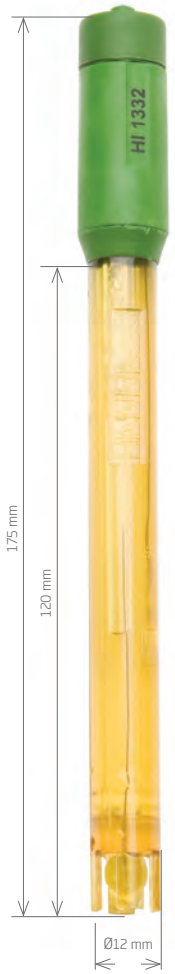
pH Electrodes with Temperature Sensor

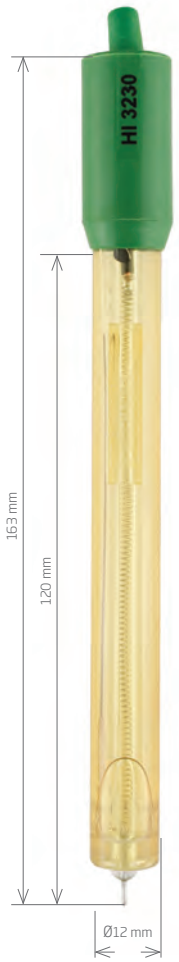




Code	HI1610D	HI1611D	HI1612D
Description	pH electrode	pH electrode	pH electrode
Reference	single, Ag/AgCl	single, Ag/AgCl	single, Ag/AgCl
Junction / Flow Rate	ceramic, single / 15-20 µL/h	ceramic, single	ceramic, triple / 40-50 µL/h
Electrolyte	KCl 3.5M + AgCl	gel	KCl 3.5M + AgCl
Max Pressure	0.1 bar	2 bar	0.1 bar
Range	pH: 0 to 13	pH: 0 to 14	pH: 0 to 12
Recommended Operating Temp.	0 to 70°C (32 to 158°F) - 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	**HI1610D** DIN*	**HI1611D** DIN*	**HI1612D** DIN*
	* Recommended for use with HI8314 pH meter	* Recommended for use with HI8314 pH meter	* Recommended for use with HI8314 pH meter

Rugged pH and ORP Electrodes

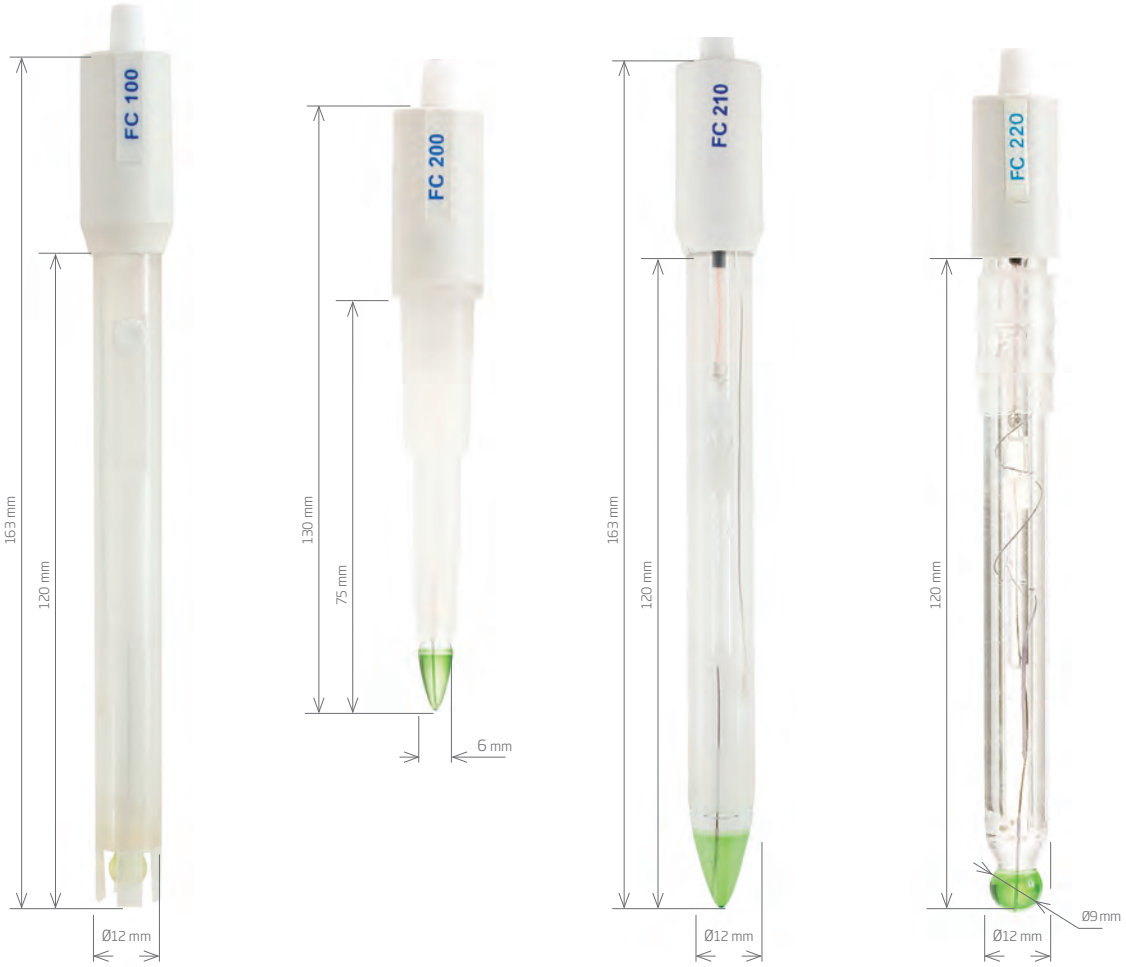




Code	HI1332[ ]	HI3230[ ]	HI4430[ ]
Description	pH electrode	gel-filled, combination ORP electrode w/ platinum contact	gel-filled, combination ORP electrode w/ gold contact
Reference	double, Ag/AgCl	single, Ag/AgCl	single, Ag/AgCl
Junction / Flow Rate	ceramic, single / 15-20 µL/h	ceramic, single	ceramic, single
Electrolyte	KCl 3.5M	gel	gel
Max Pressure	0.1 bar	2 bar	2 bar
Range	pH: 0 to 13	ORP: ±2000 mV	ORP: ±2000 mV
Recommended Operating Temp.	0 to 70°C (32 to 158°F) - GP	-5 to 70°C (23 to 158°F)	-5 to 70°C (23 to 158°F)
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	municipal water, quality control	oxidants, ozone
Connection	**HI1332B** BNC **HI1332P** BNC + pin* **HI1332D** DIN	**HI3230B** BNC **HI3230D** DIN	**HI4430B** BNC **HI4430D** DIN

* For pH meters with CAL Check™ system

Electrodes for the Food Industry

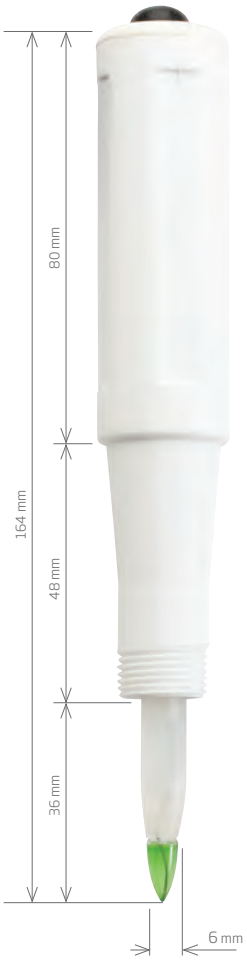


Code	FC100B	FC200[ ]	FC210B	FC220B
Description	pH electrode	pH electrode	pH electrode	pH electrode
Reference	double, Ag/AgCl	single, Ag/AgCl	double, Ag/AgCl	single, Ag/AgCl
Junction / Flow Rate	ceramic, single / 15-20 µL/h	open	open	ceramic, triple / 40-50 µL/h
Electrolyte	KCl 3.5M	viscolene	viscolene	KCl 3.5M + AgCl
Max Pressure	0.1 bar	0.1 bar	0.1 bar	0.1 bar
Range	pH: 0 to 13	pH: 0 to 12	pH: 0 to 12	pH: 0 to 12
Recommended Operating Temp.	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	-5 to 70°C (23 to 158°F) - LT
Tip /Shape	spheric (dia: 7.5 mm)	conic (6 x 10 mm)	conic (12 x 12 mm)	spheric (dia: 9.5 mm)
Temperature Sensor	no	no	no	no
Amplifier	no	no	no	no
Body Material	PVDF	PVDF	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	cheese	milk, yogurt, dairy products, semi-solid foods	milk, yogurt, creams	creams, fruit juices, sauces
Connection	**FC100B** BNC	**FC200B** BNC **FC200D** DIN **FC200S** screw cap	**FC210B** BNC	**FC220B** BNC

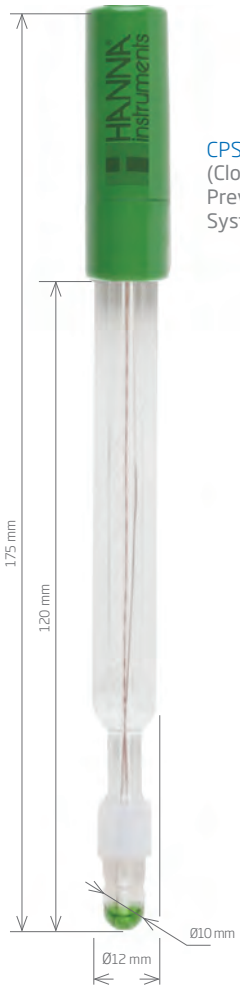
** Not for screw cap models

Electrodes for the Food Industry

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



AISI stainless steel sheath

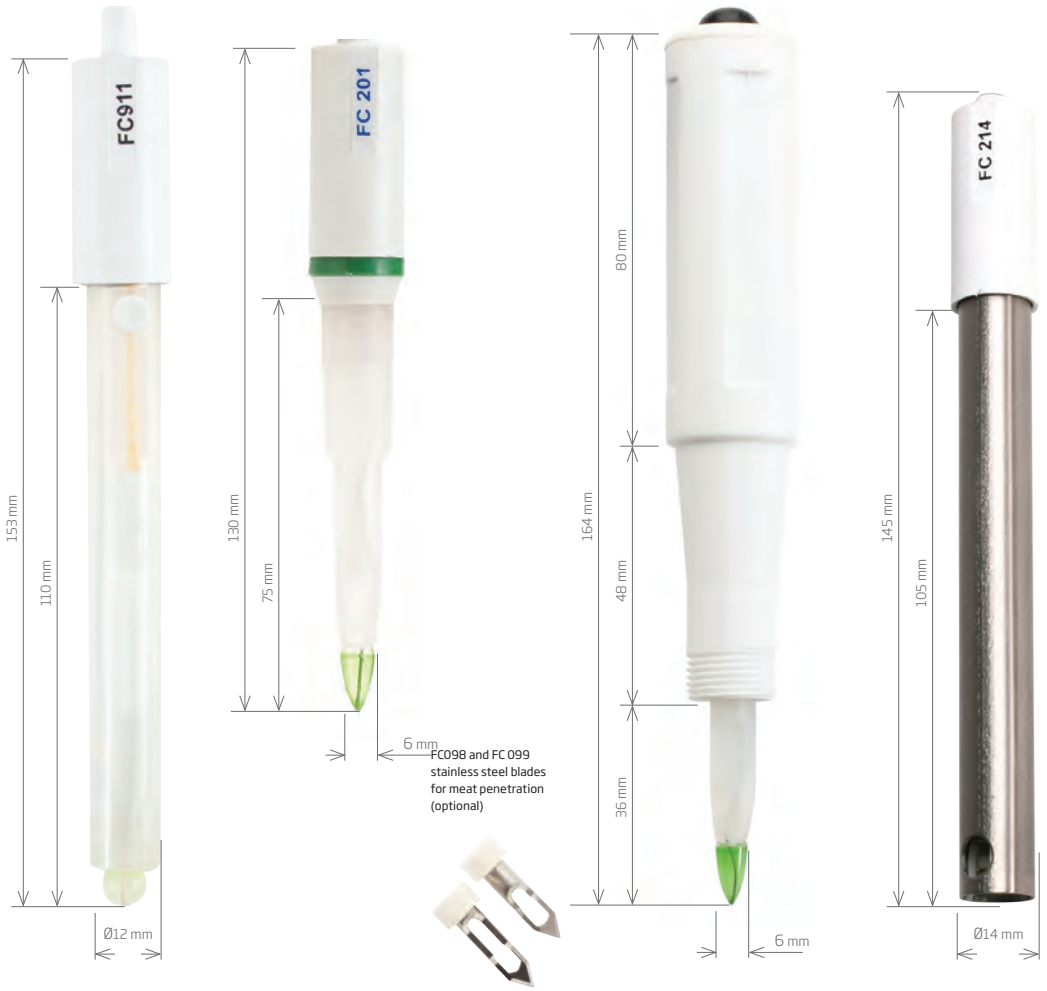


CPS™ (Clogging Prevention System)

Code	FC230B	FC240B	FC400B	HI1048[ ]
Description	combination pH electrode with PVDF outer body	combination pH electrode with stainless steel sheath	pH electrode	pH electrode with CPS™ (Clogging Prevention System)
Reference	single, Ag/AgCl	single, Ag/AgCl	double, Ag/AgCl	double, Ag/AgCl
Junction / Flow Rate	open	open	open	open, CPS™
Electrolyte	viscolene	viscolene	viscolene	KCl 3.5M
Max Pressure	0.1 bar	0.1 bar	0.1 bar	0.1 bar
Range	pH: 0 to 12	pH: 0 to 13	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) - GP	0 to 50°C (32 to 122°F) - LT	0 to 80°C (32 to 176°F) - GP
Tip /Shape	conic (6 x 10 mm)	conic (3 x 5 mm)	conic (6 x 10 mm)	dome (dia: 8 mm)
Temperature Sensor	no	no	no	yes
Amplifier	no	no	no	yes
Body Material	PVDF	AISI 316	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	meat, semi frozen products	dairy products, cheese quality control	meat	wine, must
Connection	**FC230B** BNC	**FC240B** BNC	**FC400B** BNC	**HI1048B** BNC **HI1048B/50** BNC **HI1048P** BNC + pin* **HI1048D** DIN**

* For pH meters with CAL Check™ system
** Recommended for use with HI99111 pH meter

Electrodes for the Food Industry



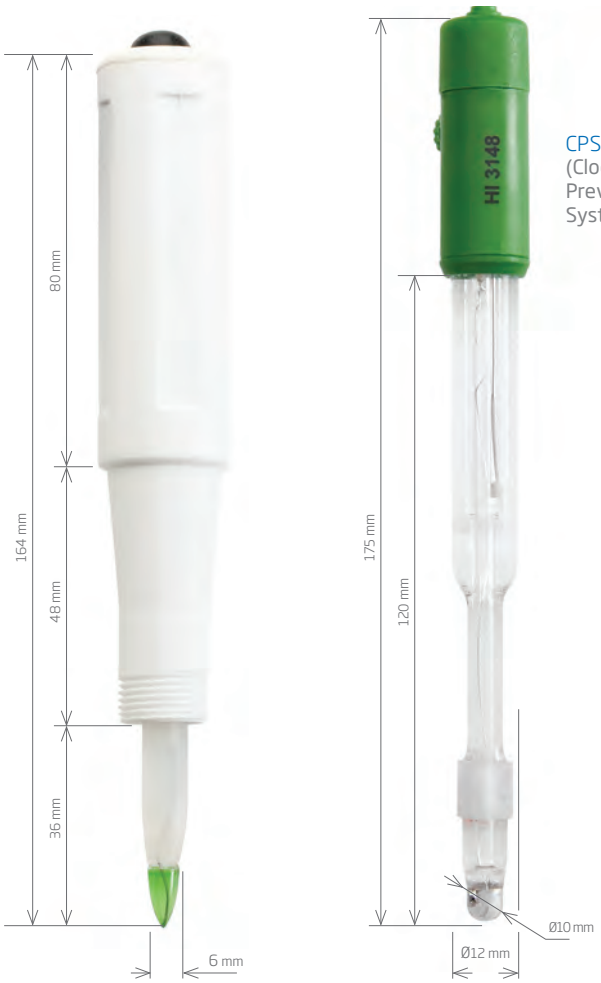
Code	FC911	FC20[ ]D	FC231D	FC214D
Description	pH electrode	pH SMART electrode	pH SMART electrode	pH electrode
Reference	double, Ag/AgCl	single, Ag/AgCl	single, Ag/AgCl	single, Ag/AgCl
Junction / Flow Rate	ceramic, single / 15-20 µL/H	open	open	cloth
Electrolyte	KCl 3.5M	viscolene	viscolene	gel
Max Pressure	0.1 bar	0.1 bar	0.1 bar	3 bar
Range	pH: 0 to 13	pH: 0 to 12	pH: 0 to 12	pH: 0 to 13
Recommended Operating Temp.	-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	spheric (dia: 7.5 mm)	conic (6 x 10 mm)	conic (6 x 10 mm)	spheric (dia: 5 mm)
Temperature Sensor	no	yes	yes	yes
Amplifier	yes	yes	yes	yes
Body Material	PVDF	PVDF	PVDF	titanium with HT glass sensor
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	creams, fruit juices, sauces	milk, yogurt, dairy products, meat, semi-solid foods	meat	beer
Connection	**FC911B** BNC	**FC201D** DIN **FC202D** DIN *	**FC231D** DIN **	**FC214D** DIN†

* Recommended for use with HI99161 pH meter

** Recommended for use with HI99163 pH meter

† Recommended for use with HI99151 pH meter

SMART Electrodes for the Food Industry



CPS™ (Clogging Prevention System)

SMART Electrodes and the Food Industry

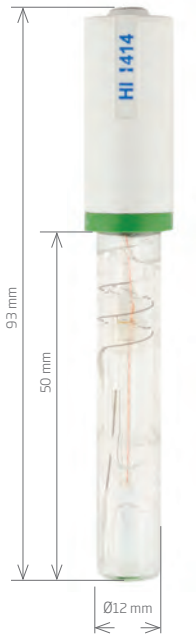
SMART electrode contain an embedded microchip inside, which retains calibration data and assigns an identity code to the host meter. As soon as a SMART electrode is connected to the host meter, the characteristics are recognized. The meter uses the accessed calibration data as a point of reference for future measurements, so even if SMART electrodes are exchanged, recalibration is not necessary.

SMART electrodes are beneficial for users who measure a variety of samples each day. By simply exchanging one SMART electrode for another, cross-contamination can be avoided and samples can be measured accurately and efficiently.

Code	FC232D	HI3148B
Description	pH SMART electrode	ORP SMART electrode
Reference	single, Ag/AgCl	double, Ag/AgCl
Junction	open	open / CPS™
Electrolyte	viscolene	KCl 3.5M + AgCl
Max Pressure	0.1 bar	0.1 bar
Range	pH: 0 to 12	ORP: ±2000 mV
Recommended Operating Temp.	0 to 50°C (32 to 122°F) - LT	-5 to 80°C (23 to 176°F)
Tip /Shape	conic (6 x 10 mm)	platinum ring
Temperature Sensor	yes	no
Amplifier	yes	no
Body Material	PVDF	glass
Cable	7-pole; 1 m (3.3')	coaxial; 1 m (3.3')
Recommended Use	meat	wine
Connection	**FC232D** DIN*	**HI3148B** BNC **HI3148B/50** BNC

* Recommended for use with HI99163 pH meter

Electrodes for Specific Analysis



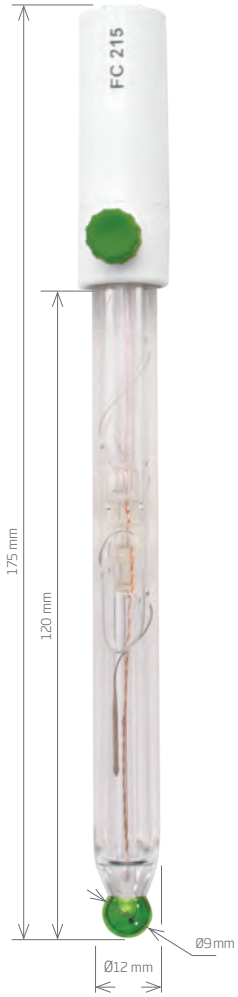
Code	HI1413B	HI1414D	HI1414D/50	HI1292D
Description	pH electrode	pH electrode	pH electrode	pH electrode
Reference	single, Ag/AgCl	single, Ag/AgCl	single, Ag/AgCl	single, Ag/AgCl
Junction	open	open	open	ceramic, triple / 40-50 µL/h
Electrolyte	viscolene	viscolene	viscolene	KCl 3.5M + AgCl
Max Pressure	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	**HI1413B** BNC	**HI1414D** 7-pinDIN*	**HI1414D/50** DIN†	**HI1292D** 7-pin DIN**

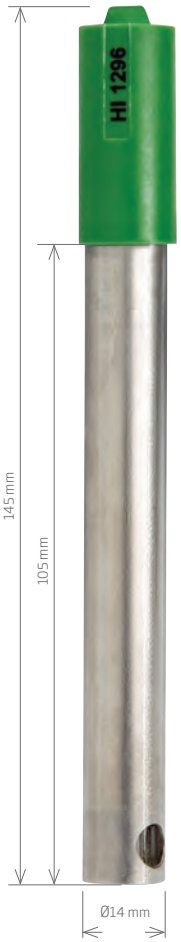
* Recommended for use with HI99171 pH meter

† Recommended for use with HI99181 pH meter

** Recommended for use with HI99121 pH meter

Electrodes for Specific Analysis





Code	FC215D	HI1296[ ]	HI1297D
Description	pH electrode	pH electrode	pH/ORP electrode
Reference	single, Ag/AgCl	single, Ag/AgCl	single, Ag/AgCl
Junction	ceramic, triple	cloth	cloth
Electrolyte	KCl 3.5M + AgCl	gel	gel
Max Pressure	0.1 bar	3 bar	3 bar
Range	pH: 0 to 12	pH: 0 to 13	pH: 0 to 13; ORP
Recommended Operating Temp.	0 to 70°C (32 to 158°F)	0 to 80°C (32 to 176°F) - GP	0 to 80°C (32 to 176°F) - GP
Tip /Shape	spheric (dia: 9.5 mm)	spheric (dia: 5 mm)	pH: conic (3 mm); ORP: platinum sensor
Temperature Sensor	yes	yes	yes
Amplifier	yes	yes	yes
Body Material	glass	Titanium	titanium
Cable	coaxial; 1 m (3.3')	7-pole; 1 m (3.3')	7-pole; 1 m (3.3')
Recommended Use	drinking water	wastewater	wastewater, municipal water, water treatment, swimming pools
Connection	**FC215D** DIN*	**HI1296D** DIN** **HI12963** DIN†	**HI1297D** DIN‡

* Recommended for use with HI99191 pH 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

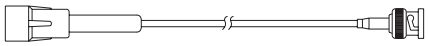
Code	HI62911D	HI72911[ ]
Description	pH electrode	pH electrode
Reference	double, Ag/AgCl	double, Ag/AgCl
Junction	PTFE	PTFE
Electrolyte	polymer	polymer
Max Pressure	3 bar	3 bar
Range	pH: 0 to 13	pH: 0 to 13
Recommended Operating Temp.	0 to 80°C (32 to 176°F) - GP	0 to 80°C (32 to 176°F) - GP
Tip /Shape	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	**HI62911D** DIN*	**HI72911D** DIN** **HI72911B** BNC + phono†

* Recommended for use with HI99131 pH meter

** Recommended for use with HI99141 pH meter
† Recommended for use with HI98192 pH meter

Electrode Extension Cables

Screw Type to BNC Cables / Connectors

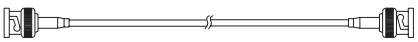


Description

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

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

BNC to BNC Cables / Connectors

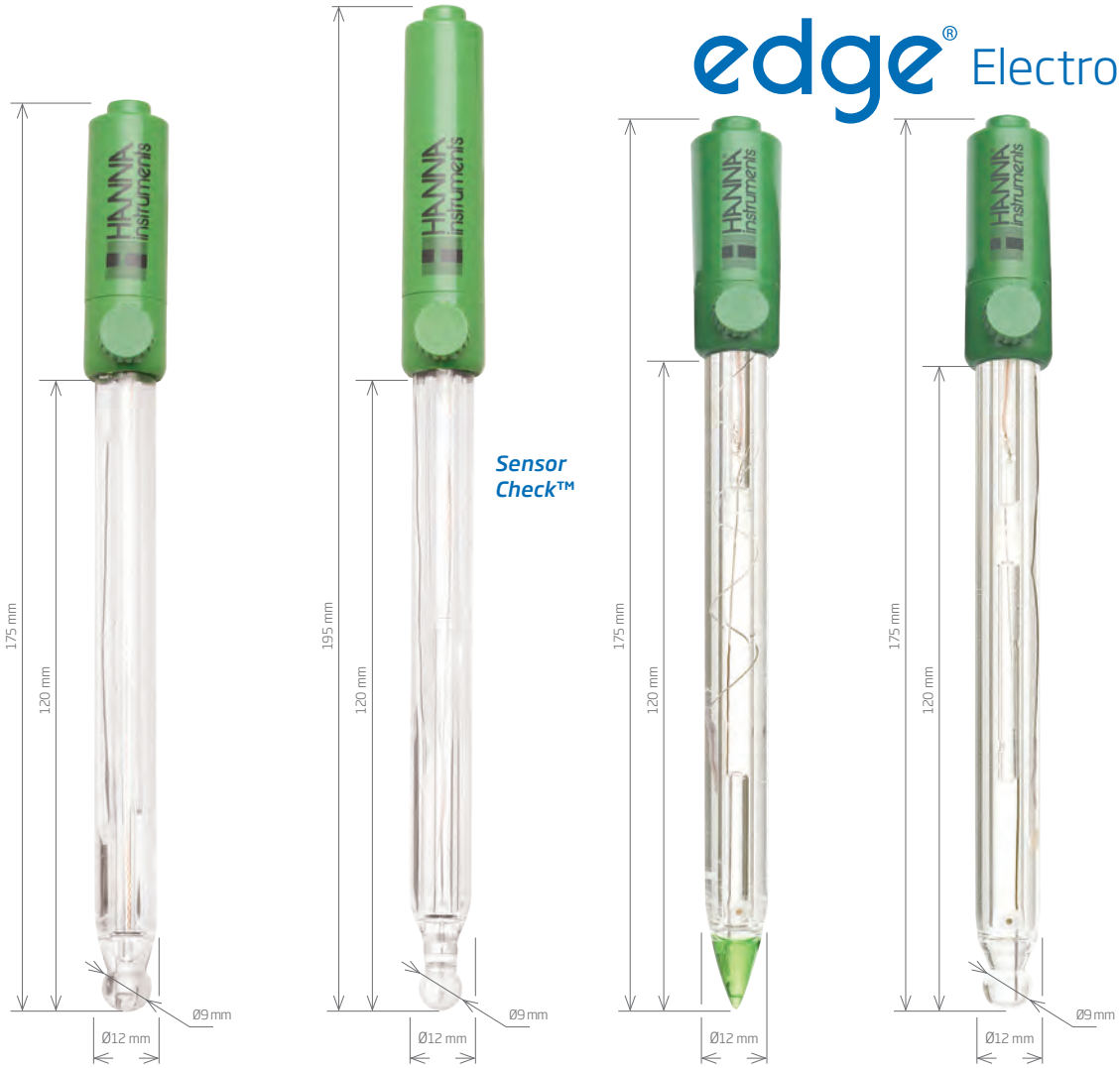


Description

3.0 mm (0.12") cable with BNC connectors

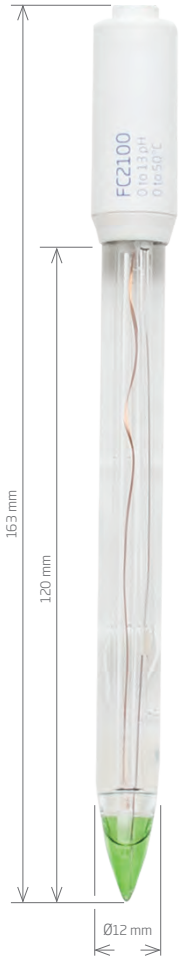
Part #	Cable Length
HI7858/1	1 m (3.3')
HI7858/5	5 m (16.5')
HI7858/10	10 m (33')

edge® 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, soil samples, potable water, semi-solid products, low conductivity solutions, emulsions	hydrocarbons, paints, solvents, sea water, strong acids and bases, high conductivity samples, tris buffer
Connection	**HI11310** 3.5 mm jack	**HI11311** 3.5 mm jack	**HI10530** 3.5 mm jack	**HI10430** 3.5 mm jack

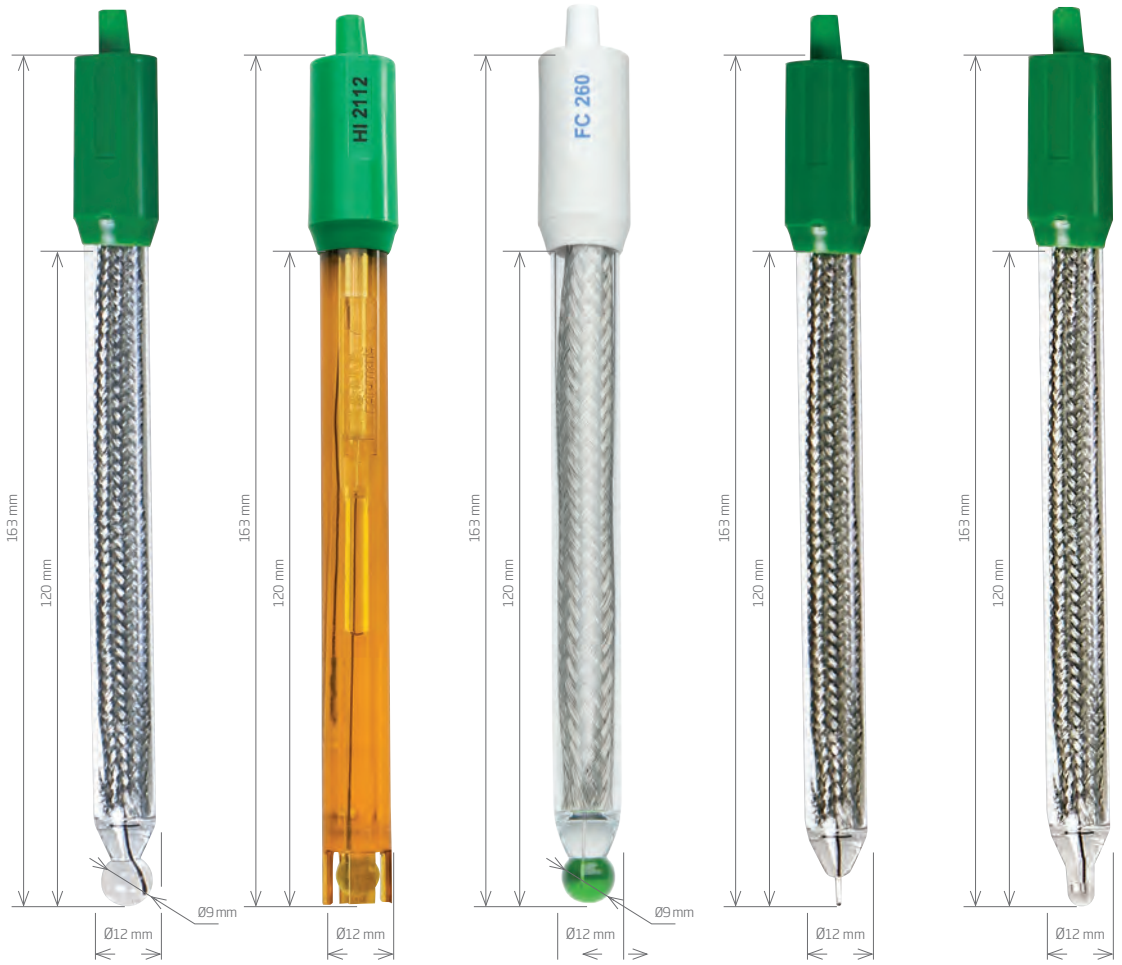
edge® Electrodes



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	open/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.	0 to 80°C (32 to 176°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	yes
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, wine	application specific purpose, meat	application specific purpose, dairy	application specific purpose, dairy
Connection	**HI10480** 3.5 mm jack	**FC2320** 3.5 mm jack	**FC2100** 3.5 mm jack	**FC2020** 3.5 mm jack

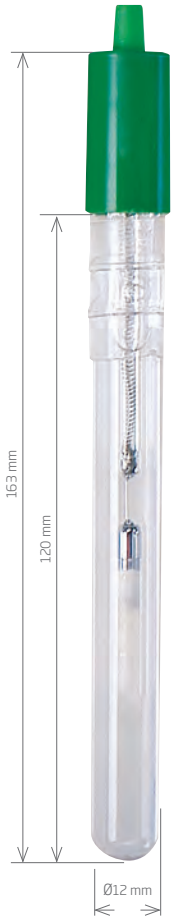
Code	HI12300	HI12301	HI36180	HI36200
Description	combination, digital pH electrode	combination, digital pH electrode	refillable, ORP digital probe	ORP digital probe
Reference	double, Ag/AgCl	double, Ag/AgCl	double, Ag/AgCl	single, Ag/AgCl
Junction / Flow Rate	ceramic, single / 15-20 µL/h	ceramic, single / 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 13	pH: 0 to 13	ORP: ±2000 mV	ORP: ±2000 mV
Recommended Operating Temp.	-5 to 70°C (23 to 158°F) - GP	-5 to 70°C (23 to 158°F) - GP	-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	**HI12300** 3.5 mm jack	**HI12301** 3.5 mm jack	**HI36180** 3.5 mm jack	**HI36200** 3.5 mm jack

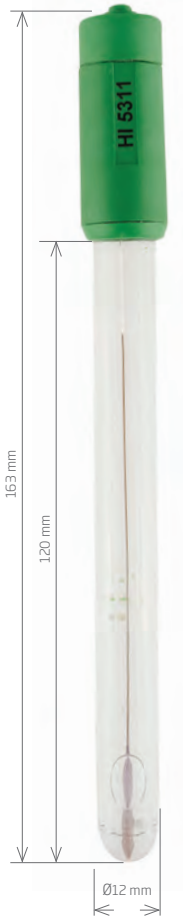
Half-Cells



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	**HI2111B** BNC	**HI2112B** BNC	**FC260B** BNC	**HI3133B** BNC	**HI5110B** BNC

Reference Electrodes



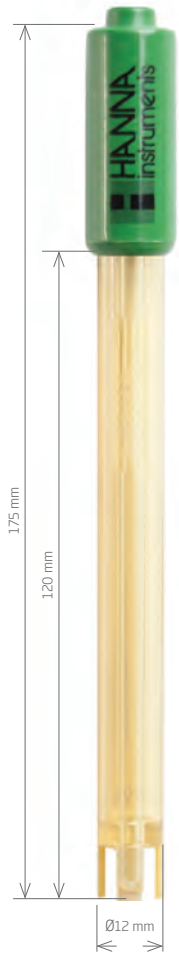


Code	HI5412	HI5311	HI5314	HI5414
Description	reference electrode	reference electrode	reference electrode	reference electrode
Reference	single, Hg/Hg_2Cl_2	double, Ag/AgCl	double, Ag/AgCl	single, Hg/Hg_2Cl_2
Junction / Flow Rate	ceramic, single / 15-20 µL/h	ceramic, single / 15-20 µL/h	ceramic, double	ceramic, double
Electrolyte	KCl 3.5M	KCl 3.5M	KCl 3.5M	KCl 3.5M
Max Pressure	0.1 bar	0.1 bar	3 bar with back pressure	3 bar with back pressure
Recommended Operating Temp.	-5 to 60°C (23 to 140°F)	-5 to 100°C (23 to 212°F)	-5 to 100°C (23 to 212°F)	-5 to 60°C (23 to 140°F)
Body Material	glass	glass	glass	glass
Cable	1 m (3.3')	1 m (3.3')	1 m (3.3')	1 m (3.3')
Recommended Use	general purpose, ISE, titrations	general purpose, titrations	measurements with remote filling	measurements with remote filling
Connection	**HI5412** 4 mm banana	**HI5311** 4 mm banana	**HI5314** 4 mm banana	**HI5414** 4 mm banana

High pressure or high concentration of contaminants

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

Reference Electrodes



Code	HI5413	HI5312	HI5313
Description	reference electrode	reference electrode	reference electrode
Reference	single, Hg/Hg_2Cl_2	double, Ag/AgCl	single, Ag/AgCl
Junction / Flow Rate	PTFE sleeve	PTFE 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, ISE	titrations, samples with suspended solids	titrations, samples with suspended solids
Connection	**HI5413** 4 mm banana	**HI5312** 4 mm banana	**HI5313** 4 mm banana

pH and ORP Solutions

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.

A Complete Range

The entire range of Hanna solutions include:

- pH buffer solutions
- Standard solutions for conductivity, TDS, turbidity, salinity and ISE calibration
- ORP test and pretreatment solutions
- Reference fill solutions for refillable electrodes
- General and specific cleaning solutions for electrodes
- Solutions for electrode maintenance and storage
- Solutions for sample preparation

Solutions are available in many sizes ranging from 20 mL sachets to 3.78 L (1 gallon) containers for large quantities used in laboratories.

For safety and traceability, all Hanna solutions are provided with a label showing the batch number and expiration date.

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.

Our application-engineered solutions have been produced with reference instruments calibrated with NIST standards. Our range of buffer and cleaning solutions have been extended with three new lines: the HI50XX series of technical buffer solutions allows for calibration of pH meters from 1.00 to 13.00 pH; the HI60XX series of solutions with millesimal resolutions is available for pH measurements with an accuracy of ±0.002 pH; finally, the HI70XX application specific cleaning solutions available in bottles of 250 and 500 mL, as well as in small sachets of 20 mL each.

A Wide Variety of Single Dose Sachets

Get the best out of your instruments using single dose Hanna calibration and maintenance solutions. A wide range of pH, conductivity, TDS and cleaning solutions are available in the form of practical 20 mL sachets.

Sachets are Practical, Safe and Ready to Use

Single dose sachets are quick and easy to use. Each sealed, light-tight sachet holds just the right amount of solution. Every time your instrument is calibrated using these Hanna sachets, it is like using a newly opened bottle of solution.

°C	°F	pH
0	32	7.13
5	41	7.10
10	50	7.07
15	59	7.04
20	68	7.03
25	**77**	**7.01**
30	86	7.00
35	95	6.99
40	104	6.98
45	113	6.98
50	122	6.98
55	131	6.98
60	140	6.98
65	149	6.99
70	158	6.99
75	167	7.00
80	176	7.01
85	185	7.02
90	194	7.03
95	203	7.04

Combination Kits in Bottles and Sachets

These kits are useful for multiparameter instruments or for two-point calibration.

Table of Reference Temperatures

All calibration solutions are provided with a label presenting a reference table of the relationship between pH or conductivity values and temperature.

Bottles that Meet FDA Standards

For accuracy over an extended period of time, ask for Hanna solutions in FDA (US Food & Drug Administration) type light-tight bottles.

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.

HI50XX and HI60XX series solutions are provided with a certificate of analysis. HI70XX series certified solutions are provided with certificate/box.

Solutions in sachets (HI700xxC series) are also available with a certificate of analysis. Just like in our bottled solutions, 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.

Electrode Cleaning, Calibration and Maintenance

Step 1: Cleaning

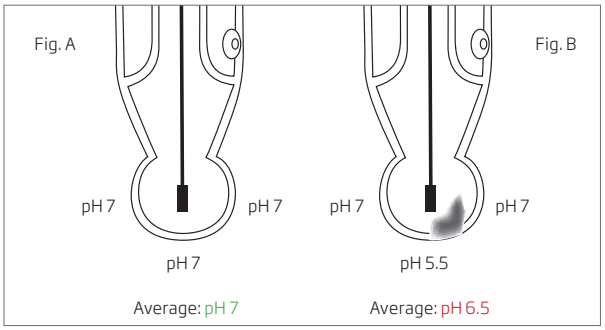


Fig. A: pH reading from a properly cleaned electrode in pH 7 solution.

Fig. B: pH reading from a dirty electrode in pH 7 solution.

Just because you can't see contamination doesn't mean it isn't there.

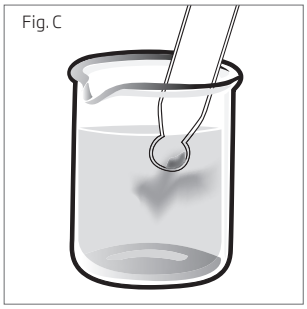
An electrode generates a voltage of the average hydrogen ion concentration from the surface area outside the pH bulb tip. Fig. A above shows that the clean electrode is submersed in pH 7 from all areas of the bulb surface.

When an electrode becomes dirty from use or neglect, the contaminated surface contributes to a voltage offset based on the surface area exposed to buffer as seen in Fig. B. Now the pH meter is mistakenly reading pH 6.5 instead of the actual pH 7.

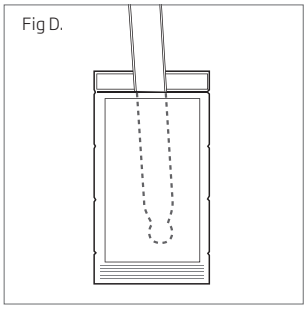
Always clean your electrode before calibration. If a dirty electrode is used for calibration, all subsequent measurements will be in error.

A dirty electrode can contaminate solutions.

Always use fresh solutions with each calibration. Buffer solutions can be contaminated by dirty electrodes as in Fig. C. Always clean your electrode before each calibration and measurement, and always use fresh solutions.



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

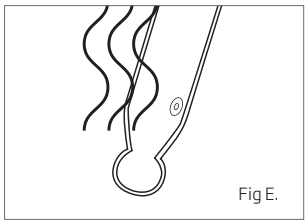


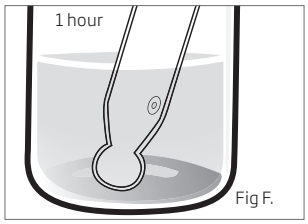
Fresh Every Time

Hanna single-use sachets are a great way to ensure your solution is always fresh. Fig. D shows just how easy it is to tear open the packet and insert the electrode. These 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 ±60 mV while Hanna only allows an offset of approximately ±30 mV. An offset voltage is the mV at 7.00 pH. The deviation from 0 mV is not unusual, in fact it represents the true characteristics of a normal pH electrode.

An offset can be compensated for by calibrating a pH meter with a properly cleaned electrode. Calibrating a meter with a dirty electrode will only compound the problem. An mV offset that continues to deviate with a properly cleaned electrode is a good indication that the electrode may need to be replaced.

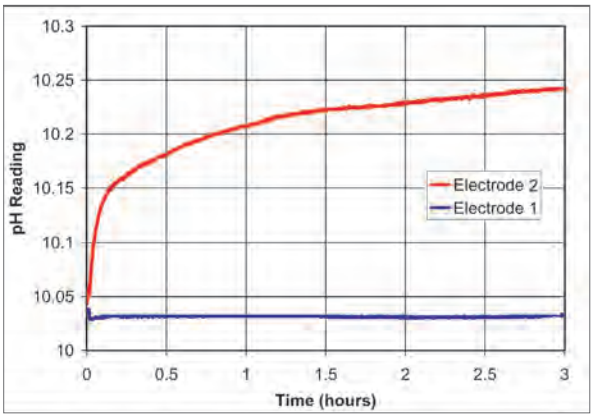


Fig G.

Electrode 1 has been properly cleaned before calibration.
Electrode 2 has not been properly cleaned.

Electrode readings may vary with insufficient cleanings.

Fig. G (above) shows that the pH measured by a dirty electrode changes over a short period of time, resulting from the residue on the pH electrode bulb. The resulting pH measurements, based upon the calibration of a coated electrode, will then be incorrect.

Conventional pH meters do not warn the user when a pH electrode is dirty or when a solution may be contaminated. A common example of this occurs just after calibrating the instrument; the pH electrode is immersed into the pH 7 buffer and the reading is lower than expected (pH 6.8 or 6.9 instead of pH 7). Hanna meters that feature our exclusive CAL Check™ electrode diagnostics automatically alert the user of any potential electrode or solution problems during calibration.

Precision Solutions

Hanna's wide range of solutions will help guarantee correct cleaning and calibration of electrodes and probes for maximum performance. Our solutions have been manufactured with your application in mind.

Step 3: Maintenance

Measurement

Always calibrate the electrode and pH meter together before making measurements. Rinse the pH electrode sensor tip with deionized or distilled water. For a faster response, and to avoid cross-contamination of the samples, rinse the electrode tip with a few drops of the solution to be tested. Before taking measurements submerse the pH sensor tip and reference junction (~3 cm /1¼") in the stirred sample.

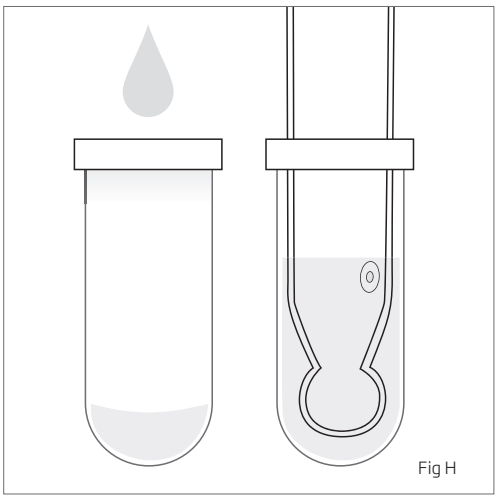


Fig H

Storage

To ensure an optimum response time, the glass sensor tip and the reference junction of the pH electrode should be kept moist and not be allowed to dry out.

Replace the solution in the protective cap with a few drops of HI70300 or HI80300 Storage Solution or, in its absence, with pH 4 or pH 7 buffer (Fig H).

NOTE: Never store the electrode in distilled or deionized water.

Inspect

Inspect and clean the electrode on a regular schedule to ensure the electrode will be ready when you need it. Coatings and reactions from samples result in decreased efficiency and longer response times.

General Cleaning, Storage and Refilling Solutions

General Use Electrode Cleaning Solutions

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

Electrode Storage Solutions

To minimize junction clogging and ensure fast response time, always keep the glass bulb and the junction of your pH electrode moist. Store the electrode with a few drops of HI70300 storage or pH 4 or pH 7 buffer solution in the protective cap.

Electrode Fill Solutions

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

Some electrolyte solutions are available in FDA compliant bottles.

General Use Electrode Cleaning Solutions

Code	Application	Package
HI70000P	rinsing	20 mL sachet (25)
HI7061L	general purpose	500 mL bottle
HI7061M	general purpose	230 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

Electrode Storage Solutions

Code	Description	Package
HI70300L	electrode storage solution	500 mL bottle
HI70300M	electrode storage solution	230 mL bottle
HI80300L	electrode storage solution	500 mL FDA bottle
HI80300M	electrode storage solution	230 mL FDA bottle

Electrode Fill Solutions

Code	Description	Package
HI7071	electrolyte solution, 3.5M KCl + AgCl	30 mL bottle (4)
HI7071M	electrolyte solution, 3.5M KCl + AgCl	230 mL bottle
HI7071L	electrolyte solution, 3.5M KCl + AgCl	500 mL bottle
HI7072	electrolyte solution, 1M KNO_3	30 mL bottle (4)
HI7072L	electrolyte solution, 1M KNO_3	500 mL bottle
HI7075	electrolyte solution, 1.7M KNO_3, 0.7M KCl	30 mL bottle (4)
HI7076	electrolyte solution, 1.0M NaCl	30 mL bottle (4)
HI7078	electrolyte solution, 0.5M $(NH_4)_2 SO_4$	30 mL bottle (4)
HI7082	electrolyte solution, 3.5M KCl	30 mL bottle (4)
HI7082M	electrolyte solution, 3.5M KCl	230 mL bottle
HI7082L	electrolyte solution, 3.5M KCl	460 mL bottle
HI8071	electrolyte solution, 3.5M KCl + AgCl	30 mL FDA bottle (4)
HI8082	electrolyte solution, 3.5M KCl	30 mL FDA bottle (4)
HI8093	electrolyte solution, 1M KCl + AgCl	30 mL FDA bottle (4)

Specific 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
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

- The easy to open and always fresh sachet package is a practical and ideal solution for field measurements.

Specific Cleaning Solutions - Sachets

Code	Description	Qty/Size
HI700601P	general purpose cleaning solution for laboratories	20 mL (25)
HI700630P	acid cleaning solution for meat grease and fats (food industry)	20 mL (25)
HI700635P	cleaning solution for wine deposits (winemaking)	20 mL (25)
HI700636P	cleaning solution for wine stains (winemaking)	20 mL (25)
HI700640P	cleaning solution for milk deposits (food industry)	20 mL (25)
HI700641P	cleaning and disinfection solution for dairy products (food industry)	20 mL (25)
HI700642P	cleaning solution for cheese deposits (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)

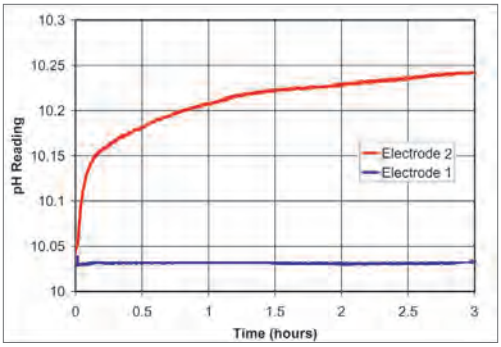
Cleaning Solution Series

Focused Cleaning for a Top Performing Sensor

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

Hanna has prepared a complete line of cleaning and disinfection solutions that eliminate impurities and residues left on electrode surfaces when immersed in special samples; residues may result from measurements in wines, musts, oils, soil, industrial solutions, grease, algae, and dairy products.

The Cleaning Solution Series ensures maximum efficiency and accuracy of your sensors when used for its designated application



Electrode 1 has been properly cleaned before calibration.

Electrode 2 has not been properly cleaned.

HI5000 Series

pH Technical Calibration Solutions

Precise Measurements

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.

Hanna offers a complete range of pH buffer solutions, that will satisfy most all calibration needs and which have been extended with two additional lines: the HI50XX series of technical buffer solutions (shown on this page), and the HI60XX series of solutions with millesimal resolution.

Technical Solutions (±0.01 pH) for Each Point of the pH Scale

This complete scale of buffer solutions offers a higher degree of accuracy for pH measurements in specific areas of application, as in monitoring the pH of must and wine. This line includes twenty solutions starting from a value of pH 1.00 up to pH 13.00 with an accuracy of ±0.01 pH, thus covering every point of the pH scale.

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

Also available are solution bottles that are colored according to a given standard calibration value: HI5004-R (Red), HI5007-G (Green) and HI5010-V (Violet).

Easy to Use Single Dose Sachets

For the highest level of reliability of field instrumentation, technical solutions are also provided in convenient single dose sachets.

Calibration solution sachets are sold in boxes containing 10 or 25 pieces to satisfy requirements for daily use.

Hanna Combination Kits in Bottles

Use our combination kits for easy ordering and reordering.

Code	Solutions (pH Value @25°C)	Bottle
HI54710	pH 4.01, pH 7.01, pH 10.01	500 mL (3)
HI54710-10	pH 4.01, pH 7.01, pH 10.01, HI70300L	500 mL (4)
HI54710-11	pH 4.01, pH 7.01, pH 10.01, HI70300L, HI7061L	500 mL (5)

Bottles

pH Value @25°C	Code	Package
1.00	**HI5001**	500 mL
1.68	**HI5016**	500 mL
2.00	**HI5002**	500 mL
2.00	**HI5002-01**	1 L
3.00	**HI5003**	500 mL
4.01	**HI5004**	500 mL
4.01	**HI5004-01**	1 L
4.01	**HI5004-R**	500 mL (color coded bottle)
4.01	**HI5004-R08**	1 G (3.78 L) (2) (color coded bottle)
5.00	**HI5005**	500 mL
5.00	**HI5005-01**	1 L
6.00	**HI5006**	500 mL
6.86	**HI5068**	500 mL
7.01	**HI5007**	500 mL
7.01	**HI5007-01**	1 L
7.01	**HI5007-G**	500 mL (color coded bottle)
7.01	**HI5007-G08**	1 G (3.78 L) (2) (color coded bottle)
7.41	**HI5074**	500 mL
8.00	**HI5008**	500 mL
8.00	**HI5008-01**	1 L
9.00	**HI5009**	500 mL
9.18	**HI5091**	500 mL
10.01	**HI5010**	500 mL
10.01	**HI5010-01**	1 L
10.01	**HI5010-V**	500 mL (color coded bottle)
10.01	**HI5010-V08**	1 G (3.78 L) (2) (color coded bottle)
11.00	**HI5011**	500 mL
12.00	**HI5012**	500 mL
12.45	**HI5124**	500 mL
13.00	**HI5013**	500 mL

Sachets

pH Value @25°C	Code	Package
1.00	**HI50001-02**	20 mL (25)
1.68	**HI50016-01**	20 mL (10)
1.68	**HI50016-02**	20 mL (25)
2.00	**HI50002-02**	20 mL (25)
3.00	**HI50003-02**	20 mL (25)
4.01	**HI50004-01**	20 mL (10)
4.01	**HI50004-02**	20 mL (25)
5.00	**HI50005-02**	20 mL (25)
6.86	**HI50068-02**	20 mL (25)
7.01	**HI50007-01**	20 mL (10)
7.01	**HI50007-02**	20 mL (25)
9.00	**HI50009-02**	20 mL (25)
9.18	**HI50091-02**	20 mL (25)
10.01	**HI50010-01**	20 mL (10)
10.01	**HI50010-02**	20 mL (25)
11.00	**HI50011-02**	20 mL (25)
12.00	**HI50012-01**	20 mL (10)
12.00	**HI50012-02**	20 mL (25)
12.45	**HI50124-02**	20 mL (25)
13.00	**HI50013-02**	20 mL (25)

Bottles

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

Sachets

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

HI6000 Series

±0.002 pH Millesimal Calibration Solutions

Millesimal Calibration Solutions

The HI60XX line of buffers with millesimal accuracy (±0.002 pH) has been prepared to meet the increasing need for assured accuracy in pH measurements. Each bottle of the series HI60XX is provided with a certificate of analysis, prepared by comparison with NIST standards.

Easy Range Identification

The colors on the HI60XX series packaging correspond to a given standard pH value. They make it easy and safe to identify the buffers to be used.

Millesimal Calibration Solution Sachets

This series is also available in handy sachets to perform accurate calibrations on-site or in the field. Single dose sachet solutions are safe, easy to carry and always fresh.

pH Standard Calibration Solutions

1.68 pH Buffer Solution

Plating bath samples, food samples and waste samples are often acidic in nature. To increase accuracy of your measurment at lower pH values, it is important to calibrate your electrode and meter at the appropriate pH also. Hanna pH 1.68 buffer is available to fufill this requirement. 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.

Our millesimal series offers ±0.002 certified accuracy and our HI5016 technical grade solution offers ±0.01 pH certified accuracy. Standard NIST traceable (no certification included) 1.68 pH buffer with ±0.01 pH accuracy is available in two sizes.

4.01 pH Buffer Solution

Hanna buffer solutions are prepared according to precise formulas and are standardized with a pH electrode and meter calibrated with NIST standards. This buffer value is widely used in water purification plants, in the food industry and wherever the pH is expected to be slightly acidic.

All pH 4.01 solutions show batch number, expiration date and the correlation table between pH and temperature.

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.

The Hanna range of pH 6.86 buffer solutions has been expanded and stability has been improved to match the stability of pH 7.01.

1.68 pH @ 25°C - Bottles

Code	Size	Certificate of Analysis
HI7001L	500 mL	on request
HI7001M	230 mL	on request

4.01 pH @ 25°C - Bottles

Code	Size	FDA Bottle	Certificate of Analysis
HI7004/1G	1 G (3.78 L) (color coded bottle)		on request
HI7004/1L	1 L (color coded bottle)		on request
HI7004L	500 mL		on request
HI7004L/C	500 mL		•
HI7004M	230 mL		on request
HI8004L	500 mL	•	•
HI8004L/C	500 mL	•	•

4.01 pH @ 25°C - Sachets

Code	Size	Package	Certificate of Analysis
HI70004C	20 mL	25 pcs.	•
HI70004P	20 mL	25 pcs.	
HI7004P/5	20 mL	500 pcs.	

4.01 & 7.01 pH @ 25°C - Sachets

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

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.	

7.01 pH @ 25°C - Bottles

Code	Size	FDA Bottle	Certificate of Analysis
HI7007/1G	1 G (3.78 L) (color coded bottle)		on request
HI7007/1L	1 L (color coded bottle)		on request
HI7007L	500 mL		on request
HI7007L/C	500 mL		•
HI7007M	230 mL		on request
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.	•
HI70007P	7.01 pH	20 mL	25 pcs.	
HI77700P	7.01 pH	20 mL	10 pcs.	
HI770710C	10.01 & 7.01 pH	20 mL	10 pcs., 5 ea	•
HI770710P	10.01 & 7.01 pH	20 mL	10 pcs., 5 ea	
HI77100C	1413 µS/cm & 7.01 pH	20 mL	20 pcs., 10 ea	•
HI77100P	1413 µS/cm & 7.01 pH	20 mL	20 pcs., 10 ea	
HI77200P	1500 mg/L (ppm) & 7.01 pH	20 mL	20 pcs., 10 ea	
HI77300C	1382 mg/L (ppm) & 7.01 pH	20 mL	20 pcs., 10 ea	•
HI77400P	4.01 & 7.01 pH	20 mL	10 pcs., 5 ea	

8.20 pH @ 25°C - Bottle

Code	Size	Package
HI70082M	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 Standard Calibration Solutions

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.

8.20 pH Buffer Solution

To increase accuracy of your measurement, Hanna offers the 8.20 pH buffer solution. The label indicates the batch code, expiration data and pH/temperature correlation table.

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 fufill this requirement.

FDA approved bottle

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

Traceability with NIST Standard Reference

Hanna pH buffers are carefully prepared using the highest quality ingredients available and are standardized with high precision meters calibrated to NIST references.

pH Standard Calibration Solutions

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
HI7010L/C	500 mL		•
HI7010M	230 mL		on request
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	

ORP and Sample Preparation Solutions

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

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

Use HI7092 for oxidizing or HI7091 for reducing pretreatment.

ORP Test and Pretreatment Solution Bottles

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

Sample Preparation Solution Bottles

Code	Description	Size
HI7051M	soil sample preparation solution	230 mL
HI7051L	soil sample preparation solution	500 mL
HI70960	preparation solution for solid or semi-solid samples	30 mL

Table of Contents

Introduction to ISE

Three Methods of Analysis

Potentiometric ion analyses with ion-selective electrodes (ISEs) are performed by use of one of three methods, each entailing its own advantages: direct potentiometry, incremental methods, and potentiometric titration. Hanna offers a solution for each of these methods.

Direct Potentiometry

Direct potentiometry is a widely used method of performing ion analysis with ISEs. This method is highly effective when the user must quickly measure large batches of samples at varying concentrations. Our direct reading meters, such as the HI98191, display concentration of the unknown sample by a direct reading after calibration of the instrument with two or more standards; ionic strength adjustments are made to both samples and standards. In some applications, quick and reliable measurements can be made on-site without taking samples back to the laboratory.

Incremental Methods

Incremental methods are useful techniques used to determine ion concentration in samples whose constituents are variable or concentrated. Incremental methods have some inherent advantages over direct potentiometry. The techniques can reduce errors from variables such as temperature, viscosity, pH or ionic strength. The electrodes remain immersed throughout the process, thus reducing sample carry over and possible liquid junction changes in the reference. Known addition, known subtraction, analyte addition, and analyte subtraction methods are four of these incremental techniques. All four techniques involve adding a standard to the sample, or sample to the standard; the meter then calculates the ion concentration of the sample.

Potentiometric Titration

A potentiometric titration can increase the precision of ISE measurements and also the number of ionic species that can be determined. ISEs are commonly used as indicators for the titrant or sample species to follow the progress of a precipitation or complexometric titration. A small change in reactant addition corresponds to a large change in electrode potential at the stoichiometric endpoint. An example of a precipitation titration is the determination of chloride using silver nitrate. A silver ISE can be used to follow this titration. A complexometric titration is used for the determination of calcium. A calcium solution is titrated with the complexing agent, EDTA. During the titration there is a gradual decrease in the free Ca^{2+} ion concentration as more EDTA is added. The endpoint corresponds to the point at which all of the Ca^{2+} is complexed. The progress of this titration can be monitored using a calcium ISE.

Ion Selective Electrode Types

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

Solid State

Solid state electrodes are available as both single half cells or as combination electrodes complete with reference electrode. These electrodes incorporate a solid sensing surface made of compressed silver halides or solid crystalline material. Hanna's offering includes sensors for the determination of bromide, cadmium, chloride, cupric, cyanide, fluoride, iodide, lead and silver ions. Rugged, solid body construction ensures a long life.

Theory: A solid state electrode develops a voltage due to ion-exchange occurring between the sample and the inorganic membrane. An equilibrium mechanism occurs due to the very limited solubility of the membrane material in the sample.

Liquid Membrane

Liquid membrane electrodes are available as single half cells or as combination electrodes complete with reference electrode. The sensing surfaces of these electrodes are comprised of a homogeneous polymer matrix containing organic ion exchangers that are selective for the determined ion. These sensors incorporate easily replaceable membrane modules and are available for measurements of nitrate, potassium and calcium.

Theory: The potassium electrode was one of the earliest liquid membrane sensors developed. The membrane is usually in the form of a thin disc of PVC impregnated with the antibiotic valinomycin. The exchanger, also known as an ionophore, is a ring structure that fits potassium ions inside, functioning as a lock and key mechanism. This type of membrane is not as rugged as the solid state type so they are designed for easy replacement of the sensing module.

Gas Membrane

Gas sensors are combination electrodes that detect dissolved gases in a solution. No external reference is required for these electrodes. The sensing element is separated from the sample solution by a gas permeable membrane. Hanna's offering of gas membrane ISEs include ammonia and carbon dioxide.

Theory: A gas sensor works due to the partial pressure of the measured gas in solution. The dissolved gas in the sample diffuses into the membrane and changes the pH in a thin film of unbuffered electrolyte on the surface of the internal pH sensor. Diffusion continues until the partial pressure of the sample and the thin film of electrolyte are the same. The pH change is proportional to the dissolved gas in the sample.

Reference and Combination Electrodes

Hanna's reference electrode is used with our half-cell ISE sensors to provide accurate and repeatable measurements. Hanna's combination electrodes incorporate the measuring electrode with the reference, making them ideal for field measurements.

Reference

Reference electrodes are used to provide a stable voltage and electrolytic contact to measure a voltage gradient across a measurement membrane. Hanna has designed an easy to use, durable, double junction, quick-fill, sleeve-style reference electrode with a cone style junction to work with the ISE family of sensors. The design forms the liquid junction with the test solution at the tip of the junction cone, producing a highly stable reference electrode with reasonable, low flow rates. The model HI5315 is a silver/silver chloride half-cell with a permanent gel-filled internal cell. The outer fill solution is easily replaceable and serves as a buffer zone between the internal chloride ion-containing gel and the sample solution. Hanna offers a complete line of silver-free fill solutions to optimize your ion measurement. A fast responding liquid junction, excellent reproducibility, and ease of use will mark this reference as your "best" in the lab.

Combination

Combination electrodes include a sensor and reference electrode within one electrode body. Our combination ISEs provide the same selectivity and response as our ISE half-cells, but include our superior double junction reference in the same electrode body. Combination solid state electrodes have a built-in solid state sensor and quick refillable reference electrode. Our liquid membrane and fluoride combination electrodes have replaceable module construction and the Hanna double junction reference stability.

Product Spotlights

HI5522 • HI5222
Research Grade Meters with CAL Check™ and Logging

4.8

pH/ORP/ISE and EC/TDS/Resistivity/Salinity and Temperature

Measure up to 8 Parameters

The HI5522 is a research grade benchtop instrument that features eight measurement ranges: channel 1 features pH, ORP (oxidation reduction potential) or ISE; channel 2 hosts conductivity, resistivity, TDS(total dissolved solids), salinity and temperature.

HI5222 is a research grade pH, ORP and temperature benchtop meter. These instruments incorporate dual channels with a separate temperature input and support the external reference electrodes required by some pH and ISE sensors. Both channels can be used simultaneously.

HI3512
Multiparameter Meter

4.12

pH/ORP/ISE and EC/TDS/Resistivity/ Salinity and Temperature

The HI3512 is a dual-channel benchtop meter with a graphic LCD designed to provide accurate laboratory results. Channel 1 features pH/ORP/ISE and temperature measurement capability while channel 2 features EC, TDS, salinity, resistivity and temperature capability.

HI2216
0.001 Resolution Meter

4.16

pH/ORP/ISE/°C

The HI2216 is a pH, ORP, ISE and °C meter with five point pH calibration and 0.001 pH resolution.

This instrument provides GLP capabilities to allow for the storage and retrieval of all data regarding pH, ORP, and ISE calibration.

The HI2216 can perform measurements using ORP electrodes in the mV scale and ISE electrodes in the ppm scale through the pH/mV/ISE channel input. A relative mV feature is also provided.

Product Spotlights

HI98191
Waterproof Meter

4.17

pH/ORP/ISE

The HI98191 is an IP67 rated, waterproof pH, ORP, ISE portable meter designed for demanding field applications.

Users can easily exchange the pH probe for an ORP or ISE probe. This meter inclues concentration readings for ions and the results are displayed in units of the users choice.

Ideal for field use, this meter is supplied with a pH electrode with an internal temperature sensor in a titanium casing and a rugged carrying case. With an extended battery life of up to 200 hours of continuous use, users are assured long operation.

HI98402
Fluoride Meter

4.19

The HI98402 measures fluoride ions 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.

HI931102
HACCP Compliant Salinity Foodcare Meter

4.21

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 grams NaCl/L 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.

Benchtop Meters

	pH Range	ISE Range	ORP Range/Relative mV	EC/TDS/Salinity Range	Resistivity Range	Temperature Range	(D)irect /(I)ncremental Measurement	ISE Calibration Points	ISE Buffers: Standard/Custom	pH CAL Check™	Temperature Compensation: (A)utomatic or (M)anual	GLP	(A)uto, (L)og on demand and Auto(E)nd Data Logging	HOLD	Predefined ISE electrode	PC Connection	On-screen Help, Tutorial and Multi-language	Application Designed	Page
HI5522	•	•	•	•	•	°C/°F	D,I	5	8/5	•	A/M	•	A, L, E	•	•	USB	•	research	4.8
HI5222	•	•	•			°C/°F	D,I	5	8/5	•	A/M	•	A, L, E	•	•	USB	•	research	4.8
HI3512	•	•	•	•	•	°C/°F	D	5	7/2	•	A/M	•	A, L		•	USB	•	general	4.12
HI3222	•	•	•			°C/°F	D	5	7/5	•	A/M	•	A, L		•	USB	•	general	4.14
HI3221	•	•	•			°C/°F	D	2	7/5	•	A/M	•	A, L			USB	•	general	4.14
HI2216	•	•	•			°C/°F	D	2	7/2	•	A/M	•	A, L			USB		general	4.16

Portable Meters

	pH Range	ISE Range	ORP Range/Relative mV	EC/TDS/Salinity Range	Resistivity Range	Temperature Range	(D)irect /(I)ncremental Measurement	ISE Calibration Points	ISE: Standard/Custom	pH CAL Check™	Temperature Compensation: (A)utomatic or (M)anual	GLP	(A)uto, (L)og on demand and Auto(E)nd Data Logging	HOLD	Predefined ISE electrode	PC Connection	On-screen Help, Tutorial and Multi-language	Application Designed	Page
HI98191	•	•	•			°C/°F	D	5	7/5	•	A/M	•	A, L, E	•		USB	•	universal	4.17
HI98402		•				°C/°F	D	2	5/0		A/M				•			fluoride	4.19
HI931100		•				°C/°F	D	2	3/0		A/M				•			NaCl sodium chloride	4.20
HI 931101		•				°C/°F	D	2	3/0		A/M				•			Na sodium	4.20
HI931102		•				°C/°F	D	2	3/0		A/M				•			NaCl	4.21

Ion Selective Sensors and Accessories Reference Chart

Electrode	Type	Half-Cell	Combination	Ionic Strength Adjusters (ISA) 500 mL bottle	Silver Free Reference Fill Solutions (4) 30 mL bottles	ISE Standards 1, 500 mL bottle	ISE Standards 2, 500 mL bottle	ISE Standards 3, 500 mL bottle	Other
Ammonia	gas	–	HI4101	**HI4001-00**	**HI4001-40**	**HI4001-01** 0.1 M	**HI4001-02** 100 mg/L (ppm)	**HI4001-03** 1000 mg/L (ppm)	**HI4000-52** replacement cap **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
Bromide	solid	HI4002	HI4102	**HI4000-00**	**HI7072**, 1 M KNO_3	**HI4002-01**, 0.1 M			**HI4000-70** polishing strip
Cadmium	solid	HI4003	HI4103	**HI4000-00**	**HI7072**, 1 M KNO_3	**HI4003-01** 0.1 M			**HI4000-70** polishing strip
Calcium	polymer membrane	HI4004	HI4104	**HI4004-00**	**HI7082**, 3.5 M KCl	**HI4004-01**, 0.1 M			**HI4004-51** module **HI4104-51** module for combination **HI4004-45** conditioning solution
Carbon Dioxide	gas	–	HI4105	**HI4005-00**	**HI4005-40**	**HI4005-01**, 0.1 M	**HI4005-03**, 1000 mg/L (ppm) CO_2 as $CaCO_3$		**HI4000-54** replacement pH internal and cap for CO_2 **HI4005-53** CO_2 membrane kit (3 pack) **HI4000-47** 4 and 7 pH buffers with chloride background **HI4005-45** conditioning solution
Chloride	solid	HI4007	HI4107	**HI4000-00**	**HI7072**, 1 M KNO_3	**HI4007-01**, 0.1 M	**HI4007-02**, 100 mg/L (ppm)	**HI4007-03**, 1000 mg/L (ppm)	**HI4000-70** polishing strip
Cupric	solid	HI4008	HI4108	**HI4000-00**	**HI7072**, 1 M KNO_3	**HI4008-01**, 0.1 M			**HI4000-70** polishing strip
Cyanide	solid	HI4009	HI4109	**HI4001-00**	**HI7072**, 1 M KNO_3				**HI4000-70** polishing strip
Fluoride	solid	HI4010	HI4110	**HI4010-00** **HI4010-05** **HI4010-06** **HI4010-30**	**HI7075**, 1 M KNO_3, 0.7 M KCL	**HI4010-01**, 0.1M	**HI4010-02**, 100 mg/L (ppm)	**HI4010-03**, 1000 mg/L (ppm)	**HI4010-11** 1 ppm with TISAB II **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**, 1 M KNO_3	**HI4011-01**, 0.1 M			**HI4000-70** polishing strip
Lead/ Sulfate	solid	HI4012	HI4112	**HI4012-00**	**HI7072**, 1 M KNO_3	**HI4012-01**, lead, 0.1 M **HI4012-21** sulfate, 0.1 M			**HI4000-70** polishing strip
Nitrate	polymer membrane	HI4013	HI4113	**HI4013-00**	**HI7078**, $(NH_4)_2SO_4$ 0.5M	**HI4013-01**, 0.1 M	**HI4013-02**, 100 mg/L (ppm) nitrate-nitrogen	**HI4013-03**, 1000 mg/L (ppm) nitrate-nitrogen	**HI4113-53** module for combination (3 pack) **HI4013-06** interferent suppressant ISA
Potassium	polymer membrane	HI4014	HI4114	**HI4014-00**	**HI7076**, 1 M NaCl	**HI4014-01**, 0.1 M			**HI4014-51** module **HI4114-51** module for combination
Silver/ Sulfide	solid	HI4015	HI4115	**HI4000-00** (Ag^+) **HI4015-00** (S^{2-})	**HI7072**, 1 M KNO_3	**HI4015-01**, 0.1 M Ag^+			**HI4000-70** polishing strip
Sodium		–	FC300	**HI4016-00**	**HI7079**, 2 M NH_4Cl + AgCl	**HI4016-01**, 0.1 M	**HI4016-02**, 100 mg/L (ppm)	**HI4016-03**, 1000 mg/L (ppm)	**HI4016-10**, 10 mg/L (ppm) **HI4016-45** storage solution **HI4016-46** conditioning solution
Reference		HI5315			**HI7072**, 1 M KNO_3 **HI7076**, 1 M NaCl **HI7078**, $(NH_4)_2SO_4$ **HI7082**, 3.5 M KCl				

HI5222 • HI5522

Research Grade Meters with CAL Check™

pH/ORP/ISE and EC/TDS/Resistivity/ Salinity and Temperature

- Capacitive touch keypad
- Clean user interface
- Five-point pH and ISE calibration
- CAL Check™
  - Checks electrode status during pH calibration
- GLP features
  - Meets Good Laboratory Practices
- Multiple input channels
  - pH/ORP/ISE and EC/TDS/Resistivity/ Salinity for HI5522
  - pH/ORP/ISE for HI5222

Measure up to 8 Parameters

The HI5522 is a research grade benchtop instrument that features eight measurement ranges: pH, ORP (oxidation reduction potential) or ISE plus temperature on channel 1; conductivity, resistivity, TDS (total dissolved solids) or salinity on channel 2 and temperature.

HI5222 is a research grade pH, ORP or ISE and temperature benchtop meter. These instruments incorporate dual channels with a separate temperature input and support the external reference electrodes required by some pH and ISE sensors.

The customizable user interface can display two channels at the same time, showing the measurements in various modes: basic measurement with or without GLP information, graph or log history.

These instruments offer multi-language support and contextual help through a dedicated help key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through all measurements and calibrations to ensure procedures are performed properly.

Calibration

Automatic, semi-automatic and manual pH calibration is available in up to five points, with eight standard (1.68, 3.00, 4.01, 6.86, 7.01, 9.18, 10.01 and 12.45) and up to five custom buffers. The Out of Calibration Range and Cal Due features alert the user in the event the measurement is far from the calibration point or when the meter is due for recalibration. Proper, scheduled calibrations are crucial for accurate and repeatable measurements.

These instruments also feature up to five-point ISE calibration points using five standard solutions or five custom solutions with or without temperature compensation. From the on-screen list, users can select their ISE electrode parameter along with it's standard configuration profile or create their own.

The HI5522 can utilize up to a four point automatic or custom standard conductivity calibration. One fixed point salinity calibration can be performed (percent scale only).

Profiles

Up to ten profiles (5 for each channel) can be saved and recalled, eliminating the need to reconfigure each time when a different electrode is used. User definable configurations can include: temperature compensation in accordance with each parameter, iso-potential points for pH and ISE, measurement units, ISE electrode type and temperature units; for the HI5522, EC temperature reference, EC temperature coefficient, EC probe type, and cell constant can be configured as well.

Logging

Three selectable logging modes are available: automatic, manual and AutoHold logging. Up to 100 logging lots can be stored for automatic or manual modes along with up to 200 USP reports, and up to 100 ISE methods reports. Automatic logging features a selectable sampling period, while GLP information includes complete data about user calibration of each parameter and identification information for the instrument, user, and company. Data can be transferred to a PC via the opto-isolated PC interface via the USB port and HI92000 software (optional).

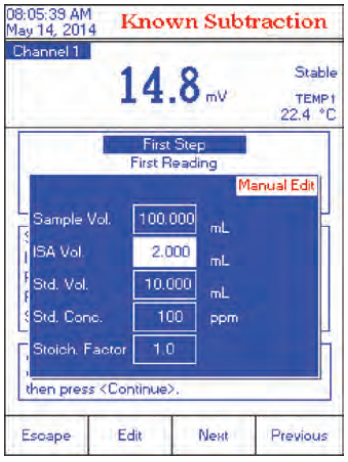
ISE Incremental Methods

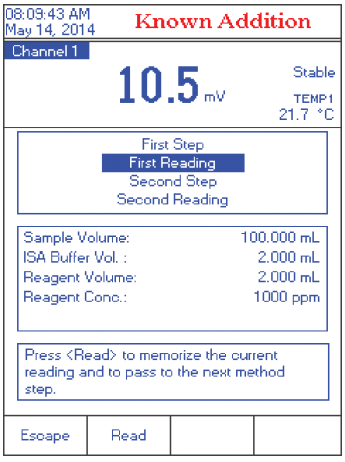
Ion concentration determinations with ISEs can be made faster and easier using the streamlined Incremental Methods.

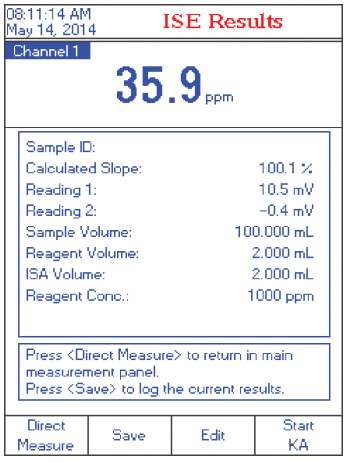
Incremental methods involve adding a standard to a sample or sample to a standard. and detecting the mV change that occurs due to the addition. Historically the user would then use mathematical equations to determine the ion concentration of the sample; with the HI5522 and HI5222, sample concentrations 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.

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.







First Step

The first step in performing an incremental method analysis is to enter the required parameters including sample, ISA and standard volumes, as well as standard concentration and stoichiometric factor.

When repeating the analysis on another sample, the parameters do not need to be reentered.

Sequence of Readings

Once the variables are entered, the user is guided step-by-step through the measurement process.

The initial mV measurement is made before the addition; next is the addition, folowed by the second mV measurement.

Results

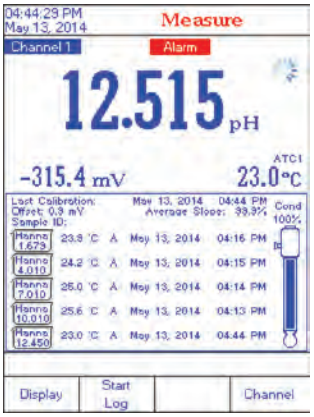
The results are automatically calculated and shown together with all the parameters used.

At this time, results can be saved into an ISE Methods Report (if necessary, the user can edit the parameters without having to redo the entire analysis). Multiple sample analysis is enabled without having to reenter set-up data.

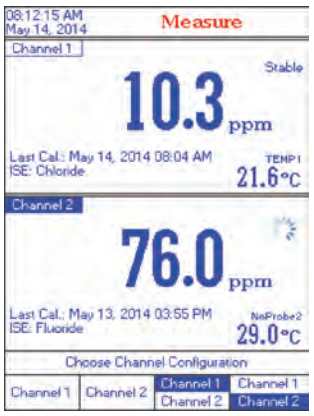
pH CAL Check™

Proper calibration of both the pH meter and 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.

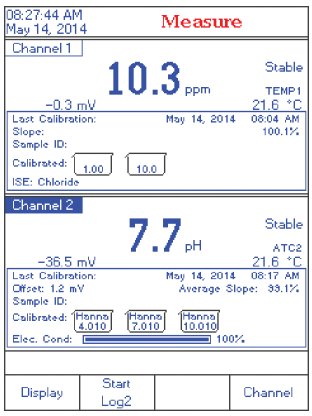
- Each time a pH calibration is performed, the instrument compares the new calibration with the previous one. When this comparison indicates a significant difference, the message alerts the user to either clean the electrode, check the buffer or both.
- When measurements are taken too far from the calibration 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.



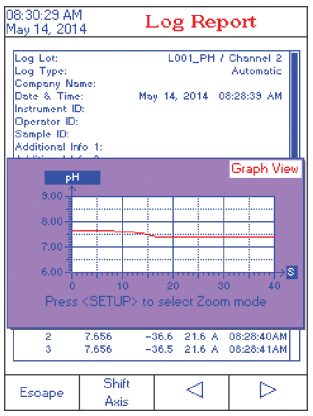
Additional Features by Screen (depending on model)



Channel Configuration

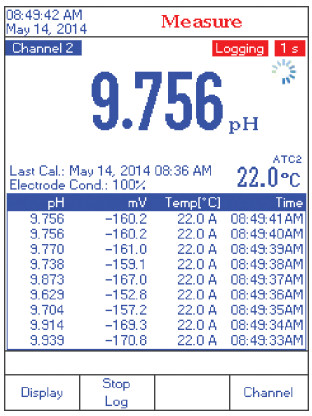


Good Laboratory Practices

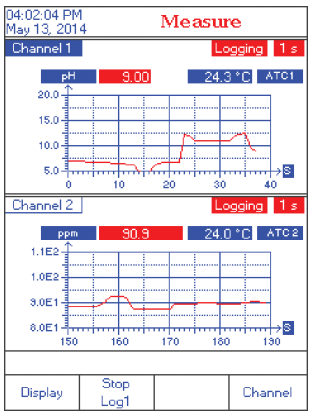


Log Recall

Simple Readout Available



Real-Time Logging



Simultaneous Dual-Channel Graphing

Specifications		HI5222	HI5522
ISE	Range	1 x 10^{-6} to 9.99 x 10^{10} concentration	1 x 10^{-6} to 9.99 x 10^{10} concentration
	Resolution	1; 0.1; 0.01; 0.001 concentration	1; 0.1; 0.01; 0.001 concentration
	Accuracy	±0.5% (monovalent ions); ±1% (divalent ions)	±0.5% (monovalent ions); ±1% (divalent ions)
pH	Range	-2.000 to 20.000 pH	-2.000 to 20.000 pH
	Resolution	0.1 pH; 0.01 pH; 0.001 pH	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	±0.1 pH; ±0.01 pH; ±0.002 pH ±1 LSD	±0.1 pH; ±0.01 pH; ±0.002 pH ±1 LSD
mV	Range	±2000 mV	±2000 mV
	Resolution	0.1 mV	0.1 mV
	Accuracy	±0.2 mV ±1 LSD	±0.2 mV ±1 LSD
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 999.9 mS/cm; 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 cells
	Calibration Type	–	automatic standard recognition, user standard single point / multi-point calibration
	Calibration Reminder	–	yes
	Temperature Coefficient	–	0.00 to 10.00 %/°C
	Reference Temperature	–	5.0 to 30.0°C
	Profiles	–	up to 10, 5 each channel
	USP Compliant	–	yes
Resistivity	Range	–	1.0 to 99.9 Ω•cm; 100 to 999 Ω•cm; 1.00 to 9.99 kΩ•cm; 10.0 to 99.9 kΩ•cm; 100 to 999 kΩ•cm; 1.00 to 9.99 MΩ•cm; 10.0 to 100.0 MΩ•cm
	Resolution	–	0.1 Ω•cm; 1 Ω•cm; 0.01 kΩ•cm; 0.1 kΩ•cm; 1 kΩ•cm; 0.01 MΩ•cm; 0.1 MΩ•cm
	Accuracy	–	±2% of reading (±1 Ω•cm)
TDS	Range	–	0.000 to 9.999 ppm; 10.00 to 99.99 ppm; 100.0 to 999.9 ppm; 1.000 to 9.999 ppt; 10.00 to 99.99 ppt; 100.0 to 400.0 ppt actual TDS* (with 1.00 factor)
	Resolution	–	0.001 ppm; 0.01 ppm; 0.1 ppm; 0.001 ppt; 0.01 ppt; 0.1 ppt
	Accuracy	–	±1% of reading (±0.01 ppm)
Salinity	Range	–	practical scale: 0.00 to 42.00 psu; natural sea water scale: 0.00 to 80.00 ppt; percent scale: 0.0 to 400.0% NaCl
	Resolution	–	0.01 for practical scale/natural sea water scale; 0.1% for percent scale
	Accuracy	–	±1% of reading
Temperature**	Range	-20.0 to 120°C; -4.0 to 248.0°F; 253.15 to 393.15K	-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	0.1°C; 0.1°F; 0.1K
	Accuracy	±0.2°C ; ±0.4°F; ±0.2K (without probe)	±0.2°C; ±0.4°F; ±0.2K (without probe)
Calibration	pH	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	
	ISE	automatic, up to five point calibration, five standard solutions available for each measurement unit, and five user defined standards	
	Conductivity	–	auto standard recognition, user standard single point/multi-point
	Salinity	–	percent scale–one-point (with HI7037 standard)
Temperature Compensation	pH	automatic or manual from -20.0 to 120.0°C; -4.0 to 248.0°; 253.15 to 393.15K	
	EC	–	disabled, linear and non-linear (natural water)
	pH Electrode	HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included)	
	EC Probe	–	HI76312 platinum, 4-ring conductivity/TDS probe with internal temperature sensor and 1 m (3.3') cable (included)
	Temperature Probe	HI7662-T stainless steel temperature probe with 1 m (3.3') cable (included)	
Additional Specifications	Input Channel(s)	2 pH/ORP/ISE	1 pH/ORP/ISE + 1 EC
	GLP	cell constant, reference temperature/coefficient, calibration points, calibration time stamp	
	Logging	**record :** 100,000 data point storage/channel, up to 100 lots with max. 50,000 records/lot; **interval:** settable between 1 second and max log time of 180 minutes; **type:** automatic, manual, AutoHOLD; **additional:** 200 records USP (HI5522); 200 records incremental methods	
	Display	240 x 320 dot-matrix color LCD with on-screen help, graphing, language selection and custom configuration	
	PC Connection / Power Supply	USB and RS232 / 12 VDC adapter (included)	
	Environment / Dimensions / Weight	0 to 50°C (32 to 122°F; 273 to 323K) RH max 95% non-condensing / 160 x 231 x 94 mm (6.3 x 9.1 x 3.7") / 1.2 kg (2.64 lbs.)	
Ordering Information		**HI5222-01** (115V) and **HI5222-02** (230V) are supplied with HI1131B pH electrode, HI7662-T temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachet (2), HI7082 3.5M KCl electrolyte solution (30 mL), HI76404N electrode holder, 12 VDC adapter and instructions. **HI5522-01** (115V) and **HI5522-02** (230V) are supplied with HI76312 conductivity/TDS probe, HI1131B pH electrode, HI7662-T temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachet (2), HI7082 3.5M KCl electrolyte solution (30 mL), HI76404N electrode holder, 12 VDC adapter and instructions.	

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100; ISE electrodes and solutions begin on page 4.22; EC , TDS and salinity solutions begin on page 6.42

(*) Absolute conductivity (or TDS) is the conductivity (or TDS) value without temperature compensation.
(**) Reduced to actual probe limits

HI3512

Multiparameter Meter

pH/ORP/ISE and EC/TDS/Resistivity/Salinity and Temperature

- CAL Check™ for pH
  - Alerts users of calibration status
- Calibration points
  - Up to five-point pH calibration and up to two-point EC calibration
- Logging
  - Automatic logging up to 600 records and log on demand up to 400 samples
- Connectivity
  - PC connectivity via opto-isolated USB
- GLP features
  - Meets Good Laboratory Practices

Two Channels, Eight Parameters

The HI3512 is a dual-channel benchtop meter with a graphic LCD designed to provide accurate laboratory results. Channel 1 features pH/ORP/ISE and temperature measurement capability while channel 2 features conductivity, TDS, salinity or resistivity measurements and temperature capability.

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.

Calibration

The pH channel offers up to five point pH calibration with seven standard buffers and up to two custom buffers.

A five point ISE calibration selected from up to six calibration standards make this instrument very useful for a large range of ion concentrations.

The EC channel permits a two-point calibration selected from seven Hanna standards. The EC channel supports autoranging, manual ranging and lock of the user selected range as well as temperature compensation selection, temperature reference selection and temperature coefficient selection.

Total dissolved Solids (TDS) factor is user-adjustable and can be set between 0.40 and 1.00.

pH and EC channels also provide "out of calibration range" warnings and a "calibration timeout" message to remind the user when a new calibration is necessary.

Messages on the graphic LCD offer directions for easy and accurate calibration for both channels, as well as diagnostics to alert the user when calibration or measurement issues are detected.

Additional Features

Other features of the HI3512 include log-on-demand of up to 400 samples, automatic logging interval with log on stability of up to 600 records, AutoHold to freeze the first stable reading on the LCD display, GLP to view the last calibration data for pH, rel mV, ISE, EC or salinity and a PC interface via USB.

Specifications		HI3512
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	±0.01 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 two custom buffers
	Temperature Compensation	automatic or manual from -20.0 to 120.0 °C (-4.0 to 248.0 °F)
mV	Range	±2000.0 mV
	Resolution	0.1 mV
	Accuracy	±0.2 mV
ISE	Range	1.00 E^{-7} to 9.99 E^{10} concentration (user selectable units)
	Resolution	3 digits
	Accuracy	±0.5% of reading (monovalent ions); ±1% of reading (divalent ions)
	Calibration	up to five-point calibration points 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	±0.2°C (±0.4°F) (excluding probe error)
EC	Range	0 µS/cm to 400 mS/cm (shows values up to 1000 mS/cm absolute conductivity); 0.001 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 999.9 mS/cm; 1000 mS/cm (autoranging)
	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; 1 mS/cm
	Accuracy	±1% of reading (±0.01 µS/cm or 1 digit whichever is greater) excluding probe error
	Calibration	automatic up to two points with seven Hanna standards (0.00 µS/cm, 84.0 µS/cm, 1.413 mS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, 111.8 mS/cm)
	Cell constant	0.010 to 10.000
	Temperature Compensation	NoTC, MTC, ATC
	Reference Temperature	15, 20, 25°C
	Temperature Coefficient	0.00 to 10.00 %/°C (for EC and TDS only; default value is 1.90%/°C)
TDS	Range	0.000 to 9.999 ppm; 10.00 to 99.99 ppm; 100.0 to 999.9 ppm; 1.000 to 9.999 g/L; 10.00 to 99.99 g/L; 100.0 to 400.0 g/L (autoranging)
	Resolution	0.001 ppm; 0.01 ppm; 0.1 ppm; 0.001 g/L; 0.01 g/L; 0.1 g/L
	Accuracy	±1% of reading (±0.05 ppm or 1 digit whichever greater) excluding probe error
	Factor	0.40 to 1.00
Resistivity	Range	1.0 to 99.9 Ω•cm; 100 to 999 KΩ•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 (autoranging)
	Resolution	0.1 Ω•cm; 1 Ω•cm; 0.01 KΩ•cm; 0.1 Ω•cm; 1 Ω•cm; 0.01 MΩ•cm; 0.1 Ω•cm
	Accuracy	±1% of reading (±10 Ω•cm or 1 digit whichever greater) excluding probe error
Salinity	Range	0.0 to 400.0% NaCl
	Resolution	0.1% NaCl
	Accuracy	±1% of reading excluding probe error
	NaCl Calibration	one-point with HI7037 standard (optional)
Additional Specifications	pH Electrode	HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included)
	Temperature probe	HI7662-T temperature probe with 1 m (3.3') cable (included)
	EC Probe	HI76310 platinum four-ring EC/TDS probe with 1 m (3.3') cable (included)
	Relative mV Offset Range	±2000 mV
	Slope Calibration	from 80 to 110%
	Temperature Source	automatic from sensor inside the probe; manual entry
	Log-on-demand	400 samples
	Interval Logging	5, 10, 30 seconds; 1, 2, 5, 10, 15, 30, 60, 120, 180 minutes, AutoEnd (max 600 samples)
	PC connection	opto-isolated USB
	Input Impedance	10^{12} ohms
	Power Supply	12 VDC adapter (included)
	Environment	0 to 50 °C (32 to 122 °F) RH max 55% non-condensing
	Dimensions / Weight	235 x 207 x 110 mm (9.2 x 8.14 x 4.33") / 1.8 kg (4 lbs.)
Ordering Information		**HI3512-01** (115V) and **HI3512-02** (230V) is supplied with HI76310 EC/TDS probe, HI1131B pH electrode, HI7662-T temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachet (2), HI7082 3.5M KCl electrolyte solution (30 mL), HI76404N electrode holder, 12 VDC adapter and instructions.

**pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100;
ISE electrodes and solutions begin on page 4.22; EC , TDS and salinity solutions begin on page 6.42**

(*) Reduced to actual sensor limits

HI3221 • HI3222

pH Benchtop Meters

pH, mV, ISE and Temperature

- CAL Check™
  - Alerts users of calibration status
- GLP Features
  - Meets Good Laboratory Practices
- Logging
  - Stability, interval and log on demand
- Connectivity
  - PC connectivity via opto-isolated USB
- Multiple Input Channels
  - One (HI3221) or two (HI3222 input channels

Up to 4 Parameters, Single and Dual Channel

Hanna's HI3221 and HI3222 benchtop instruments feature up to five point pH calibration with a choice of five custom buffers and seven standard buffers.

The HI3221 is equipped with one input channel; the HI3222 is equipped with two input channels. Having these two channels eliminates the need for swapping probes and recalibrating.

These instruments can display readings in mV with a resolution up to 0.1 mV. The HI3221 and HI3222 can use ISEs and display results in ppm. The HI3222 offers added flexibility by offering a choice of measurement units (ppb, ppm, molarity, weight/volume %). The electrode type, unit selection capability, and the ISE calibration in up to five calibration standard solutions (HI3222 only) make these instruments very useful for a large range of measurements.

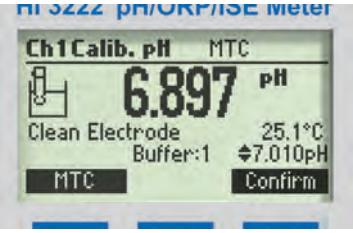
CAL Check™

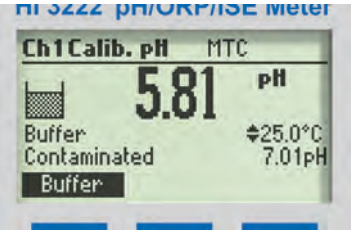
These meters feature Hanna's exclusive CAL Check™, a diagnostics system that ensures accurate pH readings every time. By alerting users of potential problems during the calibration process, the CAL Check™ system eliminates erroneous readings due to dirty or faulty pH electrodes or contaminated pH buffer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

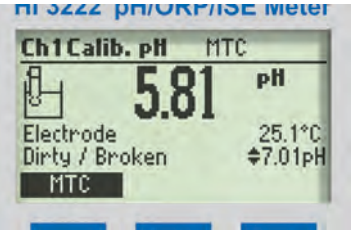
On-screen User Support

These meters feature an interactive user support interface that assists you before, during and after measurement. On-screen tutorials guide users through set-up, calibration and measurement while context ual help on any screen is available at the push of a button.

CAL Check™ Features







- Calibration
  - pH calibration features detailed CAL Check™ messages. Users are guided through the calibration procedure with step-by-step on-screen instructions.

Specifications		HI3221	HI3222
pH	Range	-2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH	-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	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	±0.01 pH; ±0.002 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	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	manual or automatic from -20.0 to 120.0°C (-4.0 to 248.0°F)	manual or automatic from -20.0 to 120.0°C (-4.0 to 248.0°F)
mV	Range	±2000 mV	±2000 mV
	Resolution	0.1 mV	0.1 mV
	Accuracy	±0.2 mV	±0.2 mV
	Relative mV Offset Range	±2000 mV	±2000 mV
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	±0.2°C (±0.4°F) (excluding probe error)	±0.2°C (±0.4°F) (excluding probe error)
ISE	Range	1.00 E^{-3} to 1.00 E^{5} ppm	1.00 E^{-7} to 9.99 E^{10} concentration (choice of units)
	Resolution	3 digits	3 digits
	Accuracy	±0.5% of reading (monovalent ions), ±1% of reading (divalent ions)	±0.5% of reading (monovalent ions), ±1% of reading (divalent ions)
	Calibration	up to two point calibration, six standard solutions (0.1, 1, 10, 100, 1000, 10000 ppm)	up to five point calibration, six standard solutions (in units selected)
Additional Specifications	pH Electrode	HI1131B pH electrode with glass body, BNC connector and 1 m (3.3') cable (included)	
	Temperature Probe	HI7662-T temperature probe, stainless steel with 1 m (3.3') cable (included)	
	Slope calibration	from 80 to 110%	
	Log-on-demand	HI3221: 300 samples; HI3222: 400 samples	
	Interval Logging	5, 10, 30 seconds; 1, 2, 5, 10, 15, 30, 60, 120, 180 minutes (max 600 samples)	
	PC connection	opto-isolated USB	
	Input Impedance	10^{12} ohms	
	Power Supply	12 VDC adapter (included)	
	Environment	0 to 50°C (32 to 122°F) RH max 55% non-condensing	
	Dimensions	235 x 207 x 110 mm (9.2 x 8.14 x 4.33")	
	Weight	1.8 kg (4 lbs.)	
Ordering Information		**HI3221-01** (115V), **HI3221-02** (230V), **HI3222-01** (115V) and **HI3222-02** (230V) are supplied with HI1131B pH electrode, HI7662-T temperature probe, HI76404N electrode holder, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachet (2), HI7082S electrolyte solution (30 mL), 12 VDC adapter and instructions.	

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100; ISE electrodes and solutions begin on page 4.22

(*) Reduced to actual sensor limits

HI2216

0.001 Resolution Meter

pH/ORP/ISE/°C

- Two-point ISE Calibration
  - Up to two-point ISE calibration with five standard solutions
- Five-point pH Calibration
  - Up to five-point pH calibration with seven standard buffers
- GLP Features
  - Meets Good Laboratory Practices
- Automatic Temperature Compensation (ATC)
- Logging
  - Manually log up to 200 records and interval log up to 500 records
- Connectivity
  - PC interface via USB

The HI2216 is a pH, ORP, ISE and °C meter with five point pH calibration and 0.001 pH resolution.

This instrument provides GLP capabilities to allow for the storage and retrieval of all data regarding pH, ORP, and ISE calibration.

The HI2216 can perform measurements using ORP electrodes in the mV scale and ISE electrodes in the ppm scale through the pH/mV/ISE channel input. A relative mV feature is also provided.

Specifications		HI2216
pH	Range	-2.0 to 16.0 pH; -2.00 to 16.00 pH; -2.000 to 16.000 pH
	Resolution	0.1; 0.01; 0.001
	Accuracy	±0.1 pH; ±0.01 pH; ±0.002 pH
	Calibration	automatic, up to five-point calibration with seven standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and two custom buffers
	Temperature Compensation	automatic or manual (with HI7662 temperature probe) from -20.0 to 120.0 °C (-4.0 to 248.0°F)
mV	Range	±999.9 mV; ±2000 mV
	Resolution	0.1 mV (±999.9 mV); 1 mV (±2000 mV)
	Accuracy	±0.2 mV (±999.9 mV); ±1 mV (±2000 mV)
	Relative mV Offset	±2000 mV
ISE	Range	0.001 to 19990 ppm
	Resolution	0.001 ppm; 0.01 ppm; 0.1 ppm; 1 ppm; 10 ppm
	Accuracy	±0.5% FS
	Calibration	automatic, one or two points with five available buffers (0.1, 1, 10, 100, 1000 ppm)
Temperature*	Range	-20.0 to 120.0 °C (-4.0 to 248.0°F)
	Resolution	0.1 °C
	Accuracy	±0.2°C
Additional Specifications	pH Electrode	HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included)
	Temperature Probe	HI7662 temperature probe, stainless steel with 1 m (3.3') cable (included)
	Input Impedance	10^{12} ohm
	PC Connectivity	opto-isolated USB
	Data Logging	log-on-demand up to 200 records; autologging up to 500 records
	Logging Interval	5, 10, 30 seconds, 1, 2, 5, 10, 15, 30, 60, 120, 180 minutes stability logging ("StAb")
	Power Supply	12 VDC adapter (included)
	Environment	0 to 50°C (32 to 122°F); RH max 95%
	Dimensions / Weight	235 x 222 x 109 mm (9.2 x 8.7 x 4.3") / 1.3 kg (2.9 lb.)
Ordering Information		**HI2216-01** (115V) and **HI2216-02** (230V) is 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, HI7082S 3.5 KCl electrolyte solution (30 mL), HI700601 cleaning solution sachet, 12 VDC adapter and instructions.

(*) Reduced to actual sensor limits

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100; ISE electrodes and solutions begin on page 4.22

HI98191

Professional Waterproof Meter

pH/ORP/ISE

- Waterproof
  - IP67 rated waterproof, rugged enclosure
- ISE measurement units
  - Extensive choice of units to display readings (ppm, ppt, g/L, µg/L, mg/L, M, mol/L, mmol/L, %, w/v, user)
- 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
- Log-on-demand
  - Store measurement data at the press of a button
- GLP
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- AutoHold
  - Automatically holds the first stable reading on the display
- Calibration timeout
  - Alerts when calibration is due at a specified interval
- Help menu
  - On-screen context specific help is readily available at the press of a button
- Clear display
  - Dot matrix display with multifunction virtual keys
- Intuitive keypad
  - Most of the available options such as GLP information, help, range, calibration and backlight have a dedicated button
- Connectivity
  - PC connectivity via opto-isolated micro-USB with HI92000 software
- Approximately 200 hour battery life
  - Powered by (4) 1.5V AA batteries

For Universal Applications

The HI98191 is an IP67 rated waterproof meter designed for universal applications. HI98191 measures pH/ORP/ISE and temperature.

Exchange out the pH probe for an ORP probe to obtain mV readings in the ±2000 mV range. HI98191 adds direct ion concentration readings for ISEs with a choice of units for calibration and display.

ISE Sensors and Calibration

HI98191 has 17 different standard ISE sensors pre-programmed in the meter. Selecting the appropriate sensor will automatically update the ion charge for slope calibration and can be calibrated up to five points with the choice of seven standards and five custom standards (choice of units). This meter allows an extensive choice of measurement units (ppm, ppt, g/L, ppb, µg/L, mg/mL, M, mol/L, mmol/L, % w/v, user) and has an expanded measuring range of 1.00×10^{-7} to 9.99×10^{10}.

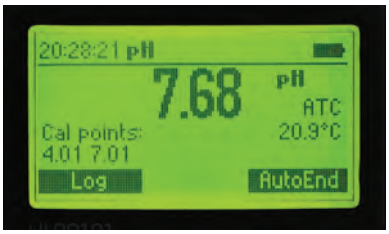
pH Calibration

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

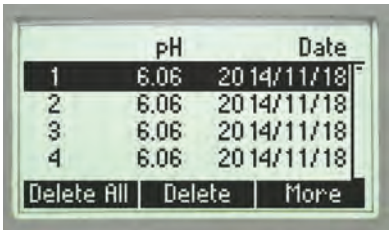
CAL Check™

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.

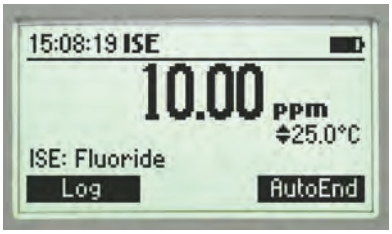
On-screen Features



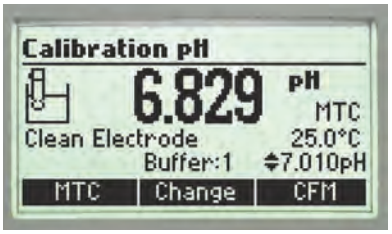
- Backlit LCD
  - Press the backlight button to view the display in low-light conditions



- Log-on-demand
  - Store measurement data at the press of a button. Data can be viewed on-screen or transferred to a PC



- ISE measurements
  - The HI98191 includes ISE measurements when used with our wide selection of ISE electrodes or a custom version



- Calibration
  - pH calibration features detailed CAL Check™ messages. Users are guided through the calibration procedure with step-by-step on-screen instructions

HI98191 shown in HI720191 rugged carrying case with custom thermoformed insert (included)

Specifications		HI98191
pH	Range	-2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH
	Resolution	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	±0.1 pH; ±0.01 pH; ±0.002 pH
	Calibration	up to five-point calibration, seven standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and five custom buffers
	Temperature Compensation	automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F)
mV	Range	±2000 mV
	Resolution	0.1 mV
	Accuracy	±0.2 mV
	Relative mV Offset Range	±2000 mV
ISE	Range	from 1.00 E^{-7} to 9.99 E^{10} concentration
	Resolution	3 digits 0.01; 0.1; 1; 10 concentration
	Accuracy	±0.5% of reading (monovalent ions), ±1% of reading (divalent ions)
	Calibration	up to five point calibration, seven standard solutions available
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)
	Calibration Slope	from 80 to 110%
	Log-on-demand	log-on-demand 300 samples (100 each pH/mV/ISE range)
	PC Connectivity	opto-isolated USB with HI92000 software and micro USB cable
	Input Impedance	10^{12} ohms
	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 or can be 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, HI 7662 Temperature Probe, HI7004M pH 4.01 buffer solution (230 mL), HI7007M pH 7.01 buffer solution (230 mL), electrode general cleaning solution sachet (2), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), instruction manual, quick start guide, quality certificate and HI720191 rugged carrying case with custom thermoformed insert.

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100; ISE electrodes and solutions begin on page 4.22

HI98402
Fluoride Meter

- ATC
  - Automatic Temperature Compensation
- Waterproof
  - Waterproof, rugged housing for both indoor and outdoor applications
- Help features
  - Tutorial messages on LCD display

The HI98402 measures fluoride from 0.05 mg/L to 1.9 g/L in five distinct ranges. The HI98402 utilizes an auto-ranging feature which automatically selects the range that provides the best resolution.

The HI98402 automatically compensates for temperature from -5 to 55°C using the optional HI7662 stainless steel temperature probe. Both the temperature and fluoride concentrations are displayed on the large LCD.

Calibration is automatic at one or two points. The calibration points can be chosen among 1 mg/L, 2 mg/L, 10 mg/L, 100 mg/L and 1000 mg/L.

The HI98402 is supplied in a rugged carrying case complete with batteries that provide up to 200 hours of continuous operation.

Specifications		HI98402
Fluoride	Range	0.050 to 0.500 mg/L (ppm); 0.50 to 5.00 mg/L (ppt) 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^{12} ohm
	Battery Type / Life	1.5V AAA (3) / approximately 200 hours of continuous use
	Environment	0 to 50°C (32 to 122°F); RH max 100%
	Dimensions	185 x 72 x 36 mm (7.3 x 2.8 x 1.4")
	Weight	300 g (10.6 oz.)
Ordering Information	**HI98402** is supplied with batteries, rugged carrying case and instructions.	

* Will be reduced by actual sensor limits.

ISE electrodes and solutions begin on page 4.22

HI931100 • HI931101

Sodium Chloride and Sodium Content Meters

- Help features
  - Tutorial messages on LCD
- Backlight
  - Dual-level LCD

HI931100 is an ion-selective sodium chloride meter that uses a sodium ion-selective electrode to measure the salinity (NaCl) content of a solution. This powerful instrument has four ranges, capable of measuring concentrations from 0.150 g/L to 300 g/L NaCl. HI931100 auto ranges from sample to sample over an extremely broad range without the need for recalibration.

The HI931101 measures sodium from ions 15.0 mg/L to 60 g/L.

Both the HI931100 and the HI931101 use the FC300B combination sodium electrode (not included). The calibration process is automatic at two points, the first at 2.3 g/L while the second can be either at 0.23 g/L (low range) or at 23.0 g/L (high range).

A separate temperature probe, HI7662 provides temperature readings from -20 to 120°C.

Specifications		HI931100	HI931101
NaCl	Range	0.150 to 1.500 g/L NaCl; 1.50 to 15.00 g/L NaCl;15.0 to 150.0 g/L NaCl; 150 to 300 g/L NaCl	0.00 to 3.00 pNa; 15.0 to 150.0 mg/L (ppm) Na;0.150 to 1.500 g/L Na; 1.50 to 15.00 g/L Na; 15.0 to 60.0 g/L Na
	Resolution	0.001 g/L NaCl; 0.01 g/L NaCl; 0.1 g/L NaCl; 1 g/L NaCl	0.01 pNa; 0.1 mg/L Na; 0.001 g/L Na; 0.01 g/L Na; 0.1 g/L Na
	Accuracy (@25°C/77°F)	±5% of reading (NaCl)	±0.05 pNa; ±5% of reading (Na)
Temperature	Range	-20.0 to 120.0°C (-4.0 to 248.0°F)	-20.0 to 120.0°C (-4.0 to 248.0°F)
	Resolution	0.1°C (0.1°F)	0.1°C (0.1°F)
	Accuracy (@25°C/77°F)	±0.2°C (±0.4°F) (excluding probe error)	±0.2°C (±0.4°F) (excluding probe error)
Additional Specifications	Calibration	automatic, one or two point at 0.30 g/L (ppt)(HI7085); 3.00 g/L (HI7083); 30.0 g/L (HI7081)	automatic, one or two point at 0.23 g/L (HI7087/HI8087) 2.3 g/L (HI7080/HI8080) 23.0 g/L (HI7086/HI8086)
	Temperature Compensation	fixed at 25°C (77°F)	
	Electrode	FC300B glass body sodium ion-selective electrode with BNC connector and 1 m (3.3') cable (not included)	
	Temperature Probe	HI7662 stainless steel temperature probe with 1 m (3.3') cable (not included)	
	Input Impedance	10^{12} ohm	
	Battery Type / Life	1.5V AAA (3) / approx. 200 hours of continuous use	
	Environment	0 to 50°C (32 to 122°F); RH max 100%	
	Dimensions	185 x 72 x 36 mm (7.3 x 2.8 x 1.4")	
	Weight	300 g (10.6 oz.)	
Ordering Information		**HI931100** and **HI931101** and are supplied with batteries, instructions and hard carrying case.	

ISE electrodes and solutions begin on page 4.22

HI931102

HACCP Compliant Salinity Foodcare Meter

- Help features
  - Tutorial messages on LCD
- Backlight
  - Dual-level LCD

Hanna has designed this waterproof salinity meter for use in food production.

The HI931102 is an ion-selective meter that uses a sodium ion-selective electrode to measure the sodium content of a solution and report it as g/L NaCl or percent NaCl. This powerful instrument has four ranges, capable of measuring concentrations from 0.150 g/L to 300 g/L. This meter is able to auto-range from sample to sample over an extremely broad range without the need for recalibration.

The HI931102 uses the FC300B combination sodium ISE to measure sodium readings from 0.150 g/L to 300 g/L. The calibration process is automatic at two points, the first is at 3.00 g/L while the second can be either at 0.30 g/L (low range) or at 30.0 g/L (high range).

A separate temperature probe, HI7662 provides temperature readings from -20 to 120°C.

Specifications		HI931102
NaCl	Range	0.150 to 1.500 g/L NaCl; 1.50 to 15.00 g/L NaCl; 15.0 to 150.0 g/L NaCl; 150 to 300 g/L NaCl; 0.0 to 30.0 % NaCl
	Resolution	0.001 g/L NaCl; 0.01 g/L NaCl; 0.1 g/L NaCl; 1 g/L NaCl; 0.1 % NaCl
	Accuracy (@25°C/77°F)	±5% of reading
Temperature	Range	-20.0 to 120.0°C (-4.0 to 248.0°F)
	Resolution	0.1°C (0.1°F)
	Accuracy (@25°C/77°F)	±0.2°C (±0.4°F) (excluding probe error)
Additional Information	Calibration	automatic, one or two point at 0.30 g/L (HI7085) 3.00 g/L (HI7083) 30.0 g/L (HI7081)
	Temperature Compensation	fixed at 25°C (77°F)
	Electrode	FC300B glass body sodium ion selective electrode with BNC connector and 1 m (3.3') cable (not included)
	Temperature Probe	HI7662 stainless steel temperature probe with 1 m (3.3') cable (not included)
	Input Impedance	10^{12} ohm
	Battery Type / Life	1.5V AAA (3) / approx. 200 hours of continuous use
	Environment	0 to 50°C (32 to 122°F); RH max 100%
	Dimensions	185 x 72 x 36 mm (7.3 x 2.8 x 1.4")
	Weight	300 g (10.6 oz.)
Ordering Information	**HI931102** is supplied with batteries, instructions and hard carrying case.	

ISE electrodes and solutions begin on page 4.22

HI4101 • HI4002 • HI4102 • HI4003 • HI4103

Ammonia • Bromide • Cadmium Ion Selective Electrodes

Parameter	Ammonia	Bromide		Cadmium	
Code	**HI4101**	**HI4002**	**HI4102**	**HI4003**	**HI4103**
Type	gas-sensing; combination	solid state; half-cell	solid state; combination	solid state; half-cell	solid state; combination
Measurement Range	1M to $1 \cdot 10^{-6}$M 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)		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 12.5	2 to 12.5
Temperature Range	0 to 40°C	0 to 80°C	0 to 80°C	0 to 80°C	0 to 80°C
Approximate Slope	-56	-56	-56	+28	+28
Body O.D.	12 mm	12 mm	12 mm	12 mm	12 mm
Insertion Length	120 mm	120 mm	120 mm	120 mm	120 mm
Body Material	Delrin®	epoxy	PEI	epoxy	PEI
Cable	1 m coaxial	1 m coaxial	1 m coaxial	1 m coaxial	1 m coaxial
Possible Applications	determination of ammonium, ammonia in wine, beer, water, waste water and soil				
Connection	BNC	BNC	BNC	BNC	BNC

Calcium • Carbon Dioxide • Chloride Ion Selective Electrodes

Parameter	Calcium		Carbon Dioxide	Chloride	
Code	**HI4004**	**HI4104**	**HI4105**	**HI4007**	**HI4107**
Type	polymer membrane; half cell	polymer membrane; combination	gas-sensing; combination	solid state; half-cell	solid state; combination
Measurement Range	1M to $3•10^{-6}$M 40080 to 0.12 mg/L (ppm)		$1•10^{-2}$M to $1•10^{-4}$M 440 to 4.4 mg/L (ppm)	1M to $5•10^{-5}$M 35000 to 1.8 mg/L (ppm)	
Optimum pH Range	4 to 10	4 to 10	4.2 to 5.2	2 to 11	2 to 11
Temperature Range	0 to 40°C	0 to 40°C	0 to 40°C	0 to 80°C	0 to 80°C
Approximate Slope	+28	+28	+54	-56	-56
Body O.D.	12 mm	12 mm	12 mm	12 mm	12 mm
Insertion Length	120 mm	120 mm	120 mm	120 mm	120 mm
Body Material	epoxy/PVC	PEI/PVC	Delrin®	epoxy	PEI
Cable	1 m coaxial	1 m coaxial	1 m coaxial	1 m coaxial	1 m coaxial
Possible Applications	determination of free calcium in beverages, water, and seawater		determination of carbonates as CO_2 in water, soft drinks and wine samples	determination of free chloride ions in emulsified food products, beverages, plants, soils and as an indicator for titration	
Connection	BNC	BNC	BNC	BNC	BNC

HI4008 • HI4108 • HI4009 • HI4109

Cupric • Cyanide Ion Selective Electrodes

Parameter	Cupric		Cyanide	
Code	**HI4008**	**HI4108**	**HI4009**	**HI4109**
Type	solid state; half-cell	solid state; combination	solid-state; half-cell	solid state; combination
Measurement Range	0.1M to $1 \cdot 10^{-6}$M 6354 to 0.06 mg/L (ppm)		10^{-2}M to $1 \cdot 10^{-6}$M 260 to 0.02 mg/L (ppm)	
Optimum pH Range	2 to 12.5	2 to 12.5	>11	>11
Temperature Range	0 to 80°C	0 to 80°C	0 to 80°C	0 to 80°C
Approximate Slope	+26	+26	-57	-57
Body O.D.	12 mm	12 mm	12 mm	12 mm
Insertion Length	120 mm	120 mm	120 mm	120 mm
Body Material	epoxy	PEI	epoxy	PEI
Cable	1 m coaxial	1 m coaxial	1 m coaxial	1 m coaxial
Possible Applications	used as an indicator for titrations using chelates		determination of free cyanide ions in plating baths, waste water and in plant and soil samples	
Connection	BNC	BNC	BNC	BNC

Parameter	Fluoride			Iodide	
Code	**HI4010**	**HI4110**	**FC301B**	**HI4011**	**HI4111**
Type	solid state; half-cell	solid state; combination	solid state; half-cell	solid state; half-cell	solid state; combination
Measurement Range	1M to $1 \cdot 10^{-6}$M Sat. to 0.02 mg/L (ppm)			1M to $1 \cdot 10^{-7}$M 127000 to 0.01 mg/L (ppm)	
Optimum pH Range	5 to 8	5 to 8	5 to 8	2 to 13	2 to 13
Temperature Range	0 to 80°C	0 to 80°C	0 to 80°C	0 to 80°C	0 to 80°C
Approximate Slope	-56	-56	-56	-56	-56
Body O.D.	12 mm	12 mm	12 mm	12 mm	12 mm
Insertion Length	120 mm	120 mm	120 mm	120 mm	120 mm
Body Material	epoxy	PEI/epoxy	epoxy	epoxy	PEI
Cable	1 m coaxial	1 m coaxial	1 m coaxial	1 m coaxial	1 m coaxial
Possible Applications	determination of free fluoride in potable water, soft drinks, wine, plants, emulsified food products, plating and pickling acids			determination of free iodide ions in emulsified food samples (iodized table salt), plants and for titration	
Connection	BNC	BNC	BNC	BNC	BNC

HI4012 • HI4112 • HI4013 • HI4113 • HI4014 • HI4114

Lead/Sulfate • Nitrate • Potassium Ion Selective Electrodes

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		1M 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	+25	+25	-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

Silver/Sulfide • Sodium • Reference Ion Selective Electrodes

Parameter	Silver/Sulfide		Sodium	Reference
Code	**HI4015**	**HI4115**	**FC300{ }**	**HI5315**
Type	solid state; half-cell	solid state; combination	glass combination	N/A
Measurement Range	1.0M to $1•10^{-6}$M 107900 to 0.11ppm (Ag^+) 1.0M to $1•10^{-7}$M 32100 to 0.003 ppm (S^{2-})	Ag+ 1.0M to $1•10^{-6}$M 107900 to 0.11ppm S^{2-} 1.0M to $1•10^{-7}$M 32100 to 0.003 ppm	1.0M to $1•10^{-5}$M 39100 to 0.039 ppm	N/A
Optimum pH Range	2 to 8 (Ag+) 12 to 14 (S^{2-})	Ag+ 2 to 8 S= 12 to 14	9.75 to 14 pH	N/A
Temperature Range	0 to 80°C	0 to 80°C	0 to 80°C	0 to 80°C
Approximate Slope	+56 (Ag^+) / -28 (S^{2-})	+56 Ag+ / -28 S^{2-}	+57	N/A
Body O.D.	12 mm	12 mm	12 mm	12 mm
Insertion Length	120 mm	120 mm	120 mm	120 mm
Body Material	epoxy	PEI	glass	PEI
Cable	1 m coaxial	1 m coaxial	1 m coaxial	1 m coaxial
Possible Applications	used as an indicator for titrations using silver nitrate; for the determination of sulfide ions in waters, paper liquors, natural waters and soils.		water, food products, soup, dairy, brines and laboratory	used to complete electrical circuit and to provide stable reference voltage for ISE half-cells
Connection	BNC	BNC	FC300B BNC FC300D DIN FC300U US	BNC

Solutions

ISE Standards

Our wide selection of Hanna ISE Standards are made and bottled in our own state-of-the-art solutions facility. ISE Standards are required for direct and incremental measurement techniques and are available with certificate of analysis.

Code	Description	Size
HI4001-01	0.1 M ammonia standard	500 mL
HI4001-02	100 mg/L (ppm) ammonia standard (as N)	500 mL
HI4001-03	1000 mg/L (ppm) ammonia standard (as N)	500 mL
HI4002-01	0.1 M bromide standard	500 mL
HI4003-01	0.1 M cadmium standard	500 mL
HI4004-01	0.1 M calcium standard	500 mL
HI4005-01	0.1 M carbon dioxide standard	500 mL
HI4005-03	1000 mg/L (ppm) carbon dioxide standard (as $CaCO_3$)	500 mL
HI4007-01	0.1 M chloride standard	500 mL
HI4007-02	100 mg/L (ppm) chloride standard	500 mL
HI4007-03	1000 mg/L (ppm) chloride standard	500 mL
HI4008-01	0.1 M cupric standard	500 mL
HI4010-01	0.1 M fluoride standard	500 mL
HI4010-02	100 mg/L (ppm) fluoride standard	500 mL
HI4010-03	1000 mg/L (ppm) fluoride standard	500 mL
HI4010-10	10 mg/L (ppm) fluoride standard premixed with TISAB II	500 mL
HI4010-11	1 mg/L (ppm) fluoride standard premixed with TISAB II	500 mL
HI4010-12	2 mg/L (ppm) fluoride standard premixed with TISAB II	500 mL
HI4010-30	kit containing 4 bottles each of : HI4010-10, HI4010-11 and HI4010-00	500 mL (3 x 4)
HI4011-01	0.1 M iodide standard	500 mL
HI4012-01	0.1 M lead standard	500 mL
HI4012-21	0.1 M sulfate standard	500 mL
HI4013-01	0.1 M nitrate standard	500 mL
HI4013-02	100 mg/L (ppm) nitrate standard (as N)	500 mL
HI4013-03	1000 mg/L (ppm) nitrate standard (as N)	500 mL
HI4014-01	0.1 M potassium standard	500 mL
HI4015-01	0.1 M silver standard	500 mL
HI4016-01	0.1 M sodium standard	500 mL
HI4016-02	100 ppm sodium standard	500 mL
HI4016-03	1000 ppm sodium standard	500 mL
HI4016-10	10 ppm sodium standard	500 mL

Gas Sensor Fill Solutions

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

Specific Solutions for ISE Sensors

Code	Description	Size
HI4000-47	pH 4 and pH 7 buffers with chloride ions background, used to check internal glass electrode of gas sensors	10 packages each and 2 beakers
HI4001-45	conditioning and storage solution for HI4101 ammonia ISE	500 mL
HI4004-45	conditioning and storage solution for HI4004 and HI4104 calcium ISEs	500 mL
HI4005-45	conditioning and storage solution for HI4105 carbon dioxide ISE	500 mL
HI4016-45	storage solution for sodium ISE	500 mL
HI4016-46	conditioning solution for sodium ISE	500 mL




Ionic Strength Adjusters (ISA)

Hanna Ionic Strength Adjusters (ISA) are formulated to provide a constant ionic strength in sample and standards alike, thus permitting concentration rather than activity measurements to be made. In some cases ISAs adjust pH and eliminate matrix effects.

Code	Description	Size
HI4000-00	ISA for halide ISEs	500 mL
HI4001-00	alkaline ISA for ammonia and cyanide ISEs	500 mL
HI4004-00	ISA for calcium ISEs	500 mL
HI4005-00	ISA for carbon dioxide ISEs	500 mL
HI4010-00	TISAB II for fluoride ISEs	500 mL
HI4010-05	TISAB II for fluoride ISEs	1 gallon
HI4010-06	TISAB III concentrate for fluoride ISEs	500 mL
HI4012-00	ISA for lead/sulfate ISEs	100 mL (5)
HI4013-00	ISA for nitrate ISEs	500 mL
HI4013-06	nitrate interferent suppressant ISA	500 mL
HI4014-00	ISA for potassium ISEs	500 mL
HI4015-00	SAOB (sulfide antioxidant buffer)	500 mL + 18 g (2 components)
HI4016-00	ISA for sodium ISEs	500 mL

Silver-free Reference Fill Solutions

Recommended for our combination ISE electrodes and the Hanna HI5315 reference electrode. Reference electrodes should be topped off daily with the correct filling solution for optimum measurement performance. These solutions are silver-free to eliminate silver precipitates found with standard electrolytes.

Code	Description	Size
HI7072	electrolyte solution, 1 M KNO_3	30 mL bottles (4)
HI7075	electrolyte solution with KNO_3 and KCl	30 mL bottles (4)
HI7076	electrolyte solution, 1 M NaCl	30 mL bottles (4)
HI7078	electrolyte solution, $(NH_4)_2SO_4$	30 mL bottles (4)
HI7082	electrolyte solution, 3.5 M KCl	30 mL bottles (4)

Reference Fill Solutions Containing Silver Chloride (AgCl)

Code	Description	Size
HI7079	2M NH_4Cl sat. with AgCl electrolyte for sodium ISE's (contains AgCl)	30 mL bottles (4)

Sodium (Na^+) ISE Standard Solutions

Code	Description	Package
HI7080L	standard solution at 2.3 g/L Na^+	500 mL bottle
HI7080M	standard solution at 2.3 g/L Na^+	230 mL bottle
HI7086L	standard solution at 23 g/L Na^+	500 mL bottle
HI7086M	standard solution at 23 g/L Na^+	230 mL bottle
HI7087L	standard solution at 0.23 g/L Na^+	500 mL bottle
HI7087M	standard solution at 0.23 g/L Na^+	230 mL bottle
HI8080L	standard solution at 2.3 g/L Na^+	500 mL FDA bottle
HI8080M	standard solution at 2.3 g/L Na^+	230 mL FDA bottle
HI8086L	standard solution at 23 g/L Na^+	500 mL FDA bottle
HI8086M	standard solution at 23 g/L Na^+	230 mL FDA bottle
HI8087L	standard solution at 0.23 g/L Na^+	500 mL FDA bottle
HI8087M	standard solution at 0.23 g/L Na^+	230 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
HI7081L	standard solution at 30 g/L NaCl	500 mL bottle
HI7081M	standard solution at 30 g/L NaCl	230 mL bottle
HI7083L	standard solution at 3.0 g/L NaCl	500 mL bottle
HI7083M	standard solution at 3.0 g/L NaCl	230 mL bottle
HI7084L	standard solution at 58.4 g/L NaCl	500 mL bottle
HI7084M	standard solution at 58.4 g/L NaCl	230 mL bottle
HI7085L	standard solution at 0.3 g/L NaCl	500 mL bottle
HI7085M	standard solution at 0.3 g/L NaCl	230 mL bottle
HI7088L	standard solution at 5.84 g/L NaCl	500 mL bottle
HI7088M	standard solution at 5.84 g/L NaCl	230 mL bottle
HI7089L	standard solution at 125 g/L NaCl	500 mL bottle
HI7089M	standard solution at 125 g/L NaCl	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 NaCl	500 mL FDA bottle
HI8084M	standard solution at 58.4 g/L NaCl	230 mL FDA bottle
HI8088L	standard solution at 5.84 g/L NaCl	500 mL FDA bottle
HI8088M	standard solution at 5.84 g/L NaCl	230 mL FDA bottle
HI8089L	standard solution at 125 g/L NaCl	500 mL FDA bottle
HI8089M	standard solution at 125 g/L NaCl	230 mL FDA bottle
HI8095L	standard solution at 146 g/L NaCl	500 mL FDA bottle
HI8095M	standard solution at 146 g/L NaCl	230 mL FDA bottle

The sodium and sodium chloride standard solutions are used for the calibration of pocket-sized, portable and bench salinity meters, as well as for the sodium ISE.

These solutions are available in 230 or 500 mL bottles, and also in opaque bottles that meet the FDA (Food & Drug Administration) specifications, in 230 or 500 mL volumes.

Fluoride standard solutions are used to calibrate all instruments that measure fluoride using a fluoride ISE. Additional fluoride standards are found on page 4.28

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

Fluoride Standard Solutions

Code	Description	Bottle
HI7023/1L	TISAB Solution	1 L
HI7023L	TISAB Solution	500 mL
HI7023M	TISAB Solution	230 mL
HI70701/1L	standard solution at 1 g/L F^-	1 L
HI70701L	standard solution at 1 g/L F^-	500 mL
HI70701M	standard solution at 1 g/L F^-	230 mL
HI70702/1L	standard solution at 10 mg/L F^-	1 L
HI70702L	standard solution at 10 mg/L F^-	500 mL
HI70702M	standard solution at 10 mg/L F^-	230 mL
HI70703/1L	standard solution at 100 mg/L F^-	1 L
HI70703L	standard solution at 100 mg/L F^-	500 mL
HI70703M	standard solution at 100 mg/L F^-	230 mL

Accessories

HI4000-50	liquid membrane sensor handle
HI4000-51	gas sensor replacement pH for ammonia sensor
HI4000-52	gas sensor membrane cap for ammonia
HI4000-54	gas sensor replacement pH for carbon dioxide ISE
HI4000-70	halide polishing strips (24)
HI4001-51	ammonia membrane kit (20 loose)
HI4004-51	calcium module for 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

Table of Contents

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 (a stoichiometric equivalent) quantity of titrant and analyte are present, this is called the equivalence point. This can be determined by an 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 secondary reaction
- The reaction must go to completion
- The reaction must have well-known stoichiometry (reaction ratios)
- A convenient method of endpoint detection must be available

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 performed by potentiometric automatic titrators include...

- Acid-base titrations
- Oxidation reduction titrations
- Complexometric titrations
- Precipitation titrations
- Non-aqueous titrations
- Argentometric
- Ion selective

Analyses performed by bivoltammetric automatic titrators include...

- Coulometric Karl Fischer (water determination)
- Volumetric Karl Fischer (water determination)

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

Hanna Instruments® Titration Systems

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

5.12

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.

HI904
Karl Fischer Coulometric Titrator

5.24

The HI904 Karl Fischer Coulometric Titrator for moisture analysis is an extension of Hanna's highly successful titrator platform. The HI904 combines an ultra-high electrolytically generated iodine dynamic dosing system with optically-regulated magnetic stirring, sophisticated endpoint determination, and background drift correction algorithms. The result is an extremely adaptable titrator capable of titrating with superior accuracy and precision for samples with low moisture content. The HI904 applies a pulsed DC current for titrant generation, detects the endpoint and performs all necessary calculations automatically.

The HI904 comes equipped with a solvent handling system to reduce cell conditioning time and can be connected directly to a laboratory analytical balance via RS232 serial interface.

HI902C
Automatic Titration System

5.8

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.

Product Spotlights

HI84529
Titratable Acid Mini Titrator and pH Meter for the Dairy Indutry

5.32

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.

HI84530
Total Titratable Acidity Titrator and pH Meter

5.28

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 ensure the accuracy of the measurement.

HI84531
Titratable Alkalinity Titrator and pH Meter

5.30

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 determines 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 end point (known as phenolphthalein alkalinity) or total alkalinity with a 4.50 pH endpoint (known as bromcresol green alkalinity).

The dispensed titrant volume is used to automatically calculate the alkalinity, which can be displayed in mg/L or meq/L as $CaCO_3$.

Mini Titrator Comparison Guides

HI84530 • HI84531

Total Titratable Acidity and Titratable Alkalinity Automatic Bench Mini Titrators

	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
HI84530	•	•			•	•	•	•	•	•	•	•	5.28
HI84531			•	•	•	•	•	•	•	•	•	•	5.30

HI84529

Dairy Products Automatic Bench Mini Titrator

	Low Range Acidity	High Range Acidity	pH Range	Temperature Range	Automatic Temperature Compensation	Three-point pH Calibration	GLP Features	Backlit Display	Data Logging	PC Connectivity	Page
HI84529	•	•	•	•	•	•	•	•	•	•	5.32

HI84532
Acidity in Fruit Juice Automatic Bench Mini Titrator

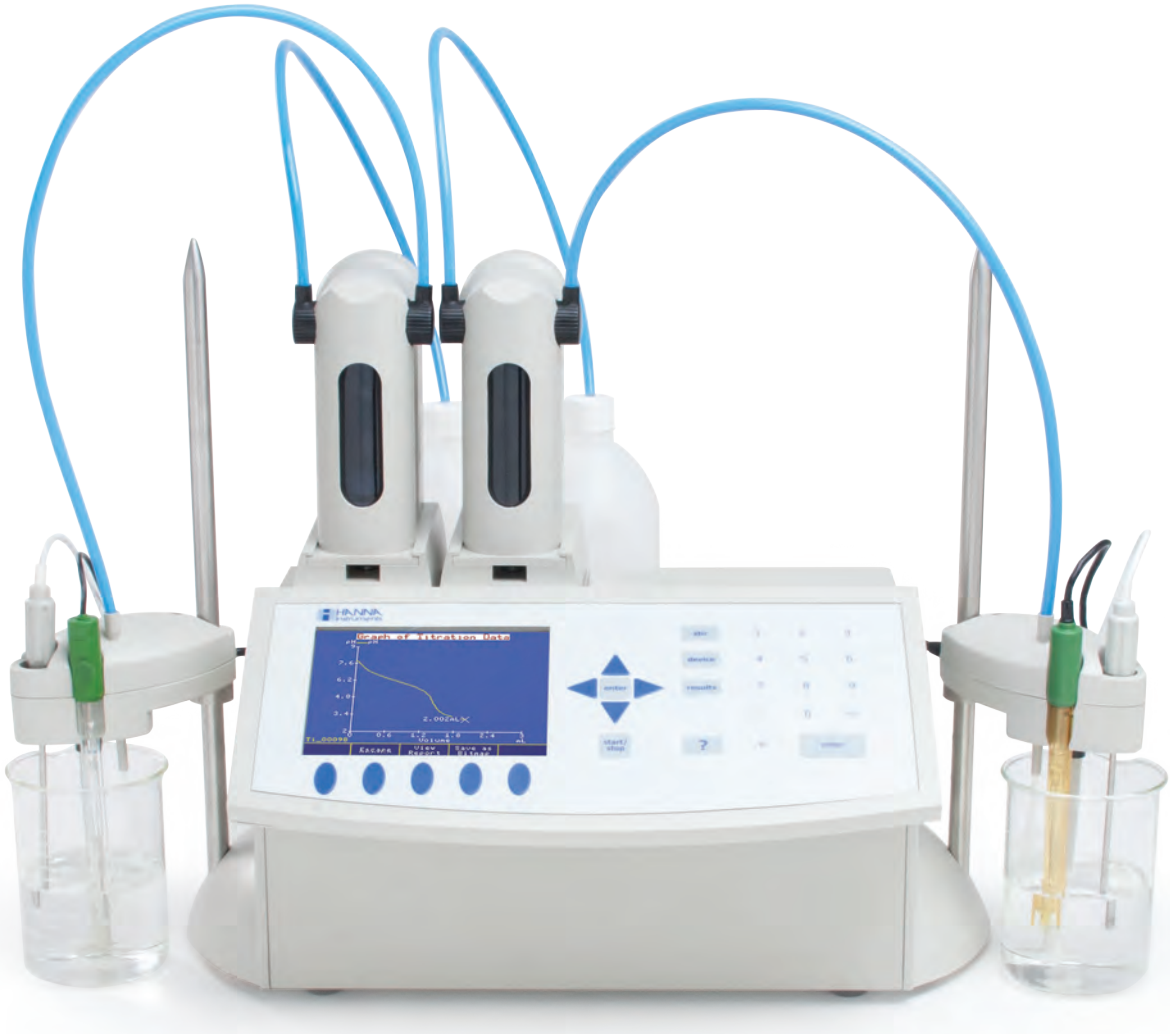
	pH Range	Temperature Range (°C)	Citric Acid Range	Malic Acid Range	Tartic Acid Range	Three-point pH Calibration	Automatic Temperature Compensation	GLP Features	Data Logging	Backlit Display	PC Connectivity	Page
HI84532	•	•	•	•	•	•	•	•	•	•	•	5.34

HI84500 • HI84502 • HI84533
Wine Products Automatic Bench Mini Titrators

	Formal 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
HI84500			•	•					•	•	•	•	5.38
HI84502		•			•	•	•	•	•	•	•	•	5.40
HI84533	•					•	•	•	•	•	•	•	5.36

HI902C

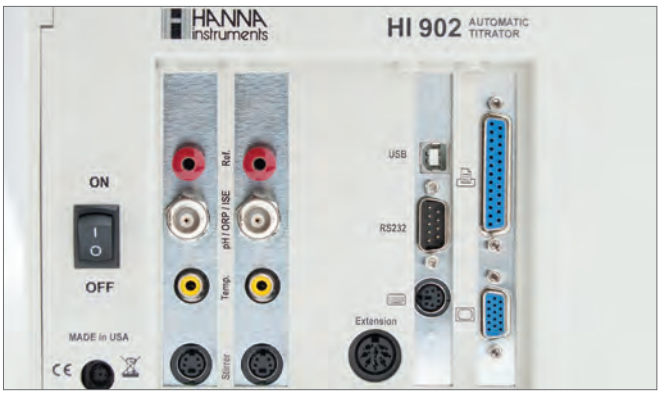
Automatic Titration System



- Linear and dynamic dosing
- USB port allows for the transfer of methods and reports to a PC or another titrator via USB flash drive
- Two sensor inputs with the addition of a second analog board
- RS232 port for connection to an analytical laboratory balance
- Multi-language support

Four working modes:

- Potentiometric titrator
  - Choice of endpoint detection: equivalence point (1st or 2nd derivative) or fixed pH/mV value
  - Clip-Lock™ exchangeable burette system enables users to exchange burettes in a matter of seconds
  - Linked titration methods allow two methods to run in sequence
  - Acid-base, non-aqueous, redox, complexometric, precipitation, non-aqueous, argentometric and ion selective titrations can be performed
  - Supports up to 100 titration methods (standard and user-defined)
  - Supplied with a standard methods pack or customizable user methods
  - Titration graph can be displayed on-screen and saved as a bitmap
  - Reminders for titrant age and standardization expiration
  - Multiple equivalence endpoint titrations with multiple molecular weights and reaction ratios
  - Supports two burette dosing pumps with the ability to perform back titrations
  - 5, 10, or 25 mL precision ground glass syringe with PTFE plunger
  - 40,000 step screw drive, piston dosing pump
  - 3-way motor driven valve
  - PTFE burette tubing with polyurethane tube jacketing
- Full featured research grade pH meter
  - Automatic Temperature Compensation (ATC)
  - Up to five calibration points with automatic recognition of standard buffers and up to five custom buffers
- mV (ORP) meter
  - Relative mV calibration
- ISE meter
  - Numerous concentration units including: mol/L, mmol/L, mg/L, mg/mL, µg/L, %, ppt, ppm, g/L and user-defined
  - Up to five calibration points with five custom standards



- Support for 2 electrodes, 2 burette dosing pumps and 2 stirrers

- Clip-Lock™ Exchangeable Burette System
  - With Clip-Lock™, it only takes a few seconds to exchange the reagent burettes to perform a different titration. No need to purge, clean and refill

- Method sequencing
  - Linked titration methods allow two methods to run in sequence

- Easy upgrades
  - Field upgradable software via USB
  - Convenient for saving data

Powerful Customization, Accurate Analysis

The HI902C is an automatic titrator that complements our wide range of products dedicated to quick and accurate laboratory analysis. HI902C can perform 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 is automatically stored and can be transferred to a flash drive or PC by USB connection.

This titrator is supplied with a pack of standard methods or you can create your own. Methods (standard or user) can be transferred between titrators using a USB flash drive. Software updates can also be performed using a USB flash drive as well.

Users can connect pH, ORP or ISE electrodes to the HI902C, as well as create a complete workstation with a PC, monitor, keyboard and printer.

The HI902C complies with GLP specifications. All GLP information from each sample can be stored, including ID number, date and time of analysis, electrode ID code, and last calibration date.

Clip-Lock™ Exchangeable Burette System

With Clip-Lock™, it only takes a few seconds to exchange the reagent burettes to perform a different titration.

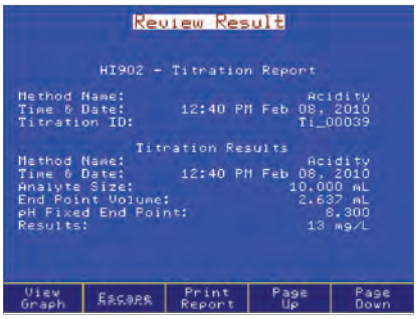
The Clip-Lock™ exchangeable burette system prevents cross contamination while reducing loss of time and reagents. Simply slide out the burettes and detach the dispensing tubes from the overhead assembly for quick exchange.

Having several prepared burettes on hand will make the Hanna HI902C one of the fastest and most versatile titration systems on the market.

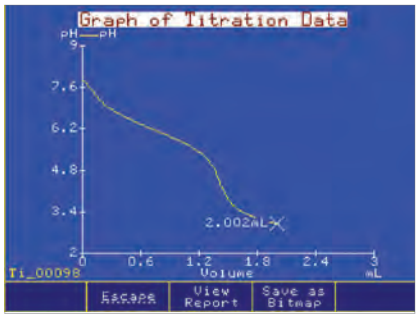
Versatile Data Management

- 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 USB flash drive or PC with the Hanna HI900PC application 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

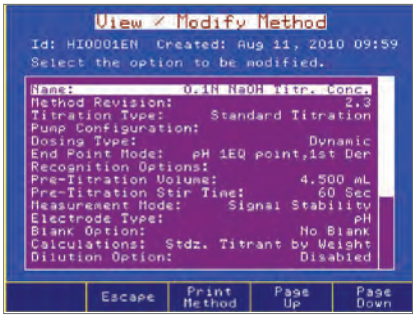
- Customizable reports
  - Data to be stored in tiration reports is fully customizable



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

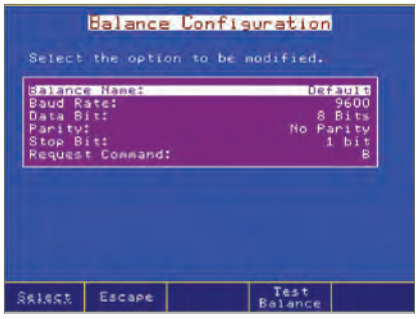


- Titration graphs
  - Titration graphs can be viewed on-screen or saved as images and transferred along with titration report

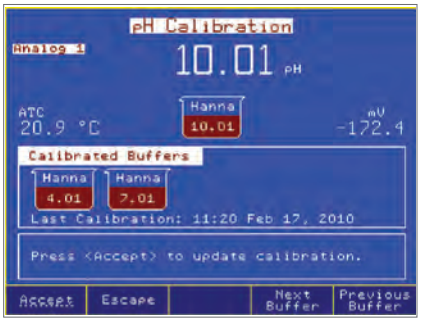


- Fully customizable titration methods

- 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

- Select your ISE type from the available list

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	$1 \cdot 10^{-6}$ to $9.99 \cdot 10^{10}$
	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	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 (pH or mV-mode), redox, precipitation, complexometric, non-aqueous, ion-selective, 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, 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
Ordering Information		**HI902C1-01** and **HI902C1-02**: titrator with one analog board, stirrer with stand, 25 mL glass burette, dosing pump drive, temperature sensor, USB cable, 256 Mb USB flash drive and PC software. **HI902C2-01** and **HI902C2-02**: titrator with two analog boards, stirrer with stand, 25 mL glass burette, dosing pump, temperature sensor, USB cable, 256 Mb USB flash drive and PC software.

Titration solutions and reagents begin on page 5.42; See accessories on page 5.43

HI921

Autosampler

control panel

- Flexible, accurate detection of the titration endpoint with HI902C potentiometric titrator
- Automation of up to 18 samples per tray
  - 16 sample tray holds 150 mL beakers
  - 18 sample tray holds 100 mL beakers
- Absolute encoder in sample tray
  - The Autosampler always knows the tray position without the need to "home" or calibrate.
- Electrode rinse feature
  - Up to 3 beakers per tray can be designated for electrode dip/spray rinses
- Automatic addition of reagents or deionized water to the sample beaker by peristaltic pump
- Included control panel for manual operation of motors and pumps
- Built-in magnetic stirrer or optional overhead propeller stirrer
- Barcode reader interface for easy sample tracking
- Built-in RFID in each tray, communicating tray serial number and type
- Optical IR beam detects presence or absence of beakers in the tray
  - Ensures the Autosampler does not proceed with titration if a beaker is missing
- Field upgradable software
- Sample trays made of chemically-resistant materials are removable, easy to clean and dishwasher safe.
- Electrode holder can accommodate 3 x 12 mm electrodes, temperature sensor, 1 aspiration tube and 5 multipurpose tubes (reagent addition, burette dosing)
- Real-time progress of the sequence and results shown on the HI902 titrator screen
- Integrated peristaltic (up to 3) or membrane pump (optional)
- Sample leveling feature
  - Automatic leveling for fast preparation of volumetric samples
- Waste removal feature
  - Aspirate completed samples into a waste container

Automate up to 18 samples

The HI921 Autosampler is an automated titration sample handling system designed for use with the HI902C Potentiometric Titration System. This high quality system makes the titration of multiple samples quick and easy.

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.

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 method is established, the user can then customize the automation sequence for their samples. Sample names and size can be customized or auto-filled with preset values. Once the Autosampler sequence is complete, two reports are available for review: a sequence report with 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.

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

The Autosampler comes with multiple configurations for pumps, including up to three peristaltic pumps and a single membrane pump. The pump system has a simple install process and can be connected without the need of a technical repair person. The membrane pump system has a simple plug-in setup with clearly defined inputs for the tubing.

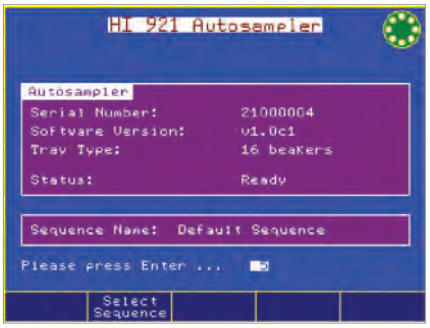
Status indicator lights

Status lights are located on both sides of the autosampler. These can be seen from far away and also correspond to the status indicator on the HI902C LCD. These lights double as a safety feature, as pressing them at any time will automatically stop any titration process.

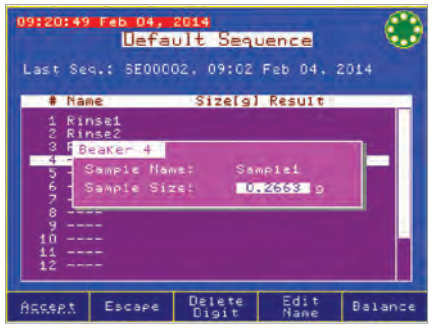
- Steady green
  - Idle, ready to start
- Flashing green
  - Titration sequence running

- Flashing yellow
  - Titration sequence paused

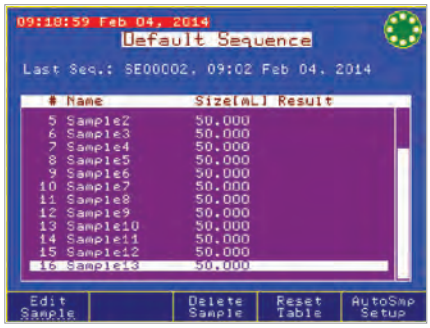
- Steady Red
  - Error or emergency stopped, or initializing during power on
- Flashing Red
  - Error during sequence running or manual operation



- 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
	1 overhead stirrer		HI920-060 (150 mL), fits HI920-11660 tray - 16 plastic beakers
Temperature Sensor	HI7662-A (included)		HI920-053 (100 mL), fits HI920-11853 tray - 18 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		2-line backlit display with status information
	installs in slots #1, 2, 3	Barcode Reader	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:

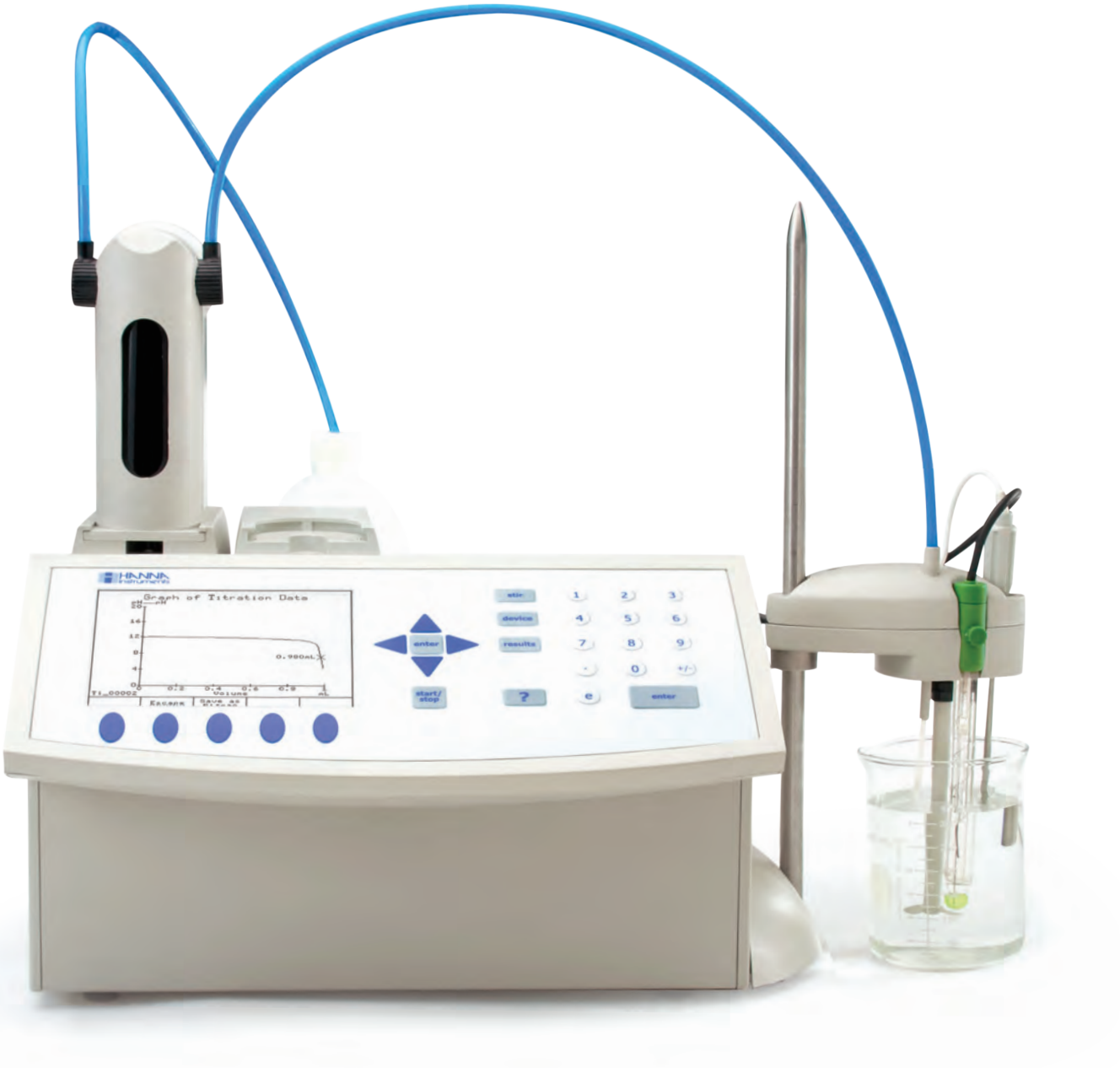
x=	1	16 sample tray
	2	18 sample tray
y=	0	no peristaltic pump
	1	one peristaltic pump
	2	two peristaltic pumps
	3	three peristaltic pumps
z=	0	no membrane pump
	1	one membrane pump

HI921 – x y z

Titration solutions and reagents begin on page 5.42; See accessories on page 5.43

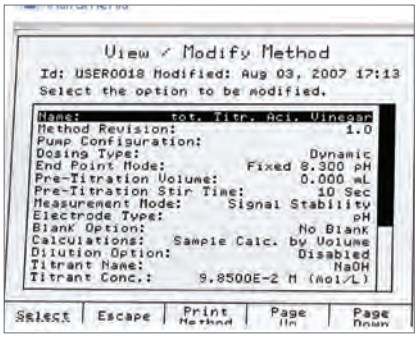
HI901

Automatic Titration System

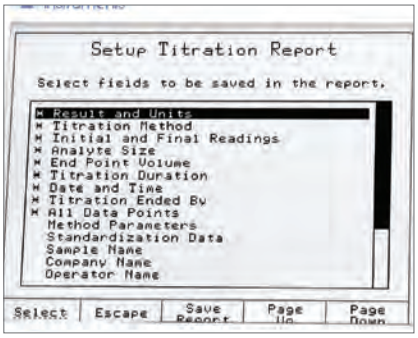


- Precise dosing system (accuracy under 0.1% of burette volume)
- Supports up to 100 titration methods (standard and user-defined)
- Clip-Lock™ Exchangeable Burette System
- Linear and dynamic dosing
- Fixed endpoint potential or pH
- Equivalence point detection (first derivative and second derivative)
- The results are displayed directly in the selected units
- Titration graph can be displayed on-screen and saved
- User-customized reports can be printed, saved on floppy disk or transferred to PC via RS232 interface
- Reminders for titrant age and standardization expiration
- Self-diagnostic features for peripheral devices including pump, valve, burette and stirrer

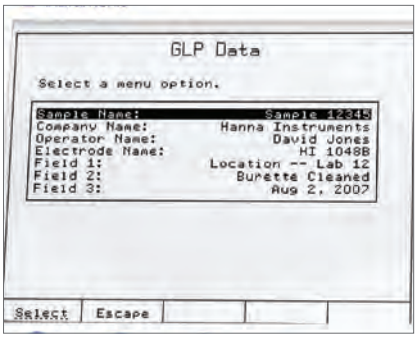
On-screen Features



- Custom methods



- Record up to 100 reports



- Incorporate Hanna 900 series titrators into any GLP data management program

Keep an Accurate Record of Analyses

- Users can easily record all necessary Good Laboratory Practice information with every sample, including sample identification, company and operator name, date, time, electrode ID codes and calibration information
- Data can also be transferred using the integrated floppy disk drive for communication with a PC or even other titration systems. Special memory cards are not required
- All test results can be transferred directly to a PC
- 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

Powerful Customization, Accurate Analysis

The HI901 is an automatic titrator that compliments our wide range of products dedicated to quick and accurate laboratory analysis.

This titration system is provided with a host of numerous features suitable for routine sample analysis and performs acid-base, potentiometric and amperometric titrations. The HI901 can also drive two pumps separately.

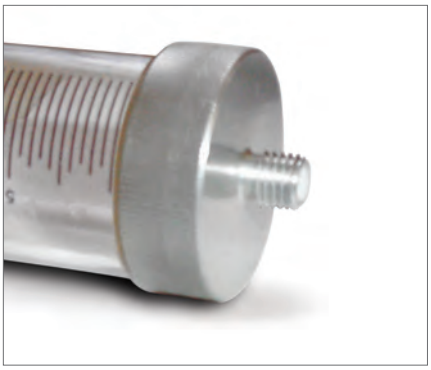
This versatile titrator supports up to 100 methods: standard or user defined. When powered on, the instrument initiates an internal diagnostics check and then readies itself for the first titration of the day. A large LCD screen clearly shows the chosen method, correlated information and also indicates which parameters may be adjusted. A real-time titration curve is 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, all data, including the graph, are automatically stored in memory and can be copied to disk via the built-in floppy drive or through direct connection with the serial cable supplied with the titrator. The titrators are equipped with an RS485 serial port.

Burette maintenance is simple and completely automated. The user can decide to purge or wash the burette, as well as select how many washings to perform. With our exclusive Clip Lock™ system for burette replacement, changing from one titrant to another is done in a flash! Often, preliminary titration operations are very long and arduous. A burette often needs to be adjusted for correct dosing, which extends waiting time for new sample analysis. Hanna has engineered a way to solve this problem.

The innovative Clip-Lock™ system allows users to change burettes in two simple steps, passing from one titrant to the next without any problem. Additionally, HI901 automatically recognizes the volume of the new burette.

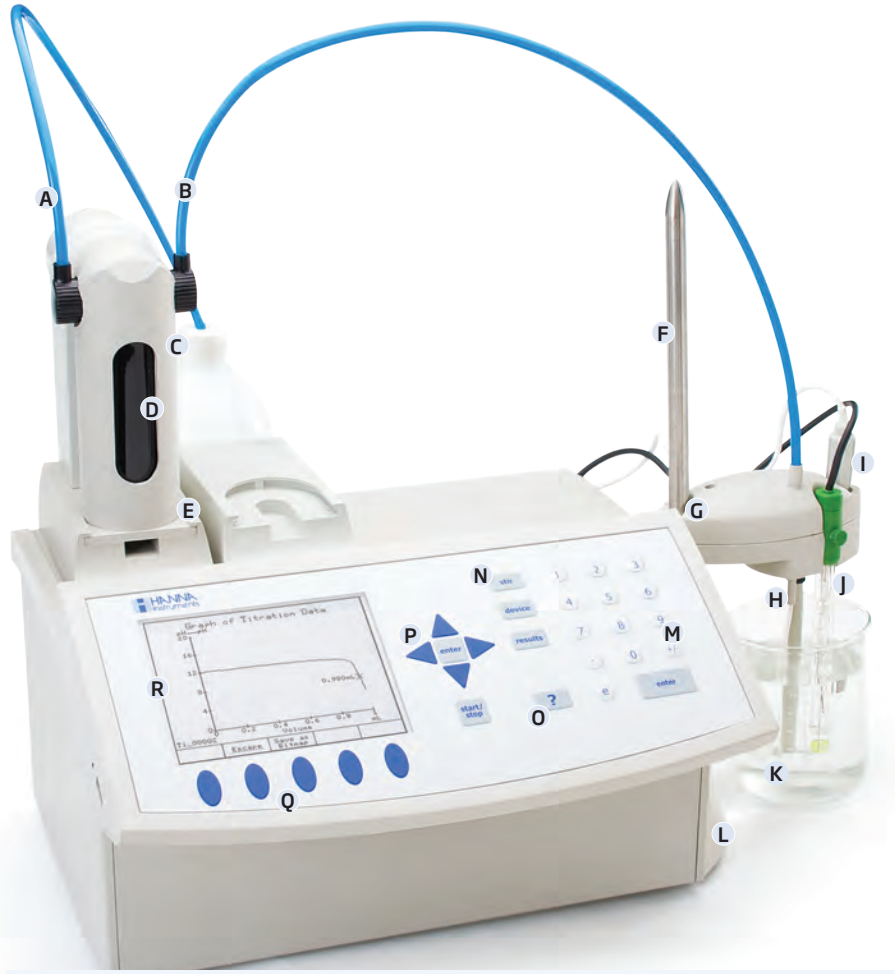
Users can connect pH, ORP or ISE electrodes to this unit, as well as create a complete workstation with a PC, monitor, keyboard and printer. This unit complies with GLP specifications, providing validation support for analysis. All GLP information from each sample can be stored, including ID number, date and time of analysis, electrode ID code and last calibration date.

Up to 100 reports of analyses, complete with titration curve graphing is possible. A calibration "time-out" can be set and the user can be advised when the pH electrode needs to be calibrated. The instrument's status can be viewed clearly on the large LCD screen. Contained in the set-up menu, features like language, display brightness, resolution, pH electrode calibration, date and hour can be adjusted. During analysis, the titration is displayed in real-time together with the stored data. Date, hour, temperature (when probe is connected) and warning messages, such as a pH electrode calibration message, can all be displayed for your convenience.



- Automatic burette volume recognition
  - This feature makes exchanging titrants convenient, safe and fast.

- Clip-lock™ Exchangeable Burette System
  - Keep several burettes on hand for a quick change.



A. Aspiration Tube (Titrant Inlet)	G. Sliding Positioning Collar	M. Numeric Keys
B. Dispensing Tube (Titrant Outlet)	H. Dispensing Tip	N. Function Keys
C. Burette Assembly	I. Temperature Sensor	O. Help Key
D. Light Shield (in closed state)	J. pH Electrode	P. Arrow Keys
E. Burette Support	K. Stirrer Propeller	Q. Option Keys
F. Support Bar	L. Stirrer Stand	R. 320 x 240 Pixel Graphic LCD

- Overhead stirrer
  - The optional stirrer ensures effective mixing with a selectable speed from 100 to 2500 rpm.

Clip-Lock™ Exchangeable Burette System

With Clip-Lock™, it only takes a couple of seconds to exchange the reagent burettes to perform a different titration.

With conventional titrators, there is the risk of cross-contamination of titrants when exchanging reagents. Reconfiguring the titrator for different sample methods consumes time and reagents. Each method may need different reagents and care must be used when purging and cleaning the burette. To avoid these problems, Hanna introduces the Clip-Lock™ exchangeable burette system to prevent cross-contamination while reducing loss of time and reagents. Burettes simply slide out for quick exchanges and detaching the aspiration and dispensing tubes from the titrant bottles is easy.

Hanna's burettes feature a threaded screw connection to prevent leakage problems. Burettes are available in 5 mL, 10 mL, 25 mL and 50 mL sizes and are made of chemically resistant material to ensure many years of trouble-free operation.

Specifications		HI901
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
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	graphic LCD, 320 x 240 pixel LCD
	Languages	English, Italian, Portuguese, Spanish
	Methods	up to 100 methods (standard and user-defined)
	Burette Auto-Detection	burette size is automatically recognized when inserted into the unit
	Programmable Stirrer	propeller type, 100-2500 RPM, resolution 100 rpm
	Flow Rate	user-selectable from 0.1 mL/min to 2 x burette volume/min
	pH/mV Measurement	titrators can also perform direct pH and mV measurements
	Temperature Compensation	manual or automatic (ATC)
	pH Calibration	manual or automatic at one to five points with four buffer sets or custom buffers
	Potentiometric Titrations	acid-base, redox, precipitation, complexometric, non-aqueous, ion-selective, argentometric
	End Point	fixed mV or pH end-point; equivalence point (with the 1st or 2nd derivatives)
	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, in pH-mode or mV-mode; pH/mV value versus time
	Data Storage	up to 100 complete titration and pH/mV logging complete reports
	Disk Drive	built-in 3.5" floppy disk drive allows storage and transfer of configurations, preprogrammed methods, custom methods, titration reports and bitmap graph files
	Peripherals	connections for VGA display, PC-keyboard, parallel printer, RS 232 input, interface for future expansion
	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	110V/220 Vac; 50-60Hz
	Dimensions	390 x 350 x 380 mm (15.3 x 13.8 x 14.9 in)
	Weight	approx. 10 kg (22 lbs.) with one pump and stirrer assembly
Ordering Information		**HI901-01** (115V) and **HI901-02** (230V) is supplied with pump assembly; burette assembly (burette with 25 mL syringe; aspiration tube with fitting and protection tube; dispensing tube with normal dispensing tip, fitting, protection tube and tube guide; tube locks; tool for valve fitting and burette cap removal; light spectrum protection screen), stirrer support, stand, collar and positioning screw; burette blank support; pump and burette locking screws with plastic head; temperature sensor; shorting cap; RS232 cable; HI900 PC software (FDD with installation kit); start-up disk (FDD with titrator installation kit); power cable; quality certificate and instruction manual.

Titration solutions and reagents begin on page 5.42; See accessories on page 5.43

HI903

Karl Fischer Volumetric Titrator

for Moisture Determination

Measures 100 ppm to 100% water content

- Precision titrant delivery system
  - 40,000 step piston dosing pump
  - Accurate to 0.1%
  - Delivers as little as 0.125 µL of titrant
  - Precision ground, 5 mL glass burette with PTFE plunger, PTFE burette tubing, and polyurethane tube jacketing (thermally insulating, light blocking)
  - Glass anti-diffusion dispensing tip
  - Clip-Lock™ exchangeable burette system enables users to exchange reagent burettes in a matter of seconds
- Sealed solvent system
  - Change to fresh solvent in a matter of seconds without opening the titration vessel
  - Minimizes exposure to ambient humidity which reduces titrant consumption and saves time
  - PTFE solvent tubing is resistant to harsh KF solvents and titrants
- Beaker top
  - Chemically-resistant reaction vessel cap and fittings
  - Quick-remove sample port plug with replaceable silicone rubber septum for sample introduction
- Anti-diffusion burette tip
  - Delivers titrant in high turbulence zone, ensuring rapid reaction
  - Prevents unwanted diffusion of titrant into solvent
- Built-in stirrer
  - Automatic, integrated magnetic stirrer adjustable from 200-2000 RPM
  - Optical feedback for automatic speed control
- Rechargeable indicating desiccant
  - Prevents the ingress of ambient humidity into the sealed solvent system while maintaining full titrator functionality
  - Minimizes changes to titrant titre
  - Indicates when adsorption capacity is depleted
  - Regenerated at 150°C
- PTFE bottle cap
  - Caps fit any GL45-threaded bottle
  - Chemically-resistant caps and fittings
  - Removable desiccant cartridges

Adaptable, High Accuracy Moisture Determination

The HI903 Karl Fischer Volumetric Titrator for moisture analysis is an extension of Hanna's highly successful potentiometric titrator platform. The HI903 combines an ultra-high precision titrant delivery system with optically-regulated magnetic stirring, sophisticated endpoint determination, dynamic dosing and background drift correction algorithms.

The result is an extremely adaptable titrator capable of titrating with superior accuracy and precision, even for samples with low moisture content. The HI903 dispenses the titrant, detects the endpoint and performs all necessary calculations automatically.

The HI903 comes equipped with a solvent-handling system to reduce cell conditioning time and can be connected directly to a laboratory analytical balance via RS232 serial interface.

The HI903's powerful software and intuitive menus are easily navigated on the large, color LCD display, making it simple to view results. Choose from included methods or develop a custom method for almost any application or sample type. Methods (standard or user) and reports can be transferred between titrator and PC via USB interface by using the Hanna PC software. Software updates can be performed using a USB flash drive.

Clip-Lock™ Exchangeable Burette System

With Clip-Lock™, it only takes a couple of seconds to exchange the reagent burettes to perform a titration with a different titrant.

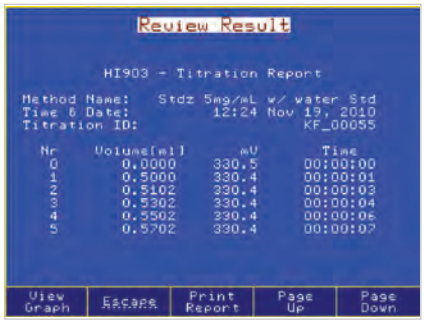
The Clip-Lock™ exchangeable burette system prevents cross contamination while reducing loss of time and reagents. Simply slide out the burettes, detach the aspiration tube from the titrant bottle, and detach the dispensing tube from the sample cell for quick exchanges.

- Titrant database
  - Stores standardization information for up to 20 titrants
  - Standardization reminders
- Supports up to 100 titration methods (standard and user defined)
- Dynamic dosing with optional pre-dispensing
  - For faster titration without sacrificing accuracy
- Results displayed directly in the selected units
- Titration graph can be displayed on-screen and saved as a bitmap
- Multi-language support
- USB flash drive input
  - Transfer methods, reports and graphs to a PC or other HI903 titration system
  - Field upgradable software
- Incorporates into any GLP data management program:
  - Easily record all necessary GLP information with every sample, including company and operator name, date, time, electrode ID codes and standardization information
- Compatible with most major brands of Karl Fischer reagents
- Proper mixing of titrant and analyte
  - Digital, magnetic stirring system with optical feedback
  - Conical titration cell to facilitate mixing over a wide volume range
  - Upward dispensing of titrant to ensure rapid reaction
- Flexible, accurate detection of the titration endpoint
  - Dual platinum pin electrode for bivoltammetric indication
  - Signal averaging reduces noise
  - Selectable endpoint criteria: fixed mV persistence, relative drift stop or absolute drift stop
- Balance interface
  - Automatically acquire sample mass via serial RS232 interface
- Easy to operate
  - User friendly interface
  - Context-sensitive help screens
  - Self-diagnostic features for external components including dosing pump, burette and stirrer
- Ideal for applications such as food and beverage, pharmaceuticals, nutraceuticals, cosmetics and chemical and petrochemical manufacturing

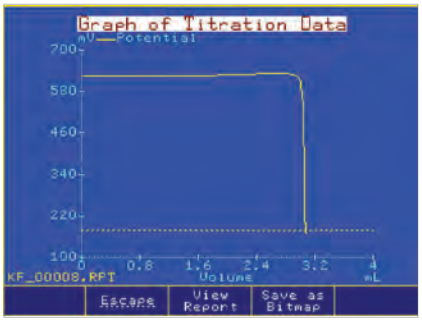
Versatile Data Management

- 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 the Hanna HI900PC software application
- 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

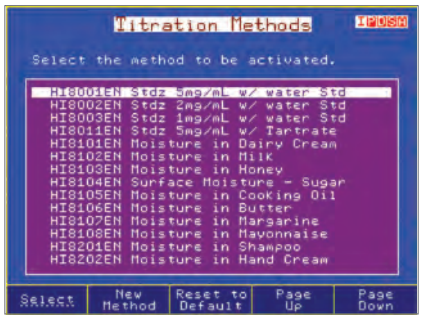
- Customizable reports
  - Titration reports are fully customizable



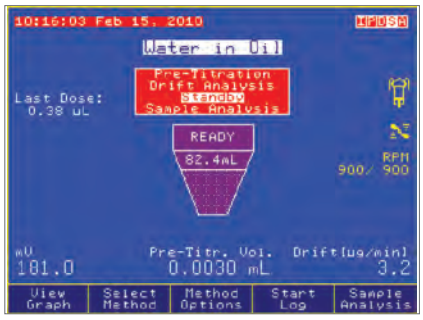
- Titration reports
  - Titration results can be viewed on-screen or transferred to a USB storage device



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

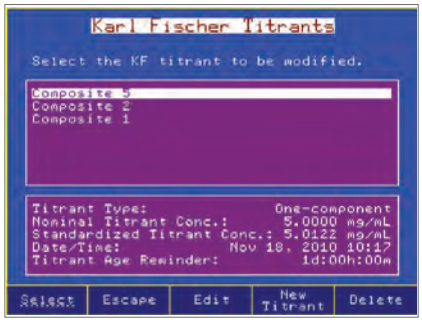


- Methods
  - The HI903 comes with a standard method pack

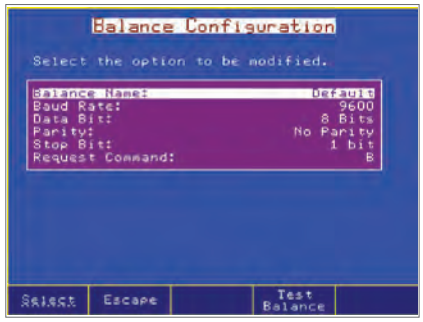


- Standby
  - The HI903 keeps the solvent dry between samples and corrects for water entering the cell (drift rate)

- Results
  - Titration results are displayed with links to average results or a user-customized report



- Titrant database
  - The HI903 stores standardization information for up to 20 titrants and displays a reminder when standardization is due



- Fully configurable balance interface
  - Enter sample size automatically from any laboratory analytical balance with RS232 serial output

- Fully customizable titration methods
  - Customize methods for any application

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
	Solvent Handling System	sealed system, integrated diaphragm air pump
Electrode	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
	Accuracy (@25°C/77°F)	±0.1 %
Stirrer	Type	magnetic, optically regulated, digital stirrer
	Speed	200-2000 rpm
	Resolution	100 rpm
Peripheral Devices	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.	

Titration solutions and reagents begin on page 5.42; See accessories on page 5.44

HI904

Karl Fischer Coulometric Titrator

Measures 1 ppm to 5% water content

- Precision dosing system by generator electrode
  - 400 mA pulsed current
  - Available with or without a diaphragm
- Molecular sieve desiccant
  - Prevents the ingress of ambient humidity into the sealed solvent system while maintaining full titrator functionality
  - Regenerated at 300°C
- Sealed cell
  - Generator electrode
  - Dual pin bivoltammetric platinum sensing electrode
  - Molecular sieve desiccant cartridge
  - Replaceable septum for liquid sampling port
  - Accessory port
  -
- Built-in stirrer
  - Automatic, integrated magnetic stirrer adjustable from 200-2000 RPM
  - Optical feedback for automatic speed control
- Sealed solvent system
  - Change to fresh reagent in a matter of seconds without opening titration vessel
  - Minimizes exposure to ambient humidity
  - PTFE tubing is resistant to harsh KF chemicals
  - Sealed tube holder to collect PTFE tube after exchanging reagent
- PTFE bottle cap
  - Caps fit any GL45-threaded bottle
  - Chemically-resistant caps and fittings
  - Removable desiccant cartridges

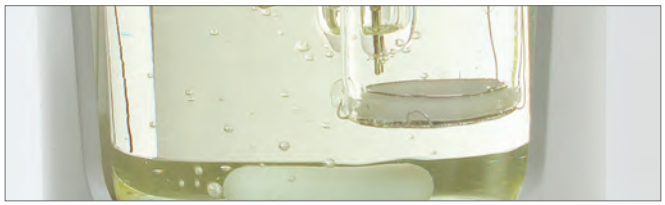
Adaptable, High Accuracy Moisture Determination

The HI904 Karl Fischer Coulometric Titrator for moisture analysis is an extension of Hanna's highly successful titrator platform. The HI904 combines an ultra-high electrolytically generated iodine dynamic dosing system with optically-regulated magnetic stirring, sophisticated endpoint determination, and background drift correction algorithms.

The result is an extremely adaptable titrator capable of titrating with superior accuracy and precision for samples with low moisture content. The HI904 applies a pulsed DC current for titrant generation, detects the endpoint and performs all necessary calculations automatically.

The HI904 comes equipped with a solvent handling system to reduce cell conditioning time and can be connected directly to a laboratory analytical balance via RS232 serial interface.

The HI904's powerful software and intuitive menus are easily navigated on the large, color LCD display, making it simple to view results. Choose from included methods or develop a custom method for almost any application or sample type. Methods (standard or user) and reports can be transferred between titrator and PC via USB interface by using the Hanna PC software. Software updates can be performed using a USB flash drive.



- Fritted (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

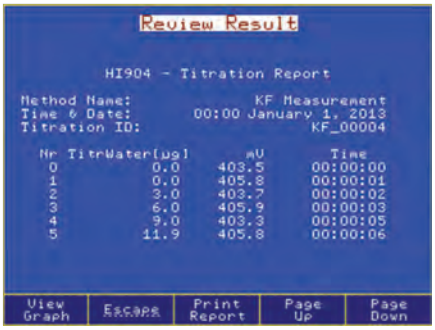
- Fritless (No Diaphragm) Generator
  - Uses one easy-to-replace Karl Fischer reagent
  - Lower and more stable drift rates
  - Easier cleaning of generator cell

- Supports up to 100 methods (standard and user-defined)
- Results displayed directly in the selected units
- Titration graph can be displayed on-screen and saved as an image to be transferred to a PC or printed
- USB flash drive input
  - Transfer methods, reports and graphs to a PC or other titration system
  - Field upgradable software
- Incorporates into any GLP data management program:
  - Easily record all necessary GLP information with every sample, including company and operator name, date, time, electrode ID codes and standardization information
- Proper mixing of reagent and sample
  - Digital, magnetic stirring system with optical feedback
  - Adjustable stirring speed to facilitate mixing
- Flexible, accurate detection of the titration endpoint
  - Dual, platinum pin polarization electrode for bivoltammetric detection of endpoint
- Multi-language support
- Balance interface
  - Automatically acquire sample mass via RS232 serial interface
- Easy to operate
  - User-friendly interface
  - Contextual help screens

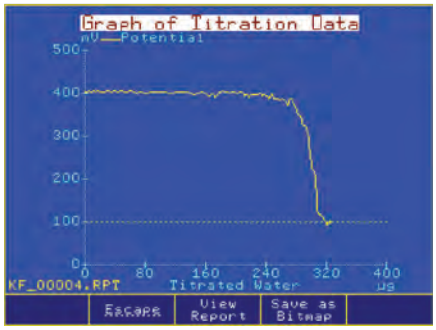
Versatile Data Management

- 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 the Hanna HI900PC software application
- 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



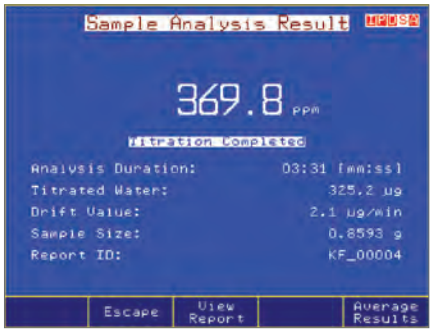
- Titration reports
  - Titration results can be viewed on-screen or transferred to a USB storage device



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

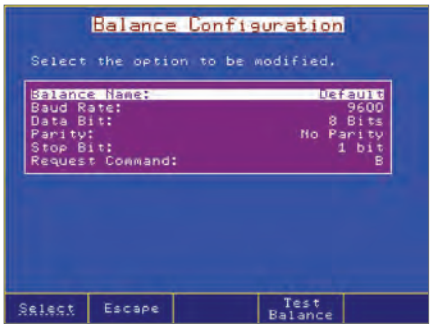
- Sample analysis
  - Interface displays real-time monitoring of water content and results

- Standby
  - The HI904 keeps the solvent dry between samples and monitors the drift rate

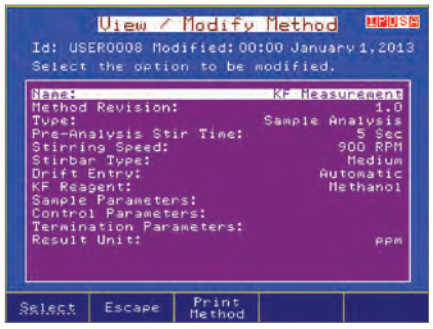


- Results
  - Titration results are displayed with options to average results or a user-customized report

- 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, µg/g, mg, µg, mg/mL, µg/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
	Result Statistic	mean, standard deviation
Detector Electrode	Type / Connection	dual platinum pin, polarization electrode / BNC connector
	Polarization Current	1, 2, 5, or 10 µA
	Voltage Range	2 mV to 1100 mV
	Voltage Resolution	0.1 mV
	Accuracy (@25°C/77°F)	±0.1%
Peripheral Devices	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
	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 (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	**HI904D-01** (with Diaphragm), **HI904-01** and **HI904D-02** (with diaphragm) and **HI904-02** are supplied with 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.	

Titration solutions and reagents begin on page 5.42; See accessories on page 5.44

HI84530

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
  - Meets Good Laboratory Practices
- Easy-to-use interface
  - User intuitive design with large keys and easy to navigate screens
- HELP features
  - Dedicated HELP key with content sensitive help
- pH/mV 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.

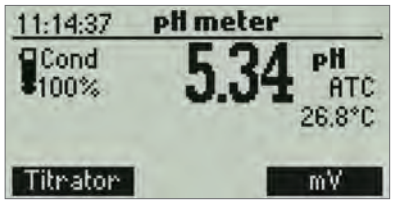
This mini titrator is also designed to be used as a benchtop pH/mV meter. The CAL Check™ function not only ensures an accurate pH reading when the HI84530 is used as a pH meter but also an accurate titration since the end point is determined by a set pH value.

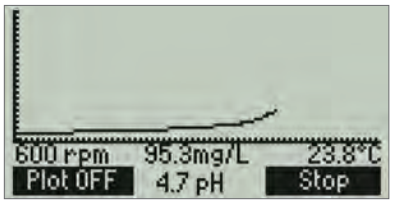
Total Titratable Acidity

Water acidity is an important parameter to monitor as it can affect the corrosive capacity of 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 hydrogen ions present in a sample. Many factors can contribute to the acidity of a 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 $CaCO_3$)	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
	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	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 (pH 4.01, 7.01, 8.30, 10.01)
	Temperature Compensation	manual or automatic from -20 to 120 °C (-4 to 248 °F)
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
	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)
	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.)
Ordering Information		**HI84530-01** (115V) and **HI84530-02** (230V) are supplied with HI1131B pH electrode, HI7662-M temperature probe, 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.

Titration solutions and reagents begin on page 5.42; See accessories on page 5.45

HI84531

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
  - Meets Good Laboratory Practices
- 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

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 determines 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 end point (known as phenolphthalein alkalinity) or total alkalinity with a 4.50 pH endpoint (known as bromcresol 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 $CaCO_3$.

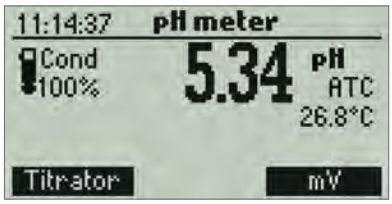
This mini titrator is also designed to be used as a benchtop pH/mV meter. The CAL Check™ function not only ensures an accurate pH reading when the HI84531 is used as a pH meter but also an accurate titration since the end point is determined by a set pH value.

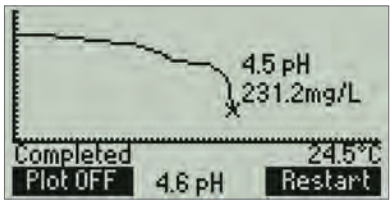
Total Alkalinity

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 $CaCO_3$)	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); 0.1 meq/L
	Accuracy (@25°C/77°F)	Low Range: ±1 mg/L or 3% of reading, whichever is greater High Range: ±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)	± 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)	± 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	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-M stainless steel temperature probe with 1 m (3.3') cable (included)
	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")
	Weight	1.9 kg (67.0 oz.)
Ordering Information		**HI84531-01** (115V) and **HI84531-02** (230V) are supplied with HI1131B pH electrode, HI7662-M temperature probe, HI84531-70 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.

Titration solutions and reagents begin on page 5.42; See accessories on page 5.45

HI84529

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
  - Meets Good Laboratory Practices
- 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

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 end point titration using sodium hydroxide, 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 end point.

Degree Soxhlet Henkel (°SH): is determined by titrating a 50 mL sample with 0.1 M sodium hydroxide to a phenolphthalein end point.

Degree Dornic (°D): is determined by titrating a 100 mL sample with N/9 sodium hydroxide to a phenolphthalein end point.

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 end point.

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 end point 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 end point 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-M stainless steel temperature probe with 1 m (3.3') cable (included)
	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 (67.0 oz.)
Ordering Information		**HI84529-01** (115V) and **HI84529-02** (230V) are supplied with HI84529-70 Reagent Kit for titratable acidity in dairy products, FC260B pH electrode, HI5315 reference electrode, HI7662-M 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.

Titration solutions and reagents begin on page 5.42; See accessories on page 5.46

HI84532

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
  - Meets Good Laboratory Practices
- Easy-to-use interface
  - Intuitive design with large keys and easy to navigate screens
- Help features
  - Dedicated HELP key
- pH/mV 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.

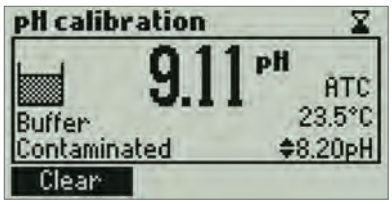
This mini titrator is also designed to be used as a benchtop pH/mV meter. The CAL Check™ function not only ensures an accurate pH reading when the HI84532 is used as a pH meter but also an accurate titration since the end point is determined by a set pH value.

The Importance of Titratable Acidity

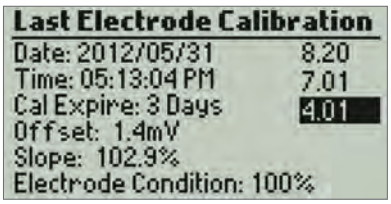
Titratable acidity is an important parameter in determining fruit maturity and sour taste in citrus fruits. The maturity of fruit is one of the most important factors to determine how well fruit will store and how it will taste. For some fruits, governmental quality standards (based on titratable acidity 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 hydrogen ions 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.

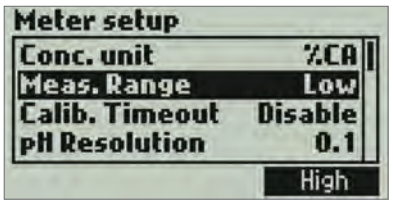
On-screen Features



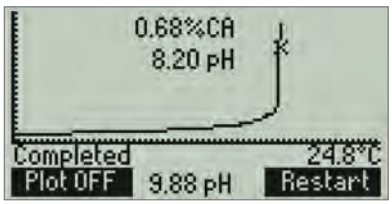
- CAL Check™
  - CAL Check™ is a Hanna exclusive process for checking the condition of pH electrodes for accurate measurments



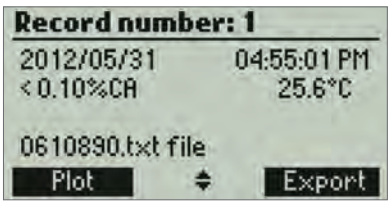
- GLP
  - The GLP feature records electrode and pump calibration data to help keep measurements accurate and reliable.



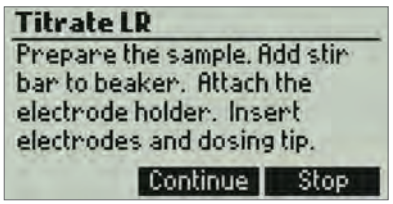
- Setup screens
  - The LCD features an easy to use setup screen.



- 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		HI84532
Titrator	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% or 3% of reading CA 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-M stainless steel temperature probe with 1 m (3.3') cable(included)
	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 (67.0 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-M 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.

Titration solutions and reagents begin on page 5.42; See accessories on page 5.46

HI84533

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
  - Meets Good Laboratory Practices
- 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

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.

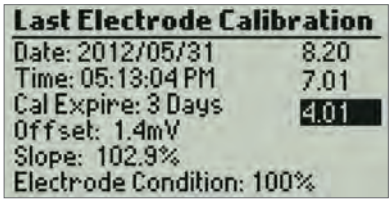
The HI84533 has two operating options:

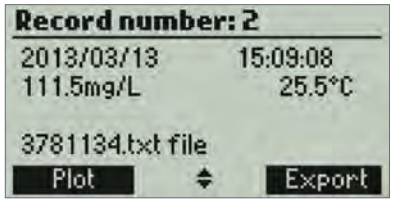
1. pH measurement using the meter in pH mode
2. Formol number determination by titration of wines and fruit juice samples with sodium hydroxide solution to an 8.2 pH endpoint.

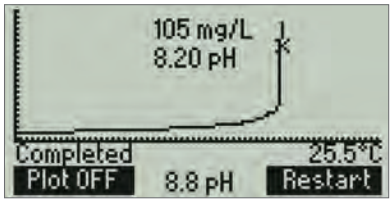
In wines, the concentration of alpha amino acid in grapes change as a function of maturity and crop load (yield to vine size ratio). The concentration increases with fruit maturation and decreases with crop load. In the fermentation of wine, there is a minimum amount of amino acid and other nitrogen 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







- GLP
  - The GLP feature records electrode and pump calibration data to help keep measurements accurate and reliable.
- 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		HI84533
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 71.4meq/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
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; 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-M stainless steel temperature probe with 1 m (3.3') cable (included)
	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		**HI84533-01** (115V) and **HI84533-02** (230V) are supplied with HI84533-70 reagent kit for formol number in wine and fruit juices, HI1131B pH electrode, HI7662-M temperature probe, HI7082 electrode fill solution (30 mL), 100 mL beakers (2), HI70500 tube set (aspiration tube with titrant bottle cap and dispensing tube with tip), dosing pump valve, HI740236 syringe (5 mL), plastic pipette (1 mL), HI731319 stir bar, cleaning solution sachets for wine deposits and wine stains (2), power adapter, instruction manual and quality certificate.

Titration solutions and reagents begin on page 5.42; See accessories on page 5.47

HI84500

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
  - Meets Good Laboratory Practices
- Easy-to-use interface
  - User intuitive design with large keys and easy to navigate screens
- HELP features
  - Dedicated HELP key for content sensitive help

Abn 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 (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 SO_2 is added to wine, a portion of it becomes immediately bound while a remaining portion is unbound SO_2. The portion that is unbound is also called free SO_2; it is responsible for protecting the wine.

The bound and free SO_2 together are referred to as total SO_2. The relationship between the amount of SO_2 added and the amount of free SO_2 is complex. This relationship is governed by the total amount of SO_2 in the wine and the ability of compounds (e.g. sugars, aldehydes, ketonic acid, quinones, anthocyanin) in the wine to bind SO_2.

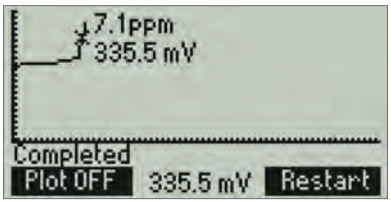
The exact relationship between free and bound SO_2 will vary from wine to wine. The amount of free SO_2 depends on how much is added, how much was present before the addition, and how much was immediately bound. Free SO_2 exists in two forms: bisulfite (HSO_3^-) is the predominant form but is relatively ineffective and molecular SO_2 is the minor form and is responsible for protecting the wine. The amount of molecular SO_2 available in wine is depended on the amount of free SO_2 present and the pH. Typically 0.8 ppm of molecular 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 SO_2; if the pH was at 3.5 you would need double the amount, 44 ppm of free SO_2.

Molecular 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 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

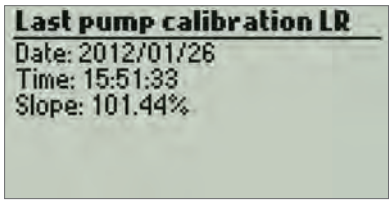
The HI84500 is supplied with the HI3148B ORP electrode featuring CPS™ technology to prevent the clogging of the reference junction. Conventional electrodes may clog quickly in biological samples such as wine. By design, the HI3148B ORP electrode utilizes a ground glass/PTFE sleeve junction which controls a steady, predictable flow of electrolyte solution, keeping the junction open. The hydrophobic properties of PTFE repels wetness and coatings.

On-screen Features

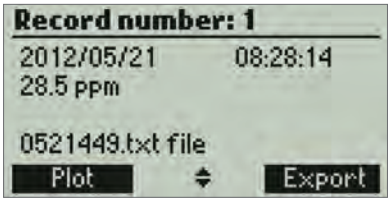


- Titration curve displayed on screen
  - The HI84500 offers real time graphing of the titration curve on the LCD.

- ORP
  - During ORP measurements, the stirrer icon will be displayed when the stirrer is on

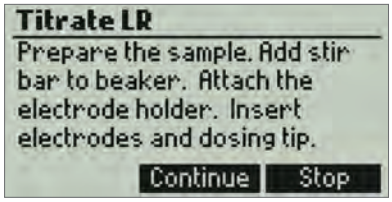


- GLP
  - Records pump calibration data to ensure measurements are accurate and reliable.



- 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_2 High Range: 30 to 400 ppm of SO_2
	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 rethod
	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)
	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		**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_2 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 (50 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, cleaning solution sachets for wine deposits (2), cleaning solution sachets for wine stains (2), 12 VDC adapter and instruction manual.

Titration solutions and reagents begin on page 5.42; See accessories on page 5.47

HI84502

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
  - Meets Good Laboratory Practices
- Easy-to-use interface
  - User intuitive design with large keys and easy to navigate screens
- Help features
  - Dedicated HELP key for content sensitive help

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 ±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.

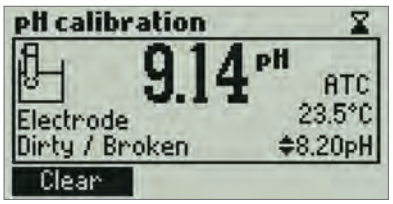
The Significance of Titratable Total Acidity

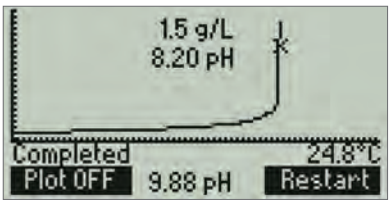
Acids occur naturally during the growing of grapes and as part of the fermentation process. Wines show lower levels of acid when there is a hot growing season or when the grapes come from warmer regions. In the proper proportion, acids are a desirable trait and give the wine character. The three predominant 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.

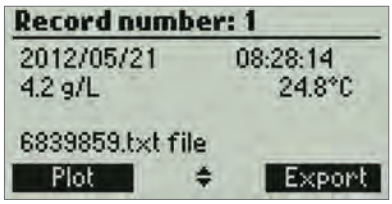
Total acidity, also called titratable acidity, is the sum of the fixed and volatile acids. In the United States the total acidity is usually expressed in terms of tartaric acid, even though the other acids are measured.

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 of tartaric acid High Range: 4.0 to 25.0 g/L 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-M stainless steel temperature probe with 1 m (3.3') cable (included)
	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	**HI84502-01** (115V) and **HI84502-02** (230V) are supplied with HI1048B pH electrode, HI7662-M 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, (2) 20 mL beakers,dosing pump valve, 2000 µL, automatic pipette 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, cleaning solution sachets for wine deposits, cleaning solution sachets for wine stains (2), 12 VDC adapter and instruction manual.	

Titration solutions and reagents begin on page 5.42; See accessories on page 5.48

Titration Solutions & Reagents

HI70401	potassium hydrogen phthalate, 20 g
HI70402	tartaric acid, 20 g
HI70403	sodium thiosulfate pentahydrate, 20 g
HI70404	KI 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
HI70423	NaOH solution (0.11N), 1 L
HI70424	amino-propanol buffer, 25 mL
HI70425	sulfuric acid solution (16%), 500 mL
HI70426	glyoxal solution (40%), 100 mL
HI70427	HNO_3 solution (1.5 M), 500 mL
HI70428	NaOH solution (0.25 N), 1 L
HI70429	$AgNO_3$ solution (0.05 M), 1L
HI70432	hydrogen peroxide solution (3%), 25 mL
HI70433	stabilized iodine solution (0.01N), 1L
HI70434	phosphoric acid (85%), 500 mL
HI70435	NaOH solution (5 M), 500 mL
HI70436	deionized water, 1 G
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), 1 L

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	$AgNO_3$ solution (0.02 M), 1 L
HI70449	EDTA solution (0.02 M), 1 L
HI70453	HCl solution (0.02 N), 1 L
HI70454	NaOH solution (0.02 N), 1 L
HI70455	NaOH solution (0.01 N), 1 L
HI70456	NaOH solution (0.1 N), 1 L
HI70457	NaOH solution (1 N), 1 L
HI70458	H_2SO_4 solution (0.01 M), 1 L
HI70459	H_2SO_4 solution (0.05 M), 1 L
HI70462	HCl solution (0.01 N), 1 L
HI70463	HCl solution (0.1 N), 1 L
HI70464	HCl solution (1 N), 1 L
HI70465	hydrogen peroxide solution (30%), 30 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 & Reagents

HI902C and HI901 Automatic Titration System Accessories

Accessory Code	Description
HI900100	dosing pump
HI900150	50 mL burette assembly (includes syringe, aspiration, and dispensing tubes)
HI900125	25 mL burette assembly (includes syringe, aspiration, and dispensing tubes)
HI900110	10 mL burette assembly (includes syringe, aspiration, and dispensing tubes)
HI900105	5 mL burette assembly (includes syringe, aspiration, and dispensing tubes)
HI900250	50 mL burette syringe
HI900225	25 mL burette syringe
HI900210	10 mL burette syringe
HI900205	5 mL burette syringe
HI900260	3-way valve (includes 3 gaskets and 2 screws)
HI900270	aspiration tube with fitting (includes blue protection tube, gasket, and tube lock)
HI900280	dispensing tube with fitting (includes standard dispensing tip, blue protection tube, gasket, and tube lock)
HI900301	overhead stirrer assembly (includes overhead stirrer and 3 propellers)
HI900302	propeller (includes 3 propellers)
HI900303	propeller (includes 3 chemically resistant propellers)
HI900310	overhead electrode holder (includes overhead stirrer without electronics or propeller)
HI900320	stirrer stand
HI7662-T	temperature probe
HI900942	tool for burette cap removal
HI900946	power adapter
HI920013	USB cable (HI902C only)

See HI902C on page 5.8; See HI901 on page 5.16

HI921 Autosampler Accessories

Accessory Code	Description
HI920-11660	single row with RFID, 16 beaker position, 60mm dia.
HI920-060	plastic beakers that fit HI920-11660 (20)
HI920-11853	single row with RFID, 18 beaker position, 53mm dia.
HI920-053	plastic beakers that fit HI920-11853 (20)
HI920-301	overhead stirrer
HI920-101	peristaltic pump with dispensing tubing
HI920-102	peristaltic pump with aspiration tubing
HI920-201	peristaltic pump replacement cap and rotor
HI920-202	peristaltic pump complete tubing set with plastic dispensing tube
HI920-203	peristaltic pump complete tubing set with stainless-steel aspiration tube
HI920-204	peristaltic pump roller tube (3)
HI920-111	membrane pump with tubing
HI920-212	membrane pump tubing set
HI920-290	5m TYGON tube
HI920-280	1.5m Burette/Autosampler titrant dispensing tube
HI920-302	replacement propellers (3)
HI920-303	high chemical resistance replacement propellers (3)
HI920-310	three electrode holder
HI920-900	USB memory stick
HI920-921	control panel for HI921
HI920-930	titrator/autosampler communication cable
HI920-931	BNC extension cable (1m)
HI920-932	reference extension cable (1m)
HI920-960	tray locking screw
HI7662-A	autosampler temperature sensor w/1.5m cable
HI731319	25 mm x 7 mm stir bars (10)

See HI921 on page 5.12

Meter Accessories & Reagents

HI903 KF Volumetric Titrator Accessories

Accessory Code	Description
HI76320D	dual platinum pin KF electrode with BNC connector
HI900100	titrant dosing Pump
HI900520	beaker assembly (beaker, dispensing tip, fittings, o-rings, top, holder,stirrer, solvent port plug)
HI900505	5 mL burette assembly (syringe, aspiration, and dispensing tubes)
HI900205	5 mL burette syringe
HI900260	3-way valve (3 gaskets and 3 screws)
HI900522	KF beaker (glass only)
HI900523	dispensing tip (2)
HI900527	septum (5)
HI900528	solvent port plugs (2)
HI900530	titrant bottle top assembly
HI900531	solvent/waste bottle top assembly
HI900532	desiccant cartridge for KF beaker or titrant bottle top
HI900533	desiccant cartridge for solvent or waste bottle top
HI900534	waste bottle
HI900180	solvent-handling pump
HI900535	tubing for solvent/waste handling
HI900536	tubing for solvent-handling pump
HI900540	O-ring set
HI900570	aspiration tubing and fitting (PTFE titrant tubing, blue protection and tube lock)
HI900580	dispensing tubing and fitting (PTFE titrant tubing)
HI900942	tool for burette cap removal
HI920013	USB cable for PC connection

See HI903 on page 5.20

HI904 KF Coulometric Titrator Accessories

Accessory Code	Description
HI900561	titration vessel (glass only)
HI76330	detector electrode
HI900511	generator electrode with diaphragm
HI900512	generator electrode without diaphragm
HI900180	solvent handling pump
HI900181	reagent adapter holder assembly
HI900182	reagent adapter holder (glass only)
HI900560	titration vessel assembly
HI900568	reagent exchange adapter
HI900537	bottle top assembly (with molecular sieves)
HI900538	desiccant cartridge for reagent/waste bottles (with molecular sieve)
HI900535	tubing set for reagent/waste handling (2)
HI900536	tubing for solvent handling pump (2)
HI900566	open-top GL18 cap
HI900563	glass stopper, standard taper 19
HI900564	desiccant cartridge for generator electrode
HI900542	O-ring set
HI900534	waste bottle
HI900551	molecular sieves, 150 g
HI900940	calibration key
HI900946	24V power supply
HI900567	septum kit (5)
HI900543	glass joint grease
HI900931	generator cable
HI920013	USB Cable for PC Connection

See HI904 on page 5.24

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-M	replacement temperature probe

See HI84530 on page 5.28

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-M	replacement temperature probe

See HI84531 on page 5.30

Meter Accessories & Reagents

HI84529 Titratable Acidity Mini Titrator and pH Meter Reagents and Accessories

Reagent Code	Description
HI84529-50	titrant solution for low range 20, 120 mL
HI84529-51	titrant solution for high range 20, 120 mL
HI84529-52	titrant solution for low range 50, 120 mL
HI84529-55	pump calibration standard, 230 mL
HI7004M	pH 4.01 buffer, 230 mL
HI70060M	pH 6.00 buffer, 230 mL
HI70083M	pH 8.30 buffer, 230 mL
HI7010M	pH 10.01 buffer, 230 mL
HI70300M	storage solution, 230 mL
HI70640M	cleaning solution for milk deposits, 230 mL
HI70641M	cleaning and disinfection solution for dairy products, 230 mL
HI7072	reference half-cell filling solution, 1M KNO_3, 30 mL (4)

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)
HI740037P	20 mL beaker (10)
HI740236	5 mL syringe for mini titrator
HI920013	PC connection cable
FC260B	replacement pH half-cell electrode for dairy
HI5315	replacement reference half-cell electrode
HI7662-M	replacement temperature probe

See HI84529 on page 5.32

HI84532 Titratable Acidity Mini Titrator and pH Meter Reagents and Accessories

Reagent Code	Description
HI84532-50	titrant solution for low range, 120 mL
HI84532-51	titrant solution for high range, 120 mL
HI84532-55	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
HI7061M	general purpose cleaning solution, 230 mL
HI7082	pH electrode filling solution, 3.5M KCl, 30 mL (4)

Accessory Code	Description
HI731342	automatic pipette (2000 µL)
HI731352	tips for 2000 µL automatic pipette (4)
HI70500	tube set with cap for titrant bottle, tip and valve
HI731319	stir bar, 25 x 7 mm (10)
HI740036P	100 mL beaker (10)
HI740037P	20 mL beaker (10)
HI740236	5 mL syringe for mini titrator
HI920013	PC connection cable
HI1131B	replacement pH electrode
HI7662-T	replacement temperature probe

See HI84529 on page 5.34

HI84533 Formol Number Mini Titrator and pH Meter Reagents and Accessories

Reagent Code	Description
HI84533-50	titrant solution, 230 mL
HI84533-55	pump calibration standard, 120 mL
HI84533-60	additional reagent, 30 mL
HI84533-61	formol base reagent, 230 mL
HI84533-62	pH adjustment reagent, 30 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
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-M	replacement temperature probe

See HI84529 on page 5.36

HI84500 Sulfur Dioxide Mini Titrator for Wine Analysis Reagents and Accessories

Reagent Code	Description
HI84500-50	titrant solution for low range, 230 mL
HI84500-51	titrant solution for high range, 230 mL
HI84500-55	pump calibration standard, 120 mL
HI84500-60	acid reagent, 230 mL
HI84500-61	alkaline reagent (Total SO_2), 120 mL
HI84500-62	stabilizer powder packets (100)
HI7082	pH electrode filling solution, 3.5M KCl, 30 mL (4)
HI7021M	ORP test solution @ 240 mV (@25 °C), 230 mL
HI7092M	oxidizing pretreatment solution, 230 mL
HI70635M	cleaning solution for wine deposits, 230 mL
HI70636M	cleaning solution for wine stains, 230 mL
HI70300M	storage 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)
HI740037P	20 mL beaker (10)
HI740236	5 mL syringe for mini titrator
HI920013	PC connection cable
HI3148B	ORP electrode for wine

See HI84500 on page 5.38

Meter Accessories & 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 µL automatic pipette (4)
HI731342	automatic pipette 2000 µL
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-M	replacement temperature probe

See HI84502 on page 5.40

Table of Contents

Conductivity/TDS Meters Introduction

Definition of Conductivity

Electrolytic conductivity, abbreviated as EC, is a measurement made in which electrical charges on atomic or larger sized particles in a medium are moved under the influence of a potential difference. EC is a measure of concentration however it is non-specific for ion type. An ion is a charged particle present in the solution that contributes to the current flow. Ions are formed when a salt such as sodium chloride is dissolved in water to form particles having electrical charges. Sodium chloride for example, separates into Na+ and Cl-. This is a simplified definition for the measurement is affected by many things such as the type of ionic compound(s) dissolved in the water; the ions mobility, the solution viscosity, temperature as well as concentration.

Electrical conductance, the ability of a substance to conduct an electrical current is the reciprocal of electrical resistance. Conductance" and "Resistance" depend on the geometrical dimensions of the substance being measured. Conductivity and resistivity are "normalized" terms that are used to denote a bulk intrinsic property of a substance. This is the measurement a standardized EC probe on a Conductivity or resistivity meter provides. Conductivity measurements can be used to provide additional industry specific measurements; TDS, Salinity and USP compliant conductivity. Many of Hanna's meters provide these measurements also.

Units of Measurement

Electrical Resistivity ρ (Greek rho), also called Specific Resistance (1cm cube) uses units of Ohm.cm. For example, ultrapure water is said to have a value of 18.16 Mohm.cm.at 25°C.

Electrical Conductivity σ (Greek sigma and other symbols used also, is the reciprocal of resistivity and uses units of Siemens/cm (S/cm, mS/cm, µS/cm, dS/m). For example, ultrapure water is said to have a conductivity of .055µS/cm at 25°C.

The IUPAC convension

1000 microSiemens/cm (µS/cm) = 1.0 milliSiemen/cm (mS/cm).

Note: prior to 1971 mho/cm was the unit used for conductivity. This unit can still be found in some older literature.

Conductivity versus Resistivity

Although conductivity and resistivity are reciprocal units that may be converted easily, convention uses Resistivity for very low electrolyte concentrations or trace contaminants i.e. Ultrapure water, and Conductivity for expressing meaningful salt Levels i.e. Sea water; electroplating baths, acid concentrations. Electrode style and measurement techniques also contribute to success in making conductivity or resistivity measurements reliably. Conductivity measurements can be used to provide useful industry specific measurements such as TDS, Salinity and USP compliant conductivity and many of Hanna's conductivity meters provide the computing power to provide these measurements automatically.

TDS

TDS (total dissolved solids), is a method used to determine solid content in a solution. To determine TDS, the solution whose volume is known is evaporated and the residue weighed. A conductivity measurement is commonly used to estimate TDS (Total Dissolved Solids) based on the assumption the solids are predominately ionic in nature and the relationship between the dissolved ions and conductivity is known. TDS uses units of mg/L (ppm), or g/L. On some meters the user can input the TDS factor for the conversion. On more basic units the factor is automatically set to 0.50 A typical

TDS factor for strong ionic solutions is 0.5, while for weak ionic solutions (e.g. fertilizers) is 0.7.

TDS = factor x EC_{25}

For example: 100µS/cm conductivity is a TDS of 50ppm when the factor is 0.5.

Conductivity/Resistivity/TDS of Commonly Measured Substances

Sample at 25°C	MΩ•cm	µS/cm	mS/cm	TDS
Ultrapure Water	18.16	.055		
Power Plant Boiler Water	1.0	1.0		0.5 ppm
Drinking Water		500-800	0.5 to 0.8	250 to 400 ppm
Ocean Water		53000	53.0	9.24 g/L
1M NaCl		85000	85.0	42.5 g/L
5% NaOH		223000	223	
50% NaOH		150000	150	
1M HCl		332000	332	
10% HCl		700000	700	
32% HCl		700000	700	
31% HNO_3		865000	865	

Salinity

Conductivity measurements can be used for determining salinity as it relates to general oceanographic

use. Three measurement scales are in use and depending on the sophistication of the meter, are available for salinity measurement in Seawater. The 3 scales are Practical Salinity Scale (PSU); 1978, Percent Scale (%);and Natural Seawater Scale(g/L); 1966.

Practical salinity and the Natural Seawater require a conductivity calibration. The meters have the algorithms to convert the measurement to the desired scale. NaCl % requires a calibration in HI70371 standard. Portable meters with this measurement make it easy to measure salinity in salt water aquariums and brackish waters.

Conductivity and Temperature

Conductivity changes with ion concentration and with temperature. For example, a standard potassium chloride solution used for calibration of a cell constant and conductivity bridge, changes conductivity as tabulated at right.

Conductivity 0.01m KCl	
°C	uS/cm
21	1305
22	1332
23	1359
24	1386
25	1413
26	1441
27	1468
28	1496

Having two variables changing would make it near impossible to take useful conductivity measurements. If the temperature was held constant, the conductivity measurement would only have the variable of ion concentration. Absolute conductivity is a conductivity measurement without temperature compensation. If the conductivity change with temperature change of a solution is a known characteristic, the Conductivity measurements can be corrected to a reference temperature (typically 20 or 25°C) by carefully measuring the solution temperature. Fortunately, Hanna EC sensors incorporate an integral temperature sensor to measure solution temperature. Compensation corrects the measured conductivity to a reference temperature by applying a fixed factor β for linear compensation. High end meters allow adjustment of β to compensate for various solutions and permit adjustment of a reference temperature over a wider range of temperatures. β for neutral salts is typically between 1.5 to 2.2%/°C.

$$EC_{25} = \frac{EC_x}{(1+\beta_{25}(T_x-25))}$$

Typical Temperature Coefficients of Various Solutions

Sample	Percent / °C
Ultrapure Water	4.55
NaCl	2.12
5% NaOH	1.72
10% HCl	1.32
5% H_2SO_4	0.96
98% H_2SO_4	2.84

Non- linear temperature compensation for Natural waters is found some high end bench meters.

(USP) United States Pharmacopeia Compliant Conductivity

Conductivity measurements are used for the preparation of pharmaceutical water for injection (WFI) worldwide. Hanna EC probes and meters can permit you to meet USP<645> Water Conductivity Requirements and European Pharmacopoeia 2.2.38 Conductivity Test for USP & EP Purified Water and Water for Injection. USP<645> with three stage compliance uses conductivity as a basis of ionic contaminants. Factors such as accuracy, resolution, cell constant certainty and ability to measure absolute conductivity are required. Stage 1 uses in-line conductivity measurements for compliance and a temperature/conductivity limit for compliance. Water that does not pass the Stage 1 limits must then be tested to Stage 2 requirements. This is a laboratory based technique that is streamlined using our meters with USP application firmware. They offer programmable set points to exceed the minimum meet USP and EP requirements and prompts to guide the technician. Water that does not pass at Stage 2 must be tested for pH.

Using Hanna conductivity will help to meet the goals of the USP Purified Water and WFI requirements that include improved water quality, improved equipment reliability and reduction in the number of required tests.

Conductivity calibration

Conductivity standards are salt solutions for which the conductivity and temperature dependence are known. A well-defined relationship between Potassium Chloride concentration and electrolytic conductivity exists so KCl solutions are typically used as standards. A standard is used to determine the cell constant, in theory a defined geometric constant volume. Standards of 84 µS/cm, 1413 µS/cm, 5.00 mS/cm, or 12.88 mS/cm, 80 mS/cm and 111.8 mS/cm are manufactured by Hanna. Calibration is conducted with a value close to the samples conductivity. If the exact cell constant is known, some meters permit the manual input of the factor. This ensures maximum flexibility and measurement accuracy. Our research grade bench meters allow several points values to be calibrated for improved accuracy over a wider measurement range.

Types of Conductivity

Three types of conductivity probes are manufactured by Hanna, The simplest design is a 2-Electrode Probe that utilizes an amperometric approach to make the measurement; a known AC voltage is applied at a specific frequency between a pair of electrodes in solution. The current produced is measured and reported in conductivity units referenced to a calibrated standard. Electrodes are made of graphite or metal. Fouling due mineral deposits and polarization at high concentration are drawbacks of this technology. Two electrodes probes are best used in clean water applications when conductivities remain less than 5 mS/cm.

Four electrode conductivity (four-ring conductivity) utilizes a potentionmetric approach to make the measurement; an alternating current is applied to the outer two "drive"electrodes to induce a current in the solution. The voltage is measured between the inner pair of electrodes in solution. The volage is proportional the conductivity This technology extends the linear range of measurement over three decades. Electrodes are made of graphite, stainless steel or Platinum. Polarization effects are reduced.

Both two and four electrode probes may incorporate a outer sleeve over the cell channel. The sleeve must stay in place during the measurement as this defines the volume of solution measured and the cell factor of the probe.

The third type of conductivity probe manufactured by Hanna is often found in industrial processes connected to a controller. An Inductive, Electrodeless or Toroidal conductivity probe uses two or more toroidal transformers which are inductively coupled side by side and encased in an inert plastic sheath. By applying a high frequency voltage to the drive toroid, a magnetic field develops that induces a current in the surrounding solution. A receiver toroid on the other side of the sensor measures the strength of the induced current. The strength depends on the conductivity of the solution. The benefits of this technology are no polarization effects, choice of material encapsulation can produce chemical resistant and relative immunity to fouling, and solutions are not needed for calibration.

Comparison Guides

Benchtop Meters

	EC Range	pH Range	ISE Range	DO Range	Resistivity Range	ORP Range	TDS Range	Salinity Range	Temperature Range(s)	EC Calibration Points	EC Calibration Solutions	ATC (Automatic Temperature Compensation)	Logging	GLP	Capacitive Touch Buttons	Auto End Feature	PC Connectivity	AutoRanging	Benchtop, Portable & Wall-Mount	Page
edge®	•*	•**		•**			•	•	°C/°F	1	6	•	•	•	•		•	•	•	6.6
edge®EC	•						•	•	°C/°F	1	6	•	•	•	•		•	•	•	6.12
HI5522	•	•	•		•	•	•	•	°C/°F K	4	†	•	•	•	•	•	•	•		6.14
HI5521	•	•			•	•	•	•	°C/°F K	4	†	•	•	•	•	•	•	•		6.14
HI3512	•	•	•		•	•	•		°C/°F	2	†	•	•	•			•	•		6.20
HI2550	•	•				•	•	•	°C	1	6	•	•	•			•	•		6.22
HI5321	•				•		•	•	°C/°F K	4	†	•	•	•	•	•	•	•		6.24
HI2300	•						•		°C	1	6	•		•			•	•		6.26
HI2316	•				•					1		•								6.28
HI2314	•									1										6.29
HI2315	•									1		•								6.29

* Using the HI2030 EC kit
** using compatible, optional pH or DO electrodes respectively. edge is available in 3 kits: pH, EC/TDS and Dissolved Oxygen
† auto standard recognition, custom calibration solution

Portable Meters

	EC Range	pH Range	Resistivity Range	ORP Range	TDS Range	Salinity Range	Temperature Range(s)	EC Calibration Points	EC Calibration Solutions	ATC (Automatic Temperature Compensation)	BEPS	Logging	GLP	HOLD Feature	PC Connectivity	AutoRanging	AutoEnd	Waterproof	Page
HI98192	•		•		•	•	°C	5	7	•	•	•	•		•	•	•	•	6.30
HI9835	•				•	•	°C/°F	1	6	•	•		•			•	•		6.32
HI99300	•				•		°C/°F	1	1	•	•			•				•	6.33
HI99301	•				•		°C/°F	1	1	•	•			•				•	6.33
HI993310	•							1		•	•								6.34
HI9033	•							1		•	•							•	6.35
HI9034					•			1			•							•	6.35
HI8633	•							1		•								•	6.36
HI8733	•							1		•								•	6.36
HI87314	•		•					1		•									6.37
HI8730	•				•		°C	1		•									6.38
HI8731	•				•		°C	1		•									6.38
HI86301					•			1		•									6.39
HI86302					•			1		•									6.39
HI86303	•				•			1		•									6.39
HI86304	•				•			1		•									6.39
HI8734					•													•	6.40
HI8033	•				•			1											6.41

edge®EC

6.12

edge®EC is thin and lightweight, measuring just 1/2" thick and weighing less than 9 ounces. edge®EC has an incredibly wide viewing angle, 5.5" LCD and a sensitive capacitive touch keypad.

edge®EC measures conductivity through its unique digital conductivity probes that connect with an easy to plug-in 3.5mm connector. edge®EC's versatile design is equally at home in your hand, on a lab bench or mounted on a wall. edge®EC simplifies measurement, configuration, calibration, diagnostics, logging and transferring data to a computer or a USB drive.

HI5321

Research Grade EC/ TDS/ Resistivity/Salinity and Temperature Meter with USP <645>

6.24

The HI5321 is a research-grade EC/Resistivity/TDS/Salinity benchtop meter with a large, color, graphic LCD, capacitive touch keypad and an extended range from 0.001 µS/cm to 1 S/cm.

The HI5321 can be used for conductivity measurement for USP <645> compliant stages 1 and 2 testing for water for injection (WFI). The instrument provides clear directions on how to perform each testing step and automatically monitors the temperature, conductivity and stability during testing and determines whether a sample is within USP limits.

HI98192

Graphic Display EC/ Resistivity/TDS/NaCl Meter

6.30

The HI98192 is a waterproof, portable conductivity meter that has an expanded conductivity range from 0.001 µS/cm to 400 mS/cm, as well as TDS, resistivity and three salinity scales. This meter automatically recognizes the probe type (two or four ring) and allows the user to adjust the nominal cell constant. The HI98192 is also ready to perform required conductivity measurements for USP <645> method compliance for water for injection (WFI).

This new meter features a 50% smaller body and is 33% lighter than previous models.

edge®

pH • EC • DO

Hanna Instruments is proud to introduce the world's most innovative pH, EC and DO meter... edge®

edge® is thin and lightweight, measuring just 1/2" (12 mm) thick and weighing less than 9 ounces (250 g). edge® has an incredibly wide viewing angle, 5.5" (14 cm) LCD and a sensitive capacitive touch keypad.

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

edge® features Hanna's exclusive pH CAL Check™ to warn you if the electrode you are using is not clean or if your buffers are contaminated during calibration. We have added Sensor Check™ for pH sensors with a matching pin. Our Sensor Check™ feature warns you if the pH bulb is cracked and/or the junction of the electrode is compromised.

edge® is the culmination of Hanna's vision, design capabilities, integrated production facilities, and world class R&D teams. With edge®, Hanna has set the new standard!

edge® Technical Features

- 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 charging edge® when the cradle is not available.

- Clear, full text readout

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

- Data logging

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

- GLP

Data from the last calibration you perform is stored in the sensor including the electrode's offset, slope, date, time and standards. When any sensor (pH, EC, or DO) is connected to edge®, GLP data is automatically transferred.

- Basic mode

You can use edge® in basic mode–ideal for routine measurements by offering a simplified screen and features.

- CAL Check™ (edge® pH measurement only)

edge® features Hanna's exclusive CAL Check™ technology to warn you if the electrode bulb is not clean or if the buffers are contaminated during calibration.

Accepts pH, EC and DO edge® compatible probes

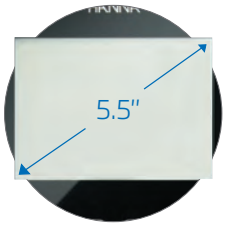
edge® Design Features

- Cradle and electrode holder

edge® is equipped with a benchtop cradle that features an adjustable swivel electrode holder which can charge and hold edge® securely in place at the optimum viewing angle.

- Capacitive touch keypad

edge® features a capacitive touch keypad that gives a distinctive, modern look. Since the keypad is part of the screen, your buttons can never get clogged with sample residue. For faster scrolling, simply hold down the arrow keys.



- 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 edge® and charge its batteries.

- 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 SMART electrodes are automatically recognized.

- Sleek design

edge® is incredibly thin and lightweight, measuring just 1/2" (12 mm) thick and weighing just 8.8 ounces (250 g).

edge pH Parameter and CAL Check™ Features

pH

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

CAL Check™

The edge® includes powerful algorithms to alert the user of potential problems during the pH calibration process. These indicators include when to clean the electrode, check the buffer, the response time, and the overall condition of the electrode.

WRONG BUFFER–Displayed when the difference between the pH reading and the value of the selected buffer is too great.

WRONG OLD POINTS INCONSISTENCY–Displayed if the new calibration differs significantly from the last value of that sensor in that buffer.

CLEAN ELECTRODE–This message indicates poor electrode performance (offset out of accepted window, or slope under the accepted lower limit).

CHECK ELECTRODE CHECK BUFFER–Displayed when electrode slope exceeds the highest accepted slope limit.

BAD ELECTRODE–Displayed if the cleaning procedure performed as a result of the previous two messages is unsuccessful.

WRONG BUFFER TEMPERATURE–Displayed if the temperature of the buffer is outside the defined buffer temperature range.

CONTAMINATED BUFFER–Displayed when the buffer could be contaminated.

Broken Temperature Sensor–If the temperature sensor should malfunction or break at any time, a temperature of "25.0°C" will blink on the second LCD line and the message **BROKEN TEMPERATURE SENSOR** will appear after leaving calibration.

Response and condition gauges appear on the display for 24 hours after an electrode calibration. These five segment displays provide a visual image of the overall condition of the pH probe based on offset and slope characteristics and speed of response based upon how long it took to stabilize in buffers during calibration.

edge EC and DO Parameter Features

Conductivity

- Four-ring platinum probe
  - Covers all ranges from 0.00 µS/cm to 500 mS/cm (absolute EC)
- Accuracy
  - ± 1% of the reading ± (0.05 µS/cm or 1 digit, whichever is greater)
- Calibration
  - Offset (0 µS/cm) and cell factor calibration
  - Choice of five standards
- Auto-ranging or manual range selection
- EC, TDS and salinity reading modes
- Temperature compensation
  - Automatic
  - NoTC (absolute)
- GLP data
  - Records date, time, offset and cell constant value (K)
- Adjustable EC to TDS conversion factor
- Adjustable temperature correction coefficient

Dissolved Oxygen

- Clark type polarographic probe with easy-to-replace membrane cap
  - Covers all ranges from 0.00 to 45.00 mg/L (ppm); 0.0 to 300% air saturation
- Accuracy
  - ±1.5% full scale
- One or two-point calibration (HI7040); 0% (solution) and 100% (air)
- Automatic Temperature Compensation from 0 to 50 °C
- Altitude compensation from -500 to 4000 m (-1640 to 13,123')
- Salinity compensation 0 to 40 g/L
- GLP data
  - Records date, time, calibration standards, altitude value and salinity value

- Portable field unit
  - edge® is ideal for field use due to its lightweight, large screen and thin design. It can be easily slipped into a backpack or messenger bag.
- Wall mount cradle
  - The included wall mount cradle makes it easy to conserve space on the benchtop and can charge edge® with the AC adapter. 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.

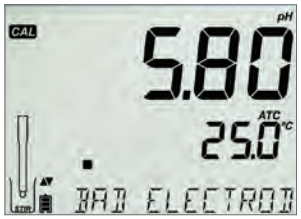
edge® Electrodes

Digital SMART Electrodes

The electrodes used with edge® are nearly as advanced as edge® itself. They feature a built-in microchip that stores sensor type, ID, and calibration information that is automatically retrieved by edge® once the electrode is plugged in.

Stored pH calibration information includes: calibrated buffers, date, time, offset and slope characteristics of the electrode. Conductivity calibration information includes: calibrated conductivity standards, date, time, and cell constant of the sensor. Dissolved oxygen calibration information includes: standards used for calibration, date, time, altitude and salinity correction.

These digital electrodes also feature an easy to plug in 3.5 mm connector so you never have to worry about the right angle or aligning pin settings.



Sensor Check™ (HI12301 and HI11311 only)

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

pH Electrodes

HI11310

Single ceramic, double junction, glass body, refillable pH electrode with temperature sensor

Recommended for laboratory and general purpose

Sensor Check™

HI11311

Single ceramic, double junction, glass body, refillable pH electrode with temperature sensor and matching pin

Recommended for laboratory and general purpose

HI12300

Single ceramic, double junction, gel filled, PEI body, pH electrode with temperature sensor

Recommended for field applications

Sensor Check™

HI12301

Single ceramic, double junction, gel filled, PEI body, pH electrode with temperature sensor and matching pin

Recommended for field applications

HI10530

Triple ceramic, double junction, glass body, refillable pH electrode with conic tip and temperature sensor

Recommended for fats and creams, and soil samples

HI10430

Triple ceramic, double junction, glass body, refillable pH electrode with temperature sensor

Recommended for paints, solvents, strong acids and bases, high conductivity samples, and Tris buffer

HI10480

Double reference, open junction, Clogging Prevention System (CPS), glass body pH electrode with temperature sensor

Recommended for wine analysis

FC2320

Double reference, open junction, viscolene electrolyte, PVDF body pH electrode with conic tip and temperature sensor

Recommended for meat applications

FC2100

Double reference, open junction, viscolene electrolyte, glass body pH electrode with conic tip and temperature sensor

Recommended for dairy analysis

FC2020

Double reference, open junction, viscolene electrolyte, PVDF body pH electrode with conic tip and temperature sensor

Recommended for dairy analysis

Conductivity Probe

HI763100

Conductivity probe with temperature sensor

Recommended for general purpose

Dissolved Oxygen Electrode

HI764080

Dissolved oxygen electrode with temperature sensor

Recommended for general purpose

- Simply connect each probe via the 3.5 mm jack, digital SMART Electrodes are automatically recognized

Specifications		edge®		
pH (using pH kit)	Range	basic mode: -2.00 to 16.00 pH; ±1000.0 mV for pH standard mode: -2.00 to 16.00 pH; -2.000 to 16.000 pH; ±1000.0 mV for pH		
	Resolution	0.01 pH; 0.001 pH; 0.1 mV		
	Accuracy (@25°C/77°F)	±0.01 pH; ±0.002 pH; ±0.2 mV		
	Calibration	Automatic, up to three points (five points†) calibration, 5 standard (7 standard†) buffers available (1.68†, 4.01 or 3.00, 6.86, 7.01, 9.18, 10.01, 12.45†) and two custom buffers†		
	Temperature Compensation*	automatic, -5.0 to 100.0°C (23.0 to 212.0°F) (using integral temperature sensor)		
	Electrode Diagnostics	standard mode: probe condition, response time and out of calibration range		
EC (using EC kit)	Range	EC	TDS	Salinity†
		0.00 to 29.99 µS/cm; 30.0 to 299.9 µS/cm; 300 to 2999 µS/cm; 30.0 to 200.0 mS/cm; up to 500.0 mS/cm (absolute EC)**	0.00 to 14.99 mg/L (ppm); 15.0 to 149.9 mg/L (ppm); 150 to 1499 mg/L (ppm); 1.50 to 14.99 g/L; 15.0 to 100.0 g/L; up to 400.0 g/L (absolute TDS)**, with 0.80 conversion factor	0.0 to 400.0 % NaCl; 2.00 to 42.00 PSU; 0.0 to 80.0 g/L
	Resolution	0.01 µS/cm; 0.1 µS/cm; 1 µS/cm; 0.01 mS/cm; 0.1 mS/cm	0.01 ppm; 0.1 ppm; 1 ppm; 0.01 g/L; 0.1 g/L (0.80 TDS factor)	0.1 % NaCl; 0.01 PSU; 0.01 g/L
	Accuracy (@25°C/77°F)	±1% of reading ±(0.5 µS or 1 digit, whichever is greater)	±1% of reading ±(0.03 ppm or 1 digit, whichever is greater)	±1% of reading
	Calibration	single cell factor calibration; six standards available: 84 µS/cm, 1413 µS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, 118.8 mS/cm, one point offset: 0.00 µS/cm	through EC calibration	one-point with HI7037 100% NaCl sea water standard
	Conductivity Temperature Coefficient	0.00 to 6.00%/°C (for EC and TDS only), default value is 1.90%/°C		
	Temperature Compensation*	automatic -5.0 to 100.0°C (23.0 to 212.0°F); NoTC – none, absolute conductivity.		
	TDS Factor	0.40 to 0.80 (default value is 0.50)		
DO (using DO kit)	Range	0.00 to 45.00 ppm (mg/L); 0.0 to 300.0 % saturation		
	Resolution	0.01 ppm (mg/L); 0.1 % saturation		
	Accuracy	± 1.5% of reading ±1 digit		
	Calibration	one or two-point at 0% (HI7040 solution) and 100% (in air)		
	Temperature Compensation*	0 to 50°C; 32.0 to 122.0°F		
	Salinity Compensation	0 to 40 g/L (with 1 g/L resolution)		
	Altitude Compensation	-500 to 4000 m (with 100 m resolution)		
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		
Additional Specifications	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	one USB port for storage; one micro USB port for charging and PC connectivity		
	pH Electrode (included in pH kit)	HI11310 digital glass body pH electrode with 1/8"(3.5mm) connector and 1 m (3.3') cable		
	EC Electrode (included in EC kit)	HI763100 digital four-ring conductivity probe with 1/8"(3.5mm) connector and 1 m (3.3') cable		
	DO Electrode (included in DO kit)	HI764080 digital dissolved oxygen electrode with 1/8"(3.5mm) connector and 1 m (3.3') cable		
	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

edge® is available in 3 kit configurations: pH, EC and DO

All kits Include: edge®, benchtop docking station with electrode holder, wall-mount cradle, USB cable, 5 VDC power adapter, quality certificate and instruction manual.

HI2020-01 (115V) and **HI2020-02** (230V) pH kit also includes: HI11310 glass body, refillable pH electrode with temperature sensor, pH 4 buffer solution sachets (2), pH 7 buffer solution sachets (2), pH 10 buffer solution sachets (2) and electrode cleaning solution sachets (2).

HI2030-01 (115V) and **HI2030-02** (230V) EC kit also includes: HI763100 EC probe, 1413 µS/cm conductivity standard sachets (3) and 12880 µS/cm conductivity standard sachets (3).

HI2040-01 (115V) and **HI2040-02** (230V) DO kit also includes: HI764080 dissolved oxygen electrode, HI7041S refill electrolyte solution, DO membrane caps (2) and o-rings (2).

All probes on the opposite page are interchangeable with edge® and can be ordered separately.

edge® compatible electrodes begin on page 3.91; pH solutions begin on page 3.100; DO solutions begin on page 7.21; EC and TDS solutions begin on page 6.42

* temperature limits will be reduced to actual probe/sensor limits
** with temperature compensation function disabled
† standard mode only

edge® EC

edge®EC is thin and lightweight, measuring just 1/2" (12 mm) thick and weighing less than 9 ounces (250 g). edge®EC has an incredibly wide viewing angle, 5.5" (14 cm) LCD and a sensitive capacitive touch keypad.

edge®EC measures conductivity through its unique digital conductivity probe. The digital conductivity probe is auto-recognized, providing type, calibration data and a serial number when connected to edge®EC by an easy to plug-in 3.5mm connector. The versatile design of edge®EC enables it to be used as a handheld, benchtop or wall-mounted meter. edge®EC simplifies measurement, configuration, calibration, diagnostics, logging and transferring data directly to a computer or USB drive.

- Digital four-ring conductivity probe
  - Covers all ranges from 0.00 µS/cm to 500 mS/cm (absolute EC)
- Accuracy
  - ± 1% of the reading ± (0.05 µS/cm or 1 digit, whichever is greater)
- Calibration
  - Offset (0 µS/cm) and cell factor calibration
  - Choice of 5 standards
- Auto-ranging or manual range selection
- EC, TDS and salinity reading modes
- Temperature compensation
  - Automatic
  - NoTC (absolute)
- GLP data
  - Records date, time, offset and cell constant value (K)
  - Data of the last performed calibration is stored in the probe: date, time, cell constant, temperature coefficient, reference temperature and battery status. When the probe is connected to edge®EC , GLP data is automatically transferred.
- Adjustable EC to TDS conversion factor
- Adjustable temperature correction coefficient

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

edge® EC Technical Features

- Two USB ports
  edge®EC includes one standard USB for exporting data to a flash drive. edge®EC also includes one micro USB port for exporting files to your computer as well as charging edge®EC when the cradle is not available.
- Clear, full text readout
  edge®EC 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®EC allows you to store up to 1000 log records of data. Data sets include readings, GLP data, date and time.
- Basic mode
  You can use edge®EC in Basic Mode–ideal for routine measurements for a simplified screen and features.

Accepts edge®EC compatible conductivity probes

edge® EC Design Features

- Capacitive touch keypad
  edge®EC features a capacitive touch keypad that gives a distinctive, modern look. Since the keypad is part of the screen, your buttons can never get clogged with sample residue. For faster scrolling, simply hold down the arrow keys.
- Easy to read LCD
  edge®ECfeatures 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 provide one of the easiest to read LCD's in the industry.
- Zero footprint
  Using the wall mount cradle (included), edge®EC can be placed on a wall, leaving zero footprint on the benchtop space. The cradle has a built in connector to power edge®EC and charge its batteries.
- 3.5 mm probe input
  Plugging an electrode in has never been simpler; no alignments or broken pins, just connect the 3.5 mm plug and begin. Digital SMART electrodes are automatically recognized.

Specifications		edge®EC
EC	Range	0.00 to 29.99 µS/cm; 30.0 to 299.9 µS/cm; 300 to 2999 µS/cm; 3.00 to 29.99 mS/cm; 30.0 to 200.0 mS/cm; up to 500.0 mS/cm (absolute EC)**
	Resolution	0.01 µS/cm; 0.1 µS/cm; 1 µS/cm; 0.01 mS/cm; 0.1 mS/cm
	Accuracy (@25°C/77°F)	±1% of reading ±(0.5 µS or 1 digit, whichever is greater)
	Calibration	single cell factor calibration; six standards available: 84 µS/cm, 1413 µS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, 118.8 mS/cm, one point offset: 0.00 µS/cm
	Temperature Coefficient	0.00 to 6.00%/°C (for EC and TDS only), default value is 1.90%/°C
TDS	Range	0.00 to 14.99 mg/L (ppm); 15.0 to 149.9 mg/L (ppm); 150 to 1499 mg/L (ppm); 1.50 to 14.99 g/L; 15.0 to 100.0 g/L; up to 400.0 g/L (absolute TDS)**, with 0.80 conversion factor
	Resolution	0.01 mg/L (ppm); 0.1 mg/L (ppm); 1 (ppm) 0.01 g/L; 0.1 g/L (0.8 TDS Factor)
	Accuracy (@25°C/77°F)	±1% of reading ±(0.03 ppm or 1 digit, whichever is greater)
	Calibration	through EC calibration
	TDS Factor	0.40 to 0.80 (default value is 0.50)
Salinity†	Range	0.0 to 400.0 % NaCl; 2.00 to 42.00 PSU; 0.0 to 80.0 g/L
	Resolution	0.1 % NaCl; 0.01 PSU; 0.01 g/L
	Accuracy (@25°C/77°F)	±1% of reading
	Calibration	one-point with HI7037 100% NaCl sea water standard
Temperature	Range*	-20.0 to 120.0°C; -4.0 to 248.0°F
	Resolution	0.1°C; 0.1°F
	Accuracy	±0.5°C; ±0.9°F
Additional Specifications	Temperature Compensation	automatic -5.0 to 100.0°C (23.0 to 212.0°F); NoTC – none, absolute conductivity.
	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	one USB port for storage; one micro USB port for charging and PC connectivity
	Probe	HI763100 digital four-ring conductivity probe with 1/8"(3.5mm) connector and 1 m (3.3') cable
	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		**HI2003-01** (115V) and **HI2003-02** (230V) edge®EC includes: HI763100 Conductivity probe, 1413 µS/cm conductivity standard sachets (3), 12880 µS/cm conductivity standard sachets (3), benchtop docking station with electrode holder, wall-mount cradle, USB cable 5 VDC power adapter, quality certificate and instruction manual.

- Portable field unit
  - edge®EC is ideal for field use due to its light weight, large screen and thin design. It can be slipped into a back pack or messenger bag. Up to 8 hours of battery life when used as a portable device.

- Wall mount cradle
  - The included wall mount cradle makes it easy to conserve space on the benchtop and can charge edge®EC with the AC adapter. 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®EC securely in place at the optimum viewing angle.

EC , TDS and salinity solutions begin on page 6.42

* temperature limits will be reduced to actual probe limits
** with temperature compensation function disabled
† standard mode only

HI5521 • HI5522

Research Grade Meters

pH/ORP/ISE and EC/TDS/Resistivity/Salinity and Temperature

Measure up to Eight Parameters

HI5521 and HI5522 are research grade benchtop instruments that feature eight measurement parameters: pH, mV (for Oxidation Reduction Potential), ISE (HI5522 only), conductivity, resistivity, TDS, salinity and temperature.

These instruments incorporate dual channels with a separate temperature input and support external reference electrodes required by half cell pH and ISE sensors.

Up to a four-point automatic or custom standard conductivity calibration can be performed in up to four points, as well as adjustable probe cell constant. One fixed-point salinity calibration can be performed on the percent scale only. Three salinity ranges are available: practical scale, natural sea water scale and percent scale.

HI5522 features up to five-point manual selection and custom standard ISE calibration with up to five standard solutions and up to five custom solutions with or without temperature compensation. From the on-screen list, users can select their ISE electrode parameter along with the standard configuration profile or create their own.

- Capacitive touch keypad
- Clear user interface
- CAL Check™ for pH
  - Alerts users of calibration status
- Five-point calibration (HI5522)
  - Five point pH and ISE calibration
- Logging
  - Large log memory with different logging methods
- Specific Applications
  - EC specific applications: USP <645> method, salinity in seawater, TDS
  - ISE Specific Applications: incremental methods
- Multiple input channels
  - pH/ORP/(ISE, HI5522) and EC/TDS/Resistivity/Salinity
- On-screen help
  - Users can consult the on-screen help from any mode simply by pressing the HELP key.

Highly Customizable

The display is customizable and capable of displaying two channels at the same time, showing the measurements in various modes: basic measurement with or without GLP information, graph or logging data. The display colors are also selectable.

Up to 10 profiles (5 for each channel) can be saved and recalled for both instruments, eliminating the need to reconfigure each time a different electrode is used. User definable configurations can include: temperature compensation modes, isopotential points for pH and ISE (HI5522 only), measurement units of ISE concentrations, ISE electrode type (HI5522 only), and temperature units.

User-friendly Features

These instruments offer multi-language support and contextual help is available through a dedicated help key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through all measurement and calibration procedures to ensure readings are taken correctly.

CAL Check™ for pH

Hanna's pH CAL Check™ ensures accurate 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. After the guided calibration process, electrode condition is evaluated and an indicator is displayed informing the user of the overall pH electrode status.

pH and EC Features

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>.

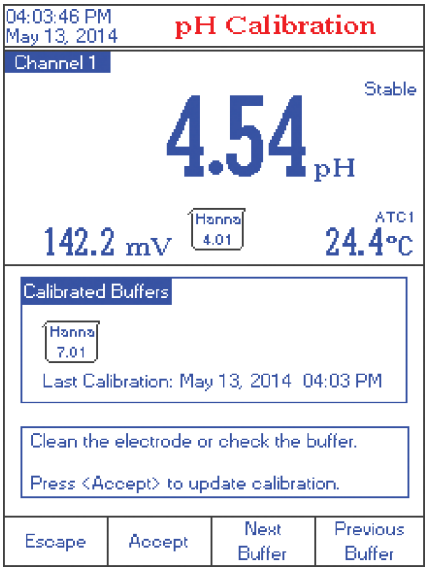
The instruments give clear instructions on how to perform each stage and automatically check that the temperature, conductivity and stability are within USP limits.

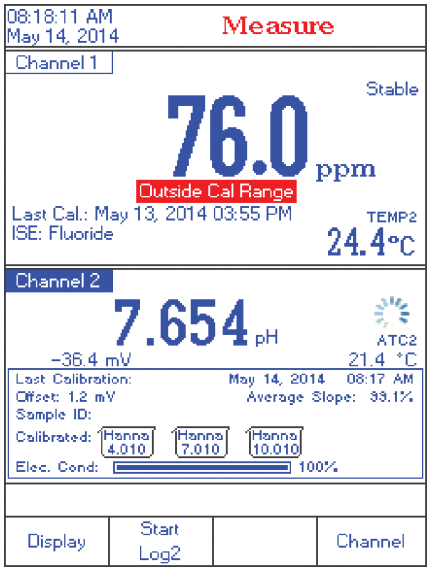
Comprehensive results are shown on a single screen at the end of the test. Up to 200 reports can be saved for future recall.

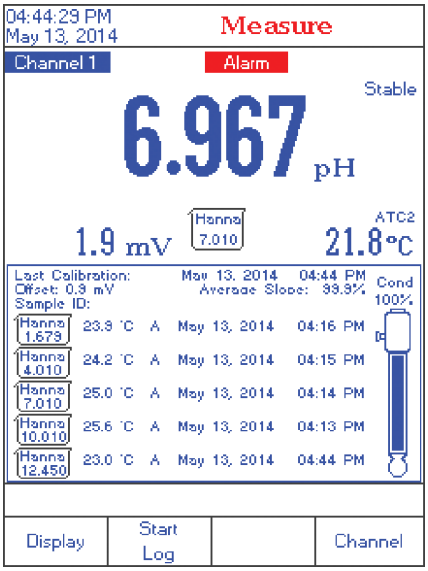
pH CAL Check™

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 to track aging.
- To avoid taking readings with old calibrations, the instrument automatically reminds the user when the calibration has expired.







ISE Features (HI5522)

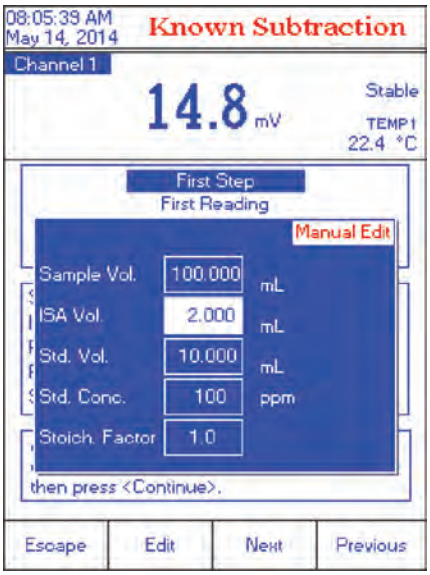
ISE Incremental Methods

Ion concentration determinations with ISEs can be made faster and easier using the streamlined incremental methods.

Incremental methods involve adding a standard to a sample or sample to a standard and detecting the mV change that occurs due to the addition, and this difference determines the concentration. Historically the user would use mathematical equations to determine the ion concentration of the sample; the HI5522, sample concentrations are calculated automatically and then logged into an ISE method report; up to 200 reports can be saved for future recall. The entire process can be repeated on multiple samples without reentering sets of parameters. Reports can be printed using HI92000 PC software.

Incremental method techniques can reduce errors from variables such as temperature, viscosity, pH or ionic strength. The electrodes remain immersed throughout the process, thus reducing measurement time as well as eliminating sample carry over and its associated errors.

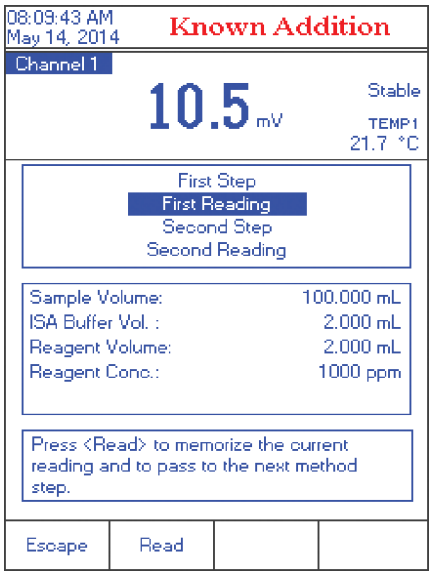
Known Addition, Known Subtraction, Analyte Addition, and Analyte Subtraction methods are standard method choices provided by the HI5522.



First Step

The first step in performing an incremental method analysis is to enter the required parameters including sample, ISA and standard volumes, as well as standard concentration and stoichiometric factor.

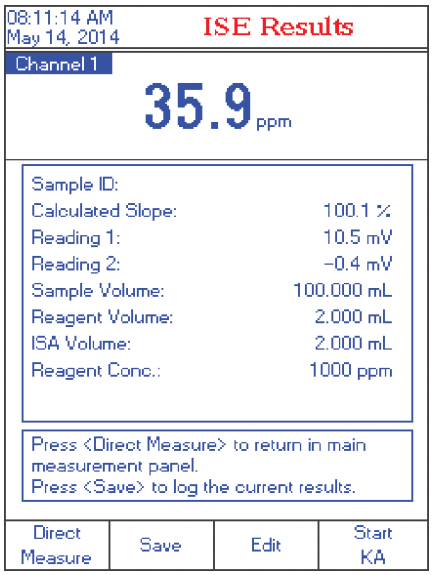
When repeating the analysis on another sample, the parameters do not need to be reentered.



Sequence of Readings

Once the variables are entered, the user is guided step-by-step through the measurement process.

The initial mV measurement is made before the addition; next is the addition, followed by the second mV measurement.



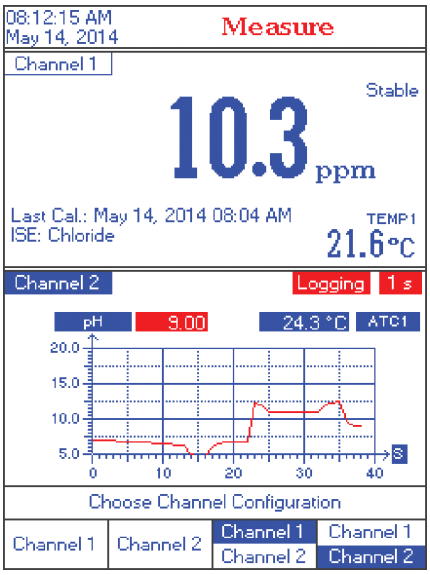
Results

The results are automatically calculated and shown together with all the parameters used.

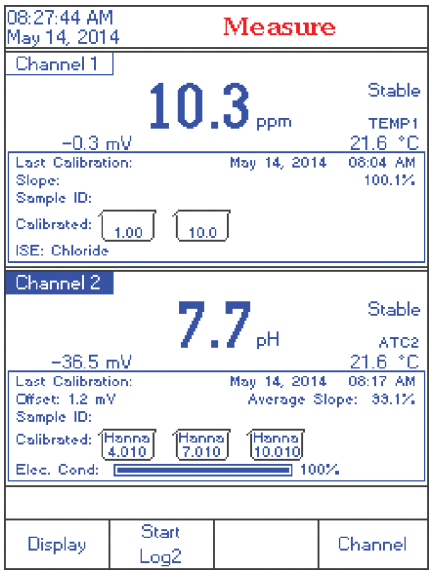
At this time, results can be saved into an ISE Methods Report and printed using using the HI92000 PC software. If necessary, the user can edit the parameters without having to redo the entire analysis. Multiple sample analysis is enabled without having to reenter set-up data.

- Low Profile
  - These intruments feature a low profile with an ideal viewing angle

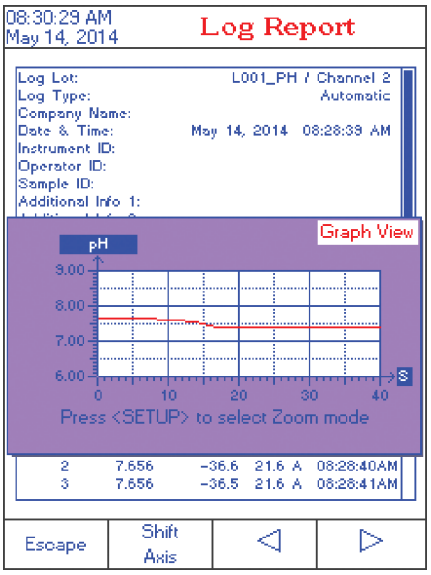
Additional Features by Screen (depending on model)



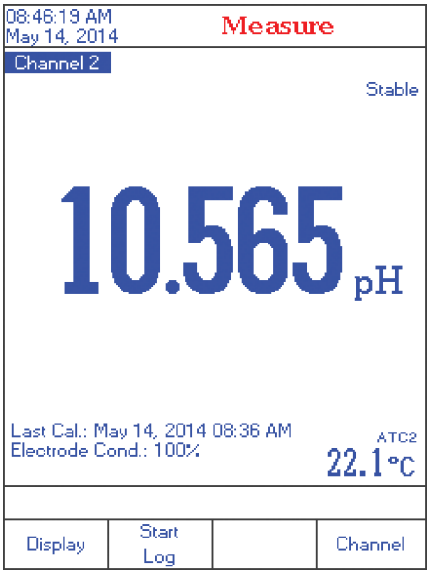
Channel Configuration



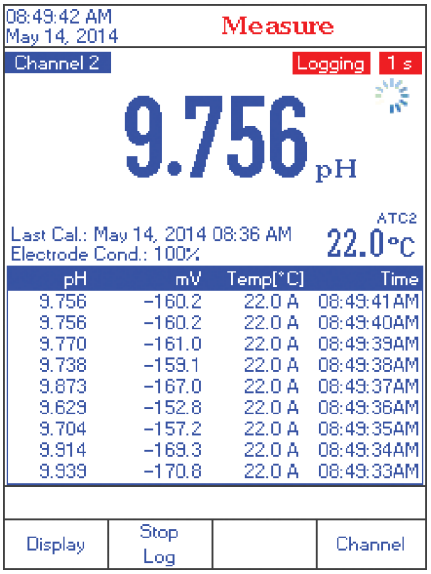
Good Laboratory Practices



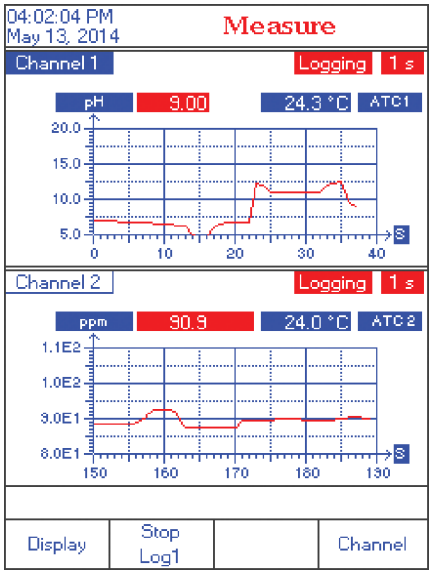
Log Recall



Simple Readout Available



Real-Time Logging



Simultaneous Dual-Channel Graphing

Dual Channels

The two measurement channels of the HI5522 and HI5521 are galvanically isolated to eliminate noise and instability.

In ISE mode (HI5522), these instruments provide the user with a choice of several incremental methods. Communication is via opto-isolated USB ports.

Specifications		HI5521	HI5522
pH	Range	-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, 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	±2000 mV
	Resolution	0.1 mV	0.1 mV
	Accuracy	±0.2 mV ±1 LSD	±0.2 mV ±1 LSD
ISE	Range	–	1×10^{-6} to 9.99×10^{10} concentration
	Resolution	–	1; 0.1; 0.01; 0.001 concentration
	Accuracy	–	±0.5% (monovalent ions); ±1% (divalent ions)
	Calibration	–	automatic, up to five-point calibration, five fixed standard solutions available for each measurement unit, and 5 user defined standards
Temperature**	Range	-20.0 to 120°C; -4.0 to 248.0°F; 253.15 to 393.15K	-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	0.1°C; 0.1°F; 0.1K
	Accuracy	±0.2°C; ±0.4°F; ±0.2K (without probe)	±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)	±1% of reading (±0.01 µS/cm)
	Cell Constant	0.0500 to 200.00	0.0500 to 200.00
	Cell Type	4 cells	4 cells
	Calibration	automatic standard recognition, user standard single point / multi-point calibration	automatic standard recognition, user standard single point / multi point calibration
	Calibration Reminder	yes	yes
	Temperature Coefficient	0.00 to 10.00 %/°C	0.00 to 10.00 %/°C
	Temperature Compensation	disabled, linear and non-linear (natural water)	disabled, linear and non-linear (natural water)
	Reference Temperature	5.0 to 30.0°C	5.0 to 30.0°C
	Profiles	up to 10, 5 each channel	up to 10, 5 each channel
	USP Compliant	yes	yes
TDS	Range	0.000 to 9.999 ppm; 10.00 to 99.99 ppm; 100.0 to 999.9 ppm; 1.000 to 9.999 ppt; 10.00 to 99.99 ppt; 100.0 to 400.0 ppt actual TDS* (with 1.00 factor)	
	Resolution	0.001 ppm; 0.01 ppm; 0.1 ppm; 0.001 ppt; 0.01 ppt; 0.1 ppt	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)	±1% of reading (±0.01 ppm)
Resistivity	Range	1.0 to 99.9 Ω•cm; 100 to 999 Ω•cm; 1.00 to 9.99 kΩ•cm; 10.0 to 99.9 kΩ•cm; 100 to 999 kΩ•cm; 1.00 to 9.99 MΩ•cm; 10.0 to 100.0 MΩ•cm	
	Resolution	0.1 Ω•cm; 1 Ω•cm; 0.01 kΩ•cm; 0.1 kΩ•cm; 1 kΩ•cm; 0.01 MΩ•cm; 0.1 MΩ•cm	
	Accuracy	±2% of reading (±1 Ω•cm)	±2% of reading (±1 Ω•cm)
Salinity	Range	practical scale: 0.00 to 42.00 psu; natural sea water scale: 0.00 to 80.00 ppt; percent scale: 0.0 to 400.0%	
	Resolution	0.01 for practical scale/natural sea water scale; 0.1% for percent scale	
	Accuracy	±1% of reading	±1% of reading
	Calibration	percent scale–one-point (with HI7037 standard)	percent scale–one-point (with HI7037 standard)
Additional Specifications	pH Electrode	HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included)	
	EC Probe	HI76312 platinum, four-ring EC/TDS probe with and 1 m (3.3') cable (included)	
	Temperature Probe	HI7662-T stainless steel temperature probe with 1 m (3.3') cable (included)	
	Input Channel(s)	1 pH/ORP + 1 EC	1 pH/ORP/ISE + 1 EC
	GLP	cell constant, reference temperature/coefficient, calibration points, cal time stamp, probe offset for conductivity	
	Logging	**record :** 100,000 data point storage/channel, up to 100 lots with max. 50,000 records/lot; **interval:** settable between 1 second and max log time of 180 minutes; **type:** automatic, manual, AutoHOLD; **additional:** 200 records USP; 200 records incremental methods (HI5522)	
	PC Connection	USB and RS232	
	Power Supply	12 VDC adapter (included)	
	Environment	0 to 50°C (32 to 122°F; 273 to 323K) RH max 95% non-condensing	
	Dimensions / Weight	160 x 231 x 94 mm (6.3 x 9.1 x 3.7") / 1.2 kg (2.64 lbs.)	
Ordering Information		**HI5521-01** (115V), **HI5521-02** (230V), **HI5522-01** (115V) and **HI5522-02** (230V) are supplied with HI76312 EC/TDS probe, HI1131B pH electrode, HI7662-T temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachet (2), HI7082 3.5M KCL electrolyte solution (30 mL), HI76404N electrode holder, 12 VDC adapter and instructions.	

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100; ISE electrodes and solutions begin on page 4.22; EC , TDS and salinity solutions begin on page 6.42

(*) Absolute conductivity (or TDS) is the conductivity (or TDS) value without temperature compensation.
(**) Reduced to actual probe limits

HI3512

Multiparameter Meter

pH/ORP/ISE and EC/TDS/Resistivity/Salinity and Temperature

- CAL Check™ for pH
  - Alerts users of calibration status
- Calibration points
  - Up to five-point pH calibration and up to two-point EC calibration
- Logging
  - Automatic logging up to 600 records and log on demand up to 400 samples
- Connectivity
  - PC connectivity via opto-isolated USB
- GLP features
  - Meets Good Laboratory Practices

Two Channels, Eight Parameters

The HI3512 is a dual-channel benchtop meter with a graphic LCD designed to provide accurate laboratory results. Channel 1 features pH/ORP/ISE and temperature measurement capability while channel 2 features conductivity, TDS, salinity or resistivity measurements and temperature capability.

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.

Calibration

The pH channel offers up to five point pH calibration with seven standard buffers and up to two custom buffers.

A five point ISE calibration selected from up to six calibration standards make this instrument very useful for a large range of ion concentrations.

The EC channel permits a two-point calibration selected from seven Hanna standards. The EC channel supports autoranging, manual ranging and lock of the user selected range as well as temperature compensation selection, temperature reference selection and temperature coefficient selection.

Total dissolved Solids (TDS) factor is user-adjustable and can be set between 0.40 and 1.00.

pH and EC channels also provide "out of calibration range" warnings and a "calibration timeout" message to remind the user when a new calibration is necessary.

Messages on the graphic LCD offer directions for easy and accurate calibration for both channels, as well as diagnostics to alert the user when calibration or measurement issues are detected.

Additional Features

Other features of the HI3512 include log-on-demand of up to 400 samples, automatic logging interval with log on stability of up to 600 records, AutoHold to freeze the first stable reading on the LCD display, GLP to view the last calibration data for pH, rel mV, ISE, EC or salinity and a PC interface via USB.

Specifications		HI3512
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	±0.01 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 two custom buffers
	Temperature Compensation	automatic or manual from -20.0 to 120.0 °C (-4.0 to 248.0 °F)
mV	Range	±2000.0 mV
	Resolution	0.1 mV
	Accuracy	±0.2 mV
ISE	Range	1.00 E^{-7} to 9.99 E^{10} concentration (user selectable units)
	Resolution	3 digits
	Accuracy	±0.5% of reading (monovalent ions); ±1% of reading (divalent ions)
	Calibration	up to five-point calibration points 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	±0.2°C (±0.4°F) (excluding probe error)
EC	Range	0 µS/cm to 400 mS/cm (shows values up to 1000 mS/cm absolute conductivity); 0.001 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 999.9 mS/cm; 1000 mS/cm (autoranging)
	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; 1 mS/cm
	Accuracy	±1% of reading (±0.01 µS/cm or 1 digit whichever is greater) excluding probe error
	Calibration	automatic up to two points with seven Hanna standards (0.00 µS/cm, 84.0 µS/cm, 1.413 mS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, 111.8 mS/cm)
	Cell constant	0.010 to 10.000
	Temperature Compensation	NoTC, MTC, ATC
	Reference Temperature	15, 20, 25°C
	Temperature Coefficient	0.00 to 10.00 %/°C (for EC and TDS only; default value is 1.90%/°C)
TDS	Range	0.000 to 9.999 ppm; 10.00 to 99.99 ppm; 100.0 to 999.9 ppm; 1.000 to 9.999 g/L; 10.00 to 99.99 g/L; 100.0 to 400.0 g/L (autoranging)
	Resolution	0.001 ppm; 0.01 ppm; 0.1 ppm; 0.001 g/L; 0.01 g/L; 0.1 g/L
	Accuracy	±1% of reading (±0.05 ppm or 1 digit whichever greater) excluding probe error
	Factor	0.40 to 1.00
Resistivity	Range	1.0 to 99.9 Ω•cm; 100 to 999 KΩ•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 (autoranging)
	Resolution	0.1 Ω•cm; 1 Ω•cm; 0.01 KΩ•cm; 0.1 Ω•cm; 1 Ω•cm; 0.01 MΩ•cm; 0.1 Ω•cm
	Accuracy	±1% of reading (±10 Ω•cm or 1 digit whichever greater) excluding probe error
Salinity	Range	0.0 to 400.0% NaCl
	Resolution	0.1% NaCl
	Accuracy	±1% of reading excluding probe error
	NaCl Calibration	one-point with HI7037 standard (optional)
Additional Specifications	pH Electrode	HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included)
	Temperature probe	HI7662-T temperature probe with 1 m (3.3') cable (included)
	EC Probe	HI76310 platinum four-ring EC/TDS probe with 1 m (3.3') cable (included)
	Relative mV Offset Range	±2000 mV
	Slope Calibration	from 80 to 110%
	Temperature Source	automatic from sensor inside the probe; manual entry
	Log-on-demand	400 samples
	Interval Logging	5, 10, 30 seconds; 1, 2, 5, 10, 15, 30, 60, 120, 180 minutes, AutoEnd (max 600 samples)
	PC connection	opto-isolated USB
	Input Impedance	10^{12} ohms
	Power Supply	12 VDC adapter (included)
	Environment	0 to 50 °C (32 to 122 °F) RH max 55% non-condensing
	Dimensions / Weight	235 x 207 x 110 mm (9.2 x 8.14 x 4.33") / 1.8 kg (4 lbs.)
Ordering Information		**HI3512-01** (115V) and **HI3512-02** (230V) is supplied with HI76310 EC/TDS probe, HI1131B pH electrode, HI7662-T temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachet (2), HI7082 3.5M KCl electrolyte solution (30 mL), HI76404N electrode holder, 12 VDC adapter and instructions.

**pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100;
ISE electrodes and solutions begin on page 4.22; EC , TDS and salinity solutions begin on page 6.42**

HI2550

Multiparameter Meter

pH/ORP/ISE/EC/TDS/Salinity

- Five Point Calibration
  - Up to five point pH calibration
- Hold Feature
  - Hold button to freeze readings on the display
- ATC
  - Automatic temperature compensation for pH and EC
- Connectivity
  - PC interface via USB
- Multiple input channels
  - Two input channels: pH/ORP/ISE and EC/TDS/Resistivity/Salinity

Dual-Channel, with Up to Seven Parameters

HI2550 is a dual-channel instrument that measures up to seven parameters. With this single laboratory bench meter you can measure pH, ORP or ISE, conductivity (EC), TDS or salinity, and temperature.

Utilizing an external temperature probe, pH readings are automatically compensated for temperature. To ensure a higher level of precision, pH calibrations can use up to five calibration points, chosen from the seven available memorized buffers.

This instrument can take measurements using ORP electrodes (pH channel input), due to its capability to measure mV with a resolution up to 0.1 mV, as well as ISE electrodes on the mV scale (pH channel input).

EC measurements can be compensated relative to a selected reference temperature. The EC calibration mode allows you to chose from among six recognized conductivity standards and perform a single-point calibration. The most suitable EC and TDS range for your application is automatically selected. The HI2550 also includes the ability to set and lock the range manually.

Good Laboratory Practice

This instrument provides GLP capabilities that allow for the storage and retrieval of all data regarding pH, ORP, EC and salinity calibration and sample measurement as well as data regarding the maintenance and status of the electrode.

Data Logging

With a built-in logging function, measurements are stored in non-volatile memory, and can be transferred to a PC through the USB port. Users can manually log up to 200 records and interval log up to 500 records.

Specifications		HI2550
pH**	Range	-2.0 to 16.0 pH; -2.00 to 16.00 pH; -2.000 to 16.000 pH
	Resolution	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	± 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 two custom buffers
	Temperature Compensation	automatic or manual from: -20.0 to 120.0 °C
	Input Impedance	10^{12} ohms
ISE and ORP	Range	±999.9 mV; ±2000 mV
	Resolution	0.1 mV (±1000.0 mV); 1 mV (± 2000 mV)
	Accuracy	± 0.2 mV (±999.9 mV); ± 1 mV (±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 (excluding probe error)
EC	Range	0.00 to 29.99 µS/cm; 30.0 to 299.9 µS/cm; 300 to 2999 µS/cm; 3.00 to 29.99 mS/cm; 30.0 to 200.0 mS/cm; up to 500.0 mS/cm actual* conductivity
	Resolution	0.01 µS/cm; 0.1 µS/cm; 1 µS/cm; 0.01 mS/cm; 0.1 mS/cm
	Accuracy	± 1 % reading (±0.05 µS/cm or 1 digit, whichever is greater)
	Calibration	one point slope calibration; six buffers available: 84.0, 1413 µS/cm; 5.00, 12.88, 80.0, 111.8 mS/cm; one point offset: 0.00 µS/cm
	Temperature Compensation	automatic or manual from -20.0 to 120.0 °C, or disabled
	Temperature Coefficient	0.00 to 6.00 %/°C (for EC and TDS only; default value is 1.90 %/°C
TDS	Range	0.00 to 14.99 ppm; 15.0 to 149.9 ppm; 150 to 1499 ppm; 1.50 to 14.99 g/L; 15.0 to 100.0 g/L; up to 400.0 g/L actual* TDS (with 0.80 factor)
	Resolution	0.01 ppm; 0.1 ppm; 1 ppm; 0.01 g/L; 0.1 g/L
	Accuracy	±1% of reading (±0.03 ppm or 1 digit, whichever is greater)
	TDS Factor	0.40 to 0.80 (default value is 0.50)
Salinity	Range	0.0 to 400.0% NaCl
	Resolution	0.1% NaCl
	Accuracy	±1% of reading (excluding probe error)
	Calibration	one point with HI7037 standard (optional)
Additional Specifications	pH Electrode	HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included)
	EC Probe	HI76310 platinum four-ring EC/TDS probe and 1 m (3.3') cable (included)
	Temperature Probe	HI7662 temperature probe with 1 m (3.3') cable (included)
	Relative mV Offset Range	±2000 mV
	PC Connectivity	opto-isolated USB
	Log-on-demand	200 samples
	Interval Logging	500 records; 5, 10, 30 sec and 1, 2, 5, 10, 15, 30, 60, 120, 180 min stability logging
	Power Supply	12 VDC (included)
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Dimensions	235 x 222 x 109 mm (9.2 x 8.7 x 4.3")
	Weight	1.3 Kg (2.9 lb); kit with holder 2.1 Kg (4.6 lb.)
Ordering Information		**HI2550-01** (115V) and **HI2550-02** (230V) are supplied with HI1131B pH electrode, HI76310 EC/TDS probe, 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), 12 VDC adapter and instruction manual.

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100; ISE electrodes and solutions begin on page 4.22; EC , TDS and salinity solutions begin on page 6.42

(*) Uncompensated conductivity (or TDS) is the conductivity (or TDS) value without temperature compensation.

(**) Reduced to actual sensor limits

HI5321

Research Grade Conductivity/TDS Meter with USP <645>

EC/TDS/Resistivity/Salinity and Temperature

- Capacitive touch keypad
- Cleaner user interface
- Methods
  - Measures pure and ultra pure water
- Calibration
  - Up to four-point EC calibration and one-point salinity calibration
- GLP features
  - Meets Good Laboratory Practices
- Logging
  - Automatic, manual and AutoHold modes available
  - Up to 100 log lots with 50,000 records/lot max. for automatic and manual modes
  - Up to 200 USP reports
- Profiles
  - Up to 10 user profiles can be saved and recalled, eliminating the need for reconfiguration when a different application is used
- Connectivity
  - PC compatible via USB

Research Grade Conductivity Measurement

The HI5321 is a research grade EC/TDS/resistivity/salinity benchtop meter with a large, color, graphic LCD with backlight, capacitive touch keypad and conductivity with an extended range from 0.001 µS/cm to 1 S/cm.

Conductivity parameters are fully configurable and include: temperature compensation coefficient, temperature reference, selectable compensation method (linear, natural water and no compensation), adjustable cell constant and TDS factor.

All ranges of conductivity, resistivity and TDS feature autoranging or users can select the unit to measure manually. Three salinity scales are available: natural sea water scale, practical salinity scale and percentage scale.

EC USP Mode

Hanna's HI5321 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.

Calibration

This HI5321 is equipped with auto standard recognition and can support custom calibration solutions. Up to a four point calibration can be obtained for enhanced accuracy over an extended measuring range.

An enhanced warning system alerts users when measuring outside the calibration range or when a new calibration is due.

Screen Features

Specifications		HI5321
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 actual 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 cells
	Calibration	automatic standard recognition, user standard single point / multi-point calibration
	Calibration Reminder	yes
	Temperature Coefficient	0.00 to 10.00 %/°C
	Temperature Compensation	disabled, linear and non-linear (natural water)
	Reference Temperature	5.0 to 30.0°C
	Profiles	up to 10, 5 each channel
	USP Compliant	yes
TDS	Range	0.000 to 9.999 ppm; 10.00 to 99.99 ppm; 100.0 to 999.9 ppm; 1.000 to 9.999 ppt; 10.00 to 99.99 ppt; 100.0 to 400.0 ppt actual TDS* (with 1.00 factor)
	Resolution	0.001 ppm; 0.01 ppm; 0.1 ppm; 0.001 ppt; 0.01 ppt; 0.1 ppt
	Accuracy	±1% of reading (±0.01 ppm)
Resistivity	Range	1.0 to 99.9 Ω•cm; 100 to 999 Ω•cm; 1.00 to 9.99 kΩ•cm; 10.0 to 99.9 kΩ•cm; 100 to 999 kΩ•cm; 1.00 to 9.99 MΩ•cm; 10.0 to 100.0 MΩ•cm
	Resolution	0.1 Ω•cm; 1 Ω•cm; 0.01 kΩ•cm; 0.1 kΩ•cm; 1 kΩ•cm; 0.01 MΩ•cm; 0.1 MΩ•cm
	Accuracy	±2% of reading (±1 Ω•cm)
Salinity	Range	practical scale: 0.00 to 42.00 psu; natural sea water scale: 0.00 to 80.00 ppt; percent scale: 0.0 to 400.0%
	Resolution	0.01 for practical scale/natural sea water scale; 0.1% for percent scale
	Accuracy	±1% of reading
	Calibration	percent scale–one-point (with HI7037 standard)
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)
Additional Specifications	EC Probe	HI76312 platinum, four-ring EC/TDS probe with and 1 m (3.3') cable (included)
	GLP	cell constant, reference temperature/coefficient, calibration points, cal time stamp, probe offset for conductivity
	Logging	**record :** 100,000 data point storage/channel, up to 100 lots with max. 50,000 records/lot; **interval:** settable between 1 second and max log time of 180 minutes; **type:** automatic, manual, AutoHOLD; **additional:** 200 records USP
	PC Connection	USB and RS232
	Power Supply	12 VDC adapter (included)
	Environment	0 to 50°C (32 to 122°F; 273 to 323K) RH max 95% non-condensing
	Dimensions / Weight	160 x 231 x 94 mm (6.3 x 9.1 x 3.7") / 1.2 kg (2.64 lbs.)
Ordering Information		**HI5321-01** (115V) and **HI5321-02** (230V) are supplied with HI76312 conductivity probe, HI76404N electrode holder, 12 VDC power adapter and instructions.

EC , TDS and salinity solutions begin on page 6.42

(*) Uncompensated conductivity (or TDS) is the conductivity (or TDS) value without temperature compensation.
(**) Reduced to actual probe limits

HI2300

Autoranging Bench Meter

EC, TDS, Salinity and Temperature

- ATC
  - Automatic temperature compensation
- Methods
  - Measures EC, TDS, salinity and temperature
- One-point calibration
  - One-point EC and salinity calibration
- Sensor Check™
  - Potentiometric probe with built-in temperature sensor
- Connectivity
  - PC compatible via USB
- GLP Features
  - Meets Good Laboratory Practices

The HI2300 measures EC, TDS, salinity and temperature. In EC and TDS ranges (up to 500 mS/cm and 400 g/L respectively) the instrument automatically chooses the best scale to maintain the highest accuracy.

EC calibration is a one-point procedure. Selectable calibration points are 0.00 µS/cm, 84.0 µS/cm, 1413 µS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, and 111.8 mS/cm selected according with the expected measurement range. Salinity calibration is a one-point procedure at 100.0% NaCl. Use HI7037 calibration solution as a 100% NaCl standard solution.

This instrument utilizes a four ring potentiometric probe with platinum sensors to offer versatility over typical amperometric designs. By utilizing the four ring-method, it is possible to measure very low or high conductivity levels without changing probes.

Three options of compensating for temperature are available for this instrument:

Automatic (ATC): The EC probe has a built-in temperature sensor which is used to automatically compensate the EC/TDS reading (from -20.0°C to 120.0°C), using the selected reference temperature (20 or 25°C) and temperature compensation coefficient from (0.0 to 6.0%)/°C.

Manual (MTC): The temperature value, shown on the secondary LCD, can be manually set with the ARROW keys. The compensation is referenced at the selected temperature. All the other parameters of temperature compensation are settable similar to ATC.

No Compensation (NoTC): For actual conductivity or TDS measurement, the temperature value shown on the secondary LCD is not taken into account.

Cell constant is selectable between 0.5 and 1.700. TDS factor is selectable between 0.40 and 0.80.

The HI2300 also provides users with GLP capabilities. Good Laboratory Practice (GLP) is a set of functions that allows storage and retrieval of data regarding the status of the system. After a successful calibration, the meter automatically stores the date and time of calibration, the calibration solution used, the calibration offset and the resulting cell constant value. All this information can be later recalled by the user. Other features include a lock range function and stability indicator.

For PC communication, use the optional HI92000 software and HI920013 USB cable. The software is provided with an exclusive online guide of all the commands available and allows data printing, plotting and exporting.

On-screen Features

Last calibration date

Last calibration year

Last calibration time

Cell constant value (K)

Offset value

Specifications		HI2300
EC	Range	0.00 to 29.99 µS/cm; 30.0 to 299.9 µS/cm; 300 to 2999 µS/cm; 3.00 to 29.99 mS/cm; 30.0 to 200.0 mS/cm; up to 500.0 mS/cm (actual EC)*
	Resolution	0.01 µS/cm; 0.1 µS/cm; 1 µS/cm; 0.01 mS/cm; 0.1 mS/cm
	Accuracy	±1% of reading ± (0.05 µS/cm or 1 digit)
TDS	Range	0.00 to 14.99 mg/L (ppm); 15.0 to 149.9 mg/L (ppm); 150 to 1499 mg/L (ppm); 1.50 to 14.99 g/L (ppt); 15.0 to 100.0 g/L (ppt); up to 400.0 g/L (actual TDS)*, with 0.80 conversion factor
	Resolution	0.01 mg/L; 0.1 mg/L; 1 mg/L; 0.01 g/L; 0.1 g/L
	Accuracy	±1% of reading ± (0.03 mg/L or 1 digit)
Salinity	Range	0.0 to 400.0% NaCl
	Resolution	0.1%
	Accuracy	±1% of reading
Temperature**	Range	-20.0 to 120.0°C
	Resolution	0.1°C
	Accuracy	±0.4°C
Additional Specifications	EC Calibration	automatic, one point with six memorized values (84, 1413, 5000, 12880, 80000, 111800 µS/cm)
	NaCl Calibration	one point, with HI7037 calibration solution (optional)
	Temperature Calibration	two point, at 0 and 50°C
	Temperature Compensation	automatic or manual from -20.0 to 120.0°C, disabled
	Temperature Coefficient	selectable from 0.00 to 6.00%/°C (EC and TDS only)
	TDS Conversion Factor	selectable from 0.40 to 0.80 (default value: 0.50)
	Probe	HI76310 platinum, four ring conductivity/TDS probe with internal temperature sensor and 1 m (3.3') cable (included)
	PC Connectivity	opto-isolated USB
	Logging	log on demand, 500 samples
	Auto-off	after five minutes of non-use (can be disabled)
	Power Supply	12 VDC adapter (included)
	Environment	0 to 50°C (32 to 122°F); RH max 95%
	Dimensions	235 x 222 x 109 mm (9.2 x 8.7 x 4.3")
	Weight	1.3 kg (2.9 lbs.)
Ordering Information		**HI2300-01** (115V) and **HI2300-02** (230V) is supplied with HI76310 conductivity probe, 12 VDC adapter and instructions.

EC , TDS and salinity solutions begin on page 6.42

* with temperature compensation function disabled

(**) Reduced to actual sensor limits

HI2316

EC and Resistivity Meter

- Automatic temperature compensation (ATC)
- One-point calibration
- Sensor Check™

The HI2316 is a combination bench meter that can read conductivity in four different ranges as well as resistivity.

For conductivity measurements, the calibration is a simple one-point procedure using the easy to operate front panel knob. The supplied EC probe also does not require recalibration when switching from one range to another. The four-ring platinum probe has a built-in temperature sensor that automatically compensates for temperature. The temperature coefficient can be adjusted from 0 to 2.5% by also using a knob on the front panel.

For resistivity measurements, the meter is factory calibrated and if necessary, calibration can be adjusted. The HI3316D resistivity probe is easy to clean and requires little maintenance. It also features a built-in temperature sensor for automatic temperature compensation and the temperature coefficient is user selectable from 2 to 7%.

Both the EC and resistivity probes use the same DIN connector on the rear panel and the meter automatically recognizes which probe is connected.

Specifications		HI2316
EC	Range	0.0 to 199.9 µS/cm; 0 to 1999 µS/cm; 0.00 to 19.99 mS/cm; 0.0 to 199.9 mS/cm
	Resolution	0.1 µS/cm; 1 µS/cm; 0.01 mS/cm; 0.1 mS/cm
	Accuracy	±1% FS
Resistivity	Range	0 to 19.90 MΩ•cm
	Resolution	0.10 MΩ•cm
	Accuracy	±2% FS
Additional Specifications	Calibration	manual, one point, for both EC and resistivity
	Temperature Compensation	Automatic, 0 to 50°C (32 to 122°F) with β user selectable coefficients between 0 to 2.5%/°C for EC and from 2 to 7%/°C for resistivity
	Probes	HI76303 platinum four ring conductivity probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included); HI3316D resistivity probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)
	Power Supply	12 VDC (power adapter included)
	Environment	0 to 50°C (32 to 122°F); RH max 95%
	Dimensions / Weight	235 x 222 x 109 mm (9.2 x 8.7 x 4.3") 1.3 kg (2.9 lbs)
Ordering Information		**HI2316-01** (115V) and **HI2316-02** (230V) are supplied with HI76303 conductivity probe, HI3316D resistivity probe, 12 VDC adapter and instruction manual.

EC solutions begin on page 6.42

HI2314 • HI2315

Conductivity Meter

- Automatic temperature compensation (ATC) (HI2315)
- one-point calibration

These instruments utilize a four ring potentiometric probe with platinum sensor that offers greater versatility over typical amperometric designs. A potentiometric probe works on the principal of induction which eliminates the effects of polarization (a common problem of amperometric systems). Two outer rings apply an alternating voltage and induce a current loop in the solution while two inner rings measure the voltage drop induced by the current loop (which is dependent on the conductivity of the solution). By utilizing the four-ring method, it is possible to measure very low or high conductivity levels (up to 200 mS/cm) without changing probes.

The temperature coefficient correction is user selectable between 0 and 2.5%/°C for HI2315.

Specifications		HI2314	HI2315
EC	Range	0.0 to 199.9 µS/cm; 0 to 1999 µS/cm; 0.00 to 19.99 mS/cm; 0.0 to 199.9 mS/cm	0.0 to 199.9 µS/cm; 0 to 1999 µS/cm; 0.00 to 19.99 mS/cm; 0.0 to 199.9 mS/cm
	Resolution	0.1 µS/cm; 1 µS/cm; 0.01 mS/cm; 0.1 mS/cm	0.1 µS/cm; 1 µS/cm; 0.01 mS/cm; 0.1 mS/cm
	Accuracy (@25°C/77°F)	±1% F.S. (excluding probe error)	±1% F.S. (excluding probe error)
Additional Specifications	Calibration	manual, one point	manual, one point
	Temperature Compensation	manual, 0 to 50°C (32 to 122°F) with β = 2%/°C	automatic, 0 to 50°C (32 to 122°F) with β adjustable coefficient from 0 to 2.5%/°C
	Probe	HI76300, platinum four ring conductivity probe with DIN connector and 1 m (3.3') cable (included)	HI76303, platinum four ring conductivity probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)
	Analog Output	–	–
	Power Supply	12 VDC adapter (included)	12 VDC adapter (included)
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Dimensions	235 x 222 x 109 mm (9.2 x 8.7 x 4.3")	235 x 222 x 109 mm (9.2 x 8.7 x 4.3")
	Weight	1.3 kg (2.9 lbs)	1.3 kg (2.9 lbs)
Ordering Information	**HI2314-01** (115V) and **HI2314-02** (230V) are supplied with HI76300 conductivity probe, 12 VDC adapter and instruction manual. **HI2315-01** (115V) and **HI2315-02** (230V) are supplied with HI76303 conductivity probe, 12 VDC adapter and instruction manual.		

EC solutions begin on page 6.42

HI98192

Professional Waterproof Meter

EC/TDS/Resistivity/Salinity Meter with USP <645>

- Waterproof
  - IP67 rated waterproof, rugged enclosure
- Salinity readings
  - Salinity can be displayed as % NaCl, seawater scale (ppt) or practical salinity scale (PSU)
- Calibration
  - Perform up to a five point calibration for enhanced accuracy
- Temperature compensation
  - Automatic Temperature Compensation
  - Configurable temperature coefficient range from 0.00 to 10.00%.°C
- Four-ring platinum probe
  - This probe can cover low EC samples to 1000 mS/cm (actual EC)
- Log-on-demand
  - Store measurement data at the press of a button
- GLP
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- AutoHold
  - Automatically holds the first stable reading on the display
- Calibration timeout
  - Alerts when calibration is due at a specified interval
- Help menu
  - On-screen context specific help is readily available at the press of a button
- Backlit LCD
- Clear display
  - Dot matrix display with multifunction virtual keys
- Intuitive keypad
  - Most of the available options such as GLP information, help, range, calibration and backlight have a dedicated button
- Connectivity
  - PC connectivity via opto-isolated micro-USB with HI92000 software
- Approximately 100 hour battery life
  - Powered by (4) 1.5V AA batteries

For Universal Applications

HI98192 is a waterproof, portable conductivity meter that has an expanded conductivity range from 0.000 µS/cm to 400 mS/cm, as well as TDS, resistivity and three salinity scales. This meter automatically recognizes the probe type (two or four ring) and allows the user to adjust the nominal cell constant. HI98192 is also ready to perform all three stages of USP <645> method required for EC measurement of ultrapure water.

Choose from seven memorized standards and obtain up to a five point conductivity calibration. For salinity (% range), HI7037 standard allows users to make a one point calibration.

EC and TDS measurements are fully customizable and include: cell constant selection between 0.010 and 10.000, selection of linear or natural water (non-linear) or no temperature compensation (for actual conductivity reading), configurable temperature compensation coefficient range from 0.00 to 10.00%/°C, choice of reference temperatures of 15°C, 20°C and 25°C, and a selectable TDS factor between 0.40 and 1.00.

Ten sets of customized measurement parameters can be stored as a user profile and later recalled.

Quick connect probe

The HI763133 four ring platinum conductivity probe features a quick connect DIN connector to make attaching and removing the probe simple and easy.

Data Logging

The HI98192's allows users to store up to 400 log-on-demand samples or 1000 lot logging samples that can be later transferred to a PC with the HI920015 USB cable and HI92000 software.

Specifications		HI98192
EC	Range	0 to 400 mS/cm (shows values up to 1000 mS/cm), actual conductivity 1000 mS/cm**; 0.001 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 (autoranging)
	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 or 1 digit, whichever is greater)
	Calibration	automatic up to five points with seven memorized standards (0.00 µS/cm, 84.0 µS/cm, 1.413 mS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, 111.8 mS/cm)
TDS	Range	0.00 to 99.99 mg/L (ppm); 100.0 to 999.9 mg/L (ppm); 1.000 to 9.999 g/L (ppt); 10.00 to 99.99 g/L (ppt); 100.0 to 400.0 g/L (ppt) (autoranging)
	Resolution	0.01 mg/L (ppm); 0.1 mg/L (ppm); 0.001 g/L (ppt); 0.01 g/L (ppt); 0.1 g/L (ppt)
	Accuracy	±1% of reading (±0.05 mg/L (ppm) or 1 digit, whichever is greater)
Resistivity	Range	1.0 to 99.9 Ω•cm; 100 to 999 Ω•cm; 1.00 to 9.99 KΩ•cm; 10.0 to 99.9 KΩ•cm; 100 to 999 KΩ•cm; 1.00 to 9.99 MΩ•cm; 10.0 to 100.0 MΩ•cm* (autoranging)
	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	±1% of reading (±10 Ω or 1 digit, whichever is greater)
Salinity	Range	% NaCl : 0.0 to 400.0%; practical salinity: 0.00 to 42.00 (PSU); seawater scale: 0.00 to 80.00 (ppt)
	Resolution	0.1%; 0.01
	Accuracy	±1% of reading
	Calibration	max. one point only in % range (with HI7037 standard); use conductivity calibration for all other ranges
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)
	Calibration	one or two points
Additional Specifications	Cell Constant Setup	0.010 to 10.000
	Temperature Compensation	NoTC, linear (-20.0 to 120.0°C (-4.0 to 248.0°F)), non linear (0 to 36°C (32 to 98.6°C)) ISO/DIS 7888 std
	Reference Temperature	15°C, 20°C and 25°C
	Temperature Coefficient	0.00 to 10.00 %/°C
	TDS Factor	0.40 to 1.00
	Probe	HI763133 platinum, four ring conductivity/TDS probe with internal temperature sensor and 1.5 m (4.9') cable (included)
	Logging	log-on-Demand: 400 samples; lot logging: 5, 10, 30 sec, 1, 2, 5, 10, 15, 30, 60, 120, 180 min (max 1000 samples)
	Memorized Profiles	up to 10
	Measurement Modes	autorange, autoend, lock and fixed range
	PC Connectivity	opto-isolated USB (with HI92000 software and micro USB cable)
	Battery Type / Life	1.5V AA batteries (4) / approximately 100 hours of continuous use (without backlight), 25 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		**HI98192** is supplied with HI763133 conductivity probe, HI7031M 1413 µS/cm calibration solution (230 mL), HI7035M 111.8 mS/cm calibration solution (230 mL), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), instruction manual, quick start guide, quality certificate and HI720192 rugged carrying case with custom thermoformed insert.

EC , TDS and salinity solutions begin on page 6.42

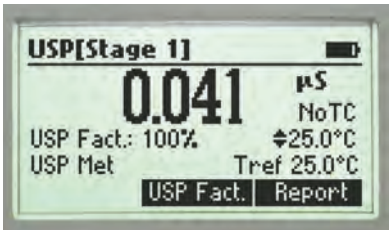
* The 0.000 µS/cm EC range and 0.1 MΩ•cm resistivity range are not available with the optional 4m cable probe
**Uncompensated temperature reading

(†) Reduced to actual sensor limits

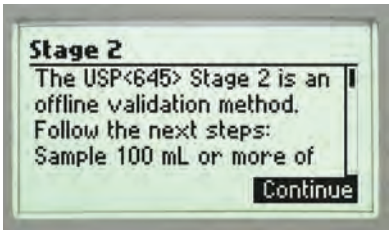
Shown in HI720192 rugged carrying case with custom thermoformed insert (included)

- 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.

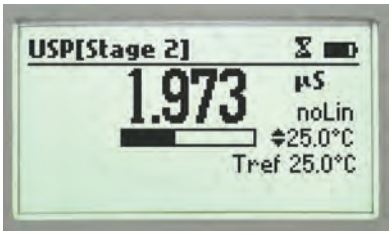
On-screen Features



- Three stages of conformity
  - Performs all 3 stages of USP <645> water quality testing requirements



- On-screen guide
  - Users are provided with on-screen instructions for each USP stage



- Progress bar
  - Displays progress towards meeting stage 2 stability requirements

HI9835

EC/TDS/Salinity/°C Meters

- ATC
  - Automatic temperature compensation
- Methods
  - Measures EC/TDS/Salinity/Temperature
- Battery Error Prevention System (BEPS)
  - Alerts the user of low battery power that could adversely affect readings
- Battery indicator
  - Battery life indicator at startup
- Help feature
  - On-screen user guides
- Backlight
  - Backlit, graphic LCD display

The HI9835 is a handheld EC/TDS/salinity/temperature meter. Users are provided with a series of diagnostic features and messages on the LCD which help guide through calibration, operation and troubleshooting.

Conductivity and TDS measurement parameters are selectable such as: cell constant range from 0.500 to 1.700, temperature coefficient from 0.00 to 6.00%/°C, temperature reference from 20 to 25°C and a selectable TDS factor of 0.40 to 0.80.

The autoranging feature of the EC and TDS modes automatically sets the meter to the scale with the highest possible resolution. The auto endpoint feature automatically freezes the display once a stable reading is reached.

HI76309 conductivity probe

The HI76309 conductivity and temperature probe features a PVC body with a stainless steel, four ring design. This design offers highly accurate readings over the entire conductivity range.

- Four-ring design
  - Immune to polarization and fouling for longer periods of time

Specifications		HI9835
EC	Range	0.00 to 29.99 µS/cm; 30.0 to 299.9 µS/cm; 300 to 2999 µS/cm; 3.00 to 29.99 mS/cm; 30.0 to 200.0 mS/cm; up to 500.0 mS/cm (actual EC)*
	Resolution	0.01 µS/cm; 0.1 µS/cm; 1 µS/cm; 0.01 mS/cm; 0.1 mS/cm
	Accuracy	±1 % of reading (±0.05 µS/cm or 1 digit)
TDS	Range	0.00 to 14.99 mg/L (ppm); 15.0 to 149.9 mg/L (ppm); 150 to 1499 mg/L (ppm); 1.50 to 14.99 g/L (ppt); 15.0 to 100.0 g/L (ppt); up to 400.0 g/L (ppt) (actual TDS)* with 0.80 conversion factor
	Resolution	0.01 mg/L (ppm); 0.1 mg/L (ppm); 1 mg/L (ppm); 0.01 g/L (ppt); 0.1 g/L (ppt)
	Accuracy	±1 % of reading (±0.03 mg/L (ppm) or 1 digit, whichever greater)
Salinity	Range	0.0 to 400.0% NaCl
	Resolution	0.1%
	Accuracy	±1% of reading
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)
Calibration	EC	automatic, one point with six memorized values (84, 1413, 5000, 12880, 80000, 111800 µS/cm)
	Salinity	one point with HI7037 calibration solution
	Temperature	two point, at 0 and 50°C (32 and 122°F)
Additional Specifications	Temperature Compensation	automatic or manual from -20.0 to 120.0 °C (-4.0 to 248.0°F) (can be disabled for measuring conductivity activity)
	Temperature Coefficient	selectable from 0.00 to 6.00%/°C (EC and TDS only); default value is 1.90%/°C
	Reference Temperature	20°C or 25°C
	TDS Conversion Factor	selectable from 0.40 to 0.80 (default value is 0.50)
	Probe	HI76309 EC/TDS probe four-ring conductivity probe with internal temperature sensor, DIN connector with 1m cable
	Battery Type / Life	1.5V AAA batteries (3) /approximately 200 hours of continuous use without backlight (50 hours with backlight on); auto-off after 5, 10, 20 and 60 minutes (can be disabled)
	Environment	0 to 50°C (32 to 122°F); RH max 95%
	Dimensions	185 x 72 x 36 mm (7.3 x 2.8 x 1.4")
	Weight	300 g (10.6 oz)
Ordering Information		**HI9835** is supplied with HI76309 conductivity probe, batteries, instructions and rugged carrying case.

**Uncompensated temperature reading

EC , TDS and salinity solutions begin on page 6.42

HI99300 • HI99301

Portable EC Meters

EC/TDS and Temperature

- ATC
  - Automatic temperature compensation
- Methods
  - Measures EC/TDS and Temperature
- BEPS
  - Alerts the user when the battery is low
- Battery indicator
  - Battery life indicator at startup
- One-point calibration
  - One-point EC/TDS calibration
- Waterpoof

The HI99300 and HI99301 are portable EC/TDS and temperature meters. HI99300 measures low range conductivity in µS/cm and TDS in ppm while the HI99301 measures high range conductivity in mS/cm and TDS in ppt. Both instruments are housed in a case rated for IP67 conditions.

These instruments offer single point, automatic calibration with automatic temperature compensated measurements. The compensation coefficient and EC/TDS conversion factor are user-selectable from 0.45 to 1.00 and temperature coefficient is selectable from 0.0 to 2.4%/°C.

These instruments easily fit in the palm of your hand and the bottom probe connection ensures the electrode cable doesn't get in your way. The large, multi-level LCD displays the primary reading, temperature and calibration guides simultaneously. Symbols and messages on the LCD indicate meter status and guides users through operations.

At start-up, the meter shows the remaining battery percentage; when a low battery condition is detected, a battery symbol appears on the LCD to advise the user that only a few hours of working time is left.

The HI76306 EC/TDS and temperature probe resists clogging and is easy to clean.

Specifications		HI99300	HI99301
EC	Range	0 to 3999 µS/cm	0.00 to 20.00 mS/cm
	Resolution	1 µS/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 µS/cm, 1382 ppm (CONV 0.5) or 1500 ppm (CONV 0.7)	automatic, one point at 12.88 mS/cm, 6.44 ppt (CONV 0.5) or 9.02 ppt (CONV 0.7)
	EC/TDS Temperature Compensation	automatic, 0 to 60°C (32 to 140°F) with β adjustable from 0.0 to 2.4%/°C with 0.1% step	
	EC/TDS Factor	adjustable from 0.45 to 1.00 with 0.01 step (default 0.50)	
	Probe	HI76306 EC/TDS probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)	
	Battery Type / Life	1.5V AAA (3) / approximately 500 hours of continuous use. auto-off after eight minutes of non-use	
	Environment	0 to 50°C (32 to 122°F); RH max. 100%	
	Dimensions	152 x 58 x 30 mm (6.0 x 2.3 x 1.2")	
	Weight	205g (7.2 oz.)	
Ordering Information		**HI99300** and **HI99301** are supplied with HI76306 EC/TDS probe, batteries, instructions and rugged carrying case.	

EC , TDS and salinity solutions begin on page 6.42

HI993310

Direct Soil Activity and Solution Conductivity Measurement Kit

- Automatic temperature compensation (ATC)
- Battery Error Prevention System (BEPS)
  - Alerts the user when the battery is low

The HI993310 is an instrument that has been designed to address the need for fast and accurate conductivity measurements in soil and liquids. It is supplied with two probes: HI76305 with stainless steel, conical tip for direct soil measurement and HI76304 for fertilizer enriched solutions.

The HI993310 measures the soil conductivity in EC (mS/cm) as well as soil activity (g/L). The different scales can be selected through two keys on the front panel and two separate LEDs indicate which parameter is being tested. In addition, HI993310 is equipped with an alarm LED that illuminates if the soil is too dry or nutritive substances such as potassium or nitrogen are lacking. Demineralized water can be added to the soil prior to proceeding with further tests.

Direct soil measurement is facilitated by the stainless steel HI76305 probe. Once inserted into the ground, the user simply waits until the meter displays the value read by the auger-like probe.

Why this meter is so important...

Conductivity is an important factor in greenhouses and hydroponics and is measured in soil as well as in fertilizer solutions since it is an excellent indication of the presence of nutritive salts. Soil conductivity is checked before and after fertilization to establish its effectiveness as well as ensuring that the soil is not too saline or damaging to the plant roots.

Conductivity of the irrigation water and fertilizer mixes is checked to make sure values are within an acceptable range and a correct fertilizer concentration strength is being applied.

Specifications		HI993310
EC	Range	0.00 to 19.99 mS/cm
	Resolution	0.01 mS/cm
	Accuracy (@25°C/77°F)	±2% F.S. (0 to 15.00 mS/cm; excluding probe error)
Soil Activity	Range	0.00 to 1.00 g/L
	Resolution	0.01 g/L
	Accuracy (@25°C/77°F)	±2% F.S. (0 to 15.00 mS/cm; excluding probe error)
Additional Specifications	Calibration	manual, one point
	Temperature Compensation	automatic from 0 to 50°C (32 to 122°F), β=2%/°C
	Probes	HI76305 stainless steel conductivity probe with internal temperature sensor, DIN connector and 1 m (3.3') cable for direct soil measurement (included); HI76304 conductivity probe with internal temperature sensor, DIN connector and 1 m (3.3') cable for measurement in soil slurry or water sample (included)
	Battery Type / Life	9V / approximately 100 hours of continuous use
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Dimensions	185 x 82 x 52 mm (7.3 x 3.2 x 2.0")
	Weight	275 g (9.7 oz.)
Ordering Information	**HI993310** is supplied with HI76304 conductivity probe, HI76305 direct soil conductivity probe, battery, instructions and rugged carrying case.	

EC solutions begin on page 6.42

HI9033 • HI9034

Multi-range EC and TDS Meters

- Automatic temperature compensation (ATC)
- Battery Error Prevention System (BEPS)
  - Alerts the user of low battery power that could adversely affect readings
- One-point calibration
- Waterpoof

The HI9033 is a rugged conductivity meter designed to hold up under extended use in wet, humid, dusty and muddy conditions. This meter has the advantage of measuring samples from deionized water to brine without having to switch or recalibrate the probe.

The HI9034 measures total dissolved solids (TDS) in three ranges and offers the highest accuracy when performing measurements in applications as diverse as HVAC, wastewater treatment and reverse osmosis. All three ranges can be activated at the touch of a button without having to change the conductivity probe.

Both instruments perform measurements with Automatic Temperature Compensation which adjusts for the effects of temperature on the probe. These instruments also feature Hanna's BEPS (Battery Error Prevention System) technology that alerts the user when low batteries could affect the readings.

Specifications	HI9033 (EC)	HI9034 (TDS)
Range	0.0 to 199.9 µS/cm; 0 to 1999 µS/cm; 0.00 to 19.99 mS/cm; 0.0 to 199.9 mS/cm	0.0 to 199.9 mg/L; 0 to 1999 mg/L; 0.00 to 19.99 g/L
Resolution	0.1 µS/cm; 1 µS/cm; 0.01 mS/cm; 0.1 mS/cm	0.1 mg/L; 1 mg/L; 0.01 g/L
Accuracy (@25°C/77°F)	±1% F.S. (excluding probe error)	±1% F.S. (excluding probe error)
Calibration	manual, one point	manual, one point
TDS Factor	–	0.5
Temperature Compensation	automatic, 10 to 50°C (50 to 122°F) with β = 2%/°C	automatic, 10 to 50°C (50 to 122°F) with β= 2%/°C
Probe	HI76302W conductivity probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)	HI76302W conductivity probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)
Battery Type / Life	9V / approximately 100 hours of continuous use	9V / approximately 100 hours of continuous use
Environment	0 to 50°C (32 to 122°F); RH max 100%	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")	185 x 72 x 36 mm (7.3 x 2.8 x 1.4")
Weight	425 g (0.9 lbs.)	425 g (0.9 lbs.)
Ordering Information	**HI9033** and **HI9034** are supplied with HI76302W conductivity probe, battery, instructions and rugged carrying case.	

EC and TDS solutions begin on page 6.42

HI8633 • HI8733

Multi-range EC Meters

- Automatic temperature compensation (ATC) (HI8733)
- Help feature
  - On-screen user guides
- One-point calibration
  - One-point calibration

The HI8633 and HI8733 conductivity meters have been designed for use in areas of production and quality control.

These meters utilize four ring potentiometric probes that offer greater versatility over typical amperometric designs. These rugged probes are made of PVC and are ideal for indoor as well as outdoor measurements.

HI8733's conductivity measurements can be automatically temperature compensated by using the HI76302W probe with built-in temperature sensor.

Temperature compensation for HI8633 is performed by manual adjustment.

Specifications	HI8633	HI8733
Range	0.0 to 199.9 µS/cm; 0 to 1999 µS/cm 0.00 to 19.99 mS/cm; 0.0 to 199.9 mS/cm	0.0 to 199.9 µS/cm; 0 to 1999 µS/cm 0.00 to 19.99 mS/cm; 0.0 to 199.9 mS/cm
Resolution	0.1 µS/cm; 1 µS/cm 0.01 mS/cm; 0.1 mS/cm	0.1 µS/cm; 1 µS/cm 0.01 mS/cm; 0.1 mS/cm
Accuracy (@25°C/77°F)	±1% F.S. (excluding probe error)	±1% F.S. (excluding probe error)
Calibration	manual, one-point through EC knob	manual, one-point through EC knob
Temperature Compensation	manual, 0 to 50°C (32 to 122°F) with β = 2%/°C	automatic, 0 to 50°C (32 to 122°F) with β adjustable from 0 to 2.5%/°C
Probe	HI76301D four ring conductivity probe with DIN connector and 1 m (3.3') cable (included)	HI76302W four-ring conductivity probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)
Battery Type / Life	9V / approximately 100 hours of continuous use	9V / approximately 100 hours of continuous use
Environment	0 to 50°C (32 to 122°F); RH max 100%	0 to 50°C (32 to 122°F); RH max 100%
Dimensions	145 x 80 x 36 mm (5.7 x 3.1 x 1.4")	145 x 80 x 36 mm (5.7 x 3.1 x 1.4")
Weight	230 g (8.1 oz.)	230 g (8.1 oz.)
Ordering Information	**HI8633** is supplied with HI76301D conductivity probe, 12880 µS/cm HI70030 calibration solution sachets (5), battery, instructions and rugged carrying case. **HI8733** is supplied with HI76302W conductivity probe, 12880 µS/cm HI70030 calibration solution sachets (5), battery, instructions and rugged carrying case.	

EC solutions begin on page 6.42

HI87314

EC and Resistivity Meter

- Automatic temperature compensation (ATC)
- One-point calibration
- Help feature
  - On-screen user guides

The HI87314 is a combination, portable meter that can read conductivity in four different ranges and resistivity.

For conductivity measurements, a one-point calibration is performed via a trimmer located in the battery compartment. The supplied probe does not require recalibration when switching from one range to another. The four-ring stainless steel probe has a built-in temperature sensor that automatically compensates for temperature changes. The temperature coefficient can be adjusted from 0 to 2.5% using a knob on the front panel.

For resistivity measurements, the meter is factory calibrated and, if necessary, calibration can be adjusted. The HI3316D resistivity probe is easy to clean and requires little maintenance. It also features a built-in temperature sensor to automatically compensate for temperature variations. The temperature coefficient is user-selectable from 2 to 7%.

Specifications		HI87314
EC	Range	199.9 µS/cm; 1999 µS/cm; 19.99 mS/cm; 199.9 mS/cm
	Resolution	0.1 µS/cm; 1 µS/cm; 0.01 mS/cm; 0.1 mS/cm
	Accuracy (@25°C/77°F)	±1% F.S.
Resistivity	Range	0 to 19.90 MΩ•cm
	Resolution	0.10 MΩ•cm
	Accuracy (@25°C/77°F)	±2% F.S.
Additional Specifications	Calibration	manual, one point, for both EC and resistivity
	Temperature Compensation	automatic from 0 to 50°C with β selectable from 0 to 2.5%/°C for EC and from 2 to 7%/°C for resistivity
	Probes	HI76302W conductivity probe with internal temperature sensor, DIN connector and 1 m (3.3') cable; HI3316D resistivity probe with internal temperature sensor, DIN connector and 1 m (3.3') cable
	Battery Type / Life	9V / approximately 100 hours of use
	Environment	0 to 50°C (32 to 122°F); RH max 100%
	Dimensions	145 x 80 x 36 mm (5.7 x 3.1 x 1.4")
	Weight	230 g (8.1 oz.)
Ordering Information	**HI87314** is supplied with HI76302W conductivity probe, HI3316D resistivity probe, HI70030 calibration solution sachet, calibration screwdriver, battery, instructions and hard carrying case.	

EC solutions begin on page 6.42

HI8730 • HI8731

EC, TDS and Temperature Meters

- Automatic temperature compensation (ATC)
- Sensor Check™
- Waterpoof

These EC/TDS meters are lightweight, water-tight and easy to maintain. Each desired measurement mode features its own key for quick selection.

The HI8730 measures EC from 0 to 1990 µS/cm and TDS from 0 to 1990 ppm.

The HI8731 measures EC and TDS with extended ranges (from 0 to 6000 µS/cm and from 0 to 3000 ppm, respectively).

The HI 761285 probe features a built-in temperature sensor and has been designed to require little maintenance.

Specifications		HI8730	HI8731
EC	Range	0 to 1990 µS/cm	0 to 6000 µS/cm
	Resolution	10 µS/cm	10 µS/cm
	Accuracy (@25°C/77°F)	±2% F.S.	±2% F.S.
TDS	Range	0 to 1990 mg/L (ppm)	0 to 3000 mg/L (ppm)
	Resolution	10 mg/L (ppm)	10 mg/L (ppm)
	Accuracy (@25°C/77°F)	±2% F.S.	±2% F.S.
Temperature	Range	0 to 70°C	0.0 to 70.0°C
	Resolution	1°C	0.1°C
	Accuracy (@25°C/77°F)	±1 °C	±0.5 °C
Additional Specifications	Calibration	EC/TDS: manual one point through knob; temperature: factory calibrated	
	TDS Factor	0.5	
	Probe	HI761285 conductivity probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)	
	Temperature Compensation	automatic from 0 to 50°C (32 to 122 °F) with β =2%/°C	
	Environment	0 to 50°C (32 to 122°F); RH max 100%	
	Battery Type / Life	1.9V / approximately 200 hours of continuous use	
	Dimensions	145 x 80 x 36 mm (5.7 x 3.1 x 1.4")	
	Weight	230 g (8.1 oz.)	

Ordering Information

HI8730 is supplied with HI761285 conductivity probe, HI70031 1413 µS/cm calibration solution sachet, HI70032 1382 mg/L (ppm) calibration solution sachet, battery, instructions and rugged carrying case.

HI8731 is supplied with HI761285 conductivity probe, HI70032 1382 mg/L (ppm) calibration solution sachet, HI70039 5000 µS/cm calibration solution sachet, battery, instructions and rugged carrying case.

EC and TDS solutions begin on page 6.42

HI86301 • HI86302
HI86303 • HI86304

EC and TDS Meters

- Automatic temperature compensation (ATC)
- Battery Error Prevention System (BEPS)
  - Alerts the user of low battery power that could adversely affect readings
- Help feature
  - On-screen user guides

The HI86301, HI86302, HI86303, and HI86304 are lightweight, portable EC/TDS meters.

These meters have been designed for simplicity of use while still retaining measurement accuracy. Readings are automatically compensated for temperature variations and calibration is manually performed at one point through a knob.

The housings of these instruments have been completely sealed against humidity for use in harsh environments. The probe is easy to clean and requires little maintenance.

Specifications	HI86301	HI86302	HI86303	HI86304
Range	0 to 1999 mg/L (ppm)	0.00 to 10.00 g/L (ppt)	0 to 1999 µS/cm	0.00 to 19.99 mS/cm
Resolution	1 mg/L (ppm)	0.01 g/L (ppt)	1 µS/cm	0.01 mS/cm
Accuracy (@25°C/77°F)	±2% F.S.	±2% F.S.	±2% F.S.	±2% F.S. (up to 15.00 mS/cm calibrated in 12.88 mS solution), ±6% F.S. over
Calibration	manual, one point, through knob			
Calibration Solution	HI70032	HI70032	HI70031	HI70039
Temperature Compensation	automatic from 0 to 50°C (32 to 122°F) with β=2%/°C			
Probe	HI7634D/1	HI7632D/1	HI7634D/1	HI7632D/1
Battery Type / Life	9V alkaline / approx. 200 hours	9V alkaline / approx. 150 hours	9V alkaline / approx. 200 hours	9V alkaline / approx. 150 hours
Environment	0 to 50°C (32 to 122°F); RH max 100%			
Dimensions	145 x 80 x 36 mm (5.7 x 3.1 x 1.4")			
Weight	230 g (8.1 oz.)	230 g (8.1 oz.)	230 g (8.1 oz.)	230 g (8.1 oz.)
Ordering Information	**HI86301** is supplied with HI7634D/1 conductivity probe, HI70032 1382 mg/L (ppm) calibration solution sachet, battery, instructions and rugged carrying case. **HI86302** is supplied with HI7632D/1 conductivity probe, HI70032 1382 mg/L (ppm) calibration solution sachet, battery, instructions and rugged carrying case. **HI86303** is supplied with HI7634D/1 conductivity probe, HI70031 1413 µS/cm calibration solution sachet, battery, instructions and rugged carrying case. **HI86304** is supplied with HI7632D/1 conductivity probe, HI70039 5000 µS/cm calibration solution sachet, battery, instructions and rugged carrying case.			

EC and TDS solutions begin on page 6.42

HI8734

TDS Meter

- One-point calibration
- Waterpoof

The HI8734 has not only been specifically designed for the water conditioning industry, but particularly in the softening, demineralization, reverse osmosis and drinking water applications.

Three ranges of measurement ensure the highest accuracy possible. All three ranges can be executed at the touch of a button, without having to change the conductivity probe. This makes it very easy to switch applications without having to worry about recalibration.

To enhance accuracy and efficiency, MTC (Manual Temperature Compensation) is available using a knob on the front panel.

For the best protection in the field, the four-ring potentiometric probe is made of rugged PVC. To access difficult areas, the probe is supplied with a 1 m (3.3') cable.

The ratio between conductivity and TDS is factory set at 0.5.

Specifications	HI8734
Range	0.0 to 199.9 mg/L (ppm); 0 to 1999 mg/L (ppm); 0.00 to 19.99 g/L (ppt)
Resolution	0.1 mg/L (ppm); 1 mg/L (ppm); 0.01 g/L (ppt)
Accuracy (@25°C/77°F)	±1% F.S. (excluding probe error)
Calibration	manual, one-point through TDS knob
Temperature Compensation	manual from 0 to 50°C (32 to 122°F) with β = 2%/°C
TDS Factor	0.5
Probe	HI76301D four ring conductivity probe with DIN connector and 1 m (3.3') cable (included)
Battery Type / Life	9V / approximately 100 hours of continuous use
Environment	0 to 50°C (32 to 122°F); RH max 100%
Dimensions	145 x 80 x 36 mm (5.7 x 3.1 x 1.4")
Weight	230 g (8.1 oz.)
Ordering Information	**HI8734** is supplied with HI76301D conductivity probe, HI70032 1382 mg/L (ppm) calibration solution sachet, battery, instructions and rugged carrying case.

TDS solutions begin on page 6.44

HI8033

EC/TDS Meter

- One-point calibration
- Manual temperature compensation

HI8033 is a handheld conductivity meter with the ability to take measurements in three different ranges.

The included HI76301W probe utilizes the four-ring potentiom etric method which measures conductivity with the utmost accuracy and reliability.

The four stainless steel rings are embedded in the resin shaft of the probe to create a smooth surface for fast and easy cleaning.

To improve accuracy in measurements, temperature compensation can be achieved with a knob on the front panel of the meter.

The dial on the front of the HI8033 easily indicates which range you are working in.

Specifications		HI8033
EC	Ranges	0.0 to 199.9 µS/cm; 0 to 1999 µS/cm; 0.00 to 19.99 mS/cm
	Resolution	0.1 µS/cm; 1 µS/cm; 0.01 mS/cm
TDS	Range	0 to 19990 mg/L (ppm)
	Resolution	10 mg/L (ppm)
	Accuracy (@25°C/77°F)	±1% F.S. (excluding probe error)
Additional Specifications	Calibration	manual, one-point
	Temperature Compensation	manual from 0 to 50°C (32 to 122°F) with β=2%/°C
	Probe	HI76301W conductivity probe with 1 m (3.3') cable (included)
	Battery Type / Life	9V / approximately 100 hours of continuous use
	Environment	0 to 50°C (32 to 122°F); RH max 95%
	Dimensions	185 x 82 x 47 mm (7.3 x 3.2 x 1.9")
	Weight	270 g (9.5 oz.)
Ordering Information	**HI8033** is supplied with HI76301W conductivity probe, battery and instructions.	

EC and TDS solutions begin on page 6.42

EC Calibration Solutions

Quality Solutions for Laboratory Applications

- Guaranteed quality
  - Each label shows the production batch number, expiration date and conductivity/temperature correlation table.
- Certified solutions available
- FDA compliant bottles
  - Opaque, light-tight bottles that meet FDA standards (HI80XX)

84 µS/cm Calibration Solution

This 84 µS/cm conductivity solution makes it possible to calibrate instruments with a conductivity scale of up to 200 µS/cm, in the measurement of pure or distilled water.

Using our single-dose 20 mL solution sachets guarantees freshness for every calibration.

1413 µS/cm Calibration Solution

The 1413 µS/cm calibration solution is best suited for general use. This solution is also available in combined sachet kits with Hanna pH 7 buffer for easy calibration of multiparameter instruments.

This solution is also available in different sized bottles and in single dose, ready to use sachets.

The HI8031L solution is provided in an opaque bottle according to FDA (Food & Drug Administration) regulations, which prevents the reagent from damage due to extended exposure to light.

Our wide range of calibration solutions also includes solutions provided with a certificate of analysis to satisfy the requirements of any application from the farm to the factory.

5000 µS/cm Calibration Solution

This calibration solution is ideal for applications that need to achieve higher reading accuracies in a conductivity scale between 2,000 µS/cm and 10000 µS/cm. This solution is widely used in agriculture for monitoring and preparing nutrient solutions for proper crop production.

Hanna has produced a 5000 µS/cm calibration solution that is available in a wide range of sizes and packages to suit every application.

84 µS/cm Bottles

Code	EC Value @25°C	Size	Package	FDA Bottle	Certificate of Analysis
HI6033	84 µS/cm	500 mL	1 bottle		•
HI7033L	84 µS/cm	500 mL	1 bottle		on request
HI7033M	84 µS/cm	230 mL	1 bottle		on request
HI8033L	84 µS/cm	500 mL	1 bottle	•	•

1413 µS/cm Bottles

Code	EC Value @25°C	Size	Package	FDA Bottle	Certificate of Analysis
HI6031	1413 µS/cm	500 mL	1 bottle		•
HI7031/1G	1413 µS/cm	1 G (3.78 L)	1 bottle		on request
HI7031L	1413 µS/cm	500 mL	1 bottle		on request
HI7031L/C	1413 µS/cm	500 mL	1 bottle		•
HI7031M	1413 µS/cm	230 mL	1 bottle		on request
HI8031L	1413 µS/cm	500 mL	1 bottle	•	•

1413 µS/cm Sachets

Code	EC Value @25°C	Size	Package	Certificate of Analysis
HI70031C	1413 µS/cm	20 mL	25 sachets	•
HI70031P	1413 µS/cm	20 mL	25 sachets	
HI77100C	1413 µS/cm & pH 7.01	20 mL	20 sachets (10 ea)	•
HI77100P	1413 µS/cm & pH 7.01	20 mL	20 sachets (10 ea)	

5000 µS/cm Bottles

Code	EC Value @25°C	Size	Package	FDA Bottle	Certificate of Analysis
HI7039L	5000 µS/cm	500 mL	1 bottle		on request
HI7039M	5000 µS/cm	230 mL	1 bottle		on request
HI8039L	5000 µS/cm	500 mL	1 bottle	•	•

5000 µS/cm Sachets

Code	EC Value @25°C	Size	Package	Certificate of Analysis
HI70039C	5000 µS/cm	20 mL	25 sachets	•
HI70039P	5000 µS/cm	20 mL	25 sachets	

EC Calibration Solutions

Quality Solutions for Laboratory Applications

- Compliant standards
  - Meets FDA standards (HI80XX)

12880 µS/cm Calibration Solution

The 12880 µS/cm (12.88 mS/cm) calibration solution is widely used to assure the proper performance of conductivity meters with a scale higher than 10 mS/cm.

This solution is used mainly for industrial applications and is available in various sizes to better meet user requirements.

80000 µS/cm Calibration Solution

The 80,000 µS/cm calibration solution is needed for the proper calibration of instrumentation used to measure high conductivity samples such as wastewater, solutions with suspended solids and plating baths.

It is available in two different sizes and also in an FDA approved light shielded bottle.

This calibration solution is also ideal for use in the agroalimentary sector.

111800 µS/cm Calibration Solution

This calibration solution is useful to calibrate instrumentation used to measure samples with conductivity higher than 100 mS/cm (100,000 µS/cm).

In fact, this solution makes it possible to calibrate instruments that perform under conditions of high salt concentrations.

This calibration solution is ideal for use in systems where phase limits have to be detected (e.g. separation of a substance from water), monitoring of bottle washing plants, beverage controls, check of acids or bases in electrodeposition processes and some plating baths.

12880 µS/cm Bottles

Code	EC Value @25°C	Size	Package	FDA Bottle	Certificate of Analysis
HI7030/1G	12880 µS/cm	1 G (3.78 L)	1 bottle		on request
HI7030L	12880 µS/cm	500 mL	1 bottle		on request
HI7030M	12880 µS/cm	230 mL	1 bottle		on request
HI8030L	12880 µS/cm	500 mL	1 bottle	•	•

12880 µS/cm Sachets

Code	EC Value @25°C	Size	Package	Certificate of Analysis
HI70030C	12880 µS/cm	20 mL	25 sachets	•
HI70030P	12880 µS/cm	20 mL	25 sachets	

80000 µS/cm Bottles

Code	EC Value @25°C	Size	Package	FDA Bottle	Certificate of Analysis
HI7034L	80000 µS/cm	500 mL	1 bottle		on request
HI7034M	80000 µS/cm	230 mL	1 bottle		on request
HI8034L	80000 µS/cm	500 mL	1 bottle	•	•

111800 µS/cm Bottles

Code	EC Value @25°C	Size	Package	FDA Bottle	Certificate of Analysis
HI7035L	111800 µS/cm	500 mL	1 bottle		on request
HI7035M	111800 µS/cm	230 mL	1 bottle		on request
HI8035L	111800 µS/cm	500 mL	1 bottle	•	•

TDS Calibration Solutions

Quality Solutions for Laboratory Applications

TDS Solutions

Hanna is one of the few producers to offer calibration solutions in packages from 20 to 500 mg/L for lab and field applications. Our packaging has been designed to keep air and light from damaging the solution.

Safety Data Sheets

The safety data sheets for all Hanna solutions in this catalog are available at www.hannainst.com or upon request.

Expiration Date

The production batch number and the expiration date are reported on all Hanna calibration solutions.

NIST Traceability

TDS solutions are produced with high-quality potassium chloride in various concentrations. They are standardized using a conductivity meter calibrated with NIST potassium chloride.

TDS Bottles

Code	TDS Value @25°C	Size	Package	Certificate of Analysis
HI6032	1382 mg/L (ppm)	500 mL	1 bottle	•
HI7032L	1382 mg/L (ppm)	500 mL	1 bottle	on request
HI7032M	1382 mg/L (ppm)	230 mL	1 bottle	on request
HI7036L	12.41 g/L (ppt)	500 mL	1 bottle	on request
HI7036M	12.41 g/L (ppt)	230 mL	1 bottle	on request
HI70442L*	1500 mg/L (ppm)	500 mL	1 bottle	on request
HI70442M*	1500 mg/L (ppm)	230 mL	1 bottle	on request

TDS Sachets

Code	TDS Value @25°C	Size	Package	Certificate of Analysis
HI70032C	1382 mg/L (ppm)	20 mL	25 sachets	•
HI70032P	1382 mg/L (ppm)	20 mL	25 sachets	
HI70038C	6.44 g/L (ppt)	20 mL	25 sachets	•
HI70038P	6.44 g/L (ppt)	20 mL	25 sachets	
HI70080C	800 mg/L (ppm)	20 mL	25 sachets	•
HI70080P	800 mg/L (ppm)	20 mL	25 sachets	
HI70442C*	1500 mg/L (ppm)	20 mL	25 sachets	•
HI70442P*	1500 mg/L (ppm)	20 mL	25 sachets	
HI77200C	1500 mg/L (ppm) & pH 7.01	20 mL	20 sachets (10 ea)	•
HI77200P*	1500 mg/L (ppm) & pH 7.01	20 mL	20 sachets (10 ea)	

* TDS Conversion Factor 4-4-2: 0.65 ppm = 1 µS/cm (approximately).

Salinity Calibration Solutions

Salinity Bottles

Code	Description	Size	Package
HI7037L	Salinity solution	500 mL	1 bottle
HI7037M	Salinity solution	230 mL	1 bottle

Table of Contents

Dissolved Oxygen Meters

Professional Instruments for a Variety of Applications

Dissolved Oxygen

Dissolved oxygen (DO) meters are instruments that measure the quantity of oxygen dissolved in water.

In normal conditions where temperature and pressure in an aqueous solution is allowed to equilibrate, oxygen constitutes about 20.9% of the total dissolved gas in the atmosphere. The atmospheric pressure at the water surface and temperature are factors that modify the concentrations of DO and therefore have to be compensated for to ensure a correct reading.

Since dissolved oxygen determination is based on measurement of a current that is established between the anode and cathode, the salinity of water is another factor that can influence readings; this must also be compensated for.

Applications

Dissolved oxygen is an important indicator of the degree to which a sample of water in specific applications. DO can exist in water can be utilized in different concentrations; it is important for the respiration of a wide variety of animals and aerobic bacteria in the aquatic environment.

Other applications include: water treatment plants, sewage treatment works, effluent activated sludge process, river monitoring, fish farming, and generally any other field where water quality is important.

Biotechnological processes are another area of applications where dissolved oxygen measurements are essential to maintain quality of finished products.

In water quality applications such as aquaculture and fish farming, the level of dissolved oxygen must be kept high. If the DO level falls too low, aquatic organisms cannot adequately respirate. For wastewater treatment, bacteria decompose the solids; if the DO level is too low, the bacteria will die and decomposition stops; if the DO level is too high, there is wasted energy expenditure from aeration of the water.

For industrial applications like boilers or cooling towers, low dissolved oxygen levels prevent corrosion and scale build-up, inhibiting efficient heat transfer.

Polarographic and Galvanic Probes

Hanna's dissolved oxygen meters utilize one of two common types of dissolved oxygen sensing probes: polarographic sensors and galvanic sensors.

Polarographic sensor technology is based on the Ross and Clark polarographic measurement method. An oxygen probe is composed of a platinum cathode and a solid silver anode. A concentrated potassium chloride solution is held in place over the surfaces of the electrodes by a PTFE membrane. An external voltage creates a difference in potential between the cathode and anode (less than 0.5 volts); the external voltage applied to the cathode, anode, KCl electrlyte solution and gas-permeable membrane material establishes a current that is proportional to the concentration of oxygen.

In contrast, a galvanic probe requires no external voltage. The difference in potential between the cathode and anode is greater than 0.5 volts. Galvanic DO sensors consist of two electrodes, a zinc or lead anode and silver cathode, both of which are immersed in electrolyte solution. An oxygen permeable membrane separates the anode and cathode from the water being measured. Oxygen diffuses across the membrane and interacts with the probe internals to produce an electrical current proportional to the oxygen concentration.

Comparison Guide

	Dissolved Oxygen Range	Barometric Pressure	% Saturation O_2	Salinity Compensation	Altitude Compensation	Temperature Range(s)	DO Calibration Points	Barometric Pressure Calibration Points	ATC	Hold Feature	BEPS	PC Connectivity	Logging	Alarm	GLP	Capacitive Touch Buttons	Benchtop, Portable & Wall-Mount	Page
Bench Meters																		
edge®	•*			•	•	•	2		•			•	•		•	•	•	7.4
edge®DO	•*			•	•	•	2		•			•	•		•	•	•	7.10
HI5421	•	•	•	•		°C/°F/K	2	1	•	•		•	•	•	•			7.12
HI2400	•		•	•	•	°C	2		•			•	•		•			7.14
Portable Meters																		
HI98193	•	•	•	•		°C/°F	2	1	•	•	•	•	•		•			7.16
HI9146	•		•	•	•	°C	2		•		•				•			7.18
HI9147	•		•	•	•	°C/°F	1		•		•							7.19
HI9142	•					°C/°F	2		•		•							7.20

* Using the HI2020 DO kit
edge® is available in 3 kits: pH, EC and Dissolved Oxygen

edge®DO

7.10

edge®DO is thin and lightweight, measuring just 1/2" thick and weighing less than 9 ounces. edge®DO has an incredibly wide viewing angle, 5.5" LCD and a sensitive capacitive touch keypad.

edge®DO measures dissolved oxygen through its unique digital conductivity electrodes that connect to with an easy to plug-in 3.5mm connector. edge®DO's versatile design is equally at home in your hand, on a lab bench or mounted on a wall. edge®DO simplifies measurement, configuration, calibration, diagnostics, logging and transferring data to a computer or a USB drive.

HI5421

Research Grade Dissolved Oxygen and BOD Meter

7.12

Hanna's research grade bench meter line expands to include HI5421. The fully customizable HI5421 features DO, BOD, OUR and SOUR measurement modes in a compact versatile instrument. The color graphic LCD is capable of displaying graphs, soft key menus, help screens and calibration reminders. HI5421 also incorporates an intuitive menu system to help streamline your workflow process and provide accurate measurements quickly and efficiently. The large log memory offers 100 lots with 10,000 records per lot. Measurements can be transferred to a PC via USB or RS 232 with Hanna software.

HI98193

Graphic Display Dissolved Oxygen Meter

7.16

HI98193 portable Dissolved Oxygen Meter has extended ranges of up to 50 ppm or 600% saturation. When measuring dissolved oxygen, compensations for salinity, temperature and pressure are essential to improve the precision of your readings.

This new meter features a 50% smaller body and is 33% lighter than previous models.

edge®

pH • EC • DO

Hanna Instruments is proud to introduce the world's most innovative pH, EC and DO meter... edge®

edge® is thin and lightweight, measuring just 1/2" (12 mm) thick and weighing less than 9 ounces (250 g). edge® has an incredibly wide viewing angle, 5.5" (14 cm) LCD and a sensitive capacitive touch keypad.

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

edge® features Hanna's exclusive pH CAL Check™ to warn you if the electrode you are using is not clean or if your buffers are contaminated during calibration. We have added Sensor Check™ for pH sensors with a matching pin. Our Sensor Check™ feature warns you if the pH bulb is cracked and/or the junction of the electrode is compromised.

edge® is the culmination of Hanna's vision, design capabilities, integrated production facilities, and world class R&D teams. With edge®, Hanna has set the new standard!

edge® Technical Features

- 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 charging edge® when the cradle is not available.

- Clear, full text readout

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

- Data logging

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

- GLP

Data from the last calibration you perform is stored in the sensor including the electrode's offset, slope, date, time and standards. When any sensor (pH, EC, or DO) is connected to edge®, GLP data is automatically transferred.

- Basic mode

You can use edge® in basic mode–ideal for routine measurements by offering a simplified screen and features.

- CAL Check™ (edge® pH measurement only)

edge® features Hanna's exclusive CAL Check™ technology to warn you if the electrode bulb is not clean or if the buffers are contaminated during calibration.

Accepts pH, EC and DO edge® compatible probes

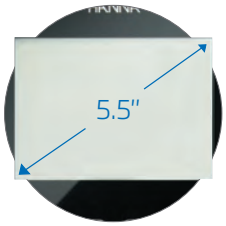
edge® Design Features

- Cradle and electrode holder

edge® is equipped with a benchtop cradle that features an adjustable swivel electrode holder which can charge and hold edge® securely in place at the optimum viewing angle.

- Capacitive touch keypad

edge® features a capacitive touch keypad that gives a distinctive, modern look. Since the keypad is part of the screen, your buttons can never get clogged with sample residue. For faster scrolling, simply hold down the arrow keys.



- 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 edge® and charge its batteries.

- 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 SMART electrodes are automatically recognized.

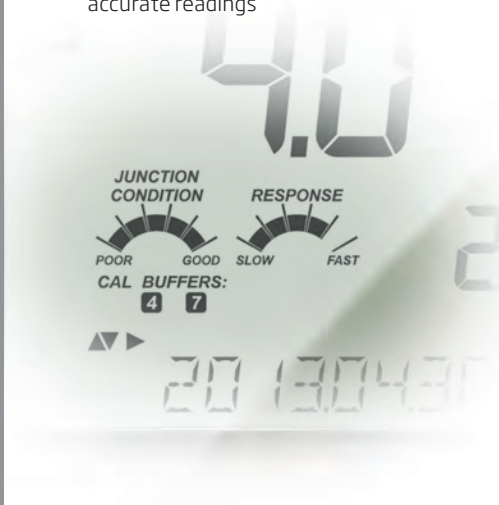
- Sleek design

edge® is incredibly thin and lightweight, measuring just 1/2" (12 mm) thick and weighing just 8.8 ounces (250 g).

edge pH Parameter and CAL Check™ Features

pH

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



CAL Check™

The edge® includes powerful algorithms to alert the user of potential problems during the pH calibration process. These indicators include when to clean the electrode, check the buffer, the response time, and the overall condition of the electrode.

WRONG BUFFER–Displayed when the difference between the pH reading and the value of the selected buffer is too great.

WRONG OLD POINTS INCONSISTENCY–Displayed if the new calibration differs significantly from the last value of that sensor in that buffer.

CLEAN ELECTRODE–This message indicates poor electrode performance (offset out of accepted window, or slope under the accepted lower limit).

CHECK ELECTRODE CHECK BUFFER–Displayed when electrode slope exceeds the highest accepted slope limit.

BAD ELECTRODE–Displayed if the cleaning procedure performed as a result of the previous two messages is unsuccessful.

WRONG BUFFER TEMPERATURE–Displayed if the temperature of the buffer is outside the defined buffer temperature range.

CONTAMINATED BUFFER–Displayed when the buffer could be contaminated.

Broken Temperature Sensor–If the temperature sensor should malfunction or break at any time, a temperature of "25.0°C" will blink on the second LCD line and the message **BROKEN TEMPERATURE SENSOR** will appear after leaving calibration.

Response and condition gauges appear on the display for 24 hours after an electrode calibration. These five segment displays provide a visual image of the overall condition of the pH probe based on offset and slope characteristics and speed of response based upon how long it took to stabilize in buffers during calibration.

edge EC and DO Parameter Features

Conductivity

- Four-ring platinum probe
  - Covers all ranges from 0.00 µS/cm to 500 mS/cm (absolute EC)
- Accuracy
  - ± 1% of the reading ± (0.05 µS/cm or 1 digit, whichever is greater)
- Calibration
  - Offset (0 µS/cm) and cell factor calibration
  - Choice of five standards
- Auto-ranging or manual range selection
- EC, TDS and salinity reading modes
- Temperature compensation
  - Automatic
  - NoTC (absolute)
- GLP data
  - Records date, time, offset and cell constant value (K)
- Adjustable EC to TDS conversion factor
- Adjustable temperature correction coefficient

Dissolved Oxygen

- Clark type polarographic probe with easy-to-replace membrane cap
  - Covers all ranges from 0.00 to 45.00 mg/L (ppm); 0.0 to 300% air saturation
- Accuracy
  - ±1.5% full scale
- One or two-point calibration (HI7040); 0% (solution) and 100% (air)
- Automatic Temperature Compensation from 0 to 50 °C
- Altitude compensation from -500 to 4000 m (-1640 to 13,123')
- Salinity compensation 0 to 40 g/L
- GLP data
  - Records date, time, calibration standards, altitude value and salinity value

- Portable field unit
  - edge® is ideal for field use due to its lightweight, large screen and thin design. It can be easily slipped into a backpack or messenger bag.
- Wall mount cradle
  - The included wall mount cradle makes it easy to conserve space on the benchtop and can charge edge® with the AC adapter. 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.

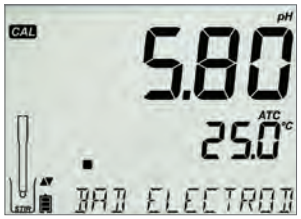
edge® Electrodes

Digital SMART Electrodes

The electrodes used with edge® are nearly as advanced as edge® itself. They feature a built-in microchip that stores sensor type, ID, and calibration information that is automatically retrieved by edge® once the electrode is plugged in.

Stored pH calibration information includes: calibrated buffers, date, time, offset and slope characteristics of the electrode. Conductivity calibration information includes: calibrated conductivity standards, date, time, and cell constant of the sensor. Dissolved oxygen calibration information includes: standards used for calibration, date, time, altitude and salinity correction.

These digital electrodes also feature an easy to plug in 3.5 mm connector so you never have to worry about the right angle or aligning pin settings.



Sensor Check™ (HI12301 and HI11311 only)

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

pH Electrodes

HI11310

Single ceramic, double junction, glass body, refillable pH electrode with temperature sensor

Recommended for laboratory and general purpose

Sensor Check™

HI11311

Single ceramic, double junction, glass body, refillable pH electrode with temperature sensor and matching pin

Recommended for laboratory and general purpose

HI12300

Single ceramic, double junction, gel filled, PEI body, pH electrode with temperature sensor

Recommended for field applications

Sensor Check™

HI12301

Single ceramic, double junction, gel filled, PEI body, pH electrode with temperature sensor and matching pin

Recommended for field applications

HI10530

Triple ceramic, double junction, glass body, refillable pH electrode with conic tip and temperature sensor

Recommended for fats and creams, and soil samples

HI10430

Triple ceramic, double junction, glass body, refillable pH electrode with temperature sensor

Recommended for paints, solvents, strong acids and bases, high conductivity samples, and Tris buffer

HI10480

Double reference, open junction, Clogging Prevention System (CPS), glass body pH electrode with temperature sensor

Recommended for wine analysis

FC2320

Double reference, open junction, viscolene electrolyte, PVDF body pH electrode with conic tip and temperature sensor

Recommended for meat applications

FC2100

Double reference, open junction, viscolene electrolyte, glass body pH electrode with conic tip and temperature sensor

Recommended for dairy analysis

FC2020

Double reference, open junction, viscolene electrolyte, PVDF body pH electrode with conic tip and temperature sensor

Recommended for dairy analysis

Conductivity Probe

HI763100

Conductivity probe with temperature sensor

Recommended for general purpose

Dissolved Oxygen Electrode

HI764080

Dissolved oxygen electrode with temperature sensor

Recommended for general purpose

- Simply connect each probe via the 3.5 mm jack, digital SMART Electrodes are automatically recognized

Specifications		edge®		
pH (using pH kit)	Range	basic mode: -2.00 to 16.00 pH; ±1000.0 mV for pH standard mode: -2.00 to 16.00 pH; -2.000 to 16.000 pH; ±1000.0 mV for pH		
	Resolution	0.01 pH; 0.001 pH; 0.1 mV		
	Accuracy (@25°C/77°F)	±0.01 pH; ±0.002 pH; ±0.2 mV		
	Calibration	Automatic, up to three points (five points†) calibration, 5 standard (7 standard†) buffers available (1.68†, 4.01 or 3.00, 6.86, 7.01, 9.18, 10.01, 12.45†) and two custom buffers†		
	Temperature Compensation*	automatic, -5.0 to 100.0°C (23.0 to 212.0°F) (using integral temperature sensor)		
	Electrode Diagnostics	standard mode: probe condition, response time and out of calibration range		
EC (using EC kit)	Range	EC	TDS	Salinity†
		0.00 to 29.99 µS/cm; 30.0 to 299.9 µS/cm; 300 to 2999 µS/cm; 30.0 to 200.0 mS/cm; up to 500.0 mS/cm (absolute EC)**	0.00 to 14.99 mg/L (ppm); 15.0 to 149.9 mg/L (ppm); 150 to 1499 mg/L (ppm); 1.50 to 14.99 g/L; 15.0 to 100.0 g/L; up to 400.0 g/L (absolute TDS)**, with 0.80 conversion factor	0.0 to 400.0 % NaCl; 2.00 to 42.00 PSU; 0.0 to 80.0 g/L
	Resolution	0.01 µS/cm; 0.1 µS/cm; 1 µS/cm; 0.01 mS/cm; 0.1 mS/cm	0.01 ppm; 0.1 ppm; 1 ppm; 0.01 g/L; 0.1 g/L (0.80 TDS factor)	0.1 % NaCl; 0.01 PSU; 0.01 g/L
	Accuracy (@25°C/77°F)	±1% of reading ±(0.5 µS or 1 digit, whichever is greater)	±1% of reading ±(0.03 ppm or 1 digit, whichever is greater)	±1% of reading
	Calibration	single cell factor calibration; six standards available: 84 µS/cm, 1413 µS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, 118.8 mS/cm, one point offset: 0.00 µS/cm	through EC calibration	one-point with HI7037 100% NaCl sea water standard
	Conductivity Temperature Coefficient	0.00 to 6.00%/°C (for EC and TDS only), default value is 1.90%/°C		
	Temperature Compensation*	automatic -5.0 to 100.0°C (23.0 to 212.0°F); NoTC – none, absolute conductivity.		
	TDS Factor	0.40 to 0.80 (default value is 0.50)		
DO (using DO kit)	Range	0.00 to 45.00 ppm (mg/L); 0.0 to 300.0 % saturation		
	Resolution	0.01 ppm (mg/L); 0.1 % saturation		
	Accuracy	± 1.5% of reading ±1 digit		
	Calibration	one or two-point at 0% (HI7040 solution) and 100% (in air)		
	Temperature Compensation*	0 to 50°C; 32.0 to 122.0°F		
	Salinity Compensation	0 to 40 g/L (with 1 g/L resolution)		
	Altitude Compensation	-500 to 4000 m (with 100 m resolution)		
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		
Additional Specifications	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	one USB port for storage; one micro USB port for charging and PC connectivity		
	pH Electrode (included in pH kit)	HI11310 digital glass body pH electrode with 1/8"(3.5mm) connector and 1 m (3.3') cable		
	EC Electrode (included in EC kit)	HI763100 digital four-ring conductivity probe with 1/8"(3.5mm) connector and 1 m (3.3') cable		
	DO Electrode (included in DO kit)	HI764080 digital dissolved oxygen electrode with 1/8"(3.5mm) connector and 1 m (3.3') cable		
	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

edge® is available in 3 kit configurations: pH, EC and DO

All kits Include: edge®, benchtop docking station with electrode holder, wall-mount cradle, USB cable, 5 VDC power adapter, quality certificate and instruction manual.

HI2020-01 (115V) and **HI2020-02** (230V) pH kit also includes: HI11310 glass body, refillable pH electrode with temperature sensor, pH 4 buffer solution sachets (2), pH 7 buffer solution sachets (2), pH 10 buffer solution sachets (2) and electrode cleaning solution sachets (2).

HI2030-01 (115V) and **HI2030-02** (230V) EC kit also includes: HI763100 EC probe, 1413 µS/cm conductivity standard sachets (3) and 12880 µS/cm conductivity standard sachets (3).

HI2040-01 (115V) and **HI2040-02** (230V) DO kit also includes: HI764080 dissolved oxygen electrode, HI7041S refill electrolyte solution, DO membrane caps (2) and o-rings (2).

All probes on the opposite page are interchangeable with edge® and can be ordered separately.

edge® compatible electrodes begin on page 3.91; pH solutions begin on page 3.100; DO solutions begin on page 7.21; EC and TDS solutions begin on page 6.42

* temperature limits will be reduced to actual probe/sensor limits
** with temperature compensation function disabled
† standard mode only

edge® DO

edge®DO is thin and lightweight, measuring just 1/2" (12 mm) thick and weighing less than 9 ounces (250 g). edge®DO has an incredibly wide viewing angle, 5.5" (14 cm) LCD and a sensitive capacitive touch keypad.

edge®DO measures dissolved oxygen through its unique digital dissolved oxygen electrodes. These digital dissolved oxygen electrodes are auto-recognized, providing sensor type, calibration data and a serial number when connected to edge®DO by an easy to plug-in 3.5mm connector. The versatile design of edge®DO enables it to be used as a handheld, benchtop or wall-mounted meter. edge®DO simplifies measurement, configuration, calibration, diagnostics, logging and transferring data directly to a computer or USB drive.

Dissolved Oxygen

- Clark type digital polarographic probe with easy-to-replace membrane cap
  - Covers all ranges from 0.00 to 45.00 mg/L (ppm); 0.0 to 300% air saturation
- Accuracy ±1.5% full scale
- One or two-point calibration (HI7040), 0% (solution) and 100% (air)
- Automatic Temperature Compensation from 0 to 50 °C
- GLP data
  - Records date, time, calibration standards, altitude value and salinity value
- Altitude compensation from -500 to 4000 meters (-1640 to 13,123')
- Salinity compensation from 0 to 40g/L

edge® DO Technical Features

- Two USB ports
  edge®DO includes one standard USB for exporting data to a flash drive. edge®DO also includes one micro USB port for exporting files to your computer as well as charging edge®DO when the cradle is not available.
- Clear, full text readout
  edge®DO 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®DO 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 electrode's calibration points, date and time. When a compatible dissolved oxygen sensor is connected to edge®DO, GLP data is automatically transferred.

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

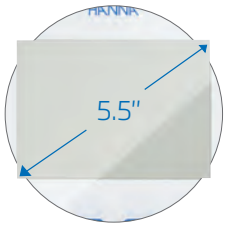
Accepts edge®DO compatible dissolved oxygen probe

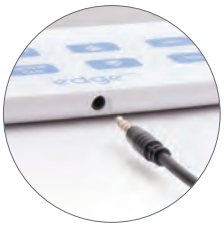
edge® DO Design Features

- Capacitive touch keypad
  edge®DO features a capacitive touch keypad that gives a distinctive, modern look. Since the keypad is part of the screen, your buttons can never get clogged with sample residue.

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

- Portable field unit
  - edge®DO is ideal for field use due to its light weight, large screen and thin design. It can be slipped into a back pack or messenger bag. Up to 8 hours of battery life when used as a portable device.





- Easy to read LCD
  edge®DO features a 5.5" (14 cm) LCD display that you can clearly view from over 5 meters (16.4'). The large display with its wide 150° viewing angle provide one of the easiest to read LCD's in the industry.

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

- Wall mount cradle
  - The included wall mount cradle makes it easy to conserve space on the benchtop and can charge edge®DO with the AC adapter. Ideal for continuous monitoring applications.

Specifications		edge®DO
DO	Range	0.00 to 45.00 ppm (mg/L); 0.0 to 300.0 % saturation
	Resolution	0.01 ppm (mg/L); 0.1 % saturation
	Accuracy	± 1.5% of reading ±1 digit
	Calibration	one or two-point at 0% (HI7040 solution) and 100% (in air)
	Temperature Compensation	ATC (0 to 50°C; 32.0 to 122.0°F)*
	Salinity Compensation	0 to 40 g/L (with 1 g/L resolution)
	Altitude Compensation	-500 to 4000 m (-1640 to 13120') (with 100 m (328') resolution))
Temperature*	Range	-20.0 to 120.0°C; -4.0 to 248.0°F
	Resolution	0.1°C; 0.1°F
	Accuracy	±0.5°C; ±0.9°F
Additional Specifications	Logging	up to 1000 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
	Electrode	HI764080 digital dissolved oxygen electrode with 1/8"(3.5mm) connector and 1 m (3.3') cable (included)
	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 (8" x 5.5" x 0.5")
	Weight	250 g (8.82 oz.)
Ordering Information		**HI2004-01** (115V) and **HI2004-02** (230V) edge®DO includes: HI764080 dissolved oxygen electrode, HI7041S refill electrolyte solution, DO membrane caps (2), o-rings (2), benchtop docking station with electrode holder, wall-mount cradle, USB cable 5 VDC power adapter, quality certificate and instruction manual.

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

DO solutions begin on page 7.21

* temperature limits will be reduced to actual probe/sensor limits

HI5421

Research Grade Bench Meter

Dissolved Oxygen and BOD

- Capacitive touch keypad
- Clean user interface
- Methods
  - % saturated, ppm, mg/L, BOD, OUR and SOUR
- GLP features
  - Meets Good Laboratory Practices
- Hold feature
  - DO direct, DO direct/autohold
- Logging
  - Large log memory with different logging methods
- Connectivity
  - PC compatible via USB
- On-screen help
  - Users can consult the on-screen help from any mode simply by pressing the HELP key. The instrument will then display the meaning and options available of the current screen.

Extensive DO Capabilities

The HI5421 is a research grade dissolved oxygen bench meter with extensive capabilities in measuring DO as well as BOD (Biological Oxygen Demand), OUR (Oxygen Uptake Rate), SOUR (Specific Oxygen Uptake Rate) and temperature.

DO measurements can be performed with ppm, mg/L or in % air saturation units of measurement and feature automatic or manual temperature and atmospheric pressure compensation, as well as manual salinity compensation.

The DO probe uses the polarographic principal of measurement and has a built-in temperature sensor.

Profiles

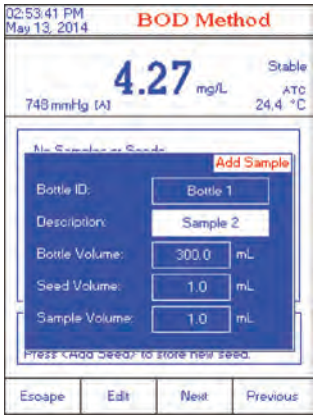
Up to 10 profiles can be saved and recalled, eliminating the need to reconfigure each time when a different application is used. User-definable configurations can include: reading mode (direct or BOD, OUR, and SOUR), measurement units, temperature units, stability criteria, and temperature, atmospheric pressure and salinity compensation.

Dedicated Help Menu

Clear tutorial messages and directions for DO measurement and calibration as well as BOD, OUR and SOUR methods are available on-screen to guide users.

On-screen Features

Direct measurement



BOD (Biological Oxygen Demand)

OUR (Oxygen Uptake Rate)

SOUR (Specific Oxygen Uptake Rate)

Specifications		HI5421
DO	Range	0.00 to 90.00 ppm (mg/L); 0.0 to 600.0 % saturation
	Resolution	0.01 ppm; 0.1% saturation
	Accuracy	±1.5% of reading ±1 digit
	Calibration	automatic using single or two-point calibration; user calibration single point
Barometric Pressure	Range	450 to 850 mmHg; 560 to 1133 mBar (additional units available (kPa, mHg, psi, atm))
	Resolution	1 mm Hg
	Accuracy	±3 mm Hg + 1 least significant digit
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)
Additional Specifications	Measurement Modes	direct DO; BOD (biochemical oxygen demand); OUR (oxygen uptake rate); SOUR (specific oxygen uptake rate)
	Temperature Compensation	0.0 to 50.0°C; 32.0 to 122.0°F; 237.1 to 323.1 K
	Salinity Compensation	0 to 45 g/L (ppt), % or PSU
	Barometric Pressure Calibration	single point calibration
	Probe	HI76483 thin body, polarographic dissolved oxygen probe with internal temperature sensor and 1 m (3.3') cable (included)
	Record Samples Logging	100,000 records storage, 100 lots each for automatic and manual logs; maximum 50,000 records/log for automatic logging
	Interval Logging	fourteen intervals available from 1 second to 180 minutes/interval
	Logging Type	manual AutoHOLD, automatic
	Alarm (DO, BOD, OUR, SOUR)	inside and outside limits
	PC Connection	opto-isolated USB
	Display	graphic color LCD with on-screen help, graphing, language selection and custom configuration
	Power Supply	12 VDC adapter (included)
	Dimensions	160 x 231 x 94 mm (6.3 x 9.1 x 3.7")
	Weight	1.2 kg (2.6 lbs.)
Ordering Information		**HI5421-01** (115V) and **HI5421-02** (230V) is supplied with HI76483 DO probe, HI76404N electrode holder, HI7041S electrolyte solution (30 mL), DO membrane caps (2), 12 VDC adapter, quality certificate and instruction manual.

DO solutions and accessories begin on page 7.21

HI2400

Dissolved Oxygen Meter

Dissolved Oxygen and Temperature

- Automatic temperature compensation (ATC)
- Calibration
  - One or two-point calibration at 0% or 100%
- GLP Features
  - Meets Good Laboratory Practices
- Connectivity
  - PC compatible via USB
- Interval logging
- Data logging and storage up to 8000 samples

Accurate, Repeatable Measurements

The HI2400 is a dissolved oxygen benchtop meter with automatic calibration and % or mg/L (ppm) measurement range. The measurement is automatically compensated for altitude and salinity based on the user settings for altitude up to 4000 m and salinity up to 40 g/L.

Measurements are automatically temperature compensated by using the polarographic DO probe with built-in temperature sensor. This probe features screw cap membranes for easy replacement.

Calibration is performed at one or two points at 0% using Hanna's HI7040 solution or 100% in air.

Data Logging

With a built-in logging function, measurements are stored in non-volatile memory, and can be transferred to a PC through the USB port using the optional HI92000 software and HI920013 USB cable. The software is provided with an exclusive online guide of all the commands available and allows data printing, plotting and exporting.

The 8000 record logging interval allows the possibility of process and experimental monitoring of DO. The logging interval is automatic with user-selectable intervals from 5 seconds to 180 minutes.

GLP Capabilities

The HI2400 also provides users with GLP (Good Laboratory Practice) capabilities. GLP is a set of functions that allow the storage and retrieval of data regarding calibration. The GLP feature provides data consistency and a calibration reminder which can be set to alert the user that too much time has elapsed since the last calibration and a new one should be performed.

HI76407

Standard DO Probe

The HI76407 dissolved oxygen probe is extremely rugged, making it ideal for both laboratory and field applications. Calibration is fast and simple, while all DO measurements are temperature compensated. The pre-tensioned, ready-made PTFE membrane can be changed in a matter of seconds without the need to stretch and cut replacements.

Several cable lengths are available.

HI76408

Thinner DO Probe for Laboratories

The HI76408 DO probe is rugged and perfect for both laboratory and field applications. Calibration is fast and simple, and measurements are temperature compensated. The sensitive PTFE membrane can be changed in a few seconds.

Available in 1 m (3.3') cable length..

HI76407A/P

Easy, Screw Cap DO Membranes

Carry Extras for Assurance

Pretensioned PTFE membranes are easily replaced using these screw on cap replacements. Should a pin hole or stretching occur, have replacements on hand.

Specifications		HI2400
Dissolved Oxygen	Range	0.00 to 45.00 mg/L (ppm); 0.0 to 300.0% saturation
	Resolution	0.01 mg/L (ppm); 0.1% saturation
	Accuracy	±1.5% FS
	Calibration	one or two points at 0% (HI7040 solution) and 100% (in air)
Temperature	Range	0.0 to 50.0°C
	Resolution	0.1°C
	Accuracy	±0.2°C (excluding probe error)
	Altitude Compensation	0 to 4000 m (with 100 m resolution)
	Salinity Compensation	0 to 40 g/L (ppt) (with 1 g/L resolution)
	Temperature Compensation	automatic from 0.0 to 50.0°C (32.0 to 122°F)
	Probe	HI76407/2 polarographic DO probe with internal temperature sensor, DIN connector and 2 m (6.6') cable (included)
	Logging Interval	5, 10, 30 seconds or 1, 2, 5, 10, 15, 30, 60, 120, 180 minutes
	PC Connection	opto-isolated USB
	Power Supply	12 VDC adapter
	Environment	0 to 50°C; RH max 95%
	Dimensions	235 x 222 x 109 mm (9.2 x 8.7 x 4.3")
	Weight	1.3 kg (2.9 lbs.)
Ordering Information	**HI2400-01** (115V) and **HI2400-02** (230V) are supplied with HI76407/2 dissolved oxygen probe, HI76407A membrane caps (2), HI7041S electrolyte solution (30 mL), 12 VDC adapter and instructions.	

DO solutions and accessories begin on page 7.21

HI98193

Professional Waterproof Meter

Dissolved Oxygen and BOD

- Waterproof
  - IP67 rated waterproof, rugged enclosure
- Choice of units
  - Display units in % saturation or mg/L (ppm)
- Salinity compensation
  - Users can set the salinity value
- Automatic pressure compensation
  - Built-in barometer with user-selectable units (mmHg, inHg, atm, psi, kPa, mbar)
- Built-in calculations
  - Determination of Biochemical Oxygen Demand (BOD), Oxygen Uptake Rate (OUR) and Specific Oxygen Uptake Rate (SOUR)
- Polarization
  - Automatic polarization of probe at startup
- Membrane caps
  - Ready-to-use PTFE preformed membrane caps
- Log-on-demand
  - Store measurement data at the press of a button
- GLP
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- AutoHold
  - Automatically holds the first stable reading on the display
- Calibration timeout
  - Alerts when calibration is due at a specified interval
- Help menu
  - On-screen context specific help is readily available at the press of a button
- Backlit LCD
- Clear display
  - Dot matrix display with multifunction virtual keys
- Intuitive keypad
  - Most of the available options such as GLP information, help, range, calibration and backlight have a dedicated button
- Connectivity
  - PC connectivity via opto-isolated micro-USB with HI92000 software

Quick Connect Probe

For Universal Applications

The HI98193 portable dissolved oxygen meter has extended ranges of up to 50 ppm and 600% saturation. When measuring dissolved oxygen, compensations for salinity, temperature and pressure are essential to improve the accuracy and precision of readings.

Salinity compensation allows for direct determination of dissolved oxygen in saline waters. Temperature compensation is automatic with the probes built-in sensor, which features a one or two-point calibration. Pressure compensation with the meter's built-in barometer can be validated against a reference barometer, and if needed, can be recalibrated in user-selectable units (mmHg, inHg, atm, psi, kPa, mbar). With the internal barometer, the HI98193 is able to compensate for changes in barometric pressure so there is no need for charts, altitude information or external barometric pressure information.

Other features include measurement, methods and calculations for BOD, OUR and SOUR.

Quick connect probe

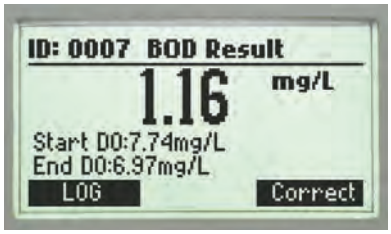
The HI764073 polarographic dissolved oxygen probe features a quick connect DIN connector to make attaching and removing the probe simple and easy.

Data Logging

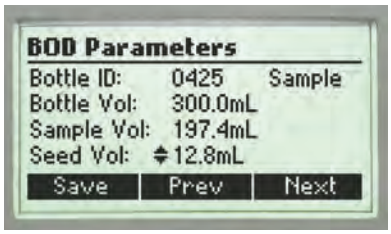
The HI98193's log-on-demand features allows users to store up to 400 samples that can be later transferred to a PC with the HI920015 USB cable and HI92000 software.

Shown in HI720193 rugged carrying case with custom thermoformed insert (included)

On-screen Features

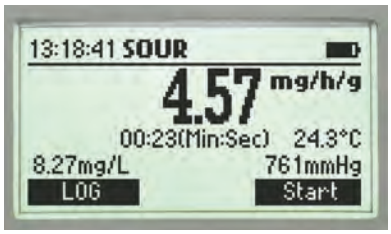


- BOD results
  - BOD is calculated in mg per liter from the difference between the initial and final dissolved oxygen concentration readings.



- BOD parameters and records
  - All necessary parameters for BOD testing can be set and displayed at once.
  - A list of all saved BOD data can be easily retrieved and shown on the LCD display.

- OUR results
  - Measured in mg of oxygen consumed per L per hour.



- SOUR results
  - Measured in mg of oxygen consumed per g of volatile suspended solids per hour.

Specifications		HI98193
DO	Range	0.00 to 50.00 mg/L (ppm); 0.0 to 600.0% saturation
	Resolution	0.01 mg/L (ppm); 0.1% saturation
	Accuracy (@25°C/77°F)	±1.5% of reading ±1 digit
	Calibration	automatic one or two point at 100 % (8.26 mg/L) and 0 % (0 mg/L).; manual one point using a value entered by the user in % saturation or mg/L
Atmospheric Pressure	Range	450 to 850 mmHg
	Resolution	1 mmHg
	Accuracy (@25°C/77°F)	± 3 mmHg within ±15% from the calibration point
	Calibration	one point at any in range pressure value
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)
	Calibration	one or two point at any in range temperature value
Additional Specifications	Measurement Modes	direct DO; BOD (biochemical oxygen demand); OUR (oxygen uptake rate); SOUR (specific oxygen uptake rate)
	Barometric Compensation	automatic from 450 to 850 mmHg
	Salinity Compensation	automatic from 0 to 70 g/L
	Temperature Compensation	automatic from 0.0 to 50.0 °C (32.0 to 122.0 °F)
	Probe	HI764073 polarographic DO probe with protective sleeve, internal temperature sensor, DIN connector and 4m (13') cable (included)
	Logging	log-on-demand up to 400 samples
	PC Connectivity	opto-isolated USB (with HI92000 software)
	Battery Type / Life	1.5V (4) AA batteries / approximately 200 hours of continuous use without backlight (50 hours with backlight)
	Auto-off	user-selectable: 5, 10, 30, 60 min or can be disabled
	Environment	0 to 50°C (32 to 122°F); RH 100% IP67
	Dimensions	185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4")
	Weight	400 g (14.2 oz.)
Ordering Information	**HI98193** is supplied with HI764073 DO probe with protective sleeve, pre-formed PTFE membrane caps (2), HI 7040 bi-component zero oxygen solution (230 mL), HI7041S electrolyte solution (30 mL), DO protective cap, o-rings (2), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), instruction manual, quick start guide, quality certificate and HI720193 rugged carrying case with custom thermoformed insert.	

DO solutions begin on page 7.21

HI9146

Dissolved Oxygen Meter

- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- One or two-point calibration
- GLP features
  - Meets Good Laboratory Practices
- Help feature
  - On-screen tutorial messages

HI9146 is a water-resistant dissolved oxygen meter that measures up to 300% saturation or 45 ppm (mg/L) with temperature compensation and automatic calibration. It has been developed for DO and temperature measurement in water, wastewater, and applications such as fish farming.

This instrument also allows altitude compensation up to 4000 m and compensates for changes in solubility of oxygen in water and for permeability of the membrane from the effects of temperature.

The included polarographic probe features built-in temperature compensation and removable protective membrane cover.

Specifications		HI9146
DO	Range	0.00 to 45.00 mg/L (ppm); 0.0 to 300.0% saturation
	Resolution	0.01 mg/L (ppm); 0.1% saturation
	Accuracy (@ 25°C/77°F)	±1.5% 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)	±0.2°C ; ±0.4°F (excluding probe error)
Additional Specifications	Dissolved Oxygen Calibration	one or two points at 0% (HI7040 solution) and 100% (in air)
	Temperature Compensation	automatic from 0 to 50°C (32 to 122°F)
	Altitude Compensation	0 to 4000 m (resolution 100 m)
	Salinity Compensation	0 to 80 g/L (ppt) (resolution 1 g/L)
	Probe	HI76407/4F polarographic DO probe, internal temperature sensor, DIN connector and 2 m (6.6') cable (included)
	Battery Type / Life	1.5V AAA (3) /approximately 200 hours of continuous use without backlight (50 hours with backlight on)
	Environment	0 to 50°C (32 to 122°F); RH max 95%
	Dimensions	185 x 72 x 36 mm (7.3 x 2.8 x 1.4")
	Weight	300 g (10.6 oz.)
Ordering Information		**HI9146-04** is supplied complete with HI76407/4F probe with 4 m (13.1') cable, HI76407A membranes (2), HI7041S electrolyte solution (30 mL), batteries, instructions and rugged carrying case. **HI9146-10** is supplied complete with HI76407/10F probe with 10 m (32.8') cable, HI76407A membranes (2), HI7041S electrolyte solution (30 mL), batteries, instructions and rugged carrying case.

DO solutions and accessories begin on page 7.21

HI9147

Dissolved Oxygen Meter for Aquaculture

- Automatic Temperature Compensation (ATC)
- Waterpoof
- Backlit LCD

The HI9147 is designed for aquaculture applications. This unit is unique among our family of DO meters as it is supplied with a galvanic probe.

Unlike polarographic probes, galvanic DO probes require no conditioning time. When you need to measure multiple samples in a given period of time, simply turn the meter on and start taking measurements.

The HI9147 is a must have for DO sensitive organisms or high bio-load environments.

DO Levels at 100% Saturation

	Salinity (ppt)				
Temperature	0	10	20	30	40
10°C / 50°F	13.0	12.2	11.4	10.6	9.8
15°C / 59°F	10.3	9.7	9.2	8.6	8.1
20°C / 68°F	9.4	8.8	8.4	7.9	7.4
25°C / 77°F	8.5	8.0	7.6	7.2	6.7
30°C / 86°F	7.8	7.4	7.0	6.6	6.2

Specifications		HI9147
DO	Range	0.0 to 50.0 mg/L (ppm); 0 to 600% saturation
	Resolution	0.1 mg/L (ppm); 1% saturation
	Accuracy (@ 20°C/68°F)	±1% of reading
Temperature	Range	0.0 to 50.0°C; 32.0 to 122.0°F
	Resolution	0.1°C; 1°F
	Accuracy (@ 20°C/68°F)	±0.2°C; ±1°F (excluding probe error)
Additional Specifications	Calibration	manual, in saturated air
	Temperature Compensation	automatic, 0° to 50°C (32°F to 122°F)
	Altitude Compensation	0 to 4000 m (resolution 100 m)
	Salinity Compensation	0 to 51 g/L (ppt) (1 g/L resolution)
	Probe	HI76409/4 galvanic DO probe (fixed) with internal temperature sensor, DIN connector and 4 m (13') cable (HI9147-04), 10 m (33') cable (HI9147-10), 15 m (49') cable (HI9147-15) or 20 m (66') cable (HI9147-20) (included)
	Battery Type / Life	1.5V AAA (3) / approx. 1000 hours of continuous use without backlight
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Dimensions	185 x 72 x 36 mm (7.3 x 2.8 x 1.4")
	Weight	450 g (15.9 oz.)
Ordering Information	**HI9147-04** is supplied with HI76409/4 probe with 4 m (13') cable and spare membranes (5), electrolyte solution (30 mL), batteries, screwdriver and instructions.	
	HI9147-10 is supplied with HI76409/10 probe with 10 m (32.8') cable and spare membranes (5), electrolyte solution (30 mL), batteries, screwdriver and instructions.	
	HI9147-15 is supplied with HI76409/15 probe with 15 m (49.2') cable and spare membranes (5), electrolyte solution (30 mL), batteries, screwdriver and instructions.	
	HI9147-20 is supplied with HI76409/20 probe with 20 m (65.6') cable and spare membranes (5), electrolyte solution (30 mL), batteries, screwdriver and instructions.	

DO solutions and accessories begin on page 7.21

HI9142

Manual Calibration Dissolved Oxygen Meter

- Automatic Temperature Compensation (ATC)
- One or two-point calibration
- Waterpoof

The ever increasing demand for instant on-site analysis results has created a need for innovative, rugged, portable and waterproof meters.

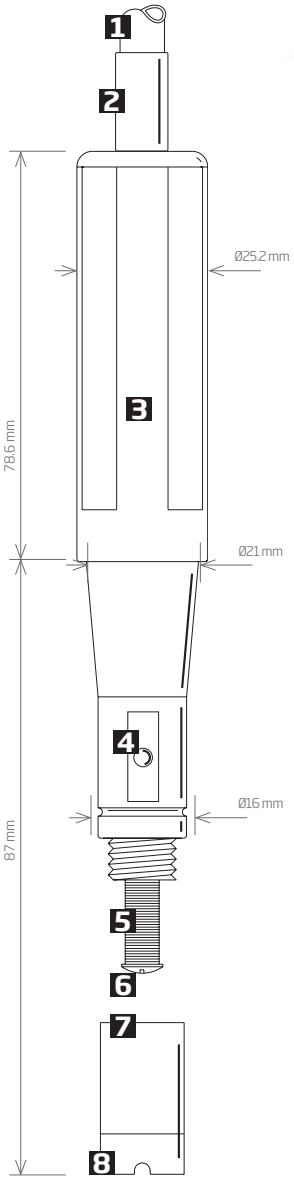
Field work can subject instrumentation to the inclemency of weather. Cold, rain, snow, dust and humidity can cause condensation to breech the housing. Once the housing has been compromised, the meter is susceptible to diminishing performance and life span. The rugged, waterproof housing of the HI9142 solves many of the problems of field use.

Calibration is performed with HI7040 zero oxygen solution, while 100% calibration is done in air.

The polarographic probe (HI76407/4) is accurate to 0.3 ppm and is supplied with a 4 m (13') cable that allows measurements to be taken even in hard to reach places.

Specifications		HI9142
Dissolved Oxygen	Range	0.0 to 19.9 mg/L (ppm)
	Resolution	0.1 mg/L (ppm)
	Accuracy (@ 25°C/77°F)	±1.5% F.S.
Temperature	Range	-5.0 to 50.0°C (23.0 to 122.0°F)
	Resolution	0.1°C (1°F)
	Accuracy (@ 25°C/77°F)	±0.2°C (±1°F) (excluding probe error)
Additional Specifications	Calibration	manual, at one or two points (zero and slope)
	Temperature Compensation	automatic, 0 to 50°C (32 to 122°F)
	Probe	HI76407/4 polarographic DO probe with internal temperature sensor, DIN connector and 4 m (13') cable
	Battery Type / Life	1.5V AAA (3) / approximately 1,000 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	**HI9142** is supplied with HI 76407/4 probe with 4 m (13') cable, 2 spare membranes, HI7041S electrolyte solution (30 mL), calibration screwdriver, batteries, instructions and rugged carrying case.	

DO solutions and accessories begin on page 7.21



HI76407

HI76407
Standard DO Probe

The HI76407 dissolved oxygen probe is extremely rugged, making it perfect for both laboratory and field applications. Calibration is fast, simple and all DO readings are temperature compensated.

The pre-tensioned, ready-made PTFE membrane can be changed in a few seconds without the need to stretch and cut replacements.

The HI76407 is offered with several cable lengths to meet your specific needs.

HI76407

1. Shielded, waterproof cable
2. Protective sleeve
3. PEI probe for best field protection
4. Linearized and accurate thermistor temperature sensor protected behind a stainless steel cover
5. Silver wire anode element
6. Glass encapsulated platinum cathode
7. Screw cap membrane that holds potassium chloride electrolyte solution (HI7041S)
8. Thin, permeable PTFE membrane isolates the sensor elements from the testing solution, but allows oxygen to enter (HI76407A/P)

Probe	Cable Length	Recommended Meter
HI76407/2	2 m (6.6')	HI5421 HI2400
HI76407/4	4 m (13')	
HI76407/10	10 m (33')	

HI76407A/P
Easy, Screw Cap DO Membranes

When the PTFE (polytetrafluoroethylene) membrane of the protective cap wears, it is always good to have a back-up.

HI76407A/P	contains 5 ready-to-use, replacement membranes

HI7041
Electrolyte Solution

It is crucial to the performance of your DO probe to keep the sensor active with regular maintenance. For this purpose, Hanna has developed HI7041 electrolyte solution to refill the membrane cap.

HI7041S	refilling electrolyte solution (30 mL)
HI7041	refilling electrolyte solution (6 x 30 mL)
HI7041M	refilling electrolyte solution (230 mL)
HI7041L	refilling electrolyte solution (500 mL)

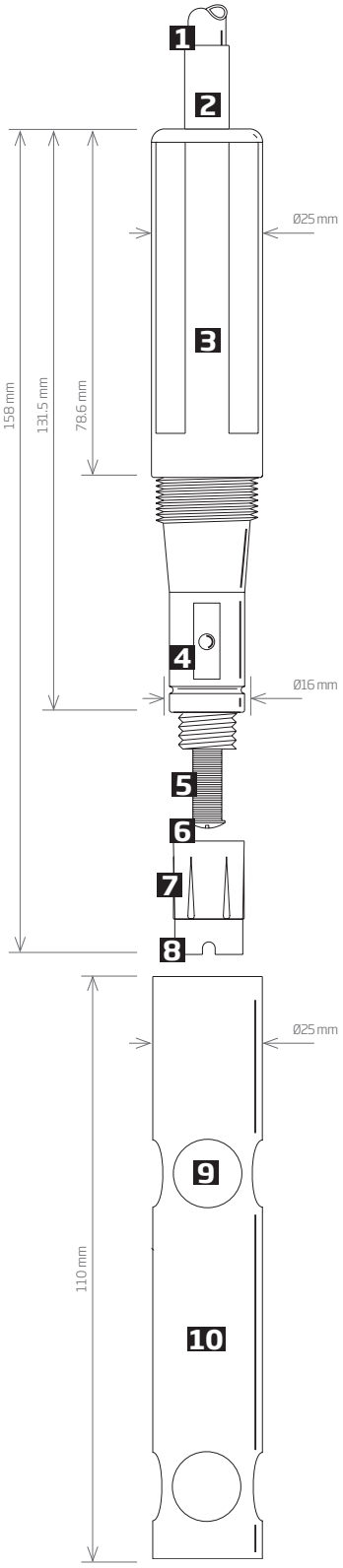
HI76407 Protected Sleeve Series

DO Probe

with Protective Sleeve

Perfect for laboratory and field applications, The Hanna HI76407F Series DO probes are extremely rugged with a screw-on protective sleeve. Calibration is fast and simple, and measurements are temperature compensated. The sensitive PTFE membrane can be changed in a few seconds.

1. Shielded, waterproof cable
2. Protective sleeve
3. PEI probe for best field protection
4. Linearized and accurate thermistor temperature sensor protected behind a stainless steel cover
5. Silver wire anode element
6. Glass encapsulated platinum cathode
7. Screw cap membrane that holds potassium chloride electrolyte solution (HI7041S)
8. Thin, permeable PTFE membrane isolates the sensor elements from the testing solution, but allows oxygen to enter (HI76407A/P)
9. Hole for solution cycling
10. Protective sleeve for field applications



Probe	Cable Length	Recommended Meter
HI76407/4F	4 m (13')	HI9146 HI9142
HI76407/10F	10 m (33')	
HI764073	4 m (13')	HI98193

HI76407A/P

Easy, Screw Cap DO Membranes

When the PTFE (polytetrafluoroethylene) membrane of the protective cap wears, it is always good to have a back-up.

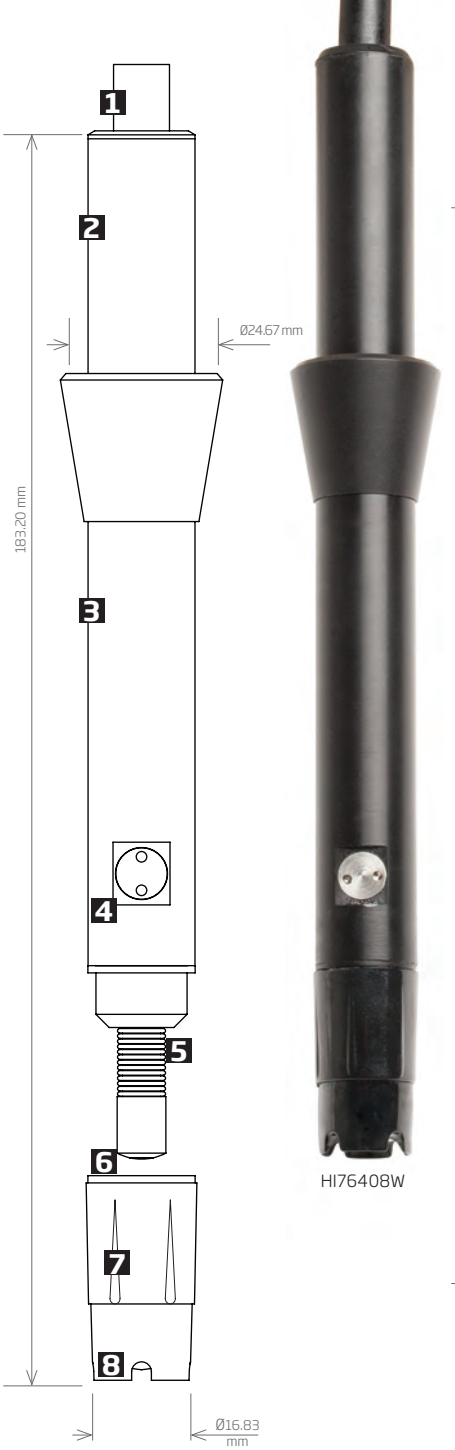
HI76407A/P	contains 5 ready-to-use, replacement membranes.

HI7040 • HI7041

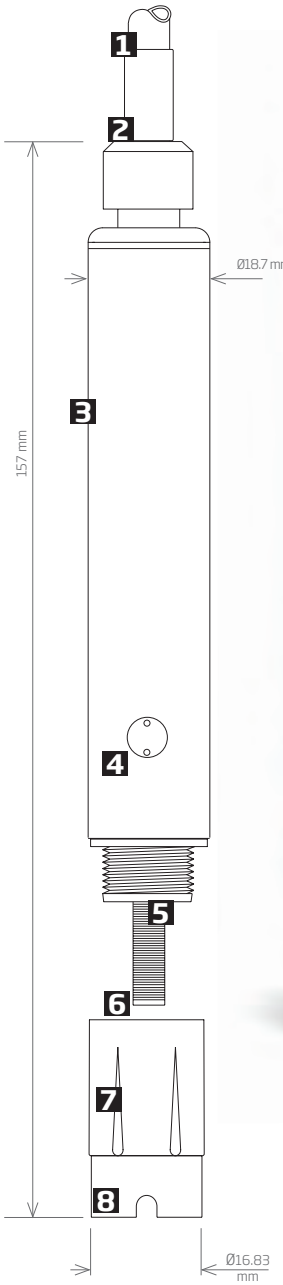
DO Solutions

It is crucial to the performance of your DO probe to keep the sensor active with regular maintenance.

HI7040L	zero oxygen solution set, 500 mL + 12g
HI7041S	refilling electrolyte solution (30 mL)
HI7041	refilling electrolyte solution (6 x 30 mL)
HI7041M	refilling electrolyte solution (230 mL)
HI7041L	refilling electrolyte solution (500 mL)



HI76408W



HI76408

HI76408 • HI76408W

Thinner, Lighter Probes

for Laboratories

The Hanna HI 76408 and the HI76408W DO probes are rugged and perfect for both laboratory and field applications. Calibration is fast and simple, and measurements are temperature compensated. The sensitive PTFE membrane can be changed in a few seconds.

1. Shielded, waterproof cable
2. Protective sleeve
3. PEI probe for best field protection
4. Linearized and accurate thermistor temperature sensor protected behind a stainless steel cover
5. Silver wire anode element
6. Glass-encapsulated platinum cathode
7. Screw cap membrane that holds potassium chloride electrolyte solution (HI7041S)
8. Thin permeable PTFE membrane isolates the sensor elements from the testing solution, but allows oxygen to enter (HI76407A/P)

Probe	Cable Length	Recommended Meter
HI76408	1 m (3.3')	HI5421 HI2400
HI76408W	1 m (3.3')	HI5421 HI2400

HI76407A/P

Easy, Screw Cap DO Membranes

When the PTFE (polytetrafluoroethylene) membrane of the protective cap wears, it is always good to have a back-up.

HI76407A/P	contains 5 ready-to-use, replacement membranes.

HI7040 • HI7041

DO Solutions

It is crucial to the performance of your DO probe to keep the sensor active with regular maintenance.

HI7040L	zero oxygen solution set, 500 mL + 12g
HI7041S	refilling electrolyte solution (30 mL)
HI7041	refilling electrolyte solution (6 x 30 mL)
HI7041M	refilling electrolyte solution (230 mL)
HI7041L	refilling electrolyte solution (500 mL)

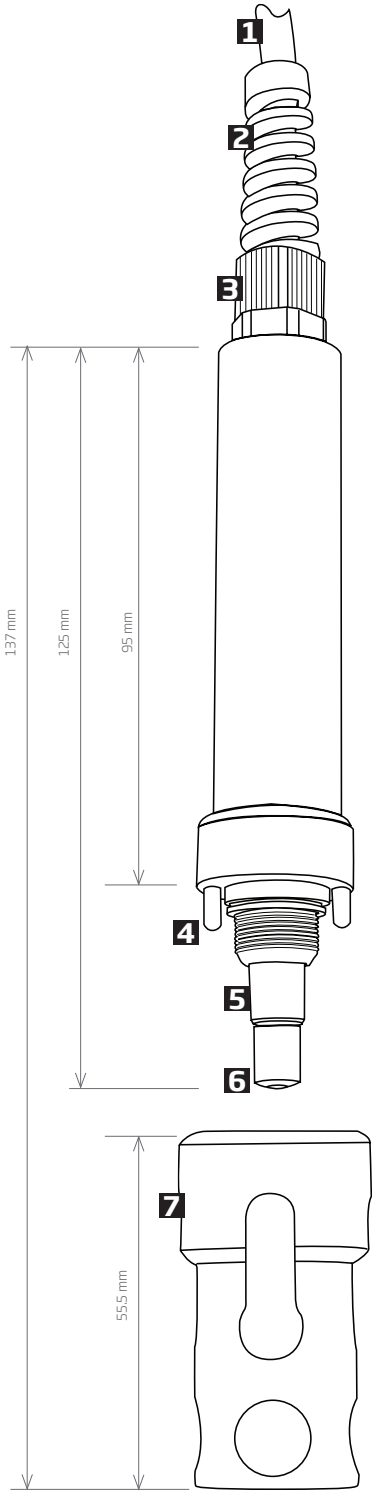
HI76409

Galvanic DO Probe

with Protective Cap

Unlike polarographic probes, galvanic DO probes require no conditioning time. When you need to measure multiple samples in a given period of time, simply turn on the meter and measure on demand.

1. Shielded, waterproof cable
2. Flex protect
3. Strain relief for cable
4. Temperature sensors
5. Zinc (Zn) anode
6. Ag^+ cathode (3.5 mm), pure silver
7. Protective cap



Probe	Cable Length	Recommended Meter
HI76409/4	4 m (13')	HI9147 (meter specific, fixed probe)
HI76409/10	10 m (33')	

HI76409A/P

Easy, Screw Cap DO Membranes

When the HDPE (High Density Polyethylene) membrane of the protective cap wears, it is always good to have a back-up.

HI76409A/P	Contains 5 ready-to-use, replacement membranes

HI7040 • HI7042

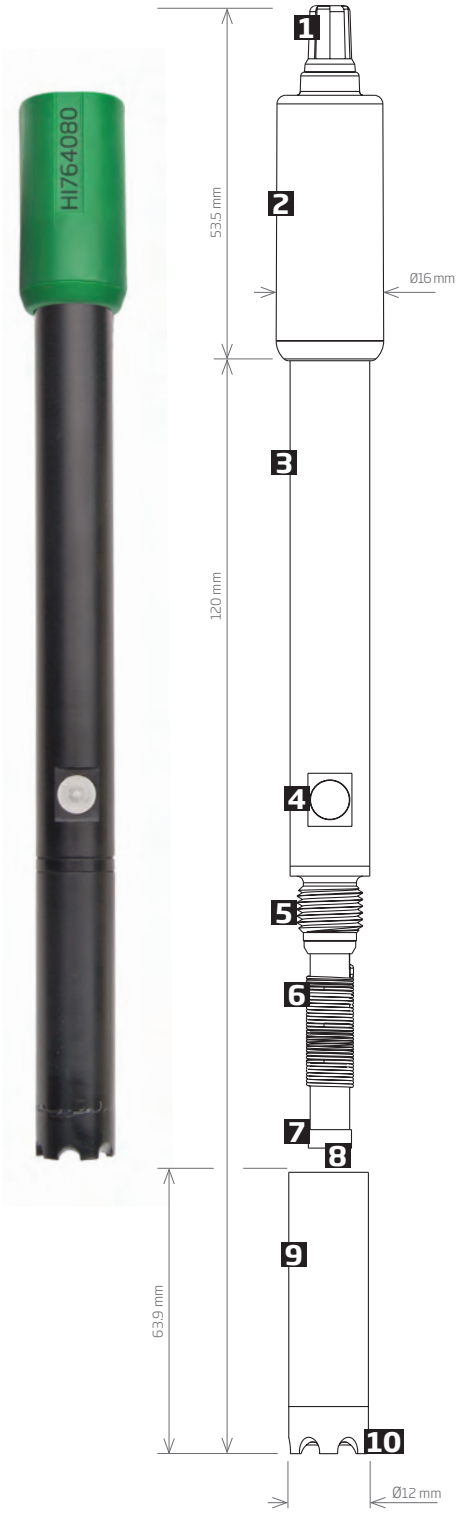
DO Solutions

It is crucial to the performance of your DO probe to keep the sensor active with regular maintenance.

HI7040L	Zero oxygen solution set, 500 mL + 12g
HI7042S	Refilling electrolyte solution (30 mL)

HI764080

edge® Compatible Digital DO Probe



The electrodes used with edge® are nearly as advanced as edge® itself. They feature a built-in microchip that stores sensor, serial number, type, ID, and calibration information that is automatically retrieved by edge® once the electrode is plugged in.

Dissolved oxygen calibration information includes: standards used for calibration, date, time, altitude and salinity correction.

These digital electrodes also feature an easy to plug in 3.5 mm connector so you never have to worry about the right angle or aligning pins.

- Probes process signal directly for noise free measurements
- Auto sensor recognition
- Store calibration specific data from the last calibration
- Are built with materials suitable for use in chemical analysis
- Have integrated temperature measurement
- Incorporate a 3.5 mm jack termination
- Unique serial ID in every probe for traceability

1 Strain relief

2 Probe cap

3 PEI probe body

4 Temperature sensor

5 Threads for membrane cap

6 Ag/AgCl anode and reference

7 Glass insulator

8 Platinum cathode

9 Disposable membrane cap

10 Oxygen permeable PTFE membrane

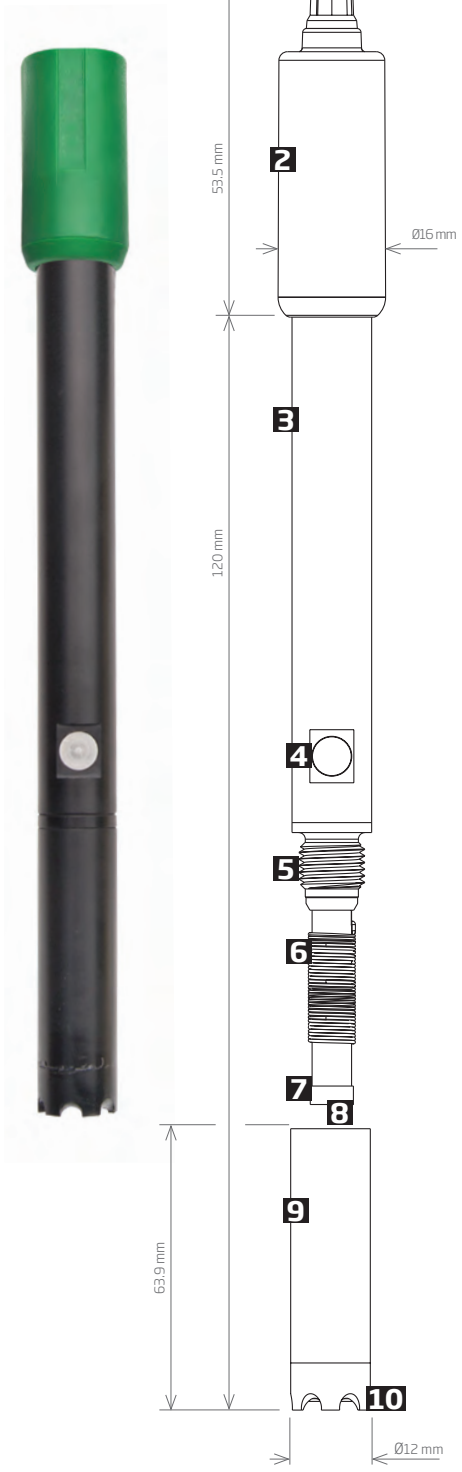
Probe	Cable Length	Compatible edge™ meters
HI764080	1 m (3.3')	HI2020 HI2030 HI2040 HI2004

HI76483

Polarographic DO Probe

This polarographic probe will provide a high degree of accuracy and reproducibility for dissolved oxygen determinations. The probe features a Pt cathode and Ag/AgCl anode assembly, a replaceable membrane cap with reinforced PTFE pre-tensioned membrane, a 12 mm PEI body and 1 m cable with connector. The 12mm OD polarographic probe was designed to cover a wide range of applications and is fits easily into wine and BOD bottles where size is an issue. For use with HI5421, HI2400, HI9146 and HI9142 and older meters HI4421 and HI98186.

- Polarographic DO probe with analog signal
- 12 mm design that incorporates integral temperature
- Durable PEI (polyetherimide) body and membrane cap has outstanding chemical resistance
- Incorporated 1 m cable and DIN connector



1 Strain relief

2 Probe cap

3 PEI probe body

4 Temperature sensor

5 Threads for membrane cap

6 Ag/AgCl anode and reference

7 Glass insulator

8 Platinum cathode

9 Disposable membrane cap

10 Oxygen permeable PTFE membrane

Probe	Cable Length	Recommended meters
HI76483	1 m (3.3')	HI5421 HI2400 HI9146 HI9142

Table of Contents

Product Spotlights

HI5521 • HI5522
Research Grade Meters

8.4

HI5521 and HI5522 are research grade, benchtop instruments that feature 8 measurement parameters: pH, ORP (Oxidation Reduction Potential), ISE (HI5522 only), conductivity, resistivity, TDS, salinity and temperature.

These instruments incorporate dual channels with a separate temperature input and support external reference electrodes required by half cell pH and ISE sensors.

HI9813-5 • HI9813-6
Portable Multiparameter Meters for Agriculture

8.40

HI9813-5 and HI9813-6 are versatile, water resistant, multiparameter portable instruments specifically designed for agricultural applications such as hydroponics, greenhouses, farming and nurseries.

This series of instruments feature an large LCD that clearly displays the parameter being measured as well as calibration instructions. Calibration is fast and easy with knobs located on the front panel of the instrument.

Multiparameter Meter Comparison Guide

	(B) Benchtop (P) Portable or	pH	ORP	ISE	EC	TDS	Resistivity	Salinity	Temperature	Ammonium	Chloride	Nitrate	Seawater σ	Turbidity	Dissolved Oxygen	Atmospheric Pressure	GPS	Fast Tracker™	Logging	Page
HI5522	B	•	•	•	•	•	•	•	•										•	8.4
HI5521	B	•	•		•	•	•	•	•										•	8.4
HI3512	B	•	•	•	•	•	•	•	•										•	8.10
HI2550	B	•	•	•	•	•		•	•										•	8.12
HI9829	P	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•*	•	•	8.14
HI98194	P	•	•		•	•	•	•	•				•		•	•			•	8.26
HI98195	P	•	•		•	•	•	•	•				•						•	8.30
HI98196	P	•	•						•						•	•			•	8.34
HI991300	P	•			•	•			•											8.38
HI991301	P	•			•	•			•											8.38
HI9813-5	P	•			•	•			•											8.40
HI9813-6	P	•			•	•			•											8.40
HI9811-5	P	•			•	•			•											8.42
HI9812-5	P	•			•	•			•											8.42

*Select models

HI9829

GPS Multiparameter Meter with Autonomously Logging Probes

8.14

Rugged, waterproof and easy to use, the HI9829 is the ideal meter for field measurements of lakes, rivers and seas. The HI9829 meter displays 1 to 12 parameters simultaneously from up to 15 user selectable parameters.

Combined with one of the HI76x9829 series probes, the HI9829 can measure water quality parameters such as pH, ORP, conductivity, turbidity, temperature, ions ammonium, nitrate, chloride (as NH_4^+–N, NO_3^-–N or Cl^-), dissolved oxygen (as % saturation or concentration), resistivity, TDS, salinity, and seawater σ. Atmospheric pressure is measured for DO concentration compensation.

HI98194 • HI98195 • HI 98196

Multiparameter Meters

8.26

pH / mV, ORP, EC, TDS, Resistivity, Salinity, Seawater σ, Dissolved Oxygen Atmospheric Pressure and Temperature

These meters provide multiparameter measurement in a compact and rugged, IP67 waterproof body. Ideal for demanding applications, each meter features our rugged, easy connect multi-function probe with field replaceable sensors.

Continuous logging and log-on-demand allows users to record and save up to 44,000 samples. This data can later be transferred to a PC with Hanna's HI920015 micro USB cable and HI92000 software.

Comprehensive GLP data are directly accessible by pressing the GLP key to display last calibration data. The contextual Help Menu can be accesssed to obtain on-screen information and assistance about each feature at the touch of a button.

A backlit, graphic LCD provides easy to read resolution even in low-lit areas. A combination of dedicated and soft keys allows easy, intuitive operation in a choice of languages.

HI5521 • HI5522

Research Grade Meters

pH/ORP/ISE and EC/TDS/Resistivity/Salinity and Temperature

Measure up to Eight Parameters

HI5521 and HI5522 are research grade benchtop instruments that feature eight measurement parameters: pH, mV (for Oxidation Reduction Potential), ISE (HI5522 only), conductivity, resistivity, TDS, salinity and temperature.

These instruments incorporate dual channels with a separate temperature input and support external reference electrodes required by half-cell pH and ISE sensors.

Up to four conductivity calibration points can be used to increase measurement accuracy. One fixed-point salinity calibration can be performed on the percent scale only. Three methods for calculating seawater salinity are supported: practical scale, natural sea water scale and percent scale.

The HI5522 features up to a five-point standard ISE calibration using standard or custom solutions. Users can select their ISE electrode parameters with the standard configuration profile or create their own and store it in a profile that can be recalled.

- Capacitive touch keypad
- Clear user interface
- CAL Check™ for pH
  - Alerts users of calibration status
- Five-point calibration (HI5522)
  - Five point pH and ISE calibration
- Logging
  - Large log memory with different logging methods
- Specific Applications
  - EC specific applications: USP <645> method, salinity in seawater, TDS
  - ISE Specific Applications: incremental methods
- Multiple input channels
  - pH/ORP/(ISE, HI5522) and EC/TDS/Resistivity/Salinity
- On-screen help
  - Users can consult the on-screen help from any mode simply by pressing the HELP key.

Highly Customizable

The display is customizable and capable of displaying two channels at the same time, showing the measurements in various modes: basic measurement with or without GLP information, graph or logging data. The display colors are also selectable.

Up to 10 profiles (5 for each channel) can be saved and recalled for both instruments, eliminating the need to reconfigure each time a different electrode is used. User definable configurations can include: temperature compensation modes, isopotential points for pH and ISE (HI5522 only), measurement units of ISE concentrations, ISE electrode type (HI5522 only), and temperature units.

User-friendly Features

These instruments offer multi-language support and contextual help is available through a dedicated help key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through all measurement and calibration procedures to ensure readings are taken correctly.

CAL Check™ for pH

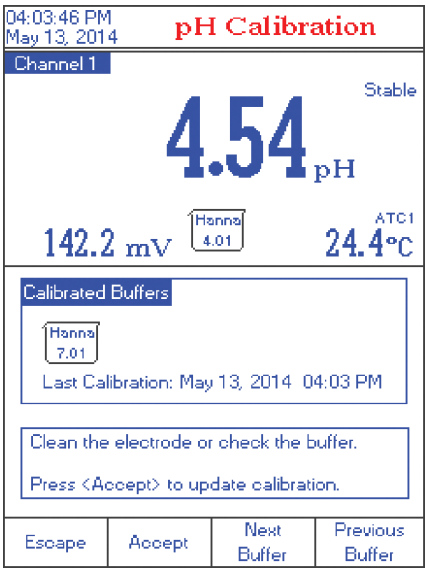
Hanna's pH CAL Check™ ensures accurate readings every time by alerting users of potential problems during the calibration process. The CAL Check™ system eliminates erroneous readings due to dirty or faulty pH electrodes or contaminated pH buffer solutions. After the guided calibration process, electrode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

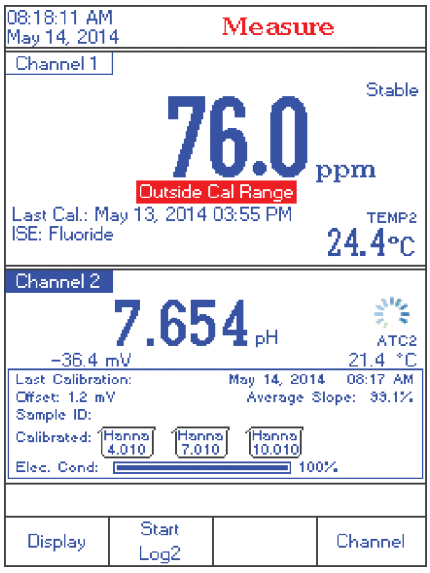
pH and EC Features

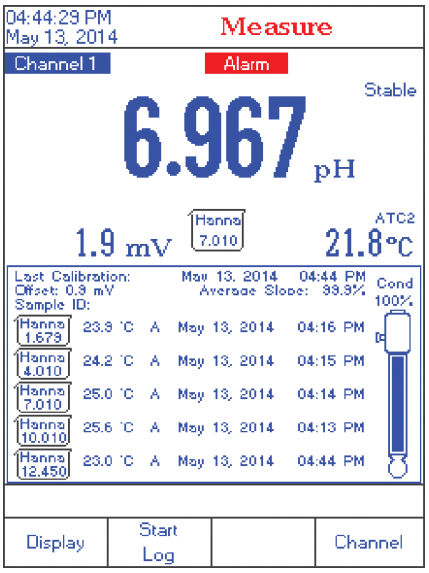
pH CAL Check™

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 (HI5522)

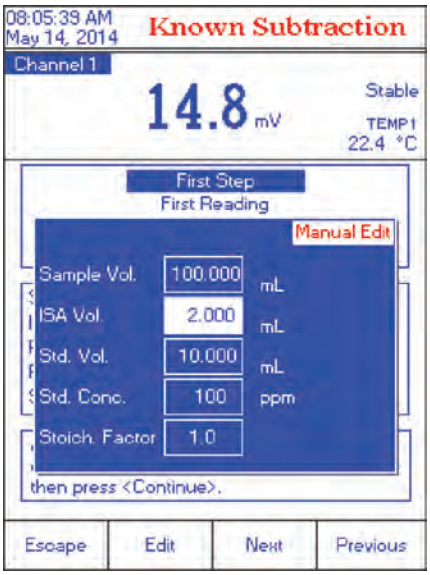
ISE Incremental Methods

Ion concentration determinations with ISEs can be made faster and easier using the streamlined incremental methods.

Incremental methods involve adding a standard to a sample or sample to a standard and detecting the mV change that occurs due to the addition, and this difference determines the concentration. Historically the user would use mathematical equations to determine the ion concentration of the sample; the HI5522, sample concentrations are calculated automatically and then logged into an ISE method report; up to 200 reports can be saved for future recall. The entire process can be repeated on multiple samples without reentering sets of parameters. Reports can be printed using HI92000 PC software.

Incremental method techniques can reduce errors from variables such as temperature, viscosity, pH or ionic strength. The electrodes remain immersed throughout the process, thus reducing measurement time as well as eliminating sample carry over and its associated errors.

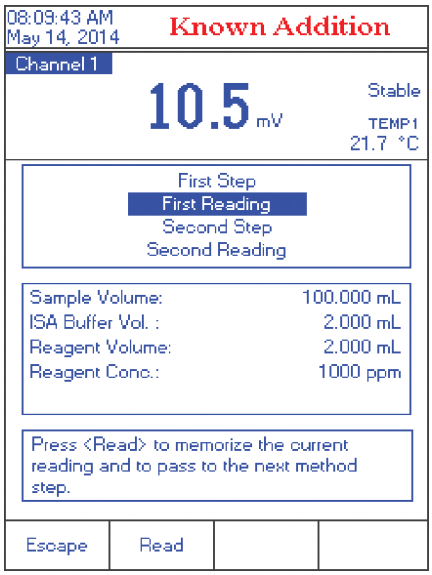
Known Addition, Known Subtraction, Analyte Addition, and Analyte Subtraction methods are standard method choices provided by the HI5522.



First Step

The first step in performing an incremental method analysis is to enter the required parameters including sample, ISA and standard volumes, as well as standard concentration and stoichiometric factor.

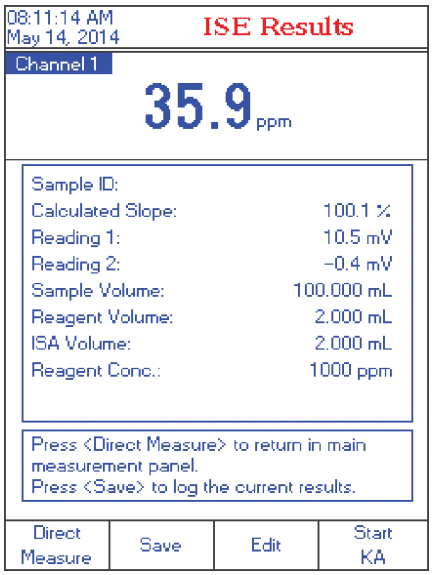
When repeating the analysis on another sample, the parameters do not need to be reentered.



Sequence of Readings

Once the variables are entered, the user is guided step-by-step through the measurement process.

The initial mV measurement is made before the addition; next is the addition, followed by the second mV measurement.



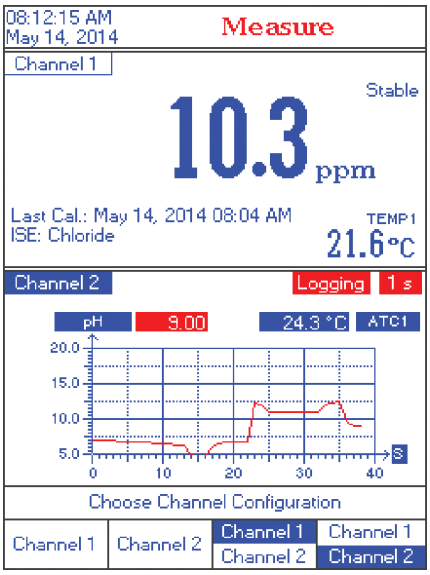
Results

The results are automatically calculated and shown together with all the parameters used.

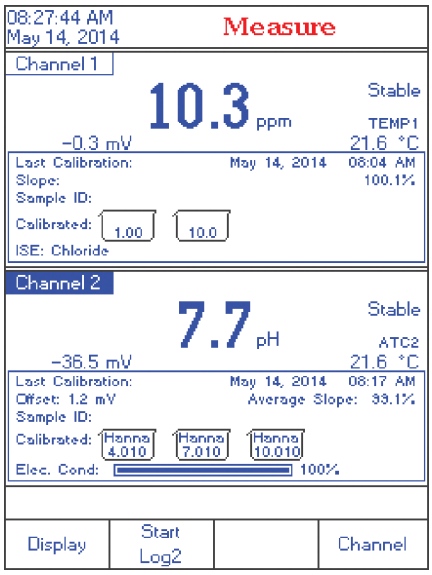
At this time, results can be saved into an ISE Methods Report and printed using using the HI92000 PC software. If necessary, the user can edit the parameters without having to redo the entire analysis. Multiple sample analysis is enabled without having to reenter set-up data.

- Low Profile
  - These intruments feature a low profile with an ideal viewing angle

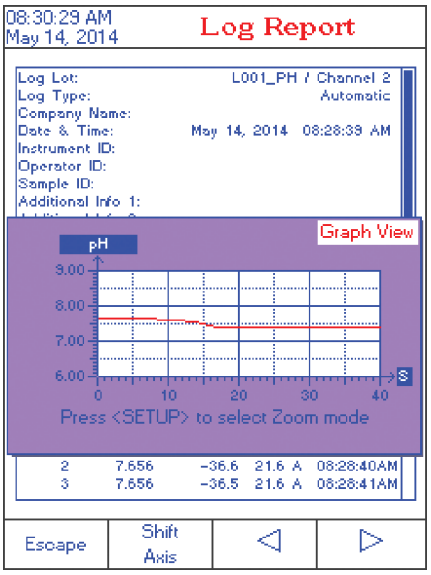
Additional Features by Screen (depending on model)



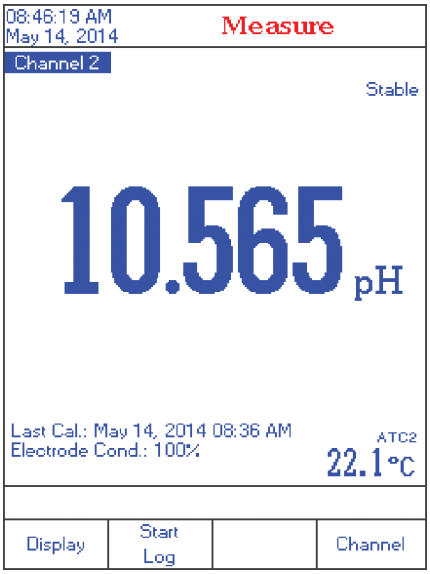
Channel Configuration



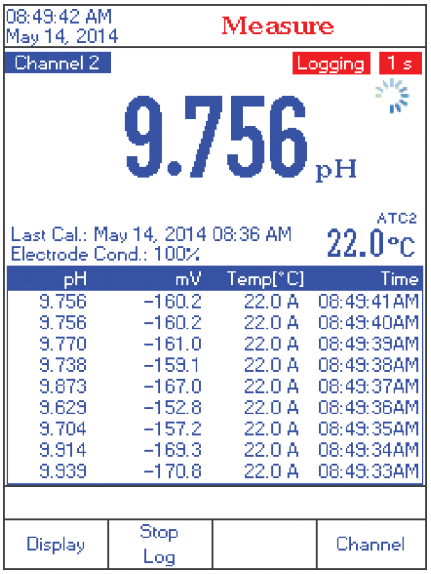
Good Laboratory Practices



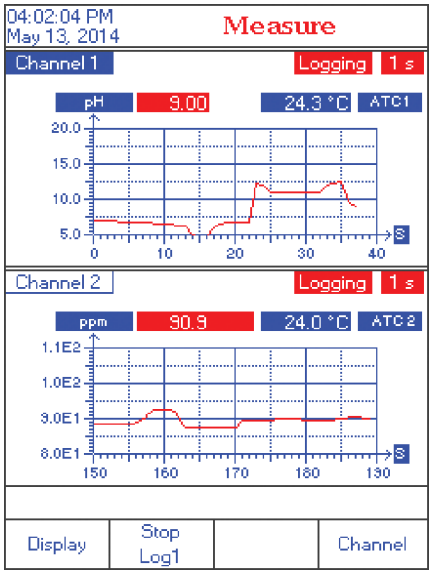
Log Recall



Simple Readout Available



Real-Time Logging



Simultaneous Dual-Channel Graphing

Dual Channels

The two measurement channels of the HI5522 and HI5521 are galvanically isolated to eliminate noise and instability.

In ISE mode (HI5522), these instruments provide the user with a choice of several incremental methods. Communication is via opto-isolated USB and RS232 ports.

Specifications		HI5521	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, 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	±2000 mV
	Resolution	0.1 mV	0.1 mV
	Accuracy	±0.2 mV ±1 LSD	±0.2 mV ±1 LSD
ISE	Range	–	1 x 10^{-7} to 9.99M concentration
	Resolution	–	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 5 user defined standards
Temperature**	Range	-20.0 to 120°C; -4.0 to 248.0°F; 253.15 to 393.15K	-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	0.1°C; 0.1°F; 0.1K
	Accuracy	±0.2°C ; ±0.4°F; ±0.2K (without probe)	±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)	±1% of reading (±0.01 µS/cm)
	Cell Constant	0.0500 to 200.00	0.0500 to 200.00
	Cell Type	4 cells	4 cells
	Calibration	automatic standard recognition, user standard single point / multi-point calibration	automatic standard recognition, user standard single point / multi-point calibration
	Calibration Reminder	yes	yes
	Temperature Coefficient	0.00 to 10.00 %/°C	0.00 to 10.00 %/°C
	Temperature Compensation	disabled, linear and non-linear (natural water)	disabled, linear and non-linear (natural water)
	Reference Temperature	5.0 to 30.0°C	5.0 to 30.0°C
	Profiles	up to 10, 5 each channel	up to 10, 5 each channel
	USP Compliant	yes	yes
TDS	Range	0.000 to 9.999 ppm; 10.00 to 99.99 ppm; 100.0 to 999.9 ppm; 1.000 to 9.999 ppt; 10.00 to 99.99 ppt; 100.0 to 400.0 ppt actual TDS* (with 1.00 factor)	
	Resolution	0.001 ppm; 0.01 ppm; 0.1 ppm; 0.001 ppt; 0.01 ppt; 0.1 ppt	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)	±1% of reading (±0.01 ppm)
Resistivity	Range	1.0 to 99.9 Ω•cm; 100 to 999 Ω•cm; 1.00 to 9.99 kΩ•cm; 10.0 to 99.9 kΩ•cm; 100 to 999 kΩ•cm; 1.00 to 9.99 MΩ•cm; 10.0 to 100.0 MΩ•cm	
	Resolution	0.1 Ω•cm; 1 Ω•cm; 0.01 kΩ•cm; 0.1 kΩ•cm; 1 kΩ•cm; 0.01 MΩ•cm; 0.1 MΩ•cm	
	Accuracy	±2% of reading (±1 Ω•cm)	±2% of reading (±1 Ω•cm)
Salinity	Range	practical scale: 0.00 to 42.00 psu; natural sea water scale: 0.00 to 80.00 ppt; percent scale: 0.0 to 400.0% NaCl	
	Resolution	0.01 for practical scale/natural sea water scale; 0.1% for percent scale	
	Accuracy	±1% of reading	±1% of reading
	Calibration	percent scale–one-point (with HI7037 standard)	percent scale–one-point (with HI7037 standard)
Additional Specifications	pH Electrode	HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included)	
	EC Probe	HI76312 platinum, four-ring EC/TDS probe with and 1 m (3.3') cable (included)	
	Temperature Probe	HI7662-T stainless steel temperature probe with 1 m (3.3') cable (included)	
	Input Channel(s)	1 pH/ORP + 1 EC	1 pH/ORP/ISE + 1 EC
	GLP	cell constant, reference temperature/coefficient, calibration points, calibration time stamp, probe offset for conductivity	
	Logging	**record :** 100,000 data point storage/channel, up to 100 lots with max. 50,000 records/lot; **interval:** settable between 1 second and max log time of 180 minutes; **type:** automatic, manual, AutoHOLD; **additional:** 200 records USP; 200 records incremental methods (HI5522)	
	Display	color graphic LCD with on-screen help, graphing, and custom color configuration	
	PC Connection	USB	
	Power Supply	12 VDC adapter (included)	
	Environment	0 to 50°C (32 to 122°F; 273 to 323K) RH max 95% non-condensing	
	Dimensions / Weight	160 x 231 x 94 mm (6.3 x 9.1 x 3.7") / 1.2 kg (2.64 lbs.)	
Ordering Information		**HI5521-01** (115V), **HI5521-02** (230V), **HI5522-01** (115V) and **HI5522-02** (230V) are supplied with HI76312 EC/TDS probe, HI1131B pH electrode, HI7662-T temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachet (2), HI7082 3.5M KCL electrolyte solution (30 mL), HI76404N electrode holder, 12 VDC adapter and instructions.	

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100; ISE electrodes and solutions begin on page 4.22; EC , TDS and salinity solutions begin on page 6.42

(*) Absolute conductivity (or TDS) is the conductivity (or TDS) value without temperature compensation.
(**) Reduced to actual probe limits

HI3512

Multiparameter Meter

pH/ORP/ISE and EC/TDS/Resistivity/Salinity and Temperature

- CAL Check™ for pH
  - Alerts users of calibration status
- Calibration points
  - Up to five-point pH calibration and up to two-point EC calibration
- Logging
  - Automatic logging up to 600 records and log on demand up to 400 samples
- Connectivity
  - PC connectivity via opto-isolated USB
- GLP features
  - Meets Good Laboratory Practices

Two Channels, Eight Parameters

The HI3512 is a dual-channel benchtop meter with a graphic LCD designed to provide accurate laboratory results. Channel 1 features pH/ORP/ISE and temperature measurement capability while channel 2 features conductivity, TDS, salinity or resistivity measurements and temperature capability.

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.

Calibration

The pH channel offers up to five point pH calibration with seven standard buffers and up to two custom buffers.

A five point ISE calibration selected from up to six calibration standards make this instrument very useful for a large range of ion concentrations.

The EC channel permits a two-point calibration selected from seven Hanna standards. The EC channel supports autoranging, manual ranging and lock of the user selected range as well as temperature compensation selection, temperature reference selection and temperature coefficient selection.

Total dissolved Solids (TDS) factor is user-adjustable and can be set between 0.40 and 1.00.

pH and EC channels also provide "out of calibration range" warnings and a "calibration timeout" message to remind the user when a new calibration is necessary.

Messages on the graphic LCD offer directions for easy and accurate calibration for both channels, as well as diagnostics to alert the user when calibration or measurement issues are detected.

Additional Features

Other features of the HI3512 include log-on-demand of up to 400 samples, automatic logging interval with log on stability of up to 600 records, AutoHold to freeze the first stable reading on the LCD display, GLP to view the last calibration data for pH, rel mV, ISE, EC or salinity and a PC interface via USB.

Specifications		HI3512
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	±0.01 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 two custom buffers
	Temperature Compensation	automatic or manual from -20.0 to 120.0 °C (-4.0 to 248.0 °F)
mV	Range	±2000.0 mV
	Resolution	0.1 mV
	Accuracy	±0.2 mV
ISE	Range	1.00 E^{-7} to 9.99 E^{10} concentration (user selectable units)
	Resolution	3 digits
	Accuracy	±0.5% of reading (monovalent ions); ±1% of reading (divalent ions)
	Calibration	up to five-point calibration points 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	±0.2°C (±0.4°F) (excluding probe error)
EC	Range	0 µS/cm to 400 mS/cm (shows values up to 1000 mS/cm absolute conductivity); 0.001 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 999.9 mS/cm; 1000 mS/cm (autoranging)
	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; 1 mS/cm
	Accuracy	±1% of reading (±0.01 µS/cm or 1 digit whichever is greater) excluding probe error
	Calibration	automatic up to two points with seven Hanna standards (0.00 µS/cm, 84.0 µS/cm, 1.413 mS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, 111.8 mS/cm)
	Cell constant	0.010 to 10.000
	Temperature Compensation	NoTC, MTC, ATC
	Reference Temperature	15, 20, 25°C
	Temperature Coefficient	0.00 to 10.00 %/°C (for EC and TDS only; default value is 1.90%/°C)
TDS	Range	0.000 to 9.999 ppm; 10.00 to 99.99 ppm; 100.0 to 999.9 ppm; 1.000 to 9.999 g/L; 10.00 to 99.99 g/L; 100.0 to 400.0 g/L (autoranging)
	Resolution	0.001 ppm; 0.01 ppm; 0.1 ppm; 0.001 g/L; 0.01 g/L; 0.1 g/L
	Accuracy	±1% of reading (±0.05 ppm or 1 digit whichever greater) excluding probe error
	Factor	0.40 to 1.00
Resistivity	Range	1.0 to 99.9 Ω•cm; 100 to 999 KΩ•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 (autoranging)
	Resolution	0.1 Ω•cm; 1 Ω•cm; 0.01 KΩ•cm; 0.1 Ω•cm; 1 Ω•cm; 0.01 MΩ•cm; 0.1 Ω•cm
	Accuracy	±1% of reading (±10 Ω•cm or 1 digit whichever greater) excluding probe error
Salinity	Range	0.0 to 400.0% NaCl
	Resolution	0.1% NaCl
	Accuracy	±1% of reading excluding probe error
	NaCl Calibration	one-point with HI7037 standard (optional)
Additional Specifications	pH Electrode	HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included)
	Temperature probe	HI7662-T temperature probe with 1 m (3.3') cable (included)
	EC Probe	HI76310 platinum four-ring EC/TDS probe with 1 m (3.3') cable (included)
	Relative mV Offset Range	±2000 mV
	Slope Calibration	from 80 to 110%
	Temperature Source	automatic from sensor inside the probe; manual entry
	Log-on-demand	400 samples
	Interval Logging	5, 10, 30 seconds; 1, 2, 5, 10, 15, 30, 60, 120, 180 minutes, AutoEnd (max 600 samples)
	PC connection	opto-isolated USB
	Input Impedance	10^{12} ohms
	Power Supply	12 VDC adapter (included)
	Environment	0 to 50 °C (32 to 122 °F) RH max 55% non-condensing
	Dimensions / Weight	235 x 207 x 110 mm (9.2 x 8.14 x 4.33") / 1.8 kg (4 lbs.)
Ordering Information		**HI3512-01** (115V) and **HI3512-02** (230V) is supplied with HI76310 EC/TDS probe, HI1131B pH electrode, HI7662-T temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachet (2), HI7082 3.5M KCl electrolyte solution (30 mL), HI76404N electrode holder, 12 VDC adapter and instructions.

**pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100;
ISE electrodes and solutions begin on page 4.22; EC , TDS and salinity solutions begin on page 6.42**

(*) Reduced to actual sensor limits

HI2550

Multiparameter Meter

pH/ORP/ISE/EC/TDS/Salinity

- Five Point Calibration
  - Up to five point pH calibration
- Hold Feature
  - Hold button to freeze readings on the display
- ATC
  - Automatic temperature compensation for pH and EC
- Connectivity
  - PC interface via USB
- Multiple input channels
  - Two input channels: pH/ORP/ISE and EC/TDS/Resistivity/Salinity

Dual-Channel, with Up to Seven Parameters

HI2550 is a dual-channel instrument that measures up to seven parameters. With this single laboratory bench meter you can measure pH, ORP or ISE, conductivity (EC), TDS or salinity, and temperature.

Utilizing an external temperature probe, pH readings are automatically compensated for temperature. To ensure a higher level of precision, pH calibrations can use up to five calibration points, chosen from the seven available memorized buffers.

This instrument can take measurements using ORP electrodes (pH channel input), due to its capability to measure mV with a resolution up to 0.1 mV, as well as ISE electrodes on the mV scale (pH channel input).

EC measurements can be compensated relative to a selected reference temperature. The EC calibration mode allows you to chose from among six recognized conductivity standards and perform a single-point calibration. The most suitable EC and TDS range for your application is automatically selected. The HI2550 also includes the ability to set and lock the range manually.

Good Laboratory Practice

This instrument provides GLP capabilities that allow for the storage and retrieval of all data regarding pH, ORP, EC and salinity calibration and sample measurement as well as data regarding the maintenance and status of the electrode.

Data Logging

With a built-in logging function, measurements are stored in non-volatile memory, and can be transferred to a PC through the USB port. Users can manually log up to 200 records and interval log up to 500 records.

Specifications		HI2550
pH**	Range	-2.0 to 16.0 pH; -2.00 to 16.00 pH; -2.000 to 16.000 pH
	Resolution	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	± 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 two custom buffers
	Temperature Compensation	automatic or manual from: -20.0 to 120.0 °C
	Input Impedance	10^{12} ohms
ISE and ORP	Range	±999.9 mV; ±2000 mV
	Resolution	0.1 mV (±1000.0 mV); 1 mV (± 2000 mV)
	Accuracy	± 0.2 mV (±999.9 mV); ± 1 mV (±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 (excluding probe error)
EC	Range	0.00 to 29.99 µS/cm; 30.0 to 299.9 µS/cm; 300 to 2999 µS/cm; 3.00 to 29.99 mS/cm; 30.0 to 200.0 mS/cm; up to 500.0 mS/cm actual* conductivity
	Resolution	0.01 µS/cm; 0.1 µS/cm; 1 µS/cm; 0.01 mS/cm; 0.1 mS/cm
	Accuracy	± 1 % reading (±0.05 µS/cm or 1 digit, whichever is greater)
	Calibration	one point slope calibration; six buffers available: 84.0, 1413 µS/cm; 5.00, 12.88, 80.0, 111.8 mS/cm; one point offset: 0.00 µS/cm
	Temperature Compensation	automatic or manual from -20.0 to 120.0 °C, or disabled
	Temperature Coefficient	0.00 to 6.00 %/°C (for EC and TDS only; default value is 1.90 %/°C
TDS	Range	0.00 to 14.99 ppm; 15.0 to 149.9 ppm; 150 to 1499 ppm; 1.50 to 14.99 g/L; 15.0 to 100.0 g/L; up to 400.0 g/L actual* TDS (with 0.80 factor)
	Resolution	0.01 ppm; 0.1 ppm; 1 ppm; 0.01 g/L; 0.1 g/L
	Accuracy	±1% of reading (±0.03 ppm or 1 digit, whichever is greater)
	TDS Factor	0.40 to 0.80 (default value is 0.50)
Salinity	Range	0.0 to 400.0% NaCl
	Resolution	0.1% NaCl
	Accuracy	±1% of reading (excluding probe error)
	Calibration	one point with HI7037 standard (optional)
Additional Specifications	pH Electrode	HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included)
	EC Probe	HI76310 platinum four-ring EC/TDS probe and 1 m (3.3') cable (included)
	Temperature Probe	HI7662 temperature probe with 1 m (3.3') cable (included)
	Relative mV Offset Range	±2000 mV
	PC Connectivity	opto-isolated USB
	Log-on-demand	200 samples
	Interval Logging	500 records; 5, 10, 30 sec and 1, 2, 5, 10, 15, 30, 60, 120, 180 min stability logging
	Power Supply	12 VDC (included)
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Dimensions	235 x 222 x 109 mm (9.2 x 8.7 x 4.3")
	Weight	1.3 Kg (2.9 lb); kit with holder 2.1 Kg (4.6 lb.)
Ordering Information		**HI2550-01** (115V) and **HI2550-02** (230V) are supplied with HI1131B pH electrode, HI76310 EC/TDS probe, 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), 12 VDC adapter and instruction manual.

pH and ORP electrodes begin on page 3.77; pH and ORP solutions begin on page 3.100; ISE electrodes and solutions begin on page 4.22; EC , TDS and salinity solutions begin on page 6.42

(*) Uncompensated conductivity (or TDS) is the conductivity (or TDS) value without temperature compensation.

(**) Reduced to actual sensor limits

HI9829

GPS Multiparameter Meters

pH/ORP/ISE, EC/TDS/ Resistivity/Salinity/Seawater σ, Turbidity, DO, Temperature and Atmospheric Pressure

- Logging
  - Logging from probe or meter
- Fast Tracker
  - Tag Identification System
- Sensor Check™
  - Auto-recognition of all sensors
- GLP features
  - Meets Good Laboratory Practices
- Connectivity
  - PC compatible via USB
- Help feature
  - On-screen user guides
- Backlight
  - Backlit, graphic LCD display
- Waterpoof
  - Waterproof casing

Rugged, Waterproof and ideal for field measurements

Rugged, waterproof and easy to use, the HI9829 is the ideal meter for field measurements of lakes, rivers and seas. The HI9829 meter displays 1 to 12 parameters simultaneously from up to 15 user selectable parameters.

Combined with one of the HI76x9829 series probes, the HI9829 can measure water quality parameters such as pH, ORP, conductivity, turbidity, temperature, ions ammonium, nitrate, chloride (as NH_4^+–N, NO_3^-–N or Cl^-), dissolved oxygen (as % saturation or concentration), resistivity, TDS, salinity, and seawater σ. Atmospheric pressure is measured for DO concentration compensation.

Autonomously Logging Probes

After starting a log, the HI7629829 and HI7639829 logging probes can autonomously log parameters without further connection to the HI 9829. Just connect the logging probe to the HI9829 or a PC to retrieve the logged measurements.

GPS Capabilities

The HI9829 with the GPS option incorporates a built-in GPS receiver and antenna that guarantees position accurately. Measurements from specific locations are tracked with detailed coordinate information that can be viewed immediately on the display.

User-friendly Features

The HI9829 features a graphic, backlit LCD that scales digits to fit up to 12 parameters and allows full configuration of each parameter measured along with an on-screen graphing capability. HELP key displays context sensitive help. The alpha-numeric keypad offers a user friendly way to complete the input fields.

The Perfect Monitoring Tool

Water scientists and managers alike utilize data-collection programs as part of environmental monitoring. These programs are designed to reveal changes in water and the environment around it over time. Reliable, dependable measurements are required to monitor these changes and understand the contributions from seasonal fluctuations, weathering, as well as manmade pollution.

HI7609829
for pH/ORP, Dissolved Oxygen, EC

HI7629829
for pH/ORP, Dissolved Oxygen, EC, Logging

Two probes to choose from. These Digital probes provide stable, noise-free sensor signal management without the need for pre-amplified pH sensors.

Specifications		HI7609829	HI7629829	
Supported Configuration	Connector 1	pH, pH/ORP, ammonium ISE, chloride ISE, nitrate ISE	pH, pH/ORP, ammonium ISE, chloride ISE, nitrate ISE	
	Connector 2	dissolved oxygen	dissolved oxygen	
	Connector 3	EC	EC	
Upgradeable		to HI7619829, adding EC/turbidity sensor and long protective shield	to HI7639829, adding EC/turbidity sensor and long protective shield	
Temperature sensor		built-in	built-in	
Autonomous Logging		–	yes	
Logging Interval		–	1 second to 3 hours	
Computer Inteface		–	USB (HI76982910)	
Memory		–	140,000 measurements (single parameter logged); 35,000 measurements (all parameters logged)	
Operating Temperature		-5 to 55°C*	-5 to 55°C*	
Maximum Depth		20 m (66')*	20 m (66')*	
Cable Specification		Multistrand-multiconductor shielded cable with internal strength member rated for 68 kg (150 lb.) intermittent use		
Wetted Materials		Body: ABS; Threads: nylon; Shield: ABS/316 SS; Temperature Probe: 316 SS; O-rings: EPDM		
Logging Probe Internal Battery Type		–	1.5V (4) AA alkaline	
Logging Probe Battery Life Note: Log space must be available for continuous logging		–	Interval	All channels logging (no averaging)
			1-5 seconds	72 hours
			1 minute	22 days
			10 minutes	70 days
Sample Environment		fresh, brackish, seawater	fresh, brackish, seawater	
Waterproof Protection		IP68	IP68	
Dimensions (without cable)		342 mm (13.5"), dia=46 mm (1.8")	442 mm (17.4"), dia 46 mm (1.8")	
Weight (with batteries and sensors)		570 g (20.1 oz.)	775 g (27.3 oz.)	

* Reduced for ISE sensors

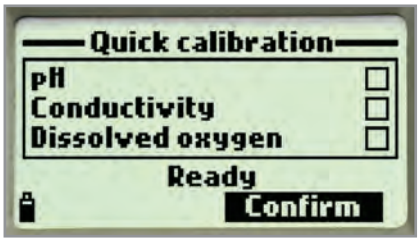
Sensors

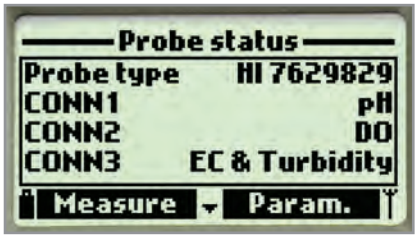
Hanna offers a selection of 7 sensors to be used on the intelligent probes. Sensor replacement is quick and easy with screw type connectors and are color coded for easy identification. The HI9829 automatically recognizes sensor presence.

The new HI7609829-4 EC/turbidity sensor is field replaceable and offers readings from both parameters at the same time.

All potentiometric sensors feature a double junction design and are gel filled to increase resistance to contamination. One of the ISE sensors can be used in place of the pH sensor and is automatically recognized. pH in mV readings are also displayed –which is useful for troubleshooting.

HI9828-25 "Quick Calibration" solution





- Field Ready
  - For field calibration, our quick calibration solution allows users to standardize pH and conductivity with one calibration solution.
- Quick Calibration
  - Simply screw the calibration beaker filled with HI 9828-25 solution onto the probe, select "Quick calibration" from the menu and press OK. Individual calibration may also be performed using multiple calibration points.
- Auto-sensor recognition
  - In this example, the HI9829 is identifying a pH, dissolved oxygen and turbidity/EC sensor

A Great Combination

The use of Hanna's microprocessor-based multiparameter intelligent probes with HI9829 will provide reliable data collection that can lead to an improved scientific understanding of the interconnections between natural, chemical and geological processes and man-made pollution to effectively evaluate applications for waste-discharge permits, remediate contaminated sites and to protect or restore biological resources.

The HI76x9829 probes utilize field replaceable sensors with auto-recognition. The sensors are housed with the probe electronics in a rugged housing and a water-tight cable connection. The HI76909829 probe allows conductivity, pH/ORP (or an ISE), and dissolved oxygen measurement. Other probe models allow turbidity and logging.

The probes are available with a choice of cable lengths such as 4m, 10m and 20m (13, 33') that utilize a DIN connection to interface with the meters. Logging probes can be connected directly to a PC with the HI76982910 USB adapter cable, and HI929829 PC application software to download log files directly from the probes.

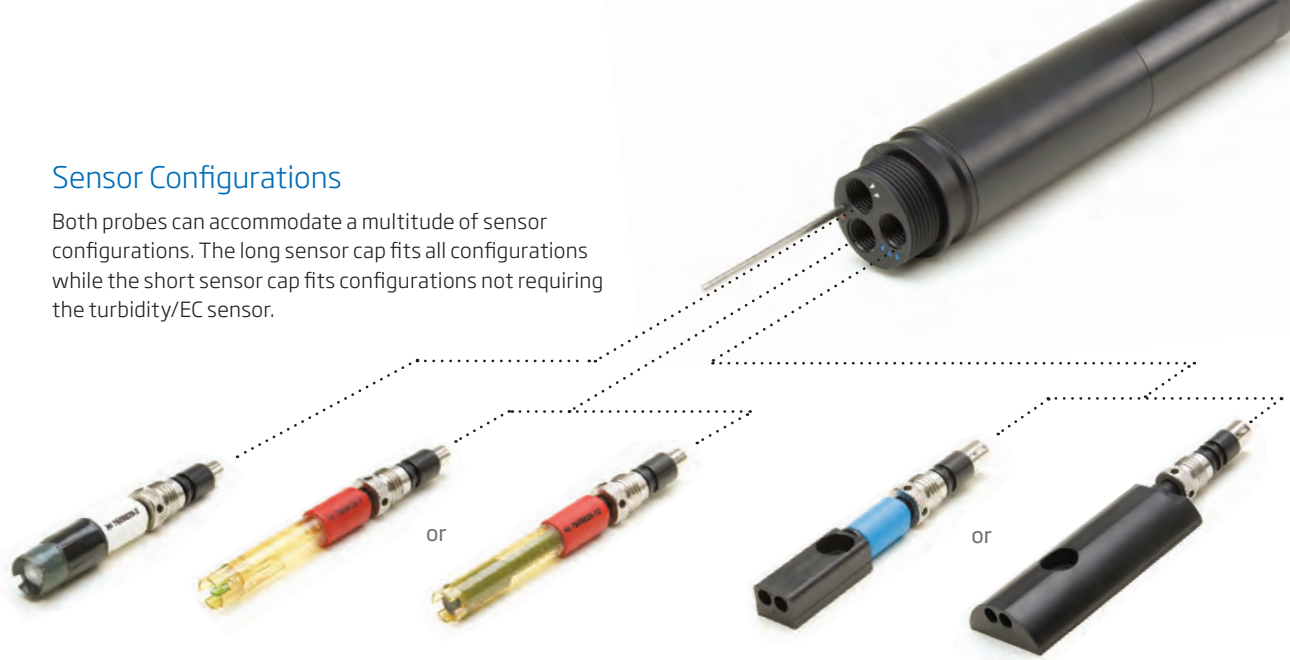
Reliable temperature measurements are a critical parameter of aquatic system monitoring. Temperature and temperature changes due to water releases can affect the ability of water to hold oxygen as well as the ability of organisms to resist certain pollutants. The intelligent probes incorporate an accurate thermistor that changes predictably with temperature changes. Accurate temperature reading in degrees Celsius, Fahrenheit and kelvin are displayed and utilized by other detectors for temperature correction.

The HI 7609829-0 and -1 feature a double junction design and are gel filled to increase resistance to contamination. These pH or pH/ORP sensors incorporate the technology that has made Hanna so successful as a pH manufacturer. Reliable pH measurements are one of the most important indicators of water chemistry indicating the relative amount of free hydrogen and hydroxyl ions in the water. Hanna's pH sensors utilize a resilient PEI body to protect them from solid particulates found in water samples. Consistency and quality are the hallmarks of these sensors. Our differential measurement system further enhances the measurement reliability, providing temperature corrected pH.

A choice of 3 ion selective electrodes (ISE) is available for constant reporting of common surface water contaminants. Nitrate, ammonium and chloride ISE's are available. Each ISE is a combination

Sensor Configurations

Both probes can accommodate a multitude of sensor configurations. The long sensor cap fits all configurations while the short sensor cap fits configurations not requiring the turbidity/EC sensor.



Dissolved Oxygen

HI7609829-2 DO

pH

HI7609829-0 pH
HI7609829-1 pH/ORP

ISE

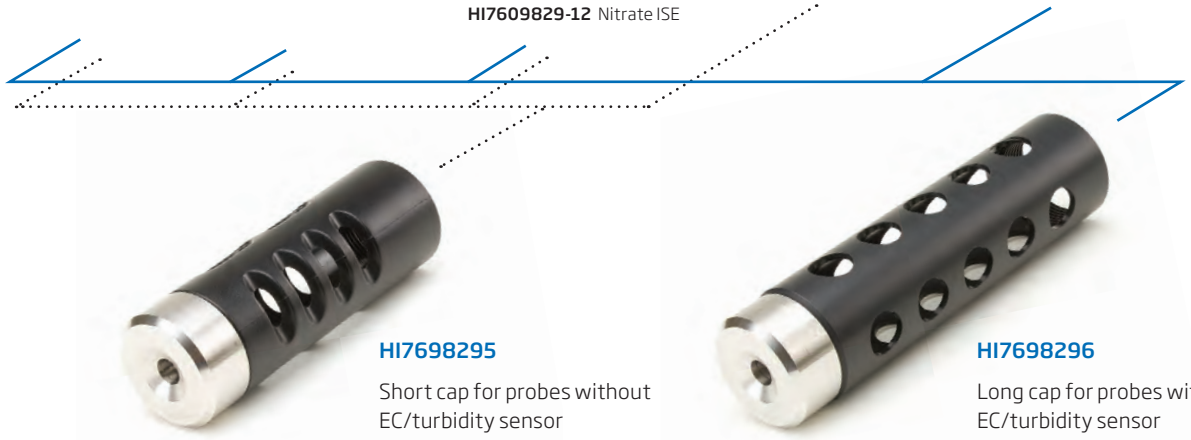
HI7609829-10 Ammonium ISE
HI7609829-11 Chloride ISE
HI7609829-12 Nitrate ISE

Conductivity

HI7609829-3 EC

Conductivity and Turbidity

HI7609829-4 EC/Turbidity



HI7698295

Short cap for probes without EC/turbidity sensor

HI7698296

Long cap for probes with EC/turbidity sensor

electrode incorporating an extremely constant reference spiral; all potentionmetric probes feature a double junction and solid gell reference design. By utilizing conductivity, the HI9829 can convert ion activity measurements to concentration units. The HI9829 displays these measurements as ppm ammonium-nitrogen, ppm chloride and ppm nitrate-nitrogen.

The HI7609829-3 4-electrode conductivity sensor using the polarographic measurement principal ensures stable conductivity readings. Electrolytic conductivity measures the ability of water to conduct an electrical current. It is highly dependent on the amount of dissolved solids (such as salt) in the water. Absolute conductivity, temperature-corrected conductivity, salinity, Seawater and water hardness (TDS) determinations are possible with measurements from this sensor.

The oxygen dissolved in lakes, rivers, and oceans is crucial for the organisms and creatures living in it. If dissolved oxygen concentrations drop below normal levels in water bodies, the water quality degrades and the organisms begin to die off. The HI7609829-2 galvanic DO sensor does not require long polarization times so is ready for measurement at a moment's notice. This sensor also utilizes a replaceable cap design for ease of maintenance and a safe non-toxic electrolyte. DO readings are compensated for the effects of temperature (using the probe's built-in temperature sensor) and atmospheric pressure (using the HI 9829's internal atmospheric pressure sensor). The DO measurement complies with standard methods 4500-O G and EPA article 360.1.

The HI7609829-4 combined EC/turbidity sensor is a replaceable design for instantaneous conductivity and turbidity measurements that conform to ISO 7027 standards. It provides measurements from 0.0 to 1000 FNU. Turbidity is the amount of particulate matter that is suspended in water. Turbidity measures the scattering effect that suspended solids have on light: the higher the intensity of scattered light, the higher the turbidity. Material that causes water to be turbid include: clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds, plankton and microscopic organisms. Conductivity measurement is the same as in the HI7609829-3.

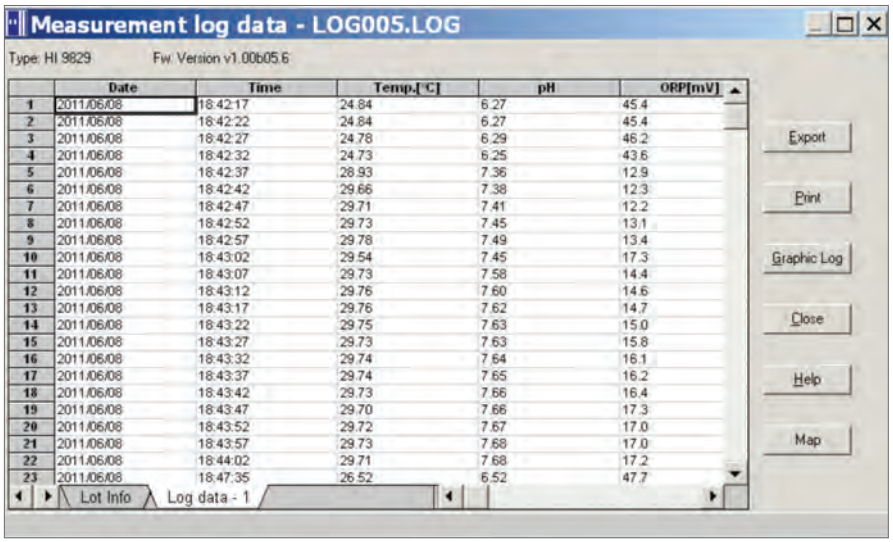
Probes with the logging function have a logging memory that allows storage of up to 140,000 individual samples or 35,000 complete sample data sets with date and time stamp thus permitting up to a 70 day deployment with all channels logging at 10 minute intervals. The probe incorporates a temperature sensor for temperature compensation of all parameters.

Monitoring and Tracking

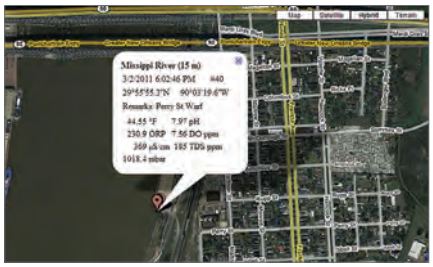
The HI 9829 with GPS module can track measurement locations with detailed coordinate information. All models of the HI 9829 are equipped with the Fast Tracker™ TAG ID system which is an invaluable tool for associating measurements with their locations. The HI 9829 also incorporates a real-time clock which stamps all logged data with a time and date in addition to location information.

GPS (Global Positioning System)

The HI 9829 with GPS features an internal 12 channel GPS receiver and antenna that calculates its position to track locations along with measurement data. The GPS tracks your location using satellites to within 30 ft (10 m) so you can be sure that you return to the same location for repeated measurements. The GPS coordinates can be shown on the LCD together with up to 10 measurement parameters and are recorded with logged data. Users can connect to GPS tracking software such as Google™ Maps* to view locations where samples have been taken. Measurement information is shown right on the map.

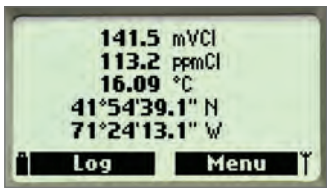


	Date	Time	Temp.[°C]	pH	ORP[mV]
1	2011/06/08	18:42:17	24.84	6.27	45.4
2	2011/06/08	18:42:22	24.84	6.27	45.4
3	2011/06/08	18:42:27	24.78	6.29	46.2
4	2011/06/08	18:42:32	24.73	6.25	43.6
5	2011/06/08	18:42:37	28.93	7.36	12.9
6	2011/06/08	18:42:42	29.66	7.38	12.3
7	2011/06/08	18:42:47	29.71	7.41	12.2
8	2011/06/08	18:42:52	29.73	7.45	13.1
9	2011/06/08	18:42:57	29.78	7.49	13.4
10	2011/06/08	18:43:02	29.54	7.45	17.3
11	2011/06/08	18:43:07	29.73	7.58	14.4
12	2011/06/08	18:43:12	29.76	7.60	14.6
13	2011/06/08	18:43:17	29.76	7.62	14.7
14	2011/06/08	18:43:22	29.75	7.63	15.0
15	2011/06/08	18:43:27	29.73	7.63	15.8
16	2011/06/08	18:43:32	29.74	7.64	16.1
17	2011/06/08	18:43:37	29.74	7.65	16.2
18	2011/06/08	18:43:42	29.73	7.66	16.4
19	2011/06/08	18:43:47	29.70	7.66	17.3
20	2011/06/08	18:43:52	29.72	7.67	17.0
21	2011/06/08	18:43:57	29.73	7.68	17.0
22	2011/06/08	18:44:02	29.71	7.68	17.2
23	2011/06/08	18:47:35	26.52	6.52	47.7

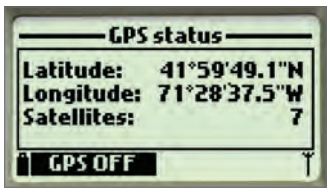


- GPS data can be customized to meet specific requirements

- Displays distances between current and predefined locations



- Display current readings along with GPS coordinates

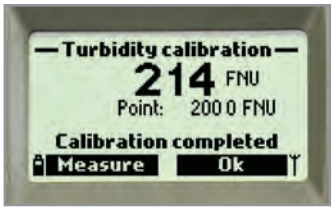


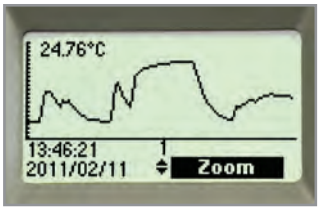
- Shows current position and number of satellites

- Basic GPS Features
  - GPS coordinates shown on the LCD with up to 10 measurement parameters
  - GPS signal strength shown on LCD
  - Logged data is embedded with GPS coordinates
  - GPS status screen
- Advanced GPS Features
  - Users can associate GPS coordinates with alphanumeric locations
  - Distances between current location and predefined locations are displayed arranged by distance
  - Memorizes last location and time should signal be lost
- HI 929829 PC Application Software
  - Manages logged data from the HI 9829
  - Displays GPS coordinates with logged data
  - Automatically maps samples on your PC (internet connection required)
  - Shows location points on map with measurement data

*Google™ is a registered trademark of Google™, inc. HANNA Instruments® has no affiliation with Google™.

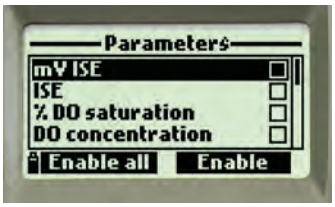
Intuitive Configuration, Measurement and Help

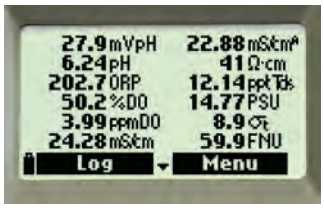




- Calibration
  - Calibration with the HI 9829(0) is easy and intuitive.
- Help
  - The context sensitive help screen is always accessible.
- Graphing
  - Trend graphing may be viewed on the display or transferred to a PC. The sample date and time stamp will also be displayed.

Fully Configurable Measurement Screen





Fast Tracker™–Tag Identification System

HANNA's Fact Tracker™–Tag Identification System simplifies test logging. iButton®s with a unique ID can be installed at various sampling sites. When the matching connector on the meter contacts the location button, measurements are logged and labeled with the alphanumeric user-entered location ID. Location, date, time and measurements are logged into the meter which can be transferred to a PC. The Fast Tracker™ system complements the GPS for ultimate tracking.

iButton® Tags are Easy to Install

Install the optional TAGs near your sampling points for quick and easy iButton® readings. Each TAG contains a computer chip with a unique identification code encased in stainless steel. You can install a practically unlimited amount of TAGs. Additional TAGs can be ordered for all of your traceability requirements.

Specifications	HI9829	HI9829 with GPS
Temperature Compensation	automatic from -5 to 55°C (23 to 131°F)	automatic from -5 to 55°C (23 to 131°F)
GPS	–	12 channel receiver, 10 m (30 ft) range
Logging Memory from Meter	44,000 records	44,000 records
Logging Interval	1 second to 3 hours	1 second to 3 hours
Computer Interface	USB (with HI 929829 software)	USB (with HI929829 software)
FastTracker™ TAG ID	Yes	Yes
Waterproof Protection	IP67	IP67
Environment	0 to 50°C (32 to 122°F); RH 100%	0 to 50°C (32 to 122°F); RH 100%
Power Supply	1.5V alkaline C cells (4) / 1.2V NiMH rechargeable C cells (4), USB, 12V power adapter	1.5V alkaline C cells (4) / 1.2V NiMH rechargeable C cells (4), USB, 12V power adapter
Dimensions	221 x 115 x 55 mm (8.7 x 4.5 x 2.2")	221 x 115 x 55 mm (8.7 x 4.5 x 2.2")
Weight	750g (26.5 oz.)	750g (26.5 oz.)

HI9829 Parameter Specifications

	pH / mV of pH input	ORP mV	Ammonium-Nitrogen	Chloride	Nitrate-Nitrogen
Range	0.00 to 14.00 pH / ±600.0 mV	±2000.0 mV	0.02 to 200 ppm (as N)	0.6 to 200 ppm	0.62 to 200 ppm (as N)
Resolution	0.01 pH / 0.1 mV	0.1 mV	0.01 ppm to 1 ppm; 0.1 ppm to 200 ppm		
Accuracy	±0.02 pH / ±0.5 mV	±1.0 mV	±5% of reading or 2 ppm, whichever is greater		
Calibration	automatic one, two, or three points with five memorized standard buffers (pH 4.01, 6.86, 7.01, 9.18, 10.01) or one custom buffer	automatic at one custom point	1 or 2 point, 10 ppm and 100 ppm		

	Conductivity	TDS	Resistivity	Salinity	Seawater σ
Range	0 to 200 mS/cm (absolute EC up to 400 mS/cm)	0 to 400000 mg/L or ppm (the maximum value depends on the TDS factor)	0 to 999999 Ω•cm; 0 to 1000.0 kΩ•cm; 0 to 1.0000 MΩ•cm	0.00 to 70.00 PSU	0 to 50.0 σt, σ0, σ15
Resolution	**manual:** 1 µS/cm; 0.001 mS/cm; 0.01 mS/cm; 0.1 mS/cm; 1 mS/cm; **automatic:** 1 µS/cm from 0 to 9999 µS/cm; 0.01 mS/cm from 10.00 to 99.99 mS/cm; 0.1 mS/cm from 100.0 to 400.0 mS/cm; **automatic mS/cm:** 0.001 mS/cm from 0.000 to 9.999 mS/cm; 0.01 mS/cm from 10.00 to 99.99 mS/cm; 0.1 mS/cm from 100.0 to 400.0 mS/cm	**manual:** 1 mg/L (ppm); 0.001 g/L (ppt); 0.01g/L (ppt); 0.1 g/L (ppt); 1 g/L (ppt); **automatic:** 1 mg/L (ppm) from 0 to 9999 mg/L (ppm); 0.01 g/L (ppt) from 10.00 to 99.99 g/L (ppt); 0.1 g/L (ppt) from 100.0 to 400.0 g/L (ppt); **autorange g/L (ppt) scales:** 0.001 g/L (ppt) from 0.000 to 9.999 g/L (ppt); 0.01 g/L (ppt) from 10.00 to 99.99 g/L (ppt); 0.1 g/L (ppt) from 100.0 to 400.0 g/L (ppt)	dependent on resistivity reading	0.01 PSU	0.1 σt, σ0, σ15
Accuracy	±1% of reading or ±1 µS/cm, whichever is greater	±1% of reading or ±1 mg/L, whichever is greater	–	±2% of reading or ±0.01 PSU, whichever is greater	±1 σt, σ0, σ15
Calibration	automatic one point with six memorized standards (84 µS/cm, 1413 µS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, 111.8 mS/cm) or custom point	based on conductivity or salinity calibration		one custom point	based on conductivity or salinity calibration

	Turbidity	Dissolved Oxygen	Atm. Pressure	Temperature
Range	0.0 to 99.9 FNU; 100 to 1000 FNU	0.0 to 500.0%; 0.00 to 50.00 ppm	450 to 850 mm Hg; 17.72 to 33.46 in Hg; 600.0 to 1133.2 mbar; 8.702 to 16.436 psi; 0.5921 to 1.1184 atm; 60.00 to 113.32 kPa	-5.00 to 55.00°C; 23.00 to 131.00°F; 268.15 to 328.15K
Resolution	0.1 FNU from 0.0 to 99.9 FNU; 1 FNU from 100 to 1000 FNU	0.1%; 0.01 ppm	0.1 mm Hg; 0.01 in Hg; 0.1 mbar; 0.001 psi; 0.0001 atm; 0.01 kPa	0.01°C; 0.01°F; 0.01K
Accuracy	±0.3 FNU or ±2% of reading, whichever is greater	0.0 to 300.0%: ±1.5% of reading or ±1.0% whichever is greater; 300.0 to 500.0%: ±3% of reading; 0.00 to 30.00 ppm: ±1.5% of reading or 0.10 ppm, whichever is greater; 30.00 ppm to 50.00 ppm: ±3% of reading	±3 mm Hg within ±15°C from the temperature during calibration	±0.15°C; ±0.27°F; ±0.15K
Calibration	Automatic 1, 2 or 3 points at 0, 20 and 200 FNU, or custom	automatic one or two points at 0, 100% or one custom point	automatic at one custom point	Automatic at one custom point

Ordering Information

Meter and Probe with Rugged Carrying Case

HI9829 – w x y z

W=	0	Basic meter, no GPS
	1	Meter with GPS
x=	0	No turbidity basic probe
	1	Turbidity basic probe
	2	Autonomously logging probe, no turbidity
	3	Autonomously logging probe with turbidity
y=	04	4 meter cable length
	10	10 meter cable length
	20	20 meter cable length
Z=	1	115V
	2	230V

All HI9829 Kits Include:

HI 9829 or HI 98290 (GPS Model) Meter
HI 710140 Hard carrying case
HI 710005/8 (115V) or HI710006/8 (230V)
Mulitiparameter Probe (see table)
HI 7692892 Probe Maintenance Kit
HI 929829 Application Software
HI 7698291 USB cable (PC to meter)
HI 710045 Power supply cable
HI 710046 Cigarette lighter cable
HI 7609829-1 pH/ORP sensor
HI 7609829-2 Galvanic DO Sensor
HI 920005 iButton® with holder (5 pcs)
HI 9828-25 Calibration solution
Instruction Manual

Optional Kit Components:

HI 7609829-12 Nitrate sensor
HI 7619829-11 Chloride ISE sensor
HI 7609829-10 Ammonium ISE sensor
HI 7698297 Long quick release flow cell
Spare Solution (see below)

HI9829-10	25 sachets 10ppm ammonia-nitrogen calibration solution
HI9829-10/11	10 sachets each of 10ppm and 100ppm ammonia-nitrogen calibration solution
HI9829-11	25 sachets 100ppm ammonia-nitrogen calibration solution
HI9829-12	25 sachets 10ppm chloride calibration solution
HI9829-12/13	10 sachets each of 10ppm and 100ppm chloride calibration solution
HI9829-13	25 sachets 100ppm chloride calibration solution
HI9829-14	25 sachets 10ppm nitrate-nitrogen calibration solution
HI9829-14/15	10 sachets each of 10ppm and 100ppm nitrate-nitrogen calibration solution
HI9829-15	25 sachets 100ppm nitrate-nitrogen calibration solution

Kit Specific Components:

Kit Number	Multiparameter Probe	HI7609829-3 EC Sensor	HI7698290 Short calibration beaker	HI7609829-4 EC/Turbidity Sensor	HI7698293 Long calibration beaker	HI9829-160 FNU calibration solution	HI9829-1720 FNU calibration solution	HI9829-18200 FNU calibration solution	HI7698291OUSB cable (PC to Probe)	HI7698295 Short protective sleeve	HI7698296 long protective sleeve
HI9829-0004Z	HI7609829/4	•	•							•	
HI9829-0010Z	HI7609829/10	•	•							•	
HI9829-0020Z	HI7609829/20	•	•							•	
HI9829-0104Z	HI7609829/4			•	•	•	•	•			•
HI9829-0110Z	HI7609829/10			•	•	•	•	•			•
HI9829-0120Z	HI7609829/20			•	•	•	•	•			•
HI9829-0204Z	HI7629829/4	•	•						•	•	
HI9829-0210Z	HI7629829/10	•	•						•	•	
HI9829-0220Z	HI7629829/20	•	•						•	•	
HI9829-0304Z	HI7629829/4			•	•	•	•	•	•		•
HI9829-0310Z	HI7629829/10			•	•	•	•	•	•		•
HI9829-0320Z	HI7629829/20			•	•	•	•	•	•		•
HI9829-1004Z	HI7609829/4	•	•							•	
HI9829-1010Z	HI7609829/10	•	•							•	
HI9829-1020Z	HI7609829/20	•	•							•	
HI9829-1104Z	HI7609829/4			•	•	•	•	•			•
HI9829-1110Z	HI7609829/10			•	•	•	•	•			•
HI9829-1120Z	HI7609829/20			•	•	•	•	•			•
HI9829-1204Z	HI7629829/4	•	•						•	•	
HI9829-1210Z	HI7629829/10	•	•						•	•	
HI9829-1220Z	HI7629829/20	•	•						•	•	
HI9829-1304Z	HI7629829/4			•	•	•	•	•	•		•
HI9829-1310Z	HI7629829/10			•	•	•	•	•	•		•
HI9829-1320Z	HI7629829/20			•	•	•	•	•	•		•

z=1 is supplied with 115V AC to 12V DC Adapter
z=2 is supplied with 230V AC to 12V DC Adapter

Meter with Probe Ordering Information

Choose Your Configuration Below

Meter and Probe with Rugged Carrying Case

Basic	**HI9829-00041** (115V) **HI9829-00042** (230V)	HI9829 meter, HI7609829/4 probe, HI7698291 USB cable (PC to meter), HI920005 iButton® with holder (5 pcs), HI929829 PC application software, HI7609829-3 EC sensor, HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI710045 power supply cable, HI7698292 probe maintenance kit, HI7698290 short calibration beaker, HI9828-25 calibration solution (500 mL), HI710046 cigarette lighter cable, HI710005/8 (115V) or HI710006/8 (230V), instruction manual.
	HI9829-00101 (115V) **HI9829-00102** (230V)	HI9829 meter, HI7609829/10 probe, HI7698291 USB cable (PC to meter), HI920005 iButton® with holder (5 pcs), HI929829 PC application software, HI7609829-3 EC sensor, HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI710045 power supply cable, HI7698292 probe maintenance kit, HI7698290 short calibration beaker, HI9828-25 calibration solution (500 mL), HI710046 cigarette lighter cable, HI710005/8 (115V) or HI710006/8 (230V), instruction manual.
	HI9829-00201 (115V) **HI9829-00202** (230V)	HI9829 meter, HI7609829/20 probe, HI7698291 USB cable (PC to meter), HI920005 iButton® with holder (5 pcs), HI929829 PC application software, HI7609829-3 EC sensor, HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI710045 power supply cable, HI7698292 probe maintenance kit, HI7698290 short calibration beaker, HI9828-25 calibration solution (500 mL), HI710046 cigarette lighter cable, HI710005/8 (115V) or HI710006/8 (230V), instruction manual.
GPS	**HI9829-10041** (115V) **HI9829-10042** (230V)	HI9829 meter with GPS, HI7609829/4 probe, HI7698291 USB cable (PC to meter), HI920005 iButton® with holder (5 pcs), HI929829 PC application software, HI7609829-3 EC sensor, HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI710045 power supply cable, HI7698292 probe maintenance kit, HI7698290 short calibration beaker, HI9828-25 calibration solution (500 mL), HI710046 cigarette lighter cable, HI710005/8 (115V) or HI710006/8 (230V), instruction manual.
	HI9829-10101 (115V) **HI9829-10102** (230V)	HI9829 meter with GPS, HI7609829/10 probe, HI7698291 USB cable (PC to meter), HI920005 iButton® with holder (5 pcs), HI929829 PC application software, HI7609829-3 EC sensor, HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI710045 power supply cable, HI7698292 probe maintenance kit, HI7698290 short calibration beaker, HI9828-25 calibration solution (500 mL), HI710046 cigarette lighter cable, HI710005/8 (115V) or HI710006/8 (230V), instruction manual.
	HI9829-10201 (115V) **HI9829-10202** (230V)	HI9829 meter with GPS, HI7609829/20 probe, HI7698291 USB cable (PC to meter), HI920005 iButton® with holder (5 pcs), HI929829 PC application software, HI7609829-3 EC sensor, HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI710045 power supply cable, HI7698292 probe maintenance kit, HI7698290 short calibration beaker, HI9828-25 calibration solution (500 mL), HI710046 cigarette lighter cable, HI710005/8 (115V) or HI710006/8 (230V), instruction manual.
Basic & Turbidity	**HI9829-01041** (115V) **HI9829-01042** (230V)	HI9829 meter, HI7619829/4 probe, HI7698291 USB cable (PC to meter), HI920005 iButton® with holder (5 pcs), HI929829 PC application software, HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI7609829-4 EC/Turbidity sensor, HI710045 power supply cable, HI7698292 probe maintenance kit, HI9829-16 0 FNU calibration solution (230 mL), HI9829-17 20 FNU calibration solution (230 mL), HI9829-18 200 FNU calibration solution (230 mL), HI7698293 long calibration beaker, HI9828-25 calibration solution (500 mL), HI710046 cigarette lighter cable, HI710005/8 (115V) or HI710006/8 (230V), instruction manual.
	HI9829-01101 (115V) **HI9829-01102** (230V)	HI9829 meter, HI7619829/10 probe, HI7698291 USB cable (PC to meter), HI920005 iButton® with holder (5 pcs), HI929829 PC application software, HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI7609829-4 EC/Turbidity sensor, HI710045 power supply cable,HI7698292 probe maintenance kit, HI9829-16 0 FNU calibration solution (230 mL), HI9829-17 20 FNU calibration solution (230 mL), HI9829-18 200 FNU calibration solution (230 mL), HI7698293 long calibration beaker, HI9828-25 calibration solution (500 mL), HI710046 cigarette lighter cable, HI710005/8 (115V) or HI710006/8 (230V), instruction manual.
	HI9829-01201 (115V) **HI9829-01202** (230V)	HI9829 meter, HI7619829/20 probe, HI7698291 USB cable (PC to meter), HI920005 iButton® with holder (5 pcs), HI929829 PC application software, HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI7609829-4 EC/Turbidity sensor, HI710045 power supply cable,HI7698292 probe maintenance kit, HI9829-16 0 FNU calibration solution (230 mL), HI9829-17 20 FNU calibration solution (230 mL), HI9829-18 200 FNU calibration solution (230 mL), HI7698293 long calibration beaker, HI9828-25 calibration solution (500 mL), HI710046 cigarette lighter cable, HI710005/8 (115V) or HI710006/8 (230V), instruction manual.
GPS & Turbidity	**HI9829-11041** (115V) **HI9829-11042** (230V)	HI9829 meter with GPS, HI7619829/4 probe, HI7698291 USB cable (PC to meter), HI920005 iButton® with holder (5 pcs), HI929829 PC application software, HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI7609829-4 EC/Turbidity sensor, HI710045 power supply cable, HI7698292 probe maintenance kit, HI9829-16 0 FNU calibration solution (230 mL), HI9829-17 20 FNU calibration solution (230 mL), HI9829-18 200 FNU calibration solution (230 mL), HI7698293 long calibration beaker, HI9828-25 calibration solution (500 mL), HI710046 cigarette lighter cable, HI710005/8 (115V) or HI710006/8 (230V), instruction manual.
	HI9829-11101 (115V) **HI9829-11102** (230V)	HI9829 meter with GPS, HI7619829/10 probe, HI7698291 USB cable (PC to meter), HI920005 iButton® with holder (5 pcs), HI929829 PC application software, HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI7609829-4 EC/Turbidity sensor, HI710045 power supply cable, HI7698292 probe maintenance kit, HI9829-16 0 FNU calibration solution (230 mL), HI9829-17 20 FNU calibration solution (230 mL), HI9829-18 200 FNU calibration solution (230 mL), HI7698293 long calibration beaker, HI9828-25 calibration solution (500 mL), HI710046 cigarette lighter cable, HI710005/8 (115V) or HI710006/8 (230V), instruction manual.
	HI9829-11201 (115V) **HI9829-11202** (230V)	HI9829 meter with GPS, HI7619829/20 probe, HI7698291 USB cable (PC to meter), HI920005 iButton® with holder (5 pcs), HI929829 PC application software, HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI7609829-4 EC/Turbidity sensor, HI710045 power supply cable, HI7698292 probe maintenance kit, HI9829-16 0 FNU calibration solution (230 mL), HI9829-17 20 FNU calibration solution (230 mL), HI9829-18 200 FNU calibration solution (230 mL), HI7698293 long calibration beaker, HI9828-25 calibration solution (500 mL), HI710046 cigarette lighter cable, HI710005/8 (115V) or HI710006/8 (230V), instruction manual.

Mulitiparameter Probe (Cable length: 4m, 10m, 20m)

solutions and accessories begin on page 8.24

Meter with Probe Ordering Information

Choose Your Configuration Below

Meter and Probe with Rugged Carrying Case

Basic with Autonomously Logging Probe	**HI9829-02041** (115V) **HI9829-02042** (230V)	HI9829 meter, HI7629829/4 probe, HI76982910 USB cable (PC to Probe), HI7698291 USB cable (PC to meter), HI929829 PC application software, HI920005 iButton® with holder (5 pcs), HI7609829-3 EC sensor, HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI710045 power supply cable, HI7698290 short calibration beaker, HI9828-25 calibration solution (500 mL), HI710005/8 (115V) or HI710006/8 (230V), instruction manual
	HI9829-02101 (115V) **HI9829-02102** (230V)	HI9829 meter, HI7629829/10 probe, HI76982910 USB cable (PC to Probe), HI7698291 USB cable (PC to meter), HI929829 PC application software, HI920005 iButton® with holder (5 pcs), HI7609829-3 EC sensor, HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI710045 power supply cable, HI7698290 short calibration beaker, HI9828-25 calibration solution (500 mL), HI710005/8 (115V) or HI710006/8 (230V), instruction manual
	HI9829-02201 (115V) **HI9829-02202** (230V)	HI9829 meter, HI7629829/20 probe, HI76982910 USB cable (PC to Probe), HI7698291 USB cable (PC to meter), HI929829 PC application software, HI920005 iButton® with holder (5 pcs), HI7609829-3 EC sensor, HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI710045 power supply cable, HI7698290 short calibration beaker, HI9828-25 calibration solution (500 mL), HI710005/8 (115V) or HI710006/8 (230V), instruction manual
GPS with Autonomously Logging Probe	**HI9829-12041** (115V) **HI9829-12042** (230V)	HI9829 meter with GPS, HI7629829/4 probe, HI76982910 USB cable, (PC to Probe), HI7698291 USB cable (PC to meter), HI929829 PC application software, HI920005 iButton® with holder (5 pcs), HI7609829-3 EC sensor, HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI710045 power supply cable, HI7698290 short calibration beaker, HI9828-25 calibration solution (500 mL), HI710005/8 (115V) or HI710006/8 (230V), instruction manual
	HI9829-12101 (115V) **HI9829-12102** (230V)	HI9829 meter with GPS, HI7629829/10 probe, HI76982910 USB cable (PC to Probe), HI7698291 USB cable (PC to meter), HI929829 PC application software, HI920005 iButton® with holder (5 pcs), HI7609829-3 EC sensor, HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI710045 power supply cable, HI7698290 short calibration beaker, HI9828-25 calibration solution (500 mL), HI710005/8 (115V) or HI710006/8 (230V), instruction manual
	HI9829-12201 (115V) **HI9829-12202** (230V)	HI9829 meter with GPS, HI7629829/20 probe, HI76982910 USB cable (PC to Probe), HI7698291 USB cable (PC to meter), HI929829 PC application software, HI920005 iButton® with holder (5 pcs), HI7609829-3 EC sensor, HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI710045 power supply cable, HI7698290 short calibration beaker, HI9828-25 calibration solution (500 mL), HI710005/8 (115V) or HI710006/8 (230V), instruction manual
Basic with Autonomously Logging Probe & Turbidity	**HI9829-03041** (115V) **HI9829-03042** (230V)	HI9829 meter, HI7639829/4 probe, HI76982910 USB cable (PC to Probe), HI7698291 USB cable (PC to meter), HI929829 PC application software, HI920005 iButton® with holder (5 pcs), HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI7609829-4 EC/Turbidity sensor, HI710045 power supply cable, HI7698292 probe maintenance kit, HI9829-16 0 FNU calibration solution (230 mL), HI9829-17 20 FNU calibration solution (230 mL), HI9829-18 200 FNU calibration solution (230 mL), HI7698293 long calibration beaker, HI9828-25 calibration solution (500 mL), HI710046 cigarette lighter cable, HI710005/8 (115V) or HI710006/8 (230V), instruction manual
	HI9829-03101 (115V) **HI9829-03102** (230V)	HI9829 meter, HI7639829/10 probe, HI76982910 USB cable (PC to Probe), HI7698291 USB cable (PC to meter), HI929829 PC application software, HI920005 iButton® with holder (5 pcs), HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI7609829-4 EC/Turbidity sensor, HI710045 power supply cable, HI7698292 probe maintenance kit, HI9829-16 0 FNU calibration solution (230 mL), HI9829-17 20 FNU calibration solution (230 mL), HI9829-18 200 FNU calibration solution (230 mL), HI7698293 long calibration beaker, HI9828-25 calibration solution (500 mL), HI710046 cigarette lighter cable, HI710005/8 (115V) or HI710006/8 (230V), instruction manual
	HI9829-03201 (115V) **HI9829-03202** (230V)	HI9829 meter, HI7639829/20 probe, HI76982910 USB cable (PC to Probe), HI7698291 USB cable (PC to meter), HI929829 PC application software, HI920005 iButton® with holder (5 pcs), HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI7609829-4 EC/Turbidity sensor, HI710045 power supply cable, HI7698292 probe maintenance kit, HI9829-16 0 FNU calibration solution (230 mL), HI9829-17 20 FNU calibration solution (230 mL), HI9829-18 200 FNU calibration solution (230 mL), HI7698293 long calibration beaker, HI9828-25 calibration solution (500 mL), HI710046 cigarette lighter cable, HI710005/8 (115V) or HI710006/98(230V), instruction manual
GPS with Autonomously Logging Probe & Turbidity	**HI9829-13041** (115V) **HI9829-13042** (230V)	HI9829 meter with GPS, HI7639829/4 probe,HI76982910 USB cable, (PC to Probe), HI7698291 USB cable (PC to meter), HI929829 PC application software, HI920005 iButton® with holder (5 pcs), HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI7609829-4 EC/Turbidity sensor, HI710045 power supply cable, HI7698292 probe maintenance kit, HI9829-16 0 FNU calibration solution (230 mL), HI9829-17 20 FNU calibration solution (230 mL), HI9829-18 200 FNU calibration solution (230 mL), HI7698293 long calibration beaker, HI9828-25 calibration solution (500 mL), HI710046 cigarette lighter cable, HI710005/8 (115V) or HI710006/8 (230V), instruction manual
	HI9829-13101 (115V) **HI9829-13102** (230V)	HI9829 meter with GPS, HI7639829/10 probe,HI76982910 USB cable (PC to Probe), HI7698291 USB cable (PC to meter), HI929829 PC application software, HI920005 iButton® with holder (5 pcs), HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI7609829-4 EC/Turbidity sensor, HI710045 power supply cable,HI7698292 probe maintenance kit, HI9829-16 0 FNU calibration solution (230 mL), HI9829-17 20 FNU calibration solution (230 mL), HI9829-18 200 FNU calibration solution (230 mL), HI7698293 long calibration beaker, HI9828-25 calibration solution (500 mL), HI710046 cigarette lighter cable, HI710005/8 (115V) or HI710006/8 (230V),instruction manual
	HI9829-13201 (115V) **HI9829-13202** (230V)	HI9829 meter with GPS, HI7639829/20 probe,HI76982910 USB cable (PC to Probe), HI7698291 USB cable (PC to meter), HI929829 PC application software, HI920005 iButton® with holder (5 pcs), HI7609829-2 DO sensor, HI7609829-1 pH/ORP sensor, HI7609829-4 EC/Turbidity sensor, HI710045 power supply cable, HI7698292 probe maintenance kit, HI9829-16 0 FNU calibration solution (230 mL), HI9829-17 20 FNU calibration solution (230 mL), HI9829-18 200 FNU calibration solution (230 mL), HI7698293 long calibration beaker, HI9828-25 calibration solution (500 mL), HI710046 cigarette lighter cable, HI710005/8 (115V) or HI710006/8 (230V), instruction manual

solutions and accessories begin on page 8.24

Solutions & Accessories Ordering Information

Probe Only, No Sensors

HI7609829/4	Probe for pH/pH+ORP/ISE, DO, EC, temperature with HI7698295 short protective shield and 4 m (13.1') cable
HI7609829/10	Probe for pH/pH+ORP/ISE, DO, EC, temperature with HI7698295 short protective shield and 10 m (33') cable
HI7609829/20	Probe for pH/pH+ORP/ISE, DO, EC, temperature with HI7698295 short protective shield and 20 m (65.6') cable
HI7619829/4	Probe for pH/pH+ORP/ISE, DO, EC+turbidity, temperature, with HI7698296 long protective shield and 4 m (13.1') cable
HI7619829/10	Probe for pH/pH+ORP/ISE, DO, EC+turbidity, temperature with HI7698296 long protective shield and 10 m (33') cable
HI7619829/20	Probe for pH/pH+ORP/ISE, DO, EC+turbidity, temperature with HI7698296 long protective shield and 20 m (65.6') cable
HI7629829/4	Logging probe for pH/pH+ORP/ISE, DO, EC, temperature with HI7698295 short protective shield and 4 m (13.1') cable
HI7629829/10	Logging probe for pH/pH+ORP/ISE, DO, EC, temperature with HI7698295 short protective shield and 10 m (33') cable
HI7629829/20	Logging probe for pH/pH+ORP/ISE, DO, EC, temperature with HI7698295 short protective shield and 20 m (65.6') cable
HI7639829/4	Logging probe for pH/pH+ORP/ISE, DO, EC+turbidity, temperature, with HI7698296 long protective shield, and 4 m (13.1') cable
HI7639829/10	Logging probe for pH/pH+ORP/ISE, DO, EC+turbidity, temperature, with HI7698296 long protective shield, and 10 m (33') cable
HI7639829/10	Logging probe for pH/pH+ORP/ISE, DO, EC+turbidity, temperature, with HI7698296 long protective shield, and 20 m (65.6') cable

Sensors with O-Ring

HI7609829-1	pH/ORP
HI7609829-2	Dissolved Oxygen
HI7609829-3	EC
HI7609829-4	EC/Turbidity
HI7609829-10	Ammonium ISE
HI7609829-11	Chloride ISE
HI7609829-12	Nitrate ISE

Quick Calibration Solutions

HI9828-25	Quick calibration solution, 500 mL
HI9828-27	Quick calibration solution, 1 gal

pH Calibration Solutions

HI7004L	pH 4.01 buffer solution, 500 mL
HI7007L	pH 7.01 buffer solution, 500 mL
HI7010L	pH 10.01 buffer solution, 500 mL

ORP Calibration Solutions

HI7021L	ORP test solution @240 mV, 500 mL
HI7022L	ORP test solution @470 mV, 500 mL

ISE Standards

HI9829-10/11	Kit containing 10 sachets each of 10 ppm and 100 ppm standard for HI7609829-10 ammonium ISE
HI9829-10	10 ppm standard sachet for HI7609829-10 ammonium ISE, 25 mL (25)
HI9829-11	100 ppm standard sachet for HI7609829-10 ammonium ISE, 25 mL (25)
HI9829-12/13	Kit containing 10 sachets each of 10 ppm and 100 ppm standard for HI7609829-11 chloride ISE
HI9829-12	10 ppm standard sachet for HI7609829-11 chloride ISE, 25 mL (25)
HI9829-13	100 ppm standard sachet for HI7609829-11 chloride ISE, 25 mL (25)
HI9829-14/15	Kit containing 10 sachets each of 10 ppm and 100 ppm standard for HI7609829-12 nitrate ISE
HI9829-14	10 ppm standard sachet for HI7609829-12 nitrate ISE, 25 mL (25)
HI9829-15	100 ppm standard sachet for HI7609829-12 nitrate ISE, 25 mL (25)

Solutions & Accessories Ordering Information

EC Calibration Solutions

HI7030L	12880 µS/cm cal. sol., 500 mL
HI7031L	1413 µS/cm cal. sol., 500 mL
HI7033L	84 µS/cm cal. sol., 500 mL
HI7034L	80000 µS/cm cal. sol., 500 mL
HI7035L	111800 µS/cm cal. sol., 500 mL
HI7039L	5000 µS/cm cal. sol., 500 mL

Dissolved Oxygen Solutions

HI7040L	Zero oxygen solution, 500 mL
HI7042S	Electrolyte solution, 30 mL

Turbidity Calibration Solutions

HI9829-16	0 FNU calibration solution, 230 mL
HI9829-17	20 FNU calibration solution, 230 mL
HI9829-18	200 FNU calibration solution, 230 mL

Probe Maintenance Kit

HI7698292	Probe maintenance kit consisting of HI7042S (electrolyte solution for DO sensor), O-rings for DO sensor (5), small brush, O-rings for probe (5), and syringe with grease to lubricate the O-rings.

pH/ORP Cleaning and Storage Solutions

HI70300L	pH/ORP electrode storage sol., 500 mL
HI7061L	pH/ORP electrode cleaning sol., 500 mL

Accessories

HI929829	PC application software

HI7698291	USB cable, PC to meter
HI76982910	USB cable, PC to probe

HI710046	Car accessory port cable
HI7698290	Short calibration beaker
HI7698293	Long calibration beaker
HI7698294	Short flow cell
HI7698297	Long, quick release flow cell
HI7698295	Short protective shield
HI7698296	Long protective shield
HI920005	iButton® with holder (5 pcs)
HI710140	Hard carrying case
HI710045	Power supply cable

HI98194

Multiparameter Waterproof Meter

pH / mV, ORP, EC, TDS, Resistivity, Salinity, Seawater σ, Dissolved Oxygen, Atmospheric Pressure and Temperature

- Waterproof
  - IP67 rated waterproof, rugged enclosure for meter, IP68 for probe
- Digital probe
  - Digital probe with three connections for pH (ORP), EC and DO sensors and integral temperature sensor
- Color coded, field replaceable sensors
- Auto-sensor recognition
- Quick calibration feature
- Automatic temperature compensation
- Automatic logging
  - Store up to 45,000 samples
- Log-on-demand
  - Store measurement data at the press of a button
- GLP
  - GLP data provides data from previous five calibrations to ensure Good Laboratory Practices are met
- Dedicated help key
  - On-screen context specific help is readily available at the press of a button
- Backlit LCD display with multifunction virtual keys
- Intuitive keypad
  - Hard and virtual soft keys
- Connectivity
  - PC connectivity via opto-isolated micro-USB with Hanna software
- Up to 360 hours of battery life
  - Powered by (4) 1.5V AA batteries

- Quick Connect Probe
  - Built in barometer for DO concentration in meter

For Universal Applications

HI98184 provides multiparameter measurement in a compact and rugged, IP67 waterproof enclosure. Ideal for demanding applications, each meter features our rugged, quick connect multi-function probe with field replaceable sensors.

A backlit, graphic LCD provides easy to read resolution even in low-lit areas. A combination of dedicated and soft keys allows easy, intuitive operation in a choice of languages.

Data Logging

The HI98194 allows users to store up to 45,000 continuous or log-on-demand samples with logging intervals from one second to three hours. Logged data can be later transferred to a PC with the HI920015 micro USB cable and Hanna software.

Dedicated help button

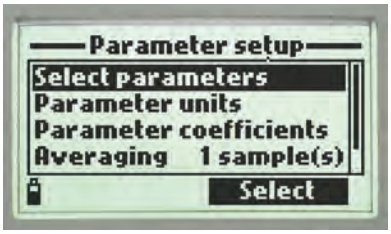
The contextual Help Menu can be accesssed to obtain on-screen information and assistance about each feature at the touch of a button.

Quick connect probe

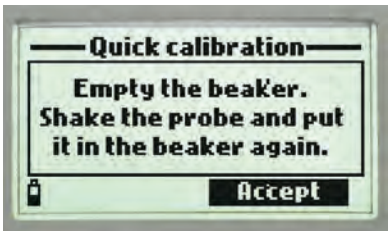
The HI7698194 probe features a quick connect DIN connector to make attaching and removing the probe simple and easy.

HI9828-25 "Quick Calibration" solution

- Field Ready with quick calibration solution
  - Standardize pH and conductivity with one calibration solution
  - Simply screw the calibration beaker filled with HI 9828-25 (500 mL) or HI9828-27 (1 gallon) solution onto the probe, select "Quick calibration" from the menu and press OK. Individual calibration may also be performed using multiple calibration points



- Setup
  - Extensive setup screen features



- Guides
  - On screen guides are displayed to help you while performing procedures such as calibration

pH Specific Features

- Calibration
  - Up to a three point calibration with five standard buffers and one custom buffer available

EC/TDS/Resistivity Specific Features

- Calibration
  - Single point calibration from six standards (84 µS/cm, 1.413 µS/cm, 5.00 mS/cm, 12.88 mS/cm, 80 mS/cm, 111.8 mS/cm or custom point)
- Temperature compensation
  - Automatic Temperature Compensation
  - Configurable temperature coefficient range from 0.00 to 6.00%/°C
  - Choice of reference temperatures at 20 or 25°C
  - Absolute conductivity can be displayed along with the temperature compensated value
- Autoranging
- Salinity readings
  - Practical Salinity Scale (PSU) based on conductivity calibration

Dissolved Oxygen Specific Features

- Choice of units
  - Display units in % saturation or mg/L (ppm)
- Salinity compensation for concentration
- Pressure compensation for concentration
  - Built-in barometer with user-selectable units (mmHg, inHg, atm, psi, kPa, mbar)
- Temperature compensation
- Polarization
  - Automatic polarization of probe at startup
- Membrane caps
  - Ready-to-use HDPE pre-tensioned membrane caps are easy to replace

- rugged carrying case with custom thermoformed insert included

Probe Specifications	HI7698194	
Sensor inputs	3 (pH, DO, EC)	
Sample Environment	Fresh, brackish, seawater	
waterproof Protection	IP68	
Operating Temperature	-5 to 55°C	
Storage Temperature	-20 to 70°C	
Maximum Depth	20 m (66')	
Dimensions (without cable)	342 mm (13.5"); 46 mm (1.8") dia	
Weight (without batteries and sensors)	570 g (20.1 oz.)	
Cable specification	Multistrand-multiconductor shielded cable with internal strength member rated for 68 kg (150 lb.) intermittent use.	
Wetted Materials	Body	ABS
	Threads	Nylon
	Shield	ABS / 316 SS
	Temperature Probe	316 SS
	O-rings	EPDM

Multi-function Sensor

- Quick sensor replacement
  - Sensor replacement is quick and easy with field replaceable, screw type connectors and are color coded for easy identification. The these meters automatically recognize sensors

Sensor Specifications		HI7698194-0	HI7698194-1	HI7698194-3	HI7698194-2
Description		pH sensor	pH/ORP sensor	EC sensor	DO sensor
Measurement Type		pH, mV (pH)	pH, mV (pH/ORP)	EC	DO (% saturation and concentration
Measurement Range		0.00 to 13.00 pH ; ±600.0 mV	0.00 to 13.00 pH; ±600.0 mV; ±2000.0 mV	0.0 to 200.0 mS/cm; 0.0 to 400 mS/cm (absolute)	0.0 to 500.0 %; 0.00 to 50.00 mg/L
Temperature Range		-5 to 55°C	-5 to 55°C	-5 to 55°C	-5 to 55°C
Color Code		red	red	blue	white
Materials	Tip	glass (pH)	glass (pH); Pt (ORP)	Stainless steel electrodes AISI 316	Cat/An: Ag/Zn
	Junction	ceramic	ceramic		Membrane: HDPE
	Body	PEI	PEI	ABS/epoxy	white top ABS
	Electrolyte	gel	gel		
	Reference	double	double		
Maintenance solution		HI70300 (storage solution)	HI70300 (storage solution)	none	HI7042S (DO electrolyte)
Dimensions		118 x 15 mm	118 x 15 mm	111 x 17 mm	99 x 17 mm
Depth		20 m (65')	20 m (65')	20 m (65')	20 m (65')

Specifications		HI98194
pH / mV	Range	0.00 to 14.00 pH / ±600.0 mV
	Resolution	0.01 pH / 0.1 mV
	Accuracy	±0.02 pH / ±0.5 mV
	Calibration	automatic one, two, or three points with automatic recognition of five standard buffers (pH 4.01, 6.86, 7.01, 9.18, 10.01) or one custom buffer
ORP	Range	±2000.0 mV
	Resolution	0.1 mV
	Accuracy	±1.0 mV
	Calibration	automatic at one custom point (relative mV)
EC	Range	0 to 200 mS/cm (absolute EC up to 400 mS/cm)
	Resolution	**manual:** 1 µS/cm; 0.001 mS/cm; 0.01 mS/cm; 0.1 mS/cm; 1 mS/cm; **automatic:** 1 µS/cm from 0 to 9999 µS/cm; 0.01 mS/cm from 10.00 to 99.99 mS/cm; 0.1 mS/cm from 100.0 to 400.0 mS/cm; **automatic mS/cm:** 0.001 mS/cm from 0.000 to 9.999 mS/cm; 0.01 mS/cm from 10.00 to 99.99 mS/cm; 0.1 mS/cm from 100.0 to 400.0 mS/cm
	Accuracy	±1% of reading or ±1 µS/cm whichever is greater
	Calibration	automatic single point, with six standard solutions (84 µS/cm, 1413 µS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, 111.8 mS/cm) or custom point
TDS	Range	0 to 400000 ppm (mg/L) (the maximum value depends on the TDS factor)
	Resolution	**manual:** 1 ppm (mg/L); 0.001 ppt (g/L); 0.01 ppt (g/L); 0.1 ppt (g/L); 1 ppt (g/L); **automatic:** 1 ppm (mg/L) from 0 to 9999 ppm (mg/L); 0.01 ppt (g/L) from 10.00 to 99.99 ppt (g/L); 0.1 ppt (g/L) from 100.0 to 400.0 ppt (g/L); **automatic ppt (g/L):** 0.001 ppt (g/L) from 0.000 to 9.999 ppt (g/L); 0.01 ppt (g/L) from 10.00 to 99.99 ppt (g/L); 0.1 ppt (g/L) from 100.0 to 400.0 ppt (g/L)
	Accuracy	±1% of reading or ±1 ppm (mg/L) whichever is greater
	Calibration	based on conductivity or salinity calibration
Resistivity	Range	0 to 999999 Ω•cm; 0 to 1000.0 kΩ•cm; 0 to 1.0000 MΩ•cm
	Resolution	dependent on resistivity reading
	Calibration	Based on conductivity or salinity calibration
Salinity	Range	0.00 to 70.00 PSU
	Resolution	0.01 PSU
	Accuracy	±2% of reading or ±0.01 PSU whichever is greater
	Calibration	based on conductivity calibration
Seawater σ	Range	0.0 to 50.0 σ_t, σ_0, σ_{15}
	Resolution	0.1 σ_t, σ_0, σ_{15}
	Accuracy	±1 σ_t, σ_0, σ_{15}
	Calibration	based on conductivity or salinity calibration
Dissolved Oxygen	Range	0.0 to 500.0%; 0.00 to 50.00 ppm (mg/L)
	Resolution	0.1%; 0.01 ppm (mg/L)
	Accuracy	0.0 to 300.0%: ±1.5% of reading or ±1.0% whichever is greater; 300.0 to 500.0%: ±3% of reading; 0.00 to 30.00 ppm (mg/L): ±1.5% of reading or ±0.10 ppm (mg/L), whichever is greater; 30.00 ppm (mg/L) to 50.00 ppm (mg/L): ±3% of reading
	Calibration	automatic one or two points at 0, 100% or one custom point
Atmospheric Pressure	Range	450 to 850 mm Hg; 17.72 to 33.46 in Hg; 600.0 to 1133.2 mbar; 8.702 to 16.436 psi; 0.5921 to 1.1184 atm; 60.00 to 113.32 kPa
	Resolution	0.1 mm Hg; 0.01 in Hg; 0.1 mbar; 0.001 psi; 0.0001 atm; 0.01 kPa
	Accuracy	±3 mm Hg within ±15°C from the temperature during calibration
	Calibration	automatic at one custom point
Temperature	Range	-5.00 to 55.00°C; 23.00 to 131.00°F; 268.15 to 328.15K
	Resolution	0.01°C; 0.01°F; 0.01K
	Accuracy	±0.15°C; ±0.27°F; ±0.15K
	Calibration	Automatic at one custom point
Additional Specifications	Temperature Compensation	automatic from -5 to 55°C (23 to 131°F)
	Logging Memory	45,000 records (continuous logging or log-on-demand of all parameters)
	Logging Interval	one second to three hours
	PC Connectivity	via USB (with Hanna PC software)
	Environment	0 to 50°C (32 to 122°F); RH 100% IP67
	Battery Type / Life	1.5V AA batteries (4) / approximately 360 hours of continuous use without backlight (50 hours with backlight)
	Dimensions / Weight	185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.)
Ordering Information	**HI98194** is supplied with HI7698194 probe, HI7698194-0 pH sensor, HI7698194-3 EC sensor and HI7698194-2 DO sensor, Hanna PC software, HI920015 micro USB cable, 1.5V AA batteries (4), instruction manual, quick start guide, quality certificate and rugged carrying case with custom thermoformed insert.	

HI98195

Multiparameter Waterproof Meter

pH / mV, ORP, EC, TDS, Resistivity, Salinity, Seawater σ and Temperature

- Waterproof
  - IP67 rated waterproof, rugged enclosure for meter, IP68 for probe
- Digital probe
  - Digital probe with two connections for pH (ORP) and EC sensors and integral temperature sensor
- Color coded, field replaceable sensors
- Auto-sensor recognition
- Quick calibration feature
- Automatic temperature compensation
- Automatic logging
  - Store up to 45,000 samples
- Log-on-demand
  - Store measurement data at the press of a button
- GLP
  - GLP data provides data from previous five calibrations to ensure Good Laboratory Practices are met
- Dedicated help key
  - On-screen context specific help is readily available at the press of a button
- Backlit LCD display with multifunction virtual keys
- Intuitive keypad
  - Hard and virtual soft keys
- Connectivity
  - PC connectivity via opto-isolated micro-USB with Hanna software
- Up to 360 hours of battery life
  - Powered by (4) 1.5V AA batteries

- Quick Connect Probe

For Universal Applications

HI98195 provides multiparameter measurement in a compact and rugged, IP67 waterproof enclosure. Ideal for demanding applications, each meter features our rugged, quick connect multi-function probe with field replaceable sensors.

A backlit, graphic LCD provides easy to read resolution even in low-lit areas. A combination of dedicated and soft keys allows easy, intuitive operation in a choice of languages.

Data Logging

The HI98195 allows users to store up to 45,000 continuous or log-on-demand samples with logging intervals from one second to three hours. Logged data can be later transferred to a PC with the HI920015 micro USB cable and Hanna software.

GLP and On-Screen Help

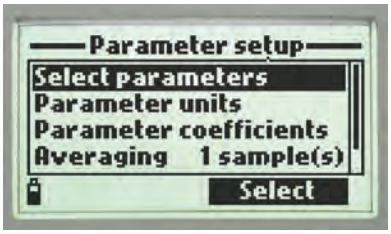
Comprehensive GLP data includes data from last five calibrations. The contextual Help Menu can be accesssed to obtain on-screen information and assistance about each feature at the touch of a button.

Quick connect probe

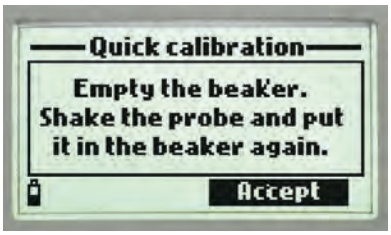
The HI7698195 probe features a quick connect DIN connector to make attaching and removing the probe simple and easy.

HI9828-25 "Quick Calibration" solution

- Field Ready with quick calibration solution
  - Standardize pH and conductivity with one calibration solution
  - Simply screw the calibration beaker filled with HI 9828-25 (500 mL) or HI9828-27 (1 gallon) solution onto the probe, select "Quick calibration" from the menu and press OK. Individual calibration may also be performed using multiple calibration points



- Setup
  - Extensive setup screen features



- Guides
  - On screen guides are displayed to help you while performing procedures such as calibration

- rugged carrying case with custom thermoformed insert included

pH Specific Features

- Calibration
  - Up to a three point calibration with five standard buffers and one custom buffer available

EC/TDS/Resistivity Specific Features

- Calibration
  - Single point calibration from six standards (84 µS/cm, 1.413 µS/cm, 5.00 mS/cm, 12.88 mS/cm, 80 mS/cm, 111.8 mS/cm or custom point)
- Temperature compensation
  - Automatic Temperature Compensation
  - Configurable temperature coefficient range from 0.00 to 6.00%/°C
  - Choice of reference temperatures at 20 or 25°C
  - Absolute conductivity can be displayed along with the temperature compensated value
- Autoranging
- Salinity readings
  - Practical Salinity Scale (PSU) based on conductivity calibration

Specifications	HI7698195	
Sensor inputs	two (pH/ORP, EC)	
Sample Environment	Fresh, brackish, seawater	
waterproof Protection	IP68	
Operating Temperature	-5 to 55°C	
Storage Temperature	-20 to 70°C	
Maximum Depth	20 m (66')	
Dimensions (without cable)	342 mm (13.5"); 46 mm (1.8") dia	
Weight (without batteries and sensors)	570 g (20.1 oz.)	
Cable specification	Multistrand-multiconductor shielded cable with internal strength member rated for 68 kg (150 lb.) intermittent use.	
Wetted Materials	Body	ABS
	Threads	Nylon
	Shield	ABS / 316 SS
	Temperature Probe	316 SS
	O-rings	EPDM

Multi-function Sensor

- Quick sensor replacement
  - Sensor replacement is quick and easy with field replaceable, screw type connectors and are color coded for easy identification. The these meters automatically recognize sensors

or

Sensor Specifications		HI7698194-0	HI7698194-1	HI7698194-3
Description		pH sensor	pH/ORP sensor	EC sensor
Measurement Type		pH, mV (pH)	pH, mV (pH/ORP)	EC
Measurement Range		0.00 to 13.00 pH ; ±600.0 mV	0.00 to 13.00 pH; ±600.0 mV; ±2000.0 mV	0.0 to 200.0 mS/cm; 0.0 to 400 mS/cm (absolute)
Temperature Range		-5 to 55°C	-5 to 55°C	-5 to 55°C
Color Code		red	red	blue
Materials	Tip	glass (pH)	glass (pH); Pt (ORP)	Stainless steel electrodes AISI 316
	Junction	ceramic	ceramic	
	Body	PEI	PEI	ABS/epoxy
	Electrolyte	gel	gel	
	Reference	double	double	
Maintenance solution		HI70300 (storage solution)	HI70300 (storage solution)	none
Dimensions		118 x 15 mm	118 x 15 mm	111 x 17 mm
Depth		20 m (65')	20 m (65')	20 m (65')

Specifications		HI98195
pH / mV	Range	0.00 to 14.00 pH / ±600.0 mV
	Resolution	0.01 pH / 0.1 mV
	Accuracy	±0.02 pH / ±0.5 mV
	Calibration	automatic one, two, or three points with automatic recognition of five standard buffers (pH 4.01, 6.86, 7.01, 9.18, 10.01) or one custom buffer
ORP	Range	±2000.0 mV
	Resolution	0.1 mV
	Accuracy	±1.0 mV
	Calibration	automatic at one custom point (relative mV)
EC	Range	0 to 200 mS/cm (absolute EC up to 400 mS/cm)
	Resolution	**manual:** 1 µS/cm; 0.001 mS/cm; 0.01 mS/cm; 0.1 mS/cm; 1 mS/cm; **automatic:** 1 µS/cm from 0 to 9999 µS/cm; 0.01 mS/cm from 10.00 to 99.99 mS/cm; 0.1 mS/cm from 100.0 to 400.0 mS/cm; **automatic mS/cm:** 0.001 mS/cm from 0.000 to 9.999 mS/cm; 0.01 mS/cm from 10.00 to 99.99 mS/cm; 0.1 mS/cm from 100.0 to 400.0 mS/cm
	Accuracy	±1% of reading or ±1 µS/cm whichever is greater
	Calibration	automatic single point, with six standard solutions (84 µS/cm, 1413 µS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, 111.8 mS/cm) or custom point
TDS	Range	0 to 400000 ppm (mg/L) (the maximum value depends on the TDS factor)
	Resolution	**manual:** 1 ppm (mg/L); 0.001 ppt (g/L); 0.01 ppt (g/L); 0.1 ppt (g/L); 1 ppt (g/L); **automatic:** 1 ppm (mg/L) from 0 to 9999 ppm (mg/L); 0.01 ppt (g/L) from 10.00 to 99.99 ppt (g/L); 0.1 ppt (g/L) from 100.0 to 400.0 ppt (g/L); **automatic ppt (g/L):** 0.001 ppt (g/L) from 0.000 to 9.999 ppt (g/L); 0.01 ppt (g/L) from 10.00 to 99.99 ppt (g/L); 0.1 ppt (g/L) from 100.0 to 400.0 ppt (g/L)
	Accuracy	±1% of reading or ±1 ppm (mg/L) whichever is greater
	Calibration	based on conductivity or salinity calibration
Resistivity	Range	0 to 999999 Ω•cm; 0 to 1000.0 kΩ•cm; 0 to 1.0000 MΩ•cm
	Resolution	dependent on resistivity reading
	Calibration	Based on conductivity or salinity calibration
Salinity	Range	0.00 to 70.00 PSU
	Resolution	0.01 PSU
	Accuracy	±2% of reading or ±0.01 PSU whichever is greater
	Calibration	based on conductivity calibration
Seawater σ	Range	0.0 to 50.0 σ_t, σ_0, σ_{15}
	Resolution	0.1 σ_t, σ_0, σ_{15}
	Accuracy	±1 σ_t, σ_0, σ_{15}
	Calibration	based on conductivity or salinity calibration
Temperature	Range	-5.00 to 55.00°C; 23.00 to 131.00°F; 268.15 to 328.15K
	Resolution	0.01°C; 0.01°F; 0.01K
	Accuracy	±0.15°C; ±0.27°F; ±0.15K
	Calibration	Automatic at one custom point
Additional Specifications	Temperature Compensation	automatic from -5 to 55°C (23 to 131°F)
	Logging Memory	45,000 records (continuous logging or log-on-demand of all parameters)
	Logging Interval	one second to three hours
	PC Connectivity	via USB (with Hanna PC software)
	Environment	0 to 50°C (32 to 122°F); RH 100% IP67
	Battery Type / Life	1.5V AA batteries (4) / approximately 360 hours of continuous use without backlight (50 hours with backlight)
	Dimensions / Weight	185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.)
Ordering Information	**HI98195** is supplied with HI7698195 probe, HI7698194-0 pH sensor, HI7698194-3 EC sensor, Hanna PC software, HI920015 micro USB cable, 1.5V AA batteries (4), instruction manual, quick start guide, quality certificate and rugged carrying case with custom thermoformed insert.	

HI98196

Multiparameter Waterproof Meter

pH / mV, ORP, Dissolved Oxygen, Atmospheric Pressure and Temperature

- Waterproof
  - IP67 rated waterproof, rugged enclosure for meter, IP68 for probe
- Digital probe
  - Digital probe with two connections for pH (ORP) and DO sensors and integral temperature sensor
- Color coded, field replaceable sensors
- Auto-sensor recognition
- Quick calibration feature
- Automatic temperature compensation
- Automatic logging
  - Store up to 45,000 samples
- GLP
  - GLP data provides data from previous five calibrations to ensure Good Laboratory Practices are met
- Dedicated help key
  - On-screen context specific help is readily available at the press of a button
- Backlit LCD display with multifunction virtual keys
- Intuitive keypad
  - Hard and virtual soft keys
- Connectivity
  - PC connectivity via opto-isolated micro-USB with Hanna software
- Up to 360 hours of battery life
  - Powered by (4) 1.5V AA batteries

- Quick Connect Probe
  - Built in barometer for DO concentration in meter

For Universal Applications

HI98196 provides multiparameter measurement in a compact and rugged, IP67 waterproof enclosure. Ideal for demanding applications, each meter features our rugged, quick connect multi-function probe with field replaceable sensors.

A backlit, graphic LCD provides easy to read resolution even in low-lit areas. A combination of dedicated and soft keys allows easy, intuitive operation in a choice of languages.

Data Logging

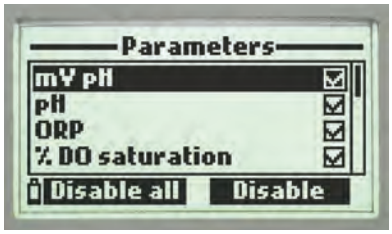
TheHI98196 allows users to store up to 45,000 continuous or log-on-demand samples with logging intervals from one second to three hours. Logged data can be later transferred to a PC with the HI920015 micro USB cable and HI929828 software.

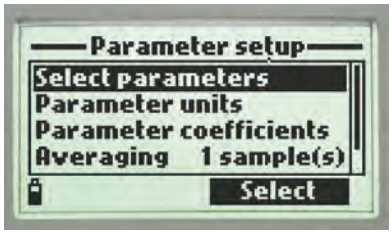
GLP and On-Screen Help

Comprehensive GLP data includes data from last five calibrations. The contextual Help Menu can be accesssed to obtain on-screen information and assistance about each feature at the touch of a button.

Quick connect probe

The HI7698196 probe features a quick connect DIN connector to make attaching and removing the probe simple and easy.





- Setup
  - Extensive setup screen features

pH Specific Features

- Calibration
  - Up to a three point calibration with five standard buffers and one custom buffer available

Dissolved Oxygen Specific Features

- Choice of units
  - Display units in % saturation or mg/L (ppm)
- Salinity compensation for concentration
- Pressure compensation for concentration
  - Built-in barometer with user-selectable units (mmHg, inHg, atm, psi, kPa, mbar)
- Temperature compensation
- Polarization
  - Automatic polarization of probe at startup
- Membrane caps
  - Ready-to-use HDPE pre-tensioned membrane caps are easy to replace

- rugged carrying case with custom thermoformed insert included

Specifications	HI7698196	
Sensor inputs	two (pH/ORP, DO)	
Sample Environment	Fresh, brackish, seawater	
waterproof Protection	IP68	
Operating Temperature	-5 to 55°C	
Storage Temperature	-20 to 70°C	
Maximum Depth	20 m (66')	
Dimensions (without cable)	342 mm (13.5"); 46 mm (1.8") dia	
Weight (without batteries and sensors)	570 g (20.1 oz.)	
Cable specification	Multistrand-multiconductor shielded cable with internal strength member rated for 68 kg (150 lb.) intermittent use.	
Wetted Materials	Body	ABS
	Threads	Nylon
	Shield	ABS / 316 SS
	Temperature Probe	316 SS
	O-rings	EPDM

Multi-function Sensor

- Quick sensor replacement
  - Sensor replacement is quick and easy with field replaceable, screw type connectors and are color coded for easy identification. The these meters automatically recognize sensors

or

Sensor Specifications		HI7698194-0	HI7698194-1	HI7698194-2
Description		pH sensor	pH/ORP sensor	DO sensor
Measurement Type		pH, mV (pH)	pH, mV (pH/ORP)	DO (% saturation and concentration
Measurement Range		0.00 to 13.00 pH ; ±600.0 mV	0.00 to 13.00 pH; ±600.0 mV; ±2000.0 mV	0.0 to 500.0 %; 0.00 to 50.00 mg/L
Temperature Range		-5 to 55°C	-5 to 55°C	-5 to 55°C
Color Code		red	red	white
Materials	Tip	glass (pH)	glass (pH); Pt (ORP)	Cat/An: Ag/Zn
	Junction	ceramic	ceramic	Membrane: HDPE
	Body	PEI	PEI	white top ABS
	Electrolyte	gel	gel	
	Reference	double	double	
Maintenance solution		HI70300 (storage solution)	HI70300 (storage solution)	HI7042S (DO electrolyte)
Dimensions		118 x 15 mm	118 x 15 mm	99 x 17 mm
Depth		20 m (65')	20 m (65')	20 m (65')

Specifications		HI98196
pH / mV	Range	0.00 to 14.00 pH / ±600.0 mV
	Resolution	0.01 pH / 0.1 mV
	Accuracy	±0.02 pH / ±0.5 mV
	Calibration	automatic one, two, or three points with automatic recognition of five standard buffers (pH 4.01, 6.86, 7.01, 9.18, 10.01) or one custom buffer
ORP	Range	±2000.0 mV
	Resolution	0.1 mV
	Accuracy	±1.0 mV
	Calibration	automatic at one custom point (relative mV)
Dissolved Oxygen	Range	0.0 to 500.0%; 0.00 to 50.00 ppm (mg/L)
	Resolution	0.1%; 0.01 ppm (mg/L)
	Accuracy	0.0 to 300.0%: ±1.5% of reading or ±1.0% whichever is greater; 300.0 to 500.0%: ±3% of reading; 0.00 to 30.00 ppm (mg/L): ±1.5% of reading or ±0.10 ppm (mg/L), whichever is greater; 30.00 ppm (mg/L) to 50.00 ppm (mg/L): ±3% of reading
	Calibration	automatic one or two points at 0, 100% or one custom point
Atmospheric Pressure	Range	450 to 850 mm Hg; 17.72 to 33.46 in Hg; 600.0 to 1133.2 mbar; 8.702 to 16.436 psi; 0.5921 to 1.1184 atm; 60.00 to 113.32 kPa
	Resolution	0.1 mm Hg; 0.01 in Hg; 0.1 mbar; 0.001 psi; 0.0001 atm; 0.01 kPa
	Accuracy	±3 mm Hg within ±15°C from the temperature during calibration
	Calibration	automatic at one custom point
Temperature	Range	-5.00 to 55.00°C; 23.00 to 131.00°F; 268.15 to 328.15K
	Resolution	0.01°C; 0.01°F; 0.01K
	Accuracy	±0.15°C; ±0.27°F; ±0.15K
	Calibration	Automatic at one custom point
Additional Specifications	Temperature Compensation	automatic from -5 to 55°C (23 to 131°F)
	Logging Memory	45,000 records (continuous logging or log-on-demand of all parameters)
	Logging Interval	one second to three hours
	PC Connectivity	via USB (with Hanna PC software)
	Environment	0 to 50°C (32 to 122°F); RH 100% IP67
	Battery Type / Life	1.5V AA batteries (4) / approximately 360 hours of continuous use without backlight (50 hours with backlight)
	Dimensions / Weight	185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.)
Ordering Information	**HI98196** is supplied with HI7698196 probe, HI7698194-0 pH sensor, HI7698194-2 DO sensor, Hanna PC software, HI920015 micro USB cable, 1.5V AA batteries (4), instruction manual, quick start guide, quality certificate and rugged carrying case with custom thermoformed insert.	

HI991300 • HI991301

pH/EC/TDS/ Temperature Meters

- ATC
  - Automatic temperature compensation
- Two-point calibration
  - One to two-point calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- Sensor Check™
  - Auto-recognition of all sensors
- Battery indicator
  - Indicates how much battery life is in the instrument
- Help feature
  - On-screen tutorial messages
- Hold feature
  - Freezes readings on the display for manual recording

HI991300 and HI991301 have been designed to offer you pH, conductivity, total dissolved solids and temperature measurements in a slim, lightweight, portable unit. From purified to brine water measurement, you can select the meter which will work best with your range of conductivity for greater precision.

There are only two buttons, yet you can select from a range of calibration buffers and even the temperature scale (°C or °F) most familiar to you. The housing is waterproof and rated for IP67 conditions.

The HI1288 pre-amplified multiparameter probe features an easy to clean sensor and a cloth junction that can be pulled longer to increase the life of the probe. To ensure against interference from transient electrical noise, a solid-state amplifier is integrated into the HI1288.

User selectable features include different TDS factors from 0.45 to 1.00 and a range of temperature coefficients (β) from 0.0 to 2.4% for greater consistency and reproducibility. Standardized buffer recognition values are also selectable.

These instruments easily fit in the palm of your hand and the bottom probe connection ensures the electrode cable doesn't get in your way. The large, multi-level LCD displays the primary reading, temperature and calibration guides simultaneously.

HI1288 Multiparameter Probe

The HI1288 multiparameter probe includes pH/EC/TDS and temperature measurements. A solid-state pre-amplifier is integrated into the probe to protect against interference from transient electrical noise.

- Amperometric conductivity probe
- Built-in temperature sensor
- Easy to clean
  - The sensor is easy to clean and keep clean by design
- pH sensor with extendable cloth junction
  - Cloth junctions allow the user to refresh the junction, effectively increasing the life of the probe

Specifications		HI991300	HI991301
pH	Range	0 to 14.00 pH	0 to 14.00 pH
	Resolution	0.01 pH	0.01 pH
	Accuracy	±0.01 pH	±0.01 pH
EC	Range	0 to 3999 µS/cm	0.00 to 20.00 mS/cm
	Resolution	1 µS/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	pH Calibration	automatic, one or two point calibration with two sets of memorized buffers (Standard 4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)	automatic, one or two point calibration with two sets of memorized buffers (Standard 4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
	EC/TDS Calibration	automatic one point at: 1382 ppm (CONV=0.5) or 1500 ppm(CONV=0.7) or 1413 µS/cm	automatic one point at: 6.44 ppt (CONV=0.5) or 9.02 ppt (CONV=0.7) or 12880 µS/cm
	pH Temp. Compensaiton	automatic	automatic
	EC/TDS Temperature Compenation	automatic with β selectable from 0.0-2.4%/°C with 0.1 increments	automatic with β selectable from 0.0-2.4%/°C with 0.1 increments
	TDS Conversion Factor	selectable from 0.45 to 1.00 with 0.01 increments (default 0.50)	
	Probe (included)	HI1288 polypropylene body, pre-amplified multiparameter probe with internal temperature sensor, DIN connector and 1m cable	
	Battery Type/Life	1.5V AAA (3) /approximately 500 hours of continuous use. auto-off after 8 minutes of inactivity	
	Environment	0 to 50°C (32 to 122°F); RH max. 100%	
	Dimensions	152 x 58 x 30 mm (6.0 x 2.3 x 1.2")	
	Weight	205g (7.2 oz.)	

Ordering Information

HI991300 is supplied with HI1288 multiparameter probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI70031 1413 µS/cm calibration solution sachet, HI70032 1382 mg/L (ppm) calibration solution sachet, HI700601 electrode cleaning solution sachet, batteries, instructions and rugged carrying case.

HI991301 is supplied with HI1288 multiparameter probe, HI70004 pH 4.01 buffer sachet, HI70007 pH 7.01 buffer sachet, HI70030 12880 µS/cm calibration solution sachet, HI70038 6.44 g/L (ppt) calibration solution sachet, HI700601 electrode cleaning solution sachet, batteries, instructions and rugged carrying case.

pH solutions begin on page 3.100; EC and TDS solutions begin on page 6.42

HI9813-5 • HI9813-6

pH/EC/TDS/ Temperature Portable Meter

- CAL Check™
  - Alerts users of calibration status (HI9813-6)
- ATC
  - Automatic temperature compensation
- Help feature
  - On-screen tutorial messages
- Battery indicator
  - Indicates how much battery life is in the instrument
- Waterpoof
  - Water-resistant

HI9813-5 and HI9813-6 are versatile, water resistant, multiparameter portable instruments specifically designed for agricultural applications such as hydroponics, greenhouses, farming and nurseries.

This series of instruments feature an large LCD that clearly displays the parameter being measured as well as calibration instructions. Calibration is fast and easy with knobs located on the front panel of the instrument.

HI9813-5 is a pH/EC/TDS meter designed for simplicity of use in taking pH, mS/cm, ppm and temperature in the °C scale measurements.

HI9813-6 includes all the features of the HI9813-5 while incorporating our exclusive CAL CHECK™ feature. CAL CHECK™ allows the user to easily check the pH probe calibration status at any time.

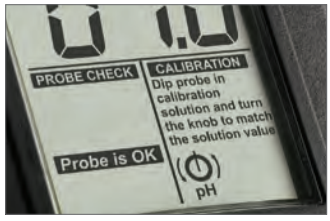
Both instruments utilize the HI1285 series pH/EC/TDS/temperature probe. This probe features a fiber junction and gel electrolyte making it ideal for fertilizer solutions.

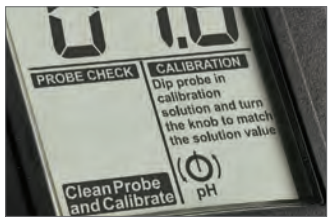
HI9813-6 Exclusive CAL CHECK™ Feature

When used in conjunction with the HI 1285-6 pH/EC/TDS/temperature probe and HI50021 check solution, the HI9813-6's CAL CHECK™ feature allows the user to check the meter calibration status at any time with a simple procedure:

1. Rinse the probe with water and immerse the probe in HI50021 check solution.
2. Press the check key.
3. If the meter is calibrated "probe is OK" message is displayed.
4. If cleaning is needed "clean probe and calibrate" message is displayed

If cleaning is needed just immerse the probe in HI700661 cleaning solution for 5 minutes, rinse the probe and check again. Calibration is needed if "clean probe and calibrate" message is displayed a second time.





Shown with HI710008 protective boot (optional)

HI1285 Series Probe

The specially engineered HI1285-5 and HI 1285-6 pH/EC/TDS/temperature probes utilize a fiber junction and gel electrolyte which provide fast response and reduced contamination. This combination makes these probes particularly suitable to be used in fertilizer solutions.

These probes can be used with instruments that use the same connector.

- Built-in pH, amperometric EC and temperature sensor
- Specialized rugged probe
  - Designed for harsh environments such as fertilizer solutions.

Specifications		HI9813-5	HI9813-6
pH	Range	0.0 to 14.0 pH	0.0 to 14.0 pH
	Resolution	0.1 pH	0.1 pH
	Accuracy	±0.1 pH	±0.1 pH
EC	Range	0.00 to 4.00 mS/cm	0.00 to 4.00 mS/cm
	Resolution	0.01 mS/cm	0.01 mS/cm
	Accuracy	±2% F.S.	±2% F.S.
TDS	Range	0 to 1999 ppm (mg/L)	0 to 1999 ppm (mg/L)
	Resolution	1 ppm (mg/L)	1 ppm (mg/L)
	Accuracy	±2% F.S.	±2% F.S.
Temperature	Range	0.0 to 60.0°C	0.0 to 60.0°C
	Resolution	0.1°C	0.1°C
	Accuracy	±0.5°C	±0.5°C
Additional Specifications	TDS Conversion Factor	0.56 to 0.78 ppm = 1 µS/cm (according to TDS 442 curve)	0.56 to 0.78 ppm = 1 µS/cm (according to TDS 442 curve)
	pH & EC/TDS Calibration	manual, one point (all parameters except temperature)	manual, one point (all parameters except temperature)
	Temp. Compensation	automatic 0 to 50°C (32 to 122°F) with β=2%/°C (EC/TDS only)	automatic 0 to 50°C (32 to 122°F) with β=2%/°C (EC/TDS only)
	Probe	HI1285-5 polypropylene body, pre-amplified multiparameter probe with internal temperature sensor, 8-pin DIN connector and 1 m (3.3') cable (included)	HI1285-6 polypropylene body, pre-amplified multiparameter probe with CAL CHECK™ compatibilty, internal temperature sensor, 8-pin DIN connector and 1 m (3.3') cable (included)
	Battery Type / Life	9V / approximately 150 hours of continuous use	
	Environment	0 to 50°C (32 to 122°F); RH max 100%	
	Dimensions	145 x 80 x 36 mm (5.7 x 3.1 x 1.4")	
	Weight	230 g (8.1 oz.)	
Ordering Information		**HI9813-5** is supplied with HI1285-5 multiparameter probe, HI70007 pH 7.01 calibration solution sachet, HI70442 1500 ppm (mg/L) calibration solution sachet, HI70031 1413 µS/cm calibration solution sachet, HI700661 electrode cleaning solution sachets (2), battery, instructions and rugged carrying case. **HI9813-6** is supplied with HI1285-6 multiparameter probe, HI70007 pH 7.01 calibration solution sachet, HI70442 1500 ppm (mg/L) calibration solution sachet, HI70031 1413 µS/cm calibration solution sachet, HI50021 electrode cleaning solution sachets (2), 9v battery (1), instructions and rugged carrying case.	

pH solutions begin on page 3.100; EC and TDS solutions begin on page 6.42

HI9811-5 • HI9812-5

pH/EC/TDS/ Temperature Portable Meters

- ATC
  - Automatic temperature compensation
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- Battery indicator
  - Indicates how much battery life is in the instrument
- Help feature
  - On-screen tutorial messages
- Waterpoof
  - Water-resistant

HI9811-5 and HI9812-5 are pH/EC/ TDS waterproof meters designed for simplicity in taking pH, µS/cm, ppm (mg/L) and temperature measurements. both the HI9811-5 and HI9812-5 are ideal for hydroponics, greenhouses, farming and ground water applications .

Due to the built-in temperature sensor, conductivity readings are automatically compensated for temperature changes. The temperature coefficient is fixed at 2%/°C.

No probe changes are required when switching your measured parameter between pH, conductivity and TDS. These multiparameter meters reduce the number of instruments required for daily water quality analysis.

HI1285-5 Probe

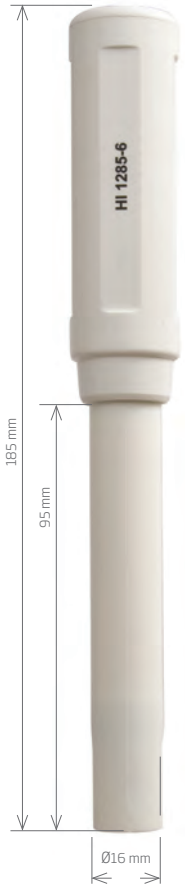
The specially engineered HI1285-5 pH/EC/TDS and temperature probe utilizes a fiber junction and gel electrolyte which provide a fast response and reduced contamination. This combination makes the HI1285-5 particularly designed to withstand harsh environments such as fertilizer solutions.

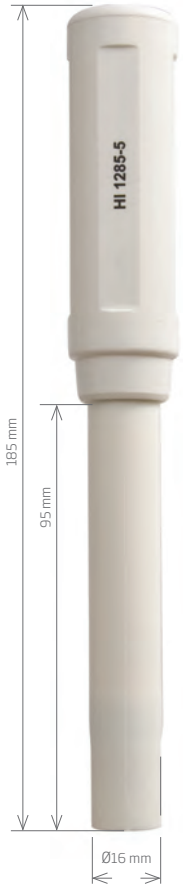
Shown with HI710008 protective boot (optional)

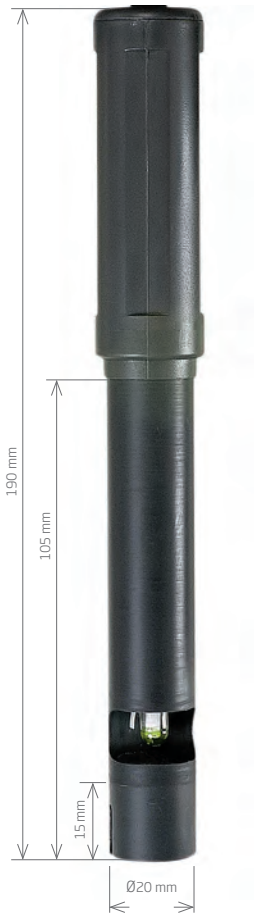
Specifications		HI9811-5	HI9812-5
pH	Range	0.0 to 14.0 pH	0.0 to 14.0 pH
	Resolution	0.1 pH	0.1 pH
	Accuracy	±0.1 pH	±0.1 pH
EC	Range	0 to 6000 µS/cm	0 to 1990 µS/cm
	Resolution	10 µS/cm	10 µS/cm
	Accuracy	±2% F.S.	±2% F.S.
TDS	Range	0 to 3000 ppm (mg/L)	0 to 1990 ppm (mg/L)
	Resolution	10 ppm (mg/L)	10 ppm (mg/L)
	Accuracy	±2% F.S.	±2% F.S.
Temperature	Range	0 to 70°C	0 to 60°C
	Resolution	0.1°C	10°C
	Accuracy	±0.5°C	±1°C
Additional Specifications	TDS Conversion Factor	0.5 ppm (mg/L) = 1 µS/cm	
	Calibration	manual, one point (all parameters except temperature)	
	Temperature Compensation	automatic from 0 to 50°C (32 to 122°F) with β = 2% /°C (EC/TDS only)	
	Probe (included)	HI1285-5 polypropylene body, pre-amplified multiparameter probe with internal temperature sensor, 8-pin DIN connector and 1 m (3.3') cable	
	Battery Type / Life	9V / approximately 150 hours of continuous use	
	Environment	0 to 50°C (32 to 122°F); RH max 100%	
	Dimensions	145 x 80 x 36 mm (5.7 x 3.1 x 1.4")	
	Weight	230 g (8.1 oz.)	
Ordering Information		**HI9811-5** and **HI9812-5** are supplied with HI1285-5 multiparameter probe, HI70007 pH 7.01 calibration solution sachet, HI70032 1382 ppm (mg/L) calibration solution sachet, HI70031 1413 µS/cm calibration solution sachet, HI700661 electrode cleaning solution sachets (2), 9v battery (1), instructions and rugged carrying case.	

pH solutions begin on page 3.100; EC and TDS solutions begin on page 6.42

Replacement Electrodes







Code	HI1285-6	HI1285-5	HI1288
Description	preamplified pH and EC probe	preamplified pH and EC probe	preamplified pH and EC probe
Reference	single, Ag/AgCl	single, Ag/AgCl	single, Ag/AgCl
Junction / Flow Rate	cloth	cloth	cloth
Electrolyte	gel	gel	gel
Max Pressure	0.1 bar	0.1 bar	1 bar
Range	pH: 0 to 13 / EC T: 0 to 50°C (32 to 122°F)	pH: 0 to 13 / EC T: 0 to 50°C (32 to 122°F)	pH: 0 to 13 / EC T: 0 to 50°C (32 to 122°F)
Tip /Shape	spheric (dia: 8.0 mm)	spheric (dia: 8.0 mm)	spheric (dia: 8.5 mm)
Temperature Sensor	yes	yes	yes
Amplifier	yes	yes	yes
Body Material	polypropylene	polypropylene	polypropylene
Cable	7-pole; 1 m (3.3')	7-pole; 1 m (3.3')	7-pole; 1 m cable (3.3')
Recommended Use	greenhouses, hydroponics, environmental monitoring, water treatment, boilers, cooling towers	greenhouses, hydroponics, environmental monitoring, water treatment, boilers, cooling towers	general purpose, water treatment, agriculture, boilers, cooling towers
Plug	DIN with CAL Check™ To be used with HI9813-6 series	DIN To be used with HI9811, HI9812 and HI9813 series	DIN To be used with HI991300 and HI991301

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Magnetic Stirrers

Speedsafe™ from Hanna

There are two types of magnetic stirrers; mechanical and electronic. Most manufacturers of magnetic stirrers use the mechanical approach, using steel and aluminum for the structural material and outdated methods of speed control. These units are not only very heavy, but also very inaccurate. The use of these materials and methods appear to make the units rugged and strong, but they are instead cumbersome and obsolete.

Something as simple as completely dissolving salts in a medium is, in reality, a science. Often this cannot be achieved with simple mechanical processes. The only choice that the user has with mechanical products is to increase the stirring time or the temperature. With electronics, you can do more... the Hanna approach is electronic.

Speed sensor and limiter: Each Hanna stirrer is equipped with a speed sensing device (opto-sensor) coupled with an FVC (frequency voltage converter), which monitors the speed. As the speed reaches a preset maximum level, the speed limiter shuts down the VCO (voltage-controlled oscillator) to slow down the motor speed. This ensures that when the load is suddenly removed from the stirrer, the motor will not accelerate to such a high speed that will be hazardous to both the user and the stirrer; a feature not commonly found in conventional stirrers.

Accuracy: Similar to the zoom function of a microscope, you can have access to two separate ranges of speed by using electronics. This assures maximum repeatability in experiments and processing.

A proper stirring speed plays an important role to minimize air contamination when mixing solutions. Too high a speed can create a deep vortex which may contaminate mixtures.

Sophisticated Engineering

Parts are engineered and manufactured to strict specifications to ensure absolute reliability. All components are mounted into a molded casing covered with either ABS plastic or a stainless steel plate, which are splash-proof and chemically-resistant. Minimal vibration and a well-balanced rotating arm provide years of trouble-free operation.

* HI180I/MB only

HI180

Compact Magnetic Mini-Stirrers

- Round edge
- Dynamic design
  - Easy to handle, these lightweight and compact stirrers need little room and are quickly recognizable on busy benches
- Built to last
  - Chemical resistant housing resists damage by accidental falls

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

Often, in the lab, a sample is removed from a stirrer before reducing the speed. Normally, this would cause the motor to accelerate until it is destroyed. Hanna stirrers incorporate electronic controls that allow the user to regulate the speed with greater precision. In addition to speed control, the Speedsafe™ mechanism will assure that the maximum speed is never exceeded. HI180 mini-stirrers are available in ten colors. The various colors can allow easy sample identification at a distance.

10 colors to choose from


HI180A - Light Yellow


HI180B - Light Sea Green


HI180C - Light Blue


HI180D - Yellow


HI180E - Green


HI180F - Blue


HI180G - Red


HI180H - Grey


HI180I - Ivory


HI180 - Black

Specifications	HI180
Maximum Stirring Capacity	1 liter (0.26 gallons)
Min. Speed Range	100 rpm
Max. Speed Range	1000 rpm
Power Supply	110/115 VAC or 220/240 VAC, 50/60 Hz
Installation Category	II
Cover Material	ABS plastic
Environment	0 to 50°C (32 to 122°F) ; RH max 95%
Dimensions	137 mm (dia) x 51 mm (h)
Weight	640 g (1.4 lbs.)
Accessories	**HI731319** Magnetic micro stir bar (10)

Ordering Information

All models are supplied with micro stir bar and instructions

HI180A-1	Light yellow mini-stirrer (115V)
HI180A-2	Light yellow mini-stirrer (230V)
HI180B-1	Light sea-green mini-stirrer (115V)
HI180B-2	Light sea-green mini-stirrer (230V)
HI180C-1	Light blue mini-stirrer (115V)
HI180C-2	Light blue mini-stirrer (230V)
HI180D-1	Yellow mini-stirrer (115V)
HI180D-2	Yellow mini-stirrer (230V)
HI180E-1	Green mini-stirrer (115V)
HI180E-2	Green mini-stirrer (230V)
HI180F-1	Blue mini-stirrer (115V)
HI180F-2	Blue mini-stirrer (230V)
HI180F-3	Blue mini-stirrer (AUS plug)
HI180G-1	Red mini-stirrer (115V)
HI180G-2	Red mini-stirrer (230V)
HI180H-1	Grey mini-stirrer (115V)
HI180H-2	Grey mini-stirrer (230V)
HI180I-1	Ivory mini-stirrer(115V)
HI180I-2	Ivory mini-stirrer (230V)
HI180I/MB	Ivory mini-stirrer (12 VDC)
HI180-1	Black mini-stirrer(115V)
HI180-2	Black mini-stirrer (230V)

HI190M • HI190M-0 • HI200M

Our Most Popular Magnetic Mini-Stirrers

- Compact size
  - The compact size of these stirrers allow users to maximize bench space for efficiency and safety
- Safety
  - Speedsafe™ limits the maximum speed to 1000 rpm even if a load is suddenly removed
- Built to last
  - The ABS housing of HI190M and HI190 M-0 resists most harmful chemicals in the lab

The HI190M, HI190M-0 and HI200M are compact and lightweight, so that lack of laboratory bench space is no longer a concern

These stirrers incorporate electronic controls that allow the user to regulate the speed with greater precision. Often, in the lab, a sample is removed from the stirrer before reducing the speed. This would cause the motor of conventional equipment to accelerate until it is destroyed. This does not pose a problem with Hanna mini-stirrers, as the Speedsafe™ mechanism ensures that the maximum speed is never exceeded.

HI190M and HI190M-0 come supplied with an ABS cover that will resist the harmful effects of chemicals that are accidentally spilled.

HI200M has an AISI 316 stainless steel cover. This model is ideal for applications that create exothermic reactions.

AISI 316 Stainless Steel

ABS Plastic

Speedsafe™

Specifications	HI190M	HI190M-0	HI200M
Maximum Stirring Capacity	1 liter (0.26 gallons)	1 liter (0.26 gallons)	1 liter (0.26 gallons)
Min. Speed Range	100 rpm	100 rpm	100 rpm
Max. Speed Range	1000 rpm	1000 rpm	1000 rpm
Power Supply	110/115 VAC or 220/240 VAC, 50/60Hz	12 VDC	110/115 VAC or 230/240 VAC, 50/60Hz
Installation Category	II	II	II
Cover Material	ABS plastic	ABS plastic	AISI 316 stainless steel
Environment	0 to 50°C (32 to 122°F); RH max 95%	0 to 50°C (32 to 122°F); RH max 95%	0 to 50°C (32 to 122°F); RH max 95%
Dimensions	120 x 120 x 45 mm (4.8 x 4.8 x 1.8")	120 x 120 x 45 mm (4.8 x 4.8 x 1.8")	120 x 120 x 45 mm (4.8 x 4.8 x 1.8")
Weight	640 g (1.4 lbs.)	610 g (1.3 lbs.)	710 g (1.6 lbs.)
Ordering Information	**HI190M-1** (110/115 Vac), **HI190M-2** (230/240 Vac), **HI190M-0** (12 VDC), **HI200M-1** (110/115 Vac) and **HI200M-2** (230/240 Vac) mini-stirrers are supplied with micro stir bar and instructions.		
Accessories	**HI731319** Magnetic micro stir bar (10)		

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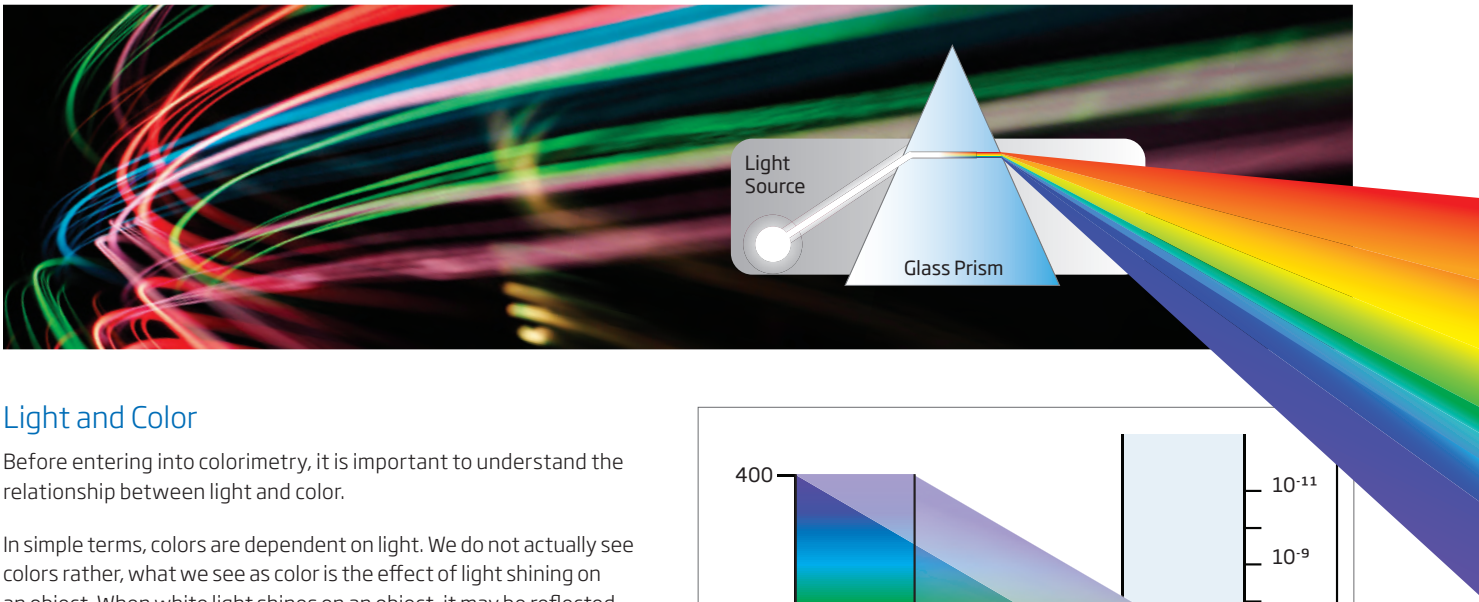


Light and Color

Before entering into colorimetry, it is important to understand the relationship between light and color.

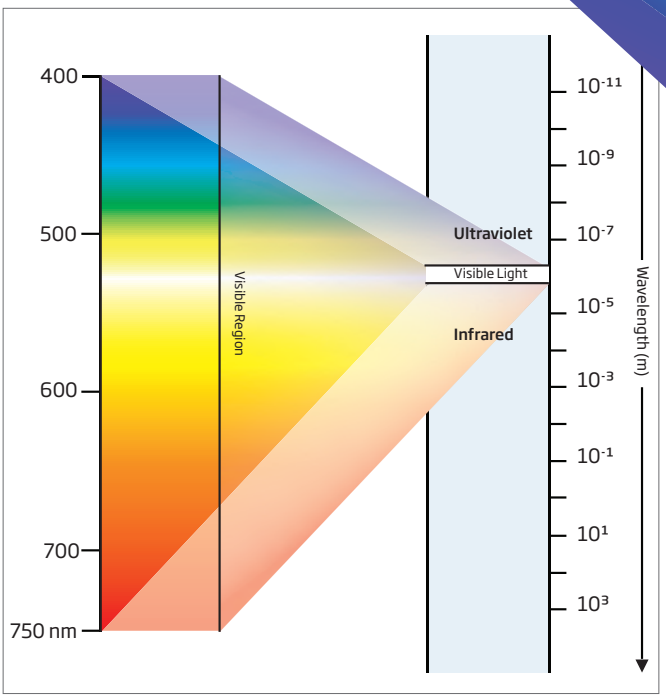
In simple terms, colors are dependent on light. We do not actually see colors rather, what we see as color is the effect of light shining on an object. When white light shines on an object, it may be reflected, absorbed, or transmitted. Glass transmits most of the light that comes into contact with it, thus it appears colorless. Snow reflects all of the light and appears white. A black cloth absorbs all light, and so appears black. A red piece of paper reflects red light better than it reflects other colors. Most objects appear colored because their chemical structure absorbs certain wavelengths of light and reflects others.

When discussing light, we are usually referring to white light. A thin line of light is called a ray; a beam is made up of many rays of light. When white light passes through a prism (a triangular transparent object) the colors that make up white light disperse into seven bands of color. These bands of color are called a spectrum. Seven colors constitute white light: red, orange, yellow, green, blue, indigo, and violet. In any spectrum, the bands of color are always organized in this order from left to right.

The color variation of a system that undergoes a change in concentration of some component is the basis of colorimetric analysis.

Suppose we shine a beam of white light at a substance that absorbs blue light. Since the blue component of the white light gets absorbed by the substance, the light that is transmitted is mostly yellow, the complementary color of blue. This yellow light reaches our eyes, and we "see" the substance as a yellow colored substance.

Wavelength (nm)	Color Absorbed	Color Observed
400	Violet	Yellow-green
435	Blue	Yellow
495	Green	Purple
560	Yellow	Blue
650	Orange	Greenish blue
800	Red	Bluish green



Colorimetry

Colorimetry is simply the measurement of color. Colorimetry is the determination of the concentration of a substance by measurement of the relative absorption of light with respect to a known concentration of the substance. In visual colorimetry, natural or artificial white light is generally used as a light source and determinations are usually made with a simple instrument termed a colorimeter, or color comparator. When the eye is replaced by a photoelectric cell, the instrument is termed a photoelectric colorimeter.

A colorimetric analysis is based on the principle that many substances react with each other and form a color which can indicate the concentration of the substance to be measured. When a substance is exposed to a beam of light of intensity ($\mathbf{I}_o$) a portion of the radiation is absorbed by the substance's molecules and a radiation of intensity ($\mathbf{I}$) is emitted. This difference in intensity is used for the colorimetric determination.

The quantity of radiation absorbed is given by the Beer-Lambert Law: $A = \log \frac{I_0}{I}$

Absorbance is also given by: $A = \varepsilon_\lambda \bullet C \bullet l$ where:

A is a dimensionless number

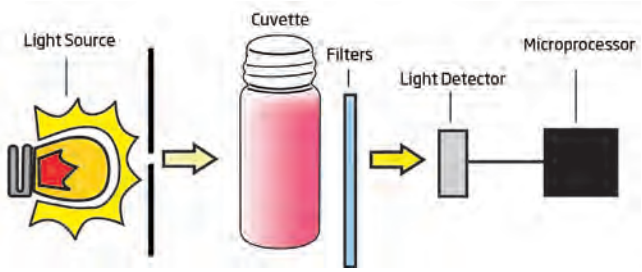
ε_λ the proportionality constant, is called the molar extinction coefficient or molar absorptivity; it is a constant for a given substance, provided the temperature and wavelength are constant [L/(mol•cm)]

C concentration of the substance (mol/liter)

l optical distance light travels through sample (cm)

Therefore, the concentration (**C**) can be calculated from the absorbance of the substance determined by the emitted radiation (**I**), as the other factors are known.

A typical block diagram of a photometer is shown below:



Sources of light used by Hanna colorimeters:

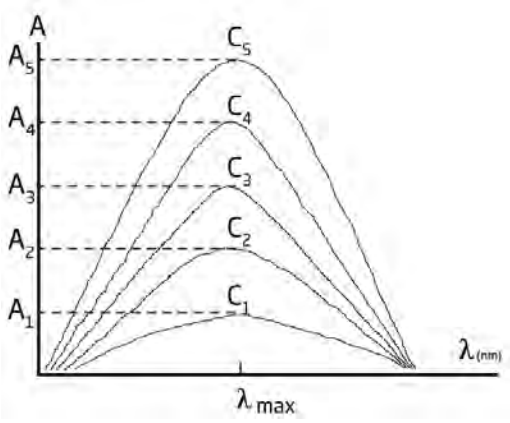
Tungsten lamp an incandescent lamp having a tungsten filament

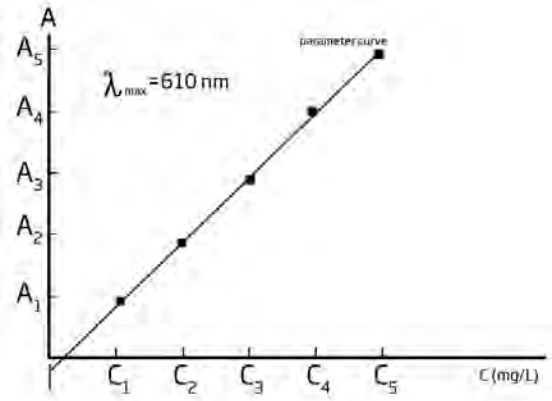
LED light emitting diode

The optical distance is measured by the dimension of the cuvette containing the sample. The photoelectric cell collects the radiation (**I**) emitted by the sample and converts it into an electric current, producing a potential in the mV range. The microprocessor uses this potential to convert the incoming value into the desired measuring unit and display it on the LCD.

In fact, the preparation of the solution to be measured occurs under known conditions, which are programmed into the meters microprocessor in the form of a calibration curve. This curve is used as a reference for each measurement. It is then possible to determine unknown concentrations of a sample by using a colorimetric reaction and the mV signal separated by a sensor in relation to the emitted intensity (**I**) (the color of the sample). By employing the calibration curve, one can determine the concentration of the sample that corresponds to the mV value.

Supposing that for one chemical substance there is a maximum absorbance at 610 nm. With the following graphs, you have one example of how the colorimeters are working to determine concentration:





One example of an early colorimetric analysis is Nessler's method for ammonia, which was first proposed in 1856. Nessler found that adding an alkaline solution of HgI_2 and KI to a dilute solution of ammonia produced a yellow to reddish brown colloid with the color intensity proportional to the concentration of ammonia present. A comparison of the samples color for a series of standards was used to determine the concentration of ammonia. Equal volumes of the sample and standards were transferred to a set of tubes with flat bottoms. The tubes were placed in a rack equipped at the bottom with a reflecting surface, allowing light to pass through the solution. The colors of the samples and standards were compared by looking down through the solutions. A modified form of this method is used for the analysis of ammonia in water and wastewater.

HI83200
Multiparameter Photometer for Laboratories

10.10

The HI83200 is one of the most versatile photometers on the market. Just one meter measures up to 44 of the most important water quality parameters.

The HI83200 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI92000 Windows® compatible software.

HI83203
Multiparameter Photometer for Aquaculture

10.11

With the ever increasing depletion of fish stocks in the open seas, aquaculture has gained prominence and can prove essential to our future dietary needs. Monitoring and controlling parameters such as the dissolved oxygen level as well as pH and nitrate content in water is vital in ensuring profitable fish production.

Accurate control can prevent disease, increase production and even reduce the premiums on crop insurance. Research personnel, fish farm operators and wildlife specialists now have one compact and easy to use meter to keep a close tab on the most important parameters in aquaculture.

The HI83203 is a multiparameter bench meter that measures thirteen methods essential for aquaculture analysis.

HI83216
Multiparameter Photometer for Pools and Spas

10.20

In order to achieve ideal water conditions, swimming pool water requires testing on a daily and sometimes hourly basis for disinfection residuals and maintaining pH levels. Equally important, calcium hardness and alkalinity levels should be monitored weekly to ensure the pool water is well balanced, thus to avoid corrosion and scale formation.

The HI83216 is a multiparameter bench meter that measures 6 different methods essential for pool and spa water analysis.

HI96771

Chlorine, Free Ultra High Range Portable Photometer

10.64

HI 96771 has been developed to check chlorine dosing in disinfection processes with ultra high concentrations of chlorine. Thanks to the extended range from 0 to 500 mg/L (ppm), it is ideal for the food industry, such as in fruit and vegetable washing.

The HI96771 meter measures the free chlorine (Cl_2) content in water samples. The methods are an adaptation of Standard Methods for the Examination of Water and Wastewater, 20th edition, 4500-Cl.

HI96713

Phosphate LR Portable Photometers

10.50

Phosphates are particularly important for the growth and development of plant roots, and hence are one of the most common fertilizers used in agriculture.

Phosphates are also utilized in detergents and are needed, in small quantities, for heating systems. However, high concentrations of phosphates can cause environmental pollution: high levels of phosphate are a primary cause of eutrophication.

For these reasons, it is necessary to closely monitor the phosphate levels present in both municipal and industrial waste water.

The HI96713 meter measures phosphate (PO_4^{3-}) content in water, wastewater and seawater in the 0.00 to 2.50 mg/L (ppm) range.

HI96725

Chlorine, Cyanuric Acid and pH Photometer

10.59

Boiling and cooling towers, when not properly disinfected, provide an ideal habitat for the growth of Legionella bacteria. Legionella bacteria species are the agent that causes human Legionnaires' disease as well as the lesser form, Pontiac Fever. Transmission is facilitated by the inhalation of mist droplets containing the Legionella bacteria.

The HI96725 measures four parameters that are crucial in monitoring or disinfection for prevention of Legionella bacteria.

Multiparameter Benchtop Photometers Comparison Guide

	HI83200	HI83203	HI83205	HI83206	HI83225	HI83215	HI83226	HI83216	HI83208
Alkalinity	•						•	•	
Aluminum	•		•						
Ammonia	•	•	•	•	•	•			•
Bromine	•		•				•		
Calcium	•				•				
Chlorine Dioxide	•		•						
Chlorine	•	•	•	•			•	•	•
Chromium VI	•		•	•					
Color of Water	•			•					
Copper	•	•	•	•			•		•
Cyanuric Acid	•			•			•	•	
Fluoride	•								•
Hardness	•						•	•	
Hydrazine	•		•						
Iodine	•								
Iron	•		•				•		•
Magnesium	•				•				
Manganese	•								•
Molybdenum	•		•	•					•
Nickel	•			•					•
Nitrate	•	•	•	•	•	•			•
Nitrite	•	•	•	•					
Oxygen, Dissolved	•	•	•	•					•
Ozone	•						•		
pH	•	•	•	•			•	•	•
Phosphate	•	•	•	•					•
Phosphorus	•			•	•	•			•
Potassium	•				•	•			
Silica	•		•	•					•
Silver	•			•					•
Sulfate	•				•				
Zinc	•		•	•					•
Page	10.10	10.11	10.12	10.13	10.14	10.15	10.19	10.20	10.21

Multiparameter Portable Photometers Comparison Guide

	HI96101	HI96104	HI96710	HI96711	HI96724	HI96725	HI96734	HI96736	HI96741	HI96742	HI96745	HI96752	HI96771
Bromine	•												
Calcium HR												•	
Chlorine, Free	•	•	•	•	•	•					•		•
Chlorine, Free HR							•						
Chlorine, Free UHR													•
Chlorine, Total	•	•	•	•	•	•					•		
Chlorine, Total HR							•						
Cyanuric Acid	•	•				•							
Hardness, Ca								•	•		•		
Hardness, Mg								•	•		•		
Hardness, Total								•	•		•		
Iodine	•												
Iron LR	•								•	•	•		
Magnesium HR												•	
Manganese LR										•			
pH	•	•	•			•		•			•		
Potassium MR													
Potassium LR													
Page	10.57	10.58	10.60	10.61	10.62	10.59	10.63	10.65	10.66	10.67	10.68	10.69	10.64

Single Parameter Portable Photometers Comparison Guide

Parameter	Meter	Page
Aluminum	HI96712	10.23
Ammonia HR	HI96733	10.24
Ammonia MR	HI96715	10.24
Ammonia LR	HI96700	10.24
Anionic Surfactants	HI96769	10.25
Bromine	HI96716	10.26
Chloride	HI96753	10.27
Chlorine Dioxide	HI96738	10.28
Chlorine, Free	HI96701	10.29
Chlorine, Free ULR	HI96762	10.29
Chlorine, Total ULR	HI96761	10.30
Chromium VI HR	HI96723	10.31
Chromium VI LR	HI96749	10.31
Color of Water	HI96727	10.32
Copper LR	HI96747	10.33
Cyanide	HI96714	10.34
Cyanuric Acid	HI96722	10.35
Fluoride HR	HI96739	10.36
Fluoride LR	HI96729	10.36
Hardness, Ca	HI96720	10.37
Hardness, Mg	HI96719	10.37
Hardness, EPA	HI96735	10.38
Honey Color	HI96785	10.39
Hydrazine	HI96704	10.40
Iodine	HI96718	10.41
Iron HR	HI96721	10.42
Iron LR	HI96746	10.42

Parameter	Meter	Page
Manganese HR	HI96709	10.43
Manganese LR	HI96748	10.43
Maple Syrup	HI96759	10.44
Molybdenum	HI96730	10.45
Nickel HR	HI96726	10.46
Nickel LR	HI96740	10.46
Nitrate, as Nitrogen	HI96728	10.47
Nitrate	HI96786	10.47
Nitrite HR	HI96708	10.48
Nitrite LR	HI96707	10.48
Oxygen, Dissolved	HI96732	10.49
Phosphate HR	HI96717	10.50
Phosphate LR	HI96713	10.50
Phosphorus	HI96706	10.51
Potassium	HI96750	10.52
Silica HR	HI96770	10.53
Silica LR	HI96705	10.53
Silver	HI96737	10.54
Sulfate	HI96751	10.55
Zinc	HI96731	10.56

Wine and Olive Oil Measurement Photometers

Concentration of Reducing Sugars	HI83746	10.72
Tartaric Acid in Wine	HI83748	10.73
Peroxide in Olive Oils	HI83730	10.74

HI 83000 Series

Multiparameter Bench Photometers

- Logging
  - Save and recall logged data at the touch of a button
- Methods
  - Up to 44 measurement methods
- BEPS
  - Alerts the user when the battery is low
- Help feature
  - On-screen tutorials
- Connectivity
  - PC compatible via USB
- Backlight
  - Backlit, graphic LCD display

Hanna bench photometers are versatile, easy to use instruments.

These instruments accommodate sophisticated optical systems, resulting in a precise measurement. The instrument casings feature a cuvette compartment door that will eliminate external light disturbances.

These photometers also feature a graphic, backlit LCD which clearly displays the method selection. Each method's measuring procedure is shown on the LCD taking the user step by step through the process. At any stage in the measurement process or during setup, context sensitive help can be displayed by pressing the help button. Additionally, the help screen also lists the required reagent sets, accessories and customer support contact information. All these features are available in a user selectable language.

Each Hanna photometer eliminates confusion by automatically converting readings to other chemical forms. Common conversions are available at the touch of a button

- Cuvette holder with door
  - The cuvette cover aids in stopping stray light from effecting measurements.

General Specifications for all Models

Light Source	up to 5 tungsten lamps with different narrow band interference filters. (see above for operating wavelengths according to methods.)
Light Detector	silicon photocell
Environment	0 to 50°C (32 to 122°F); max 90% RH non-condensing
Power Supply	external 12 VDC power adapter or built-in rechargeable battery
Dimensions	235 x 200 x 110 mm (9.2 x 7.87 x 4.33")
Weight	0.9 Kg (2 lbs.)

General Accessories

HI731321	glass cuvettes (4 pcs)	**HI740225**	60 mL graduated syringe
HI731325W	cap for cuvette (4 pcs)	**HI740226**	5 mL graduated syringe
HI740034P	cap for 100 mL beaker (10 pcs)	**HI740227**	filter assembly
HI740036P	100 mL plastic beaker (10 pcs)	**HI740228**	filter disc (25 pcs)
HI740038	60 mL glass bottle and stopper	**HI740230**	230 mL demineralized water
HI740142	1 mL graduated syringe	**HI92000**	Windows® compatible software
HI740143	1 mL graduated syringe (6 pcs)	**HI920013**	USB cable for PC connection
HI740144	pipette tip (6 pcs)	**HI93703-50**	cuvette cleaning solution, 230 mL
HI740037P	20 mL plastic beaker	**HI93703-55**	activated Carbon (50 pcs)

Application Designed Photometers

Since 1978, Hanna has introduced instruments that tailor to the needs of a specific application or industry.

From this philosophy we have created Application Designed Photometers to satisfy the needs of your specific application or industry.

Aquaculture	HI83203
Boilers & Cooling Towers	HI83205
Environmental Testing	HI83206
Nutrient Analyses	HI83215

Nutrient Analyses	HI83225
Pool and Spa Applications	HI83216
Pool and Spa Applications	HI83226
Water Conditioning	HI83208

Narrow band Interference filter wavelengths

Aluminum	525 nm
Alkalinity	575 nm
Ammonia MR	420 nm
Ammonia LR	420 nm
Bromine	525 nm
Calcium	466 nm
Chlorine, Free	525 nm
Chlorine, Total	525 nm
Chlorine Dioxide	575 nm
Chromium VI HR	525 nm
Chromium VI LR	525 nm
Color of Water	420 nm
Copper HR	575 nm
Copper LR	575 nm
Cyanuric Acid	525 nm

Fluoride	575 nm
Calcium Hardness	525 nm
Mg Hardness	525 nm
Hydrazine	420 nm
Iodine	525 nm
Iron HR	525 nm
Iron LR	575 nm
Magnesium	466 nm
Manganese HR	525 nm
Manganese LR	575 nm
Molybdenum	420 nm
Nickel HR	575 nm
Nickel LR	575 nm
Nitrate	525 nm
Nitrite HR	575 nm

Nitrite LR	525 nm
Oxygen, Dissolved	420 nm
Ozone	525 nm
pH	525 nm
Phosphate HR	525 nm
Phosphate LR	610 nm
Phosphorus	525 nm
Potassium HR	610 nm
Potassium MR	610 nm
Potassium LR	610 nm
Silica	610 nm
Silver	575 nm
Sulfate	466 nm
Zinc	575 nm

HI83200

Multiparameter Photometer for Laboratories

- Methods
  - 44 measurement methods
- Help feature
  - Full tutorial available in start up menu
- Connectivity
  - PC compatible via USB

The HI83200 is one of the most versatile photometers on the market. Just one meter measures up to 44 methods critical to analyzing water quality.

The optical system of HI83200 is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

The HI83200 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI92000 Windows® compatible software.

Test	Range	Method	Reagent Code†
Alkalinity	0 to 500 mg/L (ppm) as $CaCO_3$	bromocresol green	HI93755-01
Aluminum	0.00 to 1.00 mg/L (ppm)	aluminon	HI93712-01
Ammonia MR	0.00 to 10.00 mg/L (ppm)	Nessler	HI93715-01
Ammonia LR	0.00 to 3.00 mg/L (ppm)	Nessler	HI93700-01
Bromine	0.00 to 8.00 mg/L (ppm)	DPD	HI93716-01
Calcium	0 to 400 mg/L (ppm)	oxalate	HI937521-01**
Chlorine Dioxide	0.00 to 2.00 mg/L (ppm)	chlorophenol red	HI93738-01
Chlorine*, Free	0.00 to 2.50 mg/L (ppm)	DPD	HI93701-01
Chlorine*, Total	0.00 to 3.50 mg/L (ppm)	DPD	HI93711-01
Chromium VI HR	0 to 1000 µg/L	diphenylcarbohydrazide	HI93723-01
Chromium VI LR	0 to 300 µg/L	diphenylcarbohydrazide	HI93749-01
Color of Water	0 to 500 PCU	colorimetric platinum cobalt	–
Copper LR	0 to 1000 µg/L	bicinchoninate	HI95747-01
Copper HR	0.00 to 5.00 mg/L (ppm)	bicinchoninate	HI93702-01
Cyanuric Acid	0 to 80 mg/L (ppm)	turbidimetric	HI93722-01
Fluoride	0.00 to 2.00 mg/L (ppm)	SPADNS	HI93729-01
Hardness, Calcium	0.00 to 2.70 mg/L (ppm) (as $CaCO_3$)	calmagite	HI93720-01
Hardness, Magnesium	0.00 to 2.00 mg/L (ppm) (as $CaCO_3$)	EDTA colorimetric	HI93719-01
Hydrazine	0 to 400 µg/L	p-Dimethylaminobenzaldehyde	HI93704-01
Iodine	0.0 to 12.5 mg/L (ppm)	DPD	HI93718-01
Iron HR	0.00 to 5.00 mg/L (ppm)	phenanthroline	HI93721-01
Iron LR	0 to 400 µg/L	TPTZ	HI93746-01**
Magnesium	0 to 150 mg/L (ppm)	calmagite	HI937520-01**
Manganese HR	0.0 to 20.0 mg/L (ppm)	periodate	HI93709-01
Manganese LR	0 to 300 µg/L	PAN	HI93748-01**
Molybdenum	0.0 to 40.0 mg/L (ppm)	mercaptoacetic acid	HI93730-01
Nickel HR	0.00 to 7.00 g/L (ppt)	photometric	HI93726-01
Nickel LR	0.000 to 1.000 mg/L (ppm)	PAN	HI93740-01**
Nitrate	0.0 to 30.0 mg/L (ppm)	cadmium reduction	HI93728-01
Nitrite HR	0 to 150 mg/L (ppm)	ferrous sulfate	HI93708-01
Nitrite LR	0 .00to 1.15 mg/L (ppm)	diazotization	HI93707-01
Oxygen, Dissolved (DO)	0.0 to 10.0 mg/L (ppm)	Winkler	HI93732-01
Ozone	0.00 to 2.00 mg/L (ppm)	DPD	HI93757-01
pH	6.5 to 8.5 pH	phenol red	HI93710-01
Phosphate HR	0.0 to 30.0 mg/L (ppm)	amino acid	HI93717-01
Phosphate LR	0.00 to 2.50 mg/L (ppm)	ascorbic acid	HI93713-01
Phosphorus	0.0 to 15.0 mg/L (ppm)	amino acid	HI93706-01
Potassium HR	20 to 200 mg/L (ppm)	turbidimetric tetraphenylborate	HI93750-01
Potassium MR	10 to 100 mg/L (ppm)	turbidimetric tetraphenylborate	HI93750-01
Potassium LR	0.0 to 20.0 mg/L (ppm)	turbidimetric tetraphenylborate	HI93750-01
Silica	0.00 to 2.00 mg/L (ppm)	heteropoly blue	HI93705-01
Silver	0.000 to 1.000 mg/L (ppm)	PAN	HI93737-01**
Sulfate	0 to 100 mg/L (ppm)	turbidimetric	HI93751-01
Zinc	0.00 to 3.00 mg/L (ppm)	zincon	HI93731-01
Ordering Information	**HI83200-01** (115V) and **HI83200-02** (230V) is supplied with sample cuvettes and caps (4 ea.), sample preparation kit, cloth for wiping cuvettes, 60 mL glass bottle for dissolved oxygen analysis, scissors, AC/DC power adapter, instruction manual.		

ADP
Application Designed Photometers

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.

† Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.
* For Chlorine, liquid reagents are available.
** Reagents for 50 tests, replace -01 for -03 for 150 tests

Standard reagents begin on page 10.70; general accessories begin on page 10.8

HI83203

Multiparameter Photometer for Aquaculture

- Methods
  - 13 measurement methods
- Help feature
  - Full tutorial available in start up menu
- Connectivity
  - PC compatible via USB

With the ever increasing depletion of fish stocks in the open seas, aquaculture has gained prominence and can prove essential to our future dietary needs. Monitoring and controlling parameters such as the oxygen level as well as pH and nitrate content in water is vital in ensuring profitable fish production.

Accurate control can prevent disease, increase production and even reduce the premiums on crop insurance. Research personnel, fish farm operators and wildlife specialists now have one compact and easy to use meter to keep a close tab on the most important parameters in aquaculture.

The HI83203 is a multiparameter bench meter that measures thirteen methods essential for aquaculture analysis.

The optical system of HI83203 is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

The HI83203 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI92000 Windows® compatible software.

Test	Range	Method	Reagents†
Ammonia LR	0.00 to 3.00 mg/L (ppm)	Nessler	HI93700-01
Ammonia MR	0.00 to 10.00 mg/L (ppm)	Nessler	HI93715-01
Chlorine*, Free	0.00 to 2.50 mg/L (ppm)	DPD	HI93701-01
Chlorine*, Total	0.00 to 3.50 mg/L (ppm)	DPD	HI93711-01
Copper HR	0.00 to 5.00 mg/L (ppm)	bicinchoninate	HI93702-01
Copper LR	0 to 1000 µg/L	bicinchoninate	HI95747-01
Nitrate	0.0 to 30.0 mg/L (ppm)	cadmium reduction	HI93728-01
Nitrite HR	0 to 150 mg/L (ppm)	ferrous sulfate	HI93708-01
Nitrite LR	0.00 to 1.15 mg/L (ppm)	diazotization	HI93707-01
Oxygen, Dissolved (DO)	0.0 to 10.0 mg/L (ppm)	Winkler	HI93732-01
pH	6.5 to 8.5 pH	phenol red	HI93710-01
Phosphate HR	0.0 to 30.0 mg/L (ppm)	amino acid	HI93717-01
Phosphate LR	0.00 to 2.50 mg/L (ppm)	ascorbic acid	HI93713-01
Ordering Information	**HI83203-01** (115V) and **HI83203-02** (230V) are supplied with sample cuvettes and caps (2 ea.), cloth for wiping cuvettes, 60 mL glass bottle for dissolved oxygen analysis, scissors, AC/DC power adapter, and instruction manual.		

ADP
Application Designed Photometers

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.
† Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.
* For Chlorine measurements, liquid reagents are available

Standard reagents begin on page 10.70; general accessories begin on page 10.8

HI83205

Multiparameter Photometer for Boilers and Cooling Towers

- Methods
  - 24 measurement methods
- Help feature
  - Full tutorial available in start up menu
- Connectivity
  - PC compatible via USB

The HI83205 is a multiparameter bench meter that measures twenty-four methods essential for monitoring boiling and cooling towers.

With just one unit, technicians can keep an eye on 24 methods needed for proper and efficient functioning of their systems. The parameters that HI83205 monitors include: iron, whose presence can be an important indication of corrosion; chlorine to circumvent microbiological fouling; dissolved oxygen, whose presence causes corrosion; silica can point to a contamination of the feed water while phosphate is important to reduce scaling.

The optical system of HI83205 is based on tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

The HI83205 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI92000 Windows® compatible software.

Test	Range	Method	Reagent Code†
Aluminum	0.00 to 1.00 mg/L (ppm)	aluminon	HI93712-01
Ammonia MR	0.00 to 10.00 mg/L (ppm)	Nessler	HI93715-01
Ammonia LR	0.00 to 3.00 mg/L (ppm)	Nessler	HI93700-01
Bromine	0.00 to 8.00 mg/L (ppm)	DPD	HI93716-01
Chlorine Dioxide	0.00 to 2.00 mg/L (ppm)	chlorophenol red	HI93738-01
Chlorine*, Free	0.00 to 2.50 mg/L (ppm)	DPD	HI93701-01
Chlorine*, Total	0.00 to 3.50 mg/L (ppm)	DPD	HI93711-01
Chromium VI HR	0 to 1000 µg/L	diphenylcarbohydrazide	HI93723-01
Chromium VI LR	0 to 300 µg/L	diphenylcarbohydrazide	HI93749-01
Copper HR	0.00 to 5.00 mg/L (ppm)	bicinchoninate	HI93702-01
Copper LR	0 to 1000 µg/L	bicinchoninate	HI95747-01
Hydrazine	0 to 400 µg/L	p-Dimethylaminobenzaldehyde	HI93704-01
Iron HR	0.00 to 5.00 mg/L (ppm)	phenanthroline	HI93721-01
Iron LR	0 to 400 µg/L	TPTZ	HI93746-01**
Molybdenum	0.0 to 40.0 mg/L (ppm)	mercaptoacetic acid	HI93730-01
Nitrate	0.0 to 30.0 mg/L (ppm)	cadmium reduction	HI93728-01
Nitrite HR	0 to 150 mg/L (ppm)	ferrous sulfate	HI93708-01
Nitrite LR	0.00 to 1.15 mg/L (ppm)	diazotization	HI93707-01
Oxygen, Dissolved (DO)	0.0 to 10.0 mg/L (ppm)	Winkler	HI93732-01
pH	6.5 to 8.5 pH	phenol red	HI93710-01
Phosphate HR	0.0 to 30.0 mg/L (ppm)	amino acid	HI93717-01
Phosphate LR	0.00 to 2.50 mg/L (ppm)	ascorbic acid	HI93713-01
Silica	0.00 to 2.00 mg/L (ppm)	heteropoly blue	HI93705-01
Zinc	0.00 to 3.00 mg/L (ppm)	zincon	HI93731-01
Ordering Information	**HI83205-01** (115V) and **HI83205-02** (230V) are supplied sample cuvettes and caps (2 ea.), cloth for wiping cuvettes, 60 mL glass bottle for dissolved oxygen analysis, scissors, AC/DC power adapter, and instruction manual.		

ADP
Application Designed Photometers

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.
† Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.
* For Chlorine, liquid reagents are available.
** Reagents for 50 tests. Replace the -01 with -03 for 150 tests.

Standard reagents begin on page 10.70; general accessories begin on page 10.8

HI83206

Multiparameter Photometer for Environmental Testing

- Methods
  - 24 measurement methods
- Help feature
  - Full tutorial available in start up menu
- Connectivity
  - PC compatible via USB

The HI83206 is a multiparameter bench photometer dedicated to environmental testing. Critical environmental parameters such as pH, dissolved oxygen, nitrate, ammonia, chlorine and phosphorus or pollutants like chromium VI, nickel, silver and zinc can be monitored with this meter. This instrument measures 24 different methods.

The optical system of HI83206 is based on tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

The HI83206 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI92000 Windows® compatible software.

Test	Range	Method	Reagent Code†
Ammonia MR	0.00 to 10.00 mg/L (ppm)	Nessler	HI93715-01
Ammonia LR	0.00 to 3.00 mg/L (ppm)	Nessler	HI93700-01
Chlorine*, Free	0.00 to 2.50 mg/L (ppm)	DPD	HI93701-01
Chlorine*, Total	0.00 to 3.50 mg/L (ppm)	DPD	HI93711-01
Chromium VI HR	0 to 1000 µg/L	diphenylcarbohydrazide	HI93723-01
Chromium VI LR	0 to 300 µg/L	diphenylcarbohydrazide	HI93749-01
Color of Water	0 to 500 PCU	colorimetric platinum cobalt	–
Copper HR	0.00 to 5.00 mg/L (ppm)	bicinchoninate	HI93702-01
Copper LR	0 to 1000 µg/L	bicinchoninate	HI95747-01
Cyanuric Acid	0 to 80 mg/L (ppm)	turbidimetric	HI93722-01
Molybdenum	0.0 to 40.0 mg/L (ppm)	mercaptoacetic acid	HI93730-01
Nickel HR	0.00 to 7.00 g/L	photometric	HI93726-01
Nickel LR	0.000 to 1.000 mg/L (ppm)	PAN	HI93740-01**
Nitrate	0.0 to 30.0 mg/L (ppm)	cadmium reduction	HI93728-01
Nitrite HR	0 to 150 mg/L (ppm)	ferrous sulfate	HI93708-01
Nitrite LR	0.00 to 1.15 mg/L (ppm)	diazotization	HI93707-01
Oxygen, Dissolved (DO)	0.0 to 10.0 mg/L (ppm)	Winkler	HI93732-01
pH	6.5 to 8.5 pH	phenol red	HI93710-01
Phosphate HR	0.0 to 30.0 mg/L (ppm)	amino acid	HI93717-01
Phosphate LR	0.00 to 2.50 mg/L (ppm)	ascorbic acid	HI93713-01
Phosphorus	0.0 to 15.0 mg/L (ppm)	amino acid	HI93706-01
Silica	0.00 to 2.00 mg/L (ppm)	heteropoly blue	HI93705-01
Silver	0.000 to 1.000 mg/L (ppm)	PAN	HI93737-01**
Zinc	0.00 to 3.00 mg/L (ppm)	zincon	HI93731-01

Ordering Information

HI83206-01 (115V) and **HI83206-02** (230V) are supplied with sample cuvettes and caps (3 ea), cloth for wiping cuvettes (1), 60 mL glass bottle for dissolved oxygen (1), scissors, AC/DC power adapter and instruction manual.

Standard reagents begin on page 10.70; general accessories begin on page 10.8

Application Designed Photometers

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.
† Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.
* For Chlorine, liquid reagents are available.
** Reagents for 50 tests. Replace the -01 with -03 for 150 tests.

HI83225

Nutrient Analysis Photometer for Greenhouses and Hydroponics

- Methods
  - 15 measurement methods
- Help feature
  - Full tutorial available in start up menu
- Connectivity
  - PC compatible via USB

Nitrogen, phosphorus, and potassium (NPK) are often the first three factors considered when making recommendations to growers. Compared to the HI83215, the HI83225 provides control over three additional important growing factors: sulfur (most common as sulfates), calcium and magnesium.

HI83225 is designed for the hydroponics and greenhouse industries to measure seven nutrients commonly present in fertilizer enriched solutions. It can measure fifteen different methods using specific liquid or powder reagents.

The optical system of HI83225 is based on tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

The HI83225 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI92000 Windows® compatible software.

Test	Range	Method	Reagents†
Ammonia HR	0 to 100 mg/L (ppm)	Nessler	HI93715-01
Ammonia MR	0.0 to 50.0 mg/L (ppm)	Nessler	HI93715-01
Ammonia LR	0.0 to 10.0 mg/L (ppm)	Nessler	HI93715-01
Calcium	0 to 400 mg/L (ppm)	oxalate	HI937521-01**
Magnesium	0 to 150 mg/L (ppm)	calmagite	HI937520-01**
Nitrate HR	0 to 300 mg/L (ppm)	cadmium reduction	HI93728-01
Nitrate MR	0 to 150 mg/L (ppm)	cadmium reduction	HI93728-01
Nitrate LR	0.0 to 30.0 mg/L (ppm)	cadmium reduction	HI93728-01
Phosphorus HR	0 to 100 mg/L (ppm)	amino acid	HI93706-01
Phosphorus MR	0.0 to 50.0 mg/L (ppm)	amino acid	HI93706-01
Phosphorus LR	0.0 to 10.0 mg/L (ppm)	amino acid	HI93706-01
Potassium HR	20 to 200 mg/L (ppm)	turbidimetric tetraphenylborate	HI93750-01
Potassium MR	10 to 100 mg/L (ppm)	turbidimetric tetraphenylborate	HI93750-01
Potassium LR	0.0 to 20.0 mg/L (ppm)	turbidimetric tetraphenylborate	HI93750-01
Sulfate	0 to 100 mg/L (ppm)	turbidimetric	HI93751-01
Ordering Information	**HI83225-01** (115V) and **HI83225-02** (230V) are supplied with sample cuvettes and caps (4 ea.), sample preparation kit, cloth for wiping cuvettes (1), scissors, AC/DC power adapter and instruction manual		

ADP
Application Designed Photometers

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.
† Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.
* For chlorine, liquid reagents are available.
** Reagents for 50 tests. Replace the -01 with -03 for 150 tests.

Standard reagents begin on page 10.70; general accessories begin on page 10.8

HI83215

Nutrient Analysis Photometer

- Methods
  - 12 measurement methods
- Help feature
  - Full tutorial available in start up menu
- Connectivity
  - PC compatible via USB

Deciding which fertilizer to use can be overwhelming, but with a bit of knowledge you can be sure your garden will get the right amount of nutrients it needs. The first question you'll need to answer is, "What nutrient ratio do I need?" The nutrient analysis is actually three numbers you see usually at the middle or bottom of fertilizer packages (for example 10-20-10). These numbers represent percentages of the three major nutrients plants need: nitrogen, phosphorus and potassium (NPK for short).

The HI83215 is a multiparameter bench meter that measures twelve methods in low, medium and high ranges essential for monitoring greenhouse and hydroponics operations.

The optical system of the HI83215 is based on tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

The HI83215 has powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI92000 Windows® compatible software.

Test	Range	Method	Reagents†
Ammonia HR	0 to 100 mg/L (ppm)	Nessler	HI93715-01
Ammonia MR	0.0 to 50.0 mg/L (ppm)	Nessler	HI93715-01
Ammonia LR	0.0 to 10.0 mg/L (ppm)	Nessler	HI93715-01
Nitrate HR	0 to 300 mg/L (ppm)	cadmium reduction	HI93728-01
Nitrate MR	0 to 150 mg/L (ppm)	cadmium reduction	HI93728-01
Nitrate LR	0.0 to 30.0 mg/L (ppm)	cadmium reduction	HI93728-01
Phosphorus HR	0 to 100 mg/L (ppm)	amino acid	HI93706-01
Phosphorus MR	0.0 to 50.0 mg/L (ppm)	amino acid	HI93706-01
Phosphorus LR	0.0 to 10.0 mg/L (ppm)	amino acid	HI93706-01
Potassium HR	20 to 200 mg/L (ppm)	turbidimetric	HI93750-01
Potassium MR	10 to 100 mg/L (ppm)	turbidimetric	HI93750-01
Potassium LR	0.0 to 20.0 mg/L (ppm)	turbidimetric	HI93750-01
Ordering Informations	**HI83215-01** (115V) and **HI83215-02** (230V) is supplied with sample cuvettes and caps (4 ea.), sample preparation kit, cloth for wiping cuvettes (1), scissors, AC/DC power adapter and instruction manual		

ADP
Application Designed Photometers

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.
† Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.

Standard reagents begin on page 10.70; general accessories begin on page 10.8

HI83900

Suction Lysimeter for Root Level Soil Monitoring

- The perfect companion to the HI83225 and HI83215
- Monitor soil nutrients at the roots

The HI83900 suction lysimeter is built with a porous ceramic cap connected to a transparent tube for soil solution extraction. A rubber capillary is inserted in the tube passing through a rubber cap and reaching the ceramic tip.

The HI83900 series lysimeter is an ideal tool for collecting soil solution samples and then performing quantitative chemical analysis. In this way, the operator can easily monitor the level of nutrients such as ammonia, nitrate, phosphorous, potassium, sulfate, calcium and magnesium.

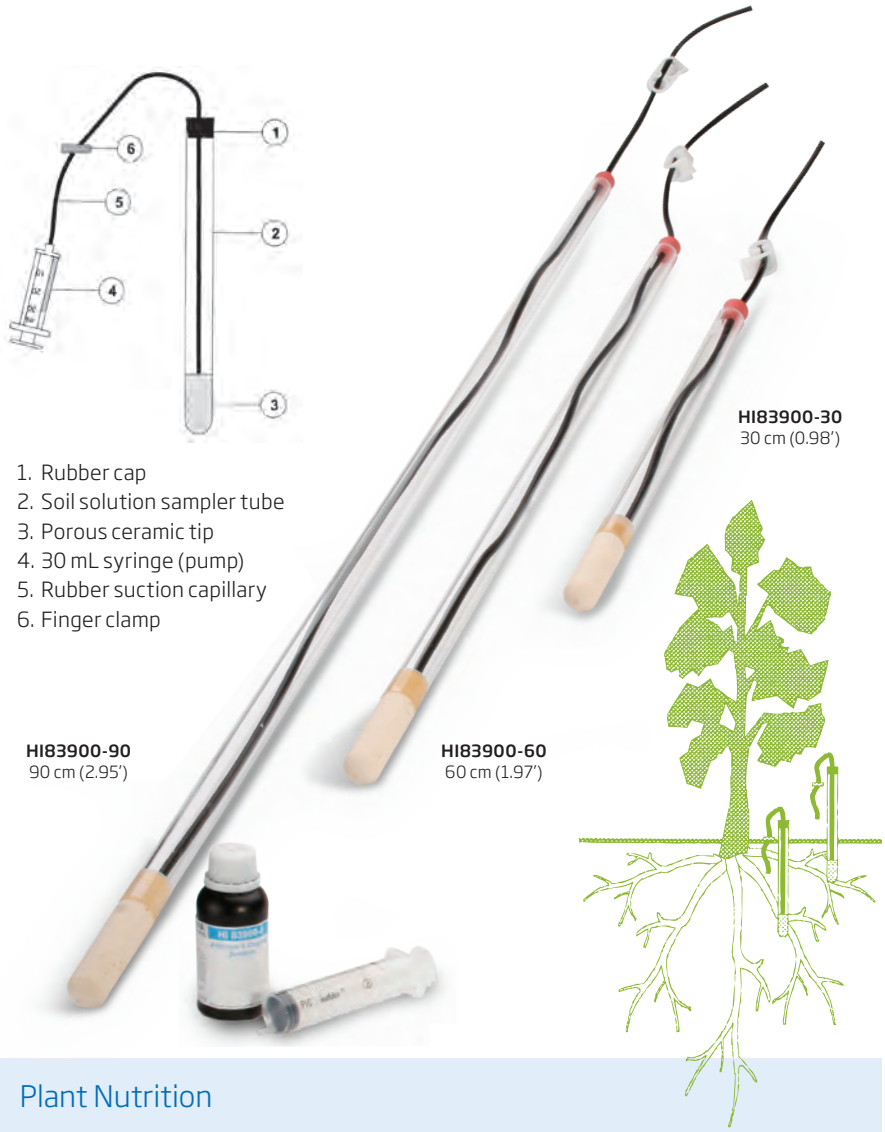
The ceramic tip of the lysimeter can be used in all types of soil. It is made of a sinterized material that does not react with the nutrients in the soil. Therefore, the soil solution collected is not affected by the chemical composition of the ceramic cap resulting in precise and reliable tests.

The HI83900 allows the extraction of a solution from the soil by creating a vacuum inside the sampler tube, that exceeds the soil water tension. This will establish an hydraulic gradient for the solution to flow through the porous ceramic cap and into the lysimeter tube. Typically, a vacuum of about -60 cb (centibar) should be drawn.

For better monitoring of soil solution composition throughout an entire growth period of crops, at least two lysimeters should be installed in the root zone of a representative plant, one at the upper part and one in the lower part of the root zone.

For better measurement accuracy and repeatability, it is recommended to replicate installations in at least two more locations.

1. Rubber cap
2. Soil solution sampler tube
3. Porous ceramic tip
4. 30 mL syringe (pump)
5. Rubber suction capillary
6. Finger clamp



Plant Nutrition

The three elements that are most needed by plants are nitrogen (N), phosphorous (P) and potassium (K).

Nitrogen is indispensable for the plant's life and is a key factor in fertilization. Nitrogen allows the development of the vegetative growth of the plant; in particular, it contributes to lengthening of trunks and sprouts and increases the production of foliage and fruits. An excess of nitrogen weakens the plants structure creating an unbalanced relationship between the leaves and the stalks. In addition, the plant becomes less resistant to diseases.

Phosphorous is an important element in the composition of DNA and RNA, the regulators of the energetic exchange (ATP and ADP), as well as the reserve substances in seeds and bulbs. It contributes to the formation of buds, roots, blooming, and lignification. A lack of phosphorous results in: stifling of plants, slow growth, a reduction of production, smaller fruits and a lower expansion of the roots.

Even though potassium is not a constituent of important compounds, it plays a remarkable role in many physiological activities in plants like the control of cellular turgor and the accumulation of carbohydrates. It increases the size of fruits, their flavor, as well as yielding a positive effect on the color and fragrance of flowers. Potassium also makes plants more resistant to disease.

Ordering Information	All include capillary rubber tube with rubber cap and finger clamp, cleaning solution starter kit (120 mL), 30 mL syringe and instructions **HI83900-30** is comprised of 30 cm (0.98') sampler tube ending with porous ceramic tip. **HI83900-60** is comprised of 60 cm (1.97') sampler tube ending with porous ceramic tip. **HI83900-90** is comprised of 90 cm (2.95') sampler tube ending with porous ceramic tip.
Accessories	**HI83900-25** cleaning solution kit, 500 mL

The Significance of Pool and Spa Water Testing

Residual Disinfection and pH Control

In swimming pool treatment, disinfection or sanitizing is essential to rid the pool of bacteria and control nuisance organisms like algae which may occur in the pool, filtration equipment, and piping.

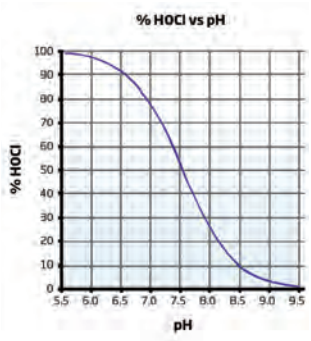
There are a number of available disinfectant compounds, including chlorine, bromine and ozone dosing systems, of which chlorine is the most common.

Chlorine

Chlorine is a strong oxidizing agent that destroys organic pollutants and bacteria. Chlorine combines with compounds containing nitrogen to form chloramines, during which only part of the chlorine will be used while the rest remains active, continuing it's disinfecting action.

Combined chlorine is the quantity of chlorine that has already combined with nitrogen containing compounds. It is much less effective as a disinfectant than free chlorine. The addition of combined chlorine, and free chlorine gives total chlorine. A pool manager needs to aim for the perfect balance where free and total chlorine are proportionally equal, and thus to keep the combined chlorine levels near zero. The presence of chloramines is undesirable because of the distinctive 'swimming pool smell' as well as irritation to the eyes and mucous membranes caused by combined chlorines like dichloramines.

Commercial chlorine for disinfection may be available as a gas (Cl_2), a liquid like sodium hypochlorite or bleach (NaOCl) or in a solid state like calcium hypochlorite, chlorohydantoins or chlorocyanuric acid compounds. These compounds, once dissolved in water, establish equilibrium between the hypochlorous acid (HOCl) and the hypochlorite ions (OCl^-). Although both forms are considered free chlorine, it is the hypochlorous acid that provides the strongest disinfecting and oxidizing characteristic of chlorine solutions. The amount of hypochlorous acid in chlorinated water depends upon the pH value of the solution. Changes in pH value will effect the HOCl equilibrium in relation to the hydrogen and hypochlorite ions.



As depicted by the graph, HOCl decreases and OCl^- increases as pH increases. At a low pH, almost all the free chlorine is in the molecular form HOCl, and at a pH of around 7.5, the ratio between HOCl and OCl^- is 50:50. Since the ionic form OCl^- is a slow acting sanitizer while the molecular HOCl is a fast acting, it is important to measure pH regularly. As a general rule a pH of about 7.2 is recommended to maintain fast acting disinfection conditions.

Bromine

In many countries bromine sanitizing has been introduced as an alternative for chlorine, although it is not as strong. The advantage of bromine lies in its stability at higher temperatures (advantageous for heated pools and hot tubs), and its maintained disinfection power at a higher pH. Furthermore, there is very little reaction between bromine and nitrogen compounds, reducing the unpleasant odor, and eye irritation problems. The main disadvantage of bromine is the slower acting disinfecting power, making it less suitable for larger pools.

Ozone

Ozone is a very strong oxidizing agent that destroys organic compounds that are especially difficult to oxidize. It allows the pool manager to very efficiently remove combined chlorine without frequently refreshing large amounts of pool water. By the time the water passes through the filter units, ozone has already completed sanitizing, and it is not effected by the pH level.

Mainly because of its strong oxidizing power, the return water may contain trace concentrations of ozone. It imperative to know that ozone is very unstable, so to ensure thorough sanitization of the water, low-level chlorination remains necessary.

The Water Balance and Langelier Index

Pool water characteristics need to be maintained in a balanced state to avoid numerous issues. Measuring certain variables is extremely important to predict if the water is corrosive or will cause scaling.

A saturation index developed by Dr. Wilfred Langelier is widely used to predict the balance of swimming pool waters. It represents the estimation of a solutions ability to dissolve or precipitate calcium carbonate deposits. A certain level of this precipitation (filming) is desired to insulate pipes and boilers from contact with water. When no protective filming is formed, water is considered to be corrosive. On the other hand, too much filming can develop into scaling and incrustation of the pipes.

In the treatment and monitoring of pool water, the pool manager must ensure that related parameters such as alkalinity, hardness and pH are carefully monitored in addition to sanitizing chemicals.

Calcium

The presence of calcium in the system is desired to ensure filming on those places where the temperature is relatively high, like in boilers and pipes transporting warm water. Scaling must be avoided because it reduces heat transfer and pump capacity, and causes cloudiness in the water.

It is recommended to maintain the calcium hardness value within the range from 200 to 400 ppm as calcium carbonate ($CaCO_3$).

Alkalinity

Alkalinity is the measure of the total concentration of alkaline substances, mostly bicarbonates, dissolved in the water. The higher the alkalinity, the more resistant the water is to pH change. At the same time, high alkaline water is a major contributor to scaling problems like incrustation in filtration equipment, pumps, and piping.

It is recommended to maintain the alkalinity value within the range from 80 to 125 ppm as calcium carbonate ($CaCO_3$).

pH

The pH of the water is an important factor since at lower pH levels the corrosion rate increases. If the alkalinity values are sufficiently high, it will not be difficult to control the pH. Most pool managers prefer to keep the pH between 7.2 and 7.4 to best maintain low corrosion rates and a sufficient activity of chlorine.

Langelier Index

The Langelier Index is a powerful tool to calculate the water balance, and to predict corrosion or scaling problems. Theoretically, a LI of zero indicates perfect water condition for swimming pools. If LI>0, scaling and staining of the water is present, and if LI<0 the water is corrosive and highly irritating. A tolerance of ±0.4 is normally acceptable.

The Langelier formula is expressed as:

LI = pH + TF + HF + AF - 12.5

Where:

LI = Langelier Index (also called Saturation Index)

pH = pH of the water

TF = temperature factor

HF = hardness factor, log (Ca hardness, ppm as $CaCO_3$)

AF = alkalinity factor, log (alkalinity, ppm as $CaCO_3$)

To calculate the exact Langelier Index of your water please use the **WATER INDEX** reference tables.

For most pools, water is balanced if:

- The pH value is maintained within the recommended ranges of pH 7.2 - 7.6
- Ideally the Alkalinity should be maintained within a range of 80 - 125 ppm
- The Calcium Hardness should be maintained within a range of 200 - 400 ppm.

To calculate your water balance, three parameters must be measured; calcium hardness, alkalinity and pH. Find the hardness and alkalinity factor in the reference tables below.

The water temperature is, in general, maintained between 24°C (76°F) and 34°C (94°F). Assuming the temperature is kept within those ranges, an average value or 0.7 may be used.

Water balance = pH+TF+HF+AF

Water Balance	Condition	Recommendation
11.0-12.0	Corrosive	Increase pH and/or alkalinity
12.1-12.3	Acceptable Balance	Retest water frequently
12.4-12.6	Ideal Balance	Maintain
12.7-12.9	Acceptable Balance	Retest water frequently
13.0-14.0	Scale Forming	Reduce pH and/or alkalinity

Water Index Reference Table

Temperature			Calcium Hardness		Alkalinity	
°C	°F	TF	mg/L (as $CaCO_3$)	HF	mg/L (as $CaCO_3$)	AF
0	32	0	5	0.7	5	0.7
4	39	0.1	25	1.4	25	1.4
8	46	0.2	50	1.7	50	1.7
12	54	0.3	75	1.9	75	1.9
16	60	0.4	100	2.0	100	2.0
20	68	0.5	150	2.2	150	2.2
24	75	0.6	200	2.3	200	2.3
28	82	0.7	250	2.4	250	2.4
32	90	0.7	300	2.5	300	2.5
36	97	0.8	400	2.6	400	2.6
40	104	0.9	500	2.7	500	2.7
50	122	1.0	1000	3.0	1000	3.0

HI83226

Multiparameter Photometer for Pools and Spas

- Methods
  - 11 measurement methods
- Help feature
  - Full tutorial available in start up menu
- Connectivity
  - PC compatible via USB

Around the world, swimming pool and spa facilities welcome dozens, even hundreds of people on a daily basis. A basic necessity of pool water treatment is to maintain the water in a safe and pleasant condition for the swimmers.

In order to achieve ideal water conditions, swimming pool water requires testing on a daily and sometimes hourly basis for disinfection residuals and maintaining pH levels. Equally important, calcium hardness and alkalinity levels should be monitored weekly to ensure the pool water is well balanced, thus to avoid corrosion and scale formation.

The HI83226 is a multiparameter bench meter that measures nine parameters essential for advanced pool and spa water analysis.

The optical system of the HI83226 is based on tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

The HI83226 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI92000 Windows® compatible software.

ADP
Application Designed Photometers

HI83226 Test	Range	Method	Reagent Code†
Alkalinity	0 to 500 mg/L (ppm) as $CaCO_3$	bromocresol green	HI93755-01
Bromine	0.00 to 10.00 mg/L (ppm)	DPD	HI93716-01
Chlorine, Free	0.00 to 5.00 mg/L (ppm)	DPD	HI93701-01
Chlorine, Total	0.00 to 5.00 mg/L (ppm)	DPD	HI93711-01
Copper, Free	0.00 to 5.00 mg/L (ppm)	bicinchoninate	HI93702-01
Copper, Total	0.00 to 5.00 mg/L (ppm)	bicinchoninate	HI93702T-01
Cyanuric Acid	0 to 200 mg/L (ppm)	turbidimetric	HI93722-01
Hardness, Calcium	0 to 500 mg/L (ppm) as $CaCO_3$	calmagite	HI93720-01
Iron	0.00 to 5.00 mg/L (ppm)	phenanthroline	HI93721-01
Ozone	0.00 to 2.00 mg/L (ppm)	DPD	HI93757-01
pH	6.5 to 8.5 pH	phenol red	HI93710-01
Ordering Information	**HI83226-01** (115V), **HI83226-02** (230V), are supplied with sample cuvettes with caps (4 ea.), cloth for wiping cuvettes, scissors, AC/DC power adapter and instruction manual		

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability. Liquid chlorine reagents are available for certain applications.
† Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.

Standard reagents begin on page 10.70; general accessories begin on page 10.8

HI83216

Multiparameter Photometer for Pools and Spas

- Methods
  - 6 measurement methods
- Help feature
  - Full tutorial available in start up menu
- Connectivity
  - PC compatible via USB

Around the world, swimming pool and spa facilities welcome dozens, even hundreds of people on a daily basis. A basic necessity of pool water treatment is to maintain the water in a safe and pleasant condition for the swimmers.

In order to achieve ideal water conditions, swimming pool water requires testing on a daily and sometimes hourly basis for disinfection residuals and maintaining pH levels. Equally important, calcium hardness and alkalinity levels should be monitored weekly to ensure the pool water is well balanced, thus to avoid corrosion and scale formation.

The HI83216 is a multiparameter bench meter that measures 6 different methods essential for pool and spa water analysis.

The optical system of the HI83216 is based on tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

The HI83216 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI92000 Windows® compatible software.

ADP
Application Designed Photometers

HI83216 Test	Range	Method	Reagent Code†
Alkalinity	0 to 500 mg/L (ppm) as $CaCO_3$	Bromocresol green	HI93755-01
Chlorine, Free	0.00 to 5.00 mg/L (ppm)	DPD	HI93701-01
Chlorine, Total	0.00 to 5.00 mg/L (ppm)	DPD	HI93711-01
Cyanuric Acid	0 to 200 mg/L (ppm)	Turbidimetric	HI93722-01
Hardness, Calcium	0 to 500 mg/L (ppm) as $CaCO_3$	Calmagite	HI93720-01
pH	6.5 to 8.5 pH	Phenol Red	HI93710-01
Ordering Information	**HI83216-01** (115V), **HI83216-02** (230V), are supplied with sample cuvettes with caps (4 ea.), cloth for wiping cuvettes, scissors, AC/DC power adapter and instruction manual		

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.
† Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.

Standard reagents begin on page 10.70; general accessories begin on page 10.8

ADP
Application Designed Photometers

HI83208

Multiparameter Photometer for Water Conditioning

- Methods
  - 23 measurement methods
- Help feature
  - Full tutorial available in start up menu
- Connectivity
  - PC compatible via USB

The global distribution of freshwater resources varies greatly from region to region, and only 3% of global water resources are defined as freshwater.

The definition of freshwater is water containing less than 1000 mg/L of dissolved solids, most often dissolved minerals.

The HI83208 was developed to measure the most common parameters in water quality monitoring.

Ammonia detection in water treatment systems is particularly important for aquarium owners and fish farm operators. Ammonia is highly soluble in water and extremely toxic to fish.

Phosphates are present in natural waters, and at normal concentrations do not pose any specific health threats to humans. Phosphate contamination that comes from agricultural fertilizer runoff can promote excessive algae growth.

The HI83208 is a multiparameter bench meter that measures twenty-three methods essential for water conditioning.

The optical system of the HI83208 is based on tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

The HI83208 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI92000 Windows® compatible software.

Test	Range	Method	Reagent Code†
Ammonia MR	0.00 to 10.00 mg/L (ppm)	Nessler	HI93715-01
Ammonia LR	0.00 to 3.00 mg/L (ppm)	Nessler	HI93700-01
Chlorine*, Free	0.00 to 2.50 mg/L (ppm)	DPD	HI93701-01
Chlorine*, Total	0.00 to 3.50 mg/L (ppm)	DPD	HI93711-01
Copper HR	0.00 to 5.00 mg/L (ppm)	bicinchoninate	HI93702-01
Copper LR	0 to 1000 µg/L	bicinchoninate	HI95747-01
Fluoride	0.00 to 2.00 mg/L (ppm)	SPADNS	HI93729-01
Iron HR	0.00 to 5.00 mg/L (ppm)	phenanthroline	HI93721-01
Iron LR	0 to 400 µg/L	TPTZ	HI93746-01**
Manganese HR	0.0 to 20.0 mg/L (ppm)	periodate	HI93709-01
Manganese LR	0 to 300 µg/L	PAN	HI93748-01**
Molybdenum	0.0 to 40.0 mg/L (ppm)	mercaptoacetic acid	HI93730-01
Nickel HR	0.00 to 7.00 g/L	photometric	HI93726-01
Nickel LR	0.000 to 1.000 mg/L (ppm)	PAN	HI93740-01**
Nitrate	0.0 to 30.0 mg/L (ppm)	cadmium reduction	HI93728-01
Oxygen, Dissolved (DO)	0.0 to 10.0 mg/L (ppm)	Winkler	HI93732-01
pH	6.5 to 8.5 pH	phenol red	HI93710-01
Phosphate HR	0.0 to 30.0 mg/L (ppm)	amino acid	HI93717-01
Phosphate LR	0.00 to 2.50 mg/L (ppm)	ascorbic acid	HI93713-01
Phosphorus	0.0 to 15.0 mg/L (ppm)	amino acid	HI93706-01
Silica	0.00 to 2.00 mg/L (ppm)	heteropoly blue	HI93705-01
Silver	0.000 to 1.000 mg/L (ppm)	PAN	HI93737-01**
Zinc	0.00 to 3.00 mg/L (ppm)	zincon	HI93731-01

Ordering Informaiton

HI83208-01 (115V), **HI83208-02** (230V) are supplied with sample cuvettes with caps (2 ea.), cloth for wiping cuvettes, 60 mL glass bottle for dissolved oxygen analysis, scissors, AC/DC power adapter and instruction manual

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.
† Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.
* For Chlorine, liquid reagents are available.
** Reagents for 50 tests. Replace the -01 with -03 for 150 tests.

Standard reagents begin on page 10.70; general accessories begin on page 10.8

HI96000 Series

Portable Photometers

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- Built-in Timer
  - Ensures reagents react for required time before measurement
- GLP Features
  - Meets Good Laboratory Practices

Hanna's line of portable photometers includes instruments to measure ammonia, chlorine, copper, anionic detergents, fluoride, iron, nitrite, phosphate, phosphorus, and more. This series features an advanced optical system and Hanna's exclusive CAL Check™ validation function. The advanced optical system is based on a special tungsten lamp and a narrow band interference filter assuring accurate readings every time.

With the exclusive CAL Check™ validation function, users are able to verify the performance of the instrument at any time. With just a few short steps, the validation procedure is extremely user friendly and ensures that the meter is properly calibrated. Just use the exclusive Hanna ready-made, NIST traceable standards to verify the performance of the instrument and recalibrate as necessary. All instruments are factory calibrated and the electronic and optical design minimizes the need for frequent calibration.

The cuvette is made from special optical glass to obtain best results and uses an exclusive positive-locking system ensures that the cuvette is in the same position every time it is placed into the measurement cell. The cell is designed to fit a wide mouth cuvette making it easier to add both samples and reagents.

The reagents are in powder or liquid form and the amount of reagent is precisely dosed to ensure maximum repeatability.

CAL Check™ Validation*

Two-step validation procedure for proper calibration.

Zero the meter prior to validation...

Place the CAL Check™ Standard A into the cuvette holder and press ZERO/CFM button. The lamp, cuvette and detector icons will appear on the display followed by "-0.0-". The meter is now zeroed and ready for validation.

... and compare accuracy against a known standard.

Place the CAL Check™ standard B into the cuvette holder and press CAL Check™. The lamp, cuvette and detector icons together with "CAL Check" will appear on the display. At the end of the measurement the display will show the validation standard value.

CAL Check™ Calibration*

Calibrate your instrument quickly and easily.

Zero the meter prior to calibration...

Press and hold CAL Check™ for three seconds to enter calibration mode. Place the CAL Check™ Standard A into the cuvette holder and press ZERO/CFM. The lamp, cuvette and detector icons will appear on the display followed by "-0.0-". The meter is now zeroed and ready for calibration.

... and calibrate to a known standard.

Place the CAL Check™ Standard B into the cuvette holder. Press READ/TIMER and the lamp, cuvette and detector icons will appear on the display. After measurement the instrument will show the CAL Check™ Standard value.

General Specifications

Power Supply	9V battery
Auto-off	after 10 minutes of non-use in measurement mode; after 1 hour of non-use in calibration mode; with last reading reminder
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")
Weight	360 g (12.7 oz.)

Solutions and Accessories

HI93703-50	Cuvette cleaning solution, 230 mL	**HI731335**	Cuvette caps (4)
HI731318	Cuvette cleaning cloth (4)	**HI740318**	Carrying case for HI96 series
HI731331	Measuring cuvettes (4)		

*Each CAL Check™ cuvette is clearly labeled with its respective measurement. Please read the full instruction manual before validation/calibration.

HI96712

Aluminum Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Aluminum is the most abundant metal and the third most abundant element in the Earth's crust, behind only oxygen and silicon. It is a lightweight, silvery metal, familiar to every household in the form of pots and pans, beverage cans, and aluminum foil. It is nontoxic, corrosion resistant, non-magnetic, and easy to form or cast into a variety of shapes.

In spite of the fact that aluminum is very active chemically, it does not corrode in moist air the way iron does. Instead, it quickly forms a thin, hard coating of aluminum oxide.

Aluminum is used in water purification because when it reacts with lime (or any base), it forms a sticky precipitate of aluminum hydroxide that binds tiny particles of impurities, thereby purifying the water.

The HI96712 measures the aluminum content in water and wastewater in the 0.00 to 1.00 mg/L range.

The meter uses an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

Specifications	HI96712 Aluminum	
Range	0.00 to 1.00 mg/L (ppm)	
Resolution	0.01 mg/L (ppm)	
Accuracy @ 25°C (77°F)	±0.02 mg/L ±4% of reading	
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360g (12.7 oz.)	
Method	adaptation of the aluminon method	
Ordering Information	**HI96712** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96712C** includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately	
Reagents and Standards	**HI96712-11**	CAL Check™ standard cuvettes
	HI93712-01	reagents for 100 tests
	HI93712-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96700 • HI96715 • HI96733

Ammonia Portable Photometers

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

The HI96700 and HI96715 meters measure the ammonia-nitrogen (NH_3–N) content in water samples. The HI96733 measures the ammonium ion (NH_4^+) content in water, wastewater and seawater.

These meters use an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

Ammonia is often an excellent indication of the presence of animal or plant microbiological decay. It is tested in fresh water fish farms due to its toxic nature. Its presence in rivers and reservoirs normally points to agricultural and/or civil pollutants. Ammonia is tested in lakes, rivers, potable water, boiler feed water, industrial and municipal waste water.

Specifications	HI96700 Ammonia LR	HI96715 Ammonia MR	HI96733 Ammonia HR
Range	0.00 to 3.00 mg/L (ppm) (as NH_3–N)	0.00 to 9.99 mg/L (ppm) (as NH_3–N)	0.0 to 50.0 mg/L (ppm) (as NH_4^+)
Resolution	0.01 mg/L	0.01 mg/L	0.01 mg/L
Accuracy @ 25°C (77°F)	±0.04 mg/L ±4% of reading	±0.05 mg/L ±5% of reading	±0.5 mg/L ±5% of reading
Light Source	tungsten lamp	light emitting diode	tungsten lamp
Light Detector	silicon photocell with narrow band interference filter @ 420 nm	silicon photocell with narrow band interference filter @ 466	silicon photocell with narrow band interference filter @ 420 nm
Power Supply	9V battery		
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder		
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing		
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")		
Weight	360g (12.7 oz.)		
Method	adaptation of the ASTM Manual of Water and Environmental Technology, D1426-93, Nessler method		
Ordering Information	**HI96700**, **HI96715** and **HI96733** are supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96700C**, **HI96715C** and **HI96733C** include photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately		

Reagents and Standards			
	HI96700	**HI96700-11**	CAL Check™ standard cuvettes
		HI93700-01	reagents for 100 tests (N-NH_3 LR)
		HI93700-03	reagents for 300 tests (N-NH_3 LR)
	HI96715	**HI96715-11**	CAL Check™ standard cuvettes
		HI93715-01	reagents for 100 tests (N-NH_3 MR)
		HI93715-03	reagents for 300 tests (N-NH_3 MR)
	HI96733	**HI96733-11**	CAL Check™ standard cuvettes
		HI93733-01	reagents for 100 tests (NH_4^+ HR)
		HI93733-03	reagents for 300 tests (NH_4^+ HR)

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96769

Anionic Surfactants Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Surfactants are produced in large quantities and are widely used in many applications. Due to their common use, surfactants are introduced into the water supply through domestic and industrial drains.

Surfactants are harmful to water treatment plants, due to the scum that is created by emulsifying oil and grease. So, by law, surfactant concentrations must be monitored in wastewaters.

The HI96769 measures anionic surfactants in drinking, surface and wastewaters. The meter uses an exclusive positive-locking system to ensure that the cuvette is in the same position every time it is placed into the measurement cell. It is designed to fit a cuvette with a larger neck, making it easier to add both sample and reagents. The cuvette is made from special optical glass to obtain the best results.

Specifications	HI96769 Anionic Surfactants	
Range	0.00 to 3.50 mg/L (ppm) as SDBS	
Resolution	0.01 mg/L	
Accuracy @ 25°C (77°F)	±0.04 mg/L ±3% of reading	
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 610 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360g (12.7 oz.)	
Method	adaptation of the USEPA method 425.1 and Standard Methods for the Examination of Water and Wastewater, 20th edition, 5540C, Anionic Surfactants as MBAS	
Ordering Information	**HI96769** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96769C** kit includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, 25 mL glass vial with cap, plastic pipettes (3), 9V battery, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately	
Reagents and Standards	**HI96769-11**	CAL Check™ standard cuvettes
	HI95769-01	reagent for 40 anionic surfactants tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96716

Bromine Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

In many countries, bromine sanitizing has been introduced as an alternative for chlorine. Although it is not as strong as chlorine, bromine remains stable at higher temperatures (advantageous for heated pools and hot tubs), and higher pH levels. Furthermore, it has little reaction to nitrogen compounds, thus reducing the unpleasant odor and eye irritation problems associated with pool water sanitation. The main disadvantage of bromine is the slower acting disinfecting power, making it less suitable for larger pools.

The HI96716 meter measures the bromine content in water samples in the 0.00 to 10.00 mg/L (ppm) range. The HI96000 series portable photometers use an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

Specifications	HI96716 Bromine	
Range	0.00 to 10.00 mg/L (ppm)	
Resolution	0.01 mg/L	
Accuracy @ 25°C (77°F)	±0.08 mg/L ± 3% of reading	
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the Standard Methods for the Examination of Water and Wastewater, 20th edition, DPD method	
Ordering Information	**HI96716** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96716C** includes photometer, CAL Check™ standards, sample cuvettes (2) and caps, 9V battery, scissors, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately	
Reagents and Standards	**HI96716-11**	CAL Check™ standard cuvettes
	HI93716-01	reagents for 100 tests
	HI93716-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96753

Chloride Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Chloride ions are one of the major inorganic anions in water and wastewater. Although high concentrations of chloride in water are not known to be toxic to humans, its regulation is mainly due to adverse effects on taste. It is essential to monitor chloride concentrations in boiler systems to prevent metal parts from being damaged. In high levels, chloride can corrode stainless steel. The level of chloride concentrations in boiler and cooling towers varies from small quantities to very high levels. Furthermore, high levels of chloride can be toxic to plant life.

Chlorides are the salts of hydrochloric acid with a metal. Some common examples are sodium chloride (NaCl), ammonium chloride (NH_4Cl), calcium chloride ($CaCl_2$), and magnesium chloride ($MgCl_2$). When dissolved in water, these salts produce chloride ions, Cl^-.

The HI96753 meter measures the chloride content in water and wastewater samples. This meter uses an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

Specifications	HI96753 Chloride	
Range	0.0 to 20.0 mg/L (ppm)	
Resolution	0.1 mg/L	
Accuracy @ 25°C (77°F)	±0.5 mg/L ±6% of reading	
Light Source	light emitting diode	
Light Detector	silicon photocell with narrow band interference filter @ 466 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360g (12.7 oz.)	
Method	adaptation of the mercury (II) thiocyanate method	
Ordering Information	**HI96753** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96753C** includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately	
Reagents and Standards	**HI96753-11**	CAL Check™ standard cuvettes
	HI93753-01	reagents for 100 tests
	HI93753-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96738

Chlorine Dioxide Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Chlorine dioxide is used primarily as a disinfectant in drinking water and also in various industrial processes. In drinking water applications, it is gaining popularity over chlorine, considering that it does not generate trihalomethanes when reacting with organic compounds. In industrial applications, it is used as a bleaching agent in such applications as pulp and paper manufacturing.

Chlorine dioxide is considered a highly-effective, eco-friendly microbiocide that carries a number of important regulatory approvals from several international organizations, including the USEPA, FDA and UK Government, for many of its uses.

Chlorine and bromine react rapidly with microbiological species and chemicals in water. This reactivity is both their strength and weakness. Since chemical reactions are usually the first to take place, only the small residual of the product remaining after the chemical reaction is completed is available for microbiological control.

Chlorine dioxide is a very safe and potent biocide. It is effective over a wide pH range in both hard and soft water and does not react with most other water treatment chemicals.

The HI96738 meter measures the chlorine dioxide content in water samples in the 0.00 to 2.00 mg/L range. This meter uses an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

Specifications	HI96738 Chlorine Dioxide	
Range	0.00 to 2.00 mg/L (ppm)	
Resolution	0.01 mg/L	
Accuracy @ 25°C (77°F)	±0.10 mg/L ±5% of reading	
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 575 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of chlorophenol red method	
Ordering Information	**HI96738** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96738C** includes HI96738 photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, scissors, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately	
Reagents and Accessories	**HI96738-11**	CAL Check™ standard cuvettes
	HI93738-01	reagents for 100 tests
	HI93738-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96701 • HI96762

Free Chlorine Portable Photometers

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Chlorine is widely used in making many everyday products, but most notably, it is used for producing safe drinking water all over the world. Even the smallest water supplies are now usually chlorinated. It is also extensively used in the production of paper products, dyestuffs, textiles, petroleum products, medicines, antiseptics, insecticides, food, solvents, paints, plastics, and many other consumer products. Most of the chlorine produced is used in the manufacture of chlorinated compounds for sanitation, pulp bleaching, disinfectants, and textile processing.

The HI96701 meter measures the free chlorine (Cl_2) content in water samples in the 0.00 to 5.00 mg/L (ppm) range.

The HI96762 meter was specially developed to measure low concentrations of free chlorine in drinking water.

These meters use an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

Specifications	HI96701 Free Chlorine	HI96762 Free Chlorine ULR
Range	0.00 to 5.00 mg/L (ppm)	0.000 to 0.500 mg/L (ppm)
Resolution	0.01 mg/L from 0.00 to 3.50 mg/L; 0.10 mg/L above 3.50 mg/L	0.001 mg/L
Accuracy @ 25°C (77°F)	±0.03 mg/L ±3% of reading	±0.020 mg/L ±3% of reading
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the USEPA method 330.5 and Standard Method 4500-Cl G	adaptation of the Standard Method 4500-Cl G
Ordering Information	**HI96701** and **HI96762** are supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96701C** and **HI96762C** include photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately	
Reagents and Standards	HI96701	**HI96701-11** CAL Check™ Standard Cuvettes **HI93701-01** reagents for 100 tests **HI93701-03** reagents for 300 tests
	HI96762	**HI96762-11** CAL Check™ Standard Cuvettes **HI95762-01** reagents for 100 tests **HI95762-03** reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96761

Chlorine, Total Portable Photometers

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Total chlorine is a measure of both chlorine available for disinfection and combined chlorine.

The HI96761 meter measures the traces of total chlorine (Cl_2) content in drinking water samples.

This meter uses an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

Specifications	HI96761 Chlorine, Total Low Range	
Range	0.000 to 0.500 mg/L (ppm)	
Resolution	0.001 mg/L	
Accuracy @ 25°C (77°F)	±0.020 mg/L ±3% of reading	
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the USEPA method 330.5	
Ordering Information	**HI96761** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96761C** includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, scissors, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately	
Reagents and Standards	**HI96761-11**	CAL Check™ Standard cuvettes
	HI95761-01	reagents for 100 tests
	HI95761-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96723 • HI96749

Chromium VI HR and LR Portable Photometers

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Chromium compounds are used in the textile industry as mordants, and by the aircraft and other industries for anodizing aluminum.

All compounds of chromium are colored; the most important are the chromates of sodium and potassium and the dichromates of potassium and ammonium. The dichromates are used as oxidizing agents in quantitative analysis, they are also used in tanning leather.

Another compound of industrial value is lead chromate, which is chrome yellow, a valuable pigment.

At normal temperatures, chromium is corrosion-resistant. For this reason, it plays an important role in the plating industry as well as cooling towers. In addition, it has certain qualities that make it useful in the production processes of the textile industry.

Chromium is very useful in industry, but the by-product hexavalent chromium (Cr VI) is produced, which is a known carcinogen, and must be removed from wastewater.

The HI96723 and HI96749 are valuable meters that measure the hexavalent chromium (Cr VI) content in water and wastewater samples.

The meters use an exclusive positive-locking system to ensure that the cuvette is in the same position every time it is placed into the measurement cell.

Specifications	HI96723 Chromium VI HR	HI96749 Chromium VI LR
Range	0 to 1000 µg/L (ppb)	0 to 300 µg/L (ppb)
Resolution	1 µg/L	1 µg/L
Accuracy @ 25°C (77°F)	±5 µg/L ±4% of reading	±1 µg/L ±4% of reading
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the ASTM Manual of Water and Environmental Technology, D1687-92, diphenylcarbohyzide method.	
Ordering Information	**HI96723** and **HI96749** are supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately	
Reagents and Standards	**HI96723-11**	CAL Check™ standard cuvettes
	HI96749-11	CAL Check™ standard cuvettes
	HI93723-01	reagents for 100 tests
	HI93723-03	reagents for 300 tests
	HI93749-01	reagents for 100 tests
	HI93749-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96727

Color of Water Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Apparent color is the color of the whole water sample, and consists of color from both dissolved and suspended components. True color is measured after filtering the water sample to remove all suspended material.

The presence of color in water does not necessarily indicate that the water is not potable. Color-causing substances such as tannins may be harmless.

Color is not removed by typical water filters; however, slow sand filters can remove color, and the use of coagulants may also succeed in trapping the color-causing compounds within the resulting precipitate.

Color, together with odor, taste and turbidity form an integral part of our sensory system.

Testing for color can be a quick and easy test which often reflects the amount of organic material in the water, although certain inorganic components like iron or manganese can also impart color.

The HI96727 measures the true and apparent color in water and wastewater in the 0 to 500 PCU (Platinum Cobalt Units) range.

The HI96727 uses an exclusive positive-locking system to ensure that the cuvette is in the same position every time it is placed into the measurement cell. It is designed to fit a cuvette with a larger neck, making it easier to add both sample and reagents. The cuvette is made from special optical glass to obtain the best results.

Specifications	HI96727 Color of Water	
Range	0 to 500 PCU (Platinum Cobalt Units)	
Resolution	10 PCU	
Accuracy @ 25°C (77°F)	±10 PCU ±5% of reading	
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 420 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	Adaptation of the Standard Method for the Examination of Water and Wastewater 18th Edition, colorimetric platinum cobalt method	
Ordering Information	**HI96727** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately	
Reagents and Standards	**HI96727-11**	CAL Check™ standard cuvettes
Accessories	**HI740227**	filter assembly
	HI740228	filter disc

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96747

Copper, Low Range Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

The HI96747 is auto-diagnostic photometer engineered to measure a wide range of copper concentrations. Due to the specially formulated powder reagent with long-term stability, copper analysis is possible even where iron and calcium is present, such as in sea water.

The HI96747 uses an exclusive positive-locking system to ensure that the cuvette is in the same position every time it is placed into the measurement cell. It is designed to fit a cuvette with a larger neck making it easier to add both sample and reagents. The cuvette is made from special optical glass to obtain best results.

Copper is one of the most abundant metals in earth's crust. Because of its malleability, thermal and electrical conductivity, corrosion resistance, and other useful qualities, it is used in a large variety of industrial and technological applications.

Copper is found in effluents and natural water both as suspended solids and salt. A high concentration is toxic for plants and animals, which accounts for its rigorous monitoring by the authorities and industry. Lower concentrations are often employed to contain the growth of plankton and algae.

Specifications	HI96747 Copper, LR	
Range	0.000 to 1.500 mg/L (ppm)	
Resolution	0.001 mg/L	
Accuracy @ 25°C (77°F)	±0.010 mg/L ±5% of reading	
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 560 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the USEPA approved bicinchoninate method	
Ordering Information	**HI96747** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate, and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96747C** includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, scissors, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case.	
Reagents and Standards	**HI96747-11**	CAL Check™ standard cuvettes
	HI95747-01	reagents for 100 tests
	HI95747-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96714

Cyanide Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Cyanide is a pollutant that originates mostly from metalurgical and galvanic industrial plants. Cyanide is poisonous to the human nervous system, and it is therefore imperative to monitor and control its level in potable water. Continuous monitoring in waste effluents is required, and cyanide is removed using an alkaline chlorination procedure. Because of this, European norm limit the concentration of cyanide in drinking water to 0.05 mg/L, while the EPA has established that the maximum level is not to exceed 0.2 mg/L.

The HI96714 meter measures the cyanide in wastewaters. The meter uses an exclusive positive-locking system to ensure that the cuvette is in the same position every time it is placed into the measurement cell. It is designed to fit cuvettes with a larger neck, making it easier to add both sample and reagents. The cuvettes are made from special optical glass to obtain the best results.

Specifications	HI96714 Cyanide	
Range	0.000 to 0.200 mg/L (ppm)	
Resolution	0.001 mg/L	
Accuracy @ 25°C (77°F)	±0.005 mg/L ±3% of reading	
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 610 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, Pyridine-Pyrazolone method	
Ordering Information	**HI96714** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately	
Reagents and Standards	**HI96714-11**	CAL Check™ standard cuvettes
	HI93714-01	reagents for 100 tests
	HI93714-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96722

Cyanuric Acid Photometers

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

The HI96722 meter measures the cyanuric acid content in water samples in the 0 to 80 mg/L (ppm) range.

This meter uses an exclusive positive-locking system to ensure that the cuvette is in the same position every time it is placed into the measurement cell. It is designed to fit cuvettes with a larger neck making it easier to add both sample and reagents. The cuvettes are made from special optical glass to obtain best results.

Cyanuric acid (CYAC) is best known as a stabilizing reagent for chlorine. It is widely applied in swimming pool and spa treatment programs to slow down the decomposition of hypochlororous acid. In outside pool areas, this process is accelerated by the effects of UV rays. When applied properly it can save up to 80% of normal chlorine consumption in pools during peak months. Cyanuric acid is also used in chlorinated beaches, selective herbicides and whitening agents.

Specifications	HI96722 Cyanuric Acid	
Range	0 to 80 mg/L (ppm)	
Resolution	1 mg/L (ppm)	
Accuracy @ 25°C (77°F)	±1 mg/L ±15% of reading	
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the turbidimetric method	
Ordering Information	**HI96722** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately	
Reagents and Standards	**HI96722-11**	CAL Check™ standard cuvettes
	HI93722-01	reagents for 100 tests
	HI93722-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96729 • HI96739

Fluoride Portable Photometers

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Fluoride is best known for preventing tooth decay. Water authorities often add fluoride to drinking water to maintain approximately a 1.0 mg/L (ppm) concentration. Fluoride can be found naturally in ground water, particularly if a reservoir is in the proximity of sea water. While fluoride does help prevent tooth decay, too little can be ineffective and too much can cause staining of teeth.

The HI96729 meter measures the fluoride (F^-) content in the 0.00 to 2.00 mg/L (ppm) range, in drinking, surface and wastewaters. The amount of reagent is precisely dosed by use of the supplied automatic pipette for maximum repeatability.

The HI96739 meter measures the fluoride (F^-) content in water, wastewater and sea water in the 0 to 20 mg/L (ppm) range.

Both meters use an exclusive positive-locking system to ensure that the cuvette is in the same position every time it is placed into the measurement cell. It is designed to fit cuvettes with a larger neck, making it easier to add both sample and reagents. The cuvettes are made from special optical glass to obtain the best results.

Specifications	HI96729 Fluoride LR	HI96739 Fluoride HR
Range	0.00 to 2.00 mg/L (ppm)	0.0 to 20.0 mg/L (ppm)
Resolution	0.01 mg/L	0.1 mg/L
Accuracy @ 25°C (77°F)	±0.03 mg/L ±3% of reading	±0.5 mg/L ±3% of reading
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 575 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the EPA method 340.1 and SPADNS method	adaptation of the SPADNS method

Ordering Information	**HI96729** and **HI96739** is supplied sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96729C** and **HI96739C** include photometer, CAL Check™ standards, sample cuvettes (2) with caps, 2000 µL automatic pipette with instruction sheet, 9V battery, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately		
Reagents and Standards	HI96729	**HI93703-53**	reagent for reducing chlorine concentration
		HI96729-11	CAL Check™ standard cuvettes
		HI93729-01	reagents for 100 tests
		HI93729-03	reagents for 300 tests
	HI96739	**HI96739-11**	CAL Check™ standard cuvettes
		HI93739-01	reagents for 100 tests
		HI93739-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96720 • HI96719

Hardness Standard Method Portable Photometers

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Water, with exception to distilled water, contains dissolved salts (magnesium and calcium carbonates). The concentration of these salts determines the water hardness, which can be expressed in calcium carbonate or magnesium carbonate. The sum of these two represents the total hardness level.

In addition, this parameter is also related to the phenomenon of pipe rusting in water heating and cooling systems, reverse osmosis and demineralization plants.

The HI96720 measures the calcium hardness content, as $CaCO_3$, in water and wastewater in the 0.00 to 2.70 mg/L (ppm) range.

The HI96719 measures the magnesium hardness content, as $CaCO_3$, in water and wastewater in the 0.00 to 2.00 mg/L (ppm) range.

Both meters use an exclusive positive-locking system to ensure that the cuvette is in the same position every time it is placed into the measurement cell. It is designed to fit cuvettes with a larger neck making it easier to add both sample and reagents. The cuvettes are made from special optical glass to obtain best results.

Specifications	HI96720 Ca Hardness	HI96719 Mg Hardness
Range	0.00 to 2.70 mg/L (ppm)	0.00 to 2.00 mg/L (ppm)
Resolution	0.01 mg/L	
Accuracy @ 25°C (77°F)	±0.11 mg/L ±5% of reading	
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 525nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th ed. Calmagite method	adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th ed. EDTA colorimetric method.
Ordering Information	**HI96720** and **HI96719** are supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96720C** and **HI96719C** include photometer, CAL Check™ standards,sample cuvettes (2) with caps, 9V battery, 1 mL syringe with tip, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately	

Reagents and Standards			
	HI96720	**HI96720-11**	CAL Check™ standard cuvettes
		HI93720-01	reagents for 100 tests
		HI93720-03	reagents for 300 tests
	HI96719	**HI96719-11**	CAL Check™ standard cuvettes
		HI93719-01	reagents for 100 tests
		HI93719-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96735

Hardness, EPA Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Total hardness refers to the presence of magnesium and calcium and is due mainly to the runoff water dissolving these salts as it flows or filters through different strata. Hardness can also cause scaling of pipes in cooling and heating systems.

The HI93735 measures the total hardness in drinking, surface and wastewater.

This meter uses an exclusive positive-locking system to ensure that the cuvette is in the same position every time it is placed into the measurement cell. It is designed to fit cuvettes with a larger neck, making it easier to add both sample and reagents. The cuvettes are made from special optical glass to obtain the best results.

Specifications — HI96735 Hardness, Total

	Hardness LR (P1)	Hardness MR (P2)	Hardness HR (P3)
Range	0 to 250 mg/L (ppm)	200 to 500 mg/L (ppm)	400 to 750 mg/L (ppm)
Resolution	1 mg/L from 0 to 100 mg/L, 5 mg/L from 100 to 250 mg/L	1 mg/L from 0-100 5 mg/L from 100-750	5 mg/L
Accuracy @ 25°C (77°F)	±5 mg/L ±4% of reading	±7 mg/L ±3% of reading	±10 mg/L ±2% of reading
Light Source	light emitting diode		
Light Detector	silicon photocell with narrow band interference filter @ 466		
Power Supply	9V battery		
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder		
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing		
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")		
Weight	360 g (12.7 oz.)		
Method	adaptation of the EPA recommended method 130.1		

Ordering Information

HI96735 is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual.

CAL Check™ standards and testing reagents sold separately

Reagents and Standards

HI96735-11	CAL Check™ standard cuvettes
HI93735-00	reagents for 100 tests (0-250 mg/L)
HI93735-01	reagents for 100 tests (200-500 mg/L)
HI93735-02	reagents for 100 tests (400-750 mg/L)
HI93735-0	reagents for 100 tests (0-750 mg/L)

*The reagents are in liquid and powder form and are supplied in bottles and in packets. The amount of reagent is precisely dosed to ensure maximum repeatability.

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96785

Honey Color Portable Analyzer

- Removes subjectivity
- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

The HI96785 portable microprocessor analyzer measures the percent light transmittance of honey compared to analytical reagent grade glycerol. The transmittance value allows identification of the honey Pfund grade. The instrument directly displays the measurement result expressed in mm Pfund.

Measurements are made using matched square optical cuvettes having a 10 mm light path.

The Color of Honey

The natural color of honey presents many tonalities: from straw yellow to amber, from dark amber to almost black with a hint of red. The color of untreated honey originates from the botanical varieties used by the bees; for this reason, its coloration allows one to commercially identify the original floral type.

The color of honey tends to darken with age or change according to the method of conservation or production used by beekeepers. These practices can include the use of old beehives, contact with metals, the temperature of conservation and exposure to light. The classes of color are expressed in millimeters (mm) on the Pfund scale, compared to an analytical standard scale of reference on the graduation of glycerin.

USDA Color Standards Designations	Color Range Pfund Scales (mm)
Water White	8 or less
Extra White	Over 8 to and including 17
White	Over 17 to and including 34
Extra Light Amber	Over 34 to and including 50
Light Amber	Over 50 to and including 85
Amber	Over 85 to and including 114
Dark Amber	Over 114

Specifications	HI96785	
Range	0 to 150 mm Pfund	
Resolution	1 mm Pfund	
Accuracy @ 25°C (77°F)	±2 mm Pfund @ 80mm Pfund	
Light Source	tungsten lamps	
Light Detector	silicon photocells with narrow band interference filter @ 420 nm and 525 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	direct measure	
Ordering Information	**HI96785** is supplied with sample cuvettes (5), 9V battery, light shield cap, cuvette wiping cloth, rigid carrying case, instrument quality certificate and instruction manual.	
Accessories	**HI93703-57**	glycerol, (4) 30 mL
	HI93703-56	consists of 82 matched square cuvettes, 30 mL of glycerol and (2) 5 mL syringes (75 tests average)
	HI70662	cleaning solution for honey meter (30 mL)

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

Application Designed Photometers

HI96704

Hydrazine Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Hydrazine is a liquid chemical substance normally used in high pressure heating plants because of its properties as an oxygen inhibitor. It is added to avoid scaling and corrosion in the plant itself. Hydrazine reacts with dissolved oxygen to yield nitrogen and water; hydrazine thus has the advantage over the sulfite treatment because it does not produce any dissolved solids in the boiled water. Hydrazine is also used in tanks because it controls the growth of bacteria. Other hydrazine uses include:

- Oxygen scavenger for water boiler feed and heating systems to prevent corrosion damage
- Energy source in fuel elements
- Reducing agent for the recovery of metals (copper, nickel and others)
- Intermediate in insecticides, herbicides, explosives, plant growth regulators, pharmaceuticals, dyes, flame-retardants, polymerization catalysts and other chemical products
- Component of photo development

The HI96704 meter measures the hydrazine content in water samples. The method is an adaptation of the ASTM Manual of Water and Environmental Technology, method D1385-88 for natural and treated water. The reaction between hydrazine and liquid reagent causes a yellow tint in the sample.

Specifications	HI96704 Hydrazine	
Range	0 to 400 µg/L (ppb)	
Resolution	1 µg/L	
Accuracy @ 25°C (77°F)	±3% of full scale	
Light Source	light emitting diode	
Light Detector	silicon photocell with narrow band interference filter @ 466 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the ASTM Manual of Water and Environmental Technology, method D1385-88 for natural and treated water	
Ordering Information	**HI96704** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96704C** includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately	
Reagents and Standards	**HI96704-11**	CAL Check™ standard cuvettes
	HI93704-01	reagents for 100 tests
	HI93704-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96718

Iodine Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

The disinfectant properties of iodine have led to its use as an alternative to chlorine and bromine. Unlike chlorinated pools, water treated with iodine decreases eye irritation among swimmers and provides a level of disinfection more stable to adverse conditions.

However, its toxic, corrosive properties and the difficulties of dissolving it in water have limited its widespread acceptance. One of its most common applications is in poultry industry process water.

The HI96718 uses an exclusive positive-locking system to ensure that the cuvette is in the same position every time it is placed into the measurement cell. It is designed to fit a cuvette with a larger neck, making it easier to add both sample and reagents. The cuvette is made from special optical glass to obtain the best results.

The HI96718 measures the iodine content in water samples in the 0.0 to 12.5 mg/L (ppm) range. The method is an adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, DPD method. The reaction between iodine and the reagent causes a pink tint in the sample.

Specifications	HI96718 Iodine	
Range	0.0 to 12.5 mg/L (ppm)	
Resolution	0.1 mg/L	
Accuracy @ 25°C (77°F)	±0.1 mg/L ±5% of reading	
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, DPD method	
Ordering Information	**HI96718** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96718C** includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, scissors, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately	
Reagents and Standards	**HI96718-11**	CAL Check™ standard cuvettes
	HI93718-01	reagents for 100 tests
	HI93718-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96746 • HI96721

Iron Portable Photometers

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Iron is naturally present in water in low concentrations, but it reaches high concentrations in wastewater effluents. The iron concentration in water needs to be monitored because it becomes harmful above certain levels.

In domestic water, for instance, iron can unpleasantly alter the taste, stain laundry, damage kitchenware and favor the growth of certain bacteria. Iron is also an indicator of ongoing corrosion in water cooling and heating systems. Moreover, iron is normally monitored in mining wastewater to avoid contamination.

The HI96746 meter measures the iron content in water, wastewater and seawater in the 0.00 to 1.60 mg/L (ppm) range.

The HI96721 meter measures total iron (Fe) content in water samples in the 0.00 to 5.00 mg/L (ppm) range. The reagent contains both a reducing and a complexing agent: the first converts all but the most resistant forms of iron present in the sample to the ferrous (Fe^{2+}) or soluble state; the second reacts with the ferrous iron to form the characteristic orange-colored complex.

Both meters use an exclusive positive-locking system to ensure that the cuvette is in the same position every time it is placed into the measurement cell. It is designed to fit a cuvette with a larger neck, making it easier to add both sample and reagents. The cuvette is made from special optical glass to obtain the best results.

For HI96746, the reaction between iron and the reagent causes a violet tint in the sample. For HI96721, the reaction between iron and phenolntroline reagent causes an orange tint in the sample.

Specifications	HI96746 Iron LR	HI96721 Iron HR
Range	0.00 to 1.60 mg/L (ppm)	0.00 to 5.00 mg/L (ppm)
Resolution	0.01 mg/L	0.01 mg/L
Accuracy @ 25°C (77°F)	±0.01 mg/L ±8% of reading	±0.04 mg/L ±2% of reading
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the TPTZ method	adaptation of the USEPA method 315B (phenanthroline) and Standard Method 3500-Fe B
Ordering Information	**HI96746** and **HI96721** are supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instructions. CAL Check™ standards and testing reagents sold separately **HI96746C** and **HI96721C** includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, scissors, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately	

Reagents and Standards			
	HI96746	**HI96746-11**	CAL Check™ standard cuvettes
		HI93746-01	liquid reagents for 50 tests
		HI93746-03	liquid reagents for 150 tests
	HI96721	**HI96721-11**	CAL Check™ standard cuvettes
		HI93721-01	powder reagents for 100 tests
		HI93721-03	powder reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96748 • HI96709

Manganese Portable Photometers

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Manganese is one of the most common metals present in nature and is used in many industrial applications, for example, the production of fertilizers and in the pharmaceutical industry.

Manganese salts are also used in iron alloys (steel manufacturing) and non-iron alloys as it improves their corrosion resistance and hardness.

The HI96748 measures the low range manganese content in water and wastewater in the 0 to 300 µg/L (ppb) range.

The HI96709 measures the high range manganese content in water and wastewater in the 0.0 to 20.0 mg/L (ppm) range.

Both meters use an exclusive positive-locking system to ensure that the cuvette is in the same position every time it is placed into the measurement cell. It is designed to fit a cuvette with a larger neck, making it easier to add both sample and reagents. The cuvette is made from special optical glass to obtain the best results.

For the HI96748, the reaction between manganese and reagent causes an orange tint. For the HI96709, the reaction between manganese and the reagent causes a violet tint in the sample.

Specifications	HI96748 Manganese, LR	HI96709 Manganese, HR
Range	0 to 300 µg/L (ppb)	0.0 to 20.0 mg/L (ppm)
Resolution	1 µg/L	0.1 mg/L
Accuracy @ 25°C (77°F)	±10 µg/L ±3% of reading	±0.2 mg/L ±3% of reading
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the 1-(2-pyridylazo)-2-naphtol PAN method	adaptation of Standard Methods for the Examination of Water and Wastewater, 18th edition, Periodate method
Ordering Information	**HI96748** and **HI96709** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96748C** and **HI96709C** includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, scissors, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately	

Reagents and Standards			
	HI96748	**HI96748-11**	CAL Check™ standard cuvettes
		HI93748-01	liquid reagents for 50 tests
		HI93748-03	liquid reagents for 150 tests
	HI96709	**HI96709-11**	CAL Check™ standard cuvettes
		HI93709-01	liquid reagents for 100 tests
		HI93709-03	liquid reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96759

Maple Syrup Portable Photometer

- Ideal for new Vermont (IMSI) standards
- USDA compliant
- GLP Features
  - Meets Good Laboratory Practices

Application Designed Photometers

The HI96759 handheld maple syrup transmittance analyzer is a high precision, USDA compliant photometer that brings judging "by eye" to an end.

The HI96759 measures the percent light transmittance of maple syrup as compared to analytical reagent glycerol. The transmittance value allows identification of syrup quality class.

A very light syrup color is the indicator of high grade. The difference in the transmittance of light of very light syrup and a glycerol standard will be negligible. A dark-colored syrup is graded lower than a light-colored syrup. The dark-colored syrup will allow less light to pass through the cuvette as compared to glycerol standard.

Maple Syrup Quality

When selecting a maple syrup, it is important to consider its clarity along with color and taste. A light, clear syrup has a high level of quality and is indicative of a very pure product; a dark, cloudy syrup is less desirable, owing to the presence of impurities and suspended solids. In Canada and the United States, maple syrup is classified into different standards based on color and clarity. Lighter, clearer syrups are produced earlier in the season while darker syrups are produced later in the season. The lightest grade is characterized by its very pale color and has a light transmittance of over 75%. The darkest grade has a light transmittance of less than 25% (27%, non-IMSI standards).

The grade of maple syrup can be determined by using color comparators or by measuring how much light is transmitted through the syrup. Hanna provides the HI96759 handheld maple syrup transmittance analyzer, which compares the percentage of light that passes through the sample to that of a glycerol reagent. With its advanced optical system, the highly precise meter eliminates subjectivity to provide readings that are accurate and repeatable.

Range (% Transmittance)	United States, USDA	Range (% Transmittance)	State of Vermont Grades and Standards (New IMSI* standards)
75.0 to 100.0	grade A light amber	75.0 to 100.0	grade A golden color/delicate taste
60.5 to 74.9	grade A medium amber	50 to 74.9	grade A amber color/rich taste
44.0 to 60.4	grade A dark amber		
27 to 43.9	grade B extra dark	25 to 49.9	grade A dark color/robust taste
Less than 27	commercial	less than 25	grade A very dark color/strong taste

Specifications	HI96759	
Range	0.0 to 100.0% transmittance	
Resolution	0.1% transmittance	
Accuracy @ 25°C (77°F)	±3% @ 75.0% transmittance	
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter 560 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	direct measure	
Ordering Information	**HI96759** are supplied with square sample cuvettes (6), light shield cap, 5 mL syringes (2), 30 mL bottle of glycerol, cuvette wiping cloth, 9V battery, instrument quality certificate, instruction manual and rigid carrying case.	
Solutions and Accessories	**HI93703-57**	glycerol, (4) 30 mL
	HI93703-50	cuvette cleaning solution, 230 mL
	HI93703-56	consists of 82 matched square cuvettes, glycerol standard(30 mL) and 5 mL syringes (2) (75 tests average)

*International Maple Syrup Institute

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96730

Molybdenum Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

The HI96730 measures the molybdenum content in water and wastewater. The meter uses an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

The cuvette has a very important role because it is an optical element and thus requires particular attention. It is important that both the measurement and the calibration (zeroing) cuvettes are optically identical to provide the same measurement conditions. Whenever possible, use the same cuvette for both. It is necessary that the surface of the cuvette is clean and not scratched to avoid interference due to unwanted reflection and absorption of light. It is recommended not to touch the cuvette walls with hands.

Furthermore, in order to maintain the same conditions during the zeroing and the measuring phases, it is necessary to close the cuvette to prevent any contamination.

The reaction between molybdenum and the reagent causes a yellow tint in the sample.

Specifications	HI96730 Molybdenum	
Range	0.0 to 40.0 mg/L (ppm)	
Resolution	0.1 mg/L	
Accuracy @ 25°C (77°F)	±0.3 mg/L ±5% of reading	
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 420 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the mercaptacetic acid method	
Ordering Information	**HI96730** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual CAL Check™ standards and testing reagents sold separately	
Reagents and Standards	**HI96730-11**	CAL Check™ standard cuvettes
	HI93730-01	reagents for 100 tests
	HI93730-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96740 • HI96726

Nickel Portable Photometers

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Nickel is commonly utilized by the electroplating industry in processes utilizing stainless steel, cobalt or nickel alloys.

Nickel is also used in batteries, fuel cells and hydrogenation of vegetable oils in the food industry.

The HI96726 and HI96740 meters measure the nickel content in water and wastewater. Both meters use an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

The cuvette has a very important role because it is an optical element and thus requires particular attention. It is important that both the measurement and the calibration (zeroing) cuvettes are optically identical to provide the same measurement conditions.

For HI96740, the reaction between nickel and the reagent causes an orange tint. For HI96726, the reaction between nickel and the reagent causes a blue tint in the sample.

Specifications	HI96740 Nickel LR	HI96726 Nickel HR
Range	0.000 to 1.000 mg/L (ppm)	0.00 to 7.00 g/L
Resolution	0.001 mg/L	0.01 g/L
Accuracy @ 25°C (77°F)	±0.010 mg/L ±7% of reading	±0.07 mg/L ±4% of reading
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 575 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 102 x 67 mm (7.6 x 4.4 x 2.6")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the 1-(2-pyridylazo)-2-naphtol PAN method	adaptation of the photometric method

Ordering Information	**HI96726** and **HI96740** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96726C** and **HI96740C** include photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, scissors, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately		
Reagents and Standards	HI96740	**HI96740-11**	CAL Check™ standard cuvettes
		HI93740-01	reagents for 50 tests
		HI93740-03	reagents for 150 tests
	HI96726	**HI96726-11**	CAL Check™ standard cuvettes
		HI93726-01	reagents for 100 tests
		HI93726-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96728 • HI96786

Nitrate Portable Photometers

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Nitrogen is abundant in the Earth's atmosphere and is present in water in the form of nitrate, nitrite and ammonia. Plants use nitrogen as a nutrient to build proteins by tracking it in through their root system. Nitrate is formed in water mainly through rainfall, decomposition of organic matter, and runoff from man-made pollutants such as sewage waste and fertilizers.

Almost all the surface waters have some measurable level of nitrate, and a moderate amount is considered beneficial. Large amounts of nitrate, however, can lead to eutrophication which may result in decreased levels of dissolved oxygen in the water.

A maximum level of 45 mg/L (ppm) is established as a worldwide guideline for nitrate concentration in water. In Europe, the maximum consented level of nitrates in potable water is 50.0 mg/L (ppm), while in the USA, the EPA has established a guideline for the maximum level of nitrate–nitrogen of 10 mg/L (NO_3^--N), which corresponds to 45.0 mg/L of nitrates.

The HI96728 and HI96786 meters measure the nitrate content in water and wastewater.

Both meters use an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

Specifications	HI96728 Nitrate-Nitrogen	HI96786 Nitrate
Range	0.0 to 30.0 mg/L (ppm)	0 to 100 mg/L (ppm)
Resolution	0.1 mg/L	1 mg/L
Accuracy @ 25°C (77°F)	±0.5 mg/L ±10% of reading	±5 mg/L ±5% of reading
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of cadmium reaction method causes amber tint in sample	
Ordering Information	**HI96728** and **HI96786** are supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96728C** and **HI76786C** include photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, scissors, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately	

Reagents and Standards			
	HI96728	**HI96728-11**	CAL Check™ standard cuvettes
		HI93728-01	reagents for 100 tests
		HI93728-03	reagents for 300 tests
	HI96786	**HI96786-11**	CAL Check™ standard cuvettes
		HI93728-01	reagents for 100 tests
		HI93728-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96707 • HI96708

Nitrite Portable Photometers

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Nitrites can be harmful to aquatic organisms even in low concentrations and for this reason, they are closely monitored in aquaculture facilities. In cooling towers, however, an adequate amount of nitrites is necessary to prevent corrosion.

In high concentrations, they can be harmful to the environment and to humans. They are, therefore, normally monitored to verify the quality of water for domestic use, as well as lakes and ponds.

Nitrites are an intermediate product in the nitrogen cycle and are produced by ammonia oxidation with water, or even originate in industrial waste directly. They must not be present in drinking water.

The HI96707 measures the Nitrite-nitrogen content in the 0.000 to 0.600 mg/L (ppm) range, in drinking, surface and saline water samples and in domestic and industrial wastes.

The HI96708 meter measures the nitrite content in water and wastewater in the 0 to 150 mg/L (ppm) range.

Both meters use an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

Specifications	HI96707 Nitrite, LR	HI96708 Nitrite, HR
Range	0.000 to 0.600 mg/L (ppm)	0 to 150 mg/L (ppm)
Resolution	0.001 mg/L	1 mg/L
Accuracy @ 25°C (77°F)	±0.020 mg/L ±4% of reading	±4 mg/L ±4% of reading
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 525 nm	silicon photocell with narrow band interference filter @ 575 nm
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of an EPA approved diazotization method	adaptation of the Ferrous Sulfate method

Ordering Information

HI96707 and **HI96708** are supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual.

CAL Check™ standards and testing reagents sold separately

HI96707C and **HI96708C** include photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, scissors, cuvette wiping cloth, instrument quality certificate, Nist traceable, instruction manual and rigid carrying case.

Reagents sold separately

Reagents and Standards

HI96707	**HI96707-11**	CAL Check™ standard cuvettes
	HI93707-01	powder reagents for 100 tests
	HI93707-03	powder reagents for 300 tests
HI96708	**HI96708-11**	CAL Check™ standard cuvettes
	HI93708-01	reagents for 100 tests
	HI93708-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96732

Dissolved Oxygen Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Dissolved oxygen analysis measures the amount of gaseous oxygen (O_2) dissolved in an aqueous solution. Dissolved oxygen is one of the most important parameters in aquatic systems. This gas is required for metabolism by aerobic organisms and also influences inorganic chemical reactions. Therefore, knowledge of the solubility and dynamics of oxygen distribution is essential to interpreting both biological and chemical processes within water bodies. Oxygen gets into water by diffusion from the surrounding air by aeration (rapid movement) and as a product of photosynthesis. The amount of oxygen (or any gas) that can dissolve in pure water (saturation point) is inversely proportional to the temperature of the water; the warmer the water, the less dissolved oxygen is present.

In aquaculture, dissolved oxygen is arguably the most important parameter of water quality. Most species require a minimum of 3 mg/L (ppm) DO, 8-10 mg/L (ppm) is preferable. Unlike other gases such as nitrogen, oxygen supersaturation doesn't usually result in gas bubble disease ("pop-eye"), so high levels generally aren't an issue.

The HI96732 measures the content of dissolved oxygen in surface, feed, natural and wastewaters in the 0.0 to 10.0 mg/L (ppm) range.

The HI96732 uses an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

Specifications	HI96732 Oxygen, Dissolved	
Range	0.0 to 10.0 mg/L (ppm)	
Resolution	0.1 mg/L	
Accuracy @ 25°C (77°F)	±0.4 mg/L ±3% of reading	
Light Source	light emitting diode	
Light Detector	silicon photocell with narrow band interference filter @ 466 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	Adaptation of Standard Methods for Examination of Water and Wastewater (18th edition) Azide modified Winkler method reaction causes a yellow tint in sample	
Ordering Information	**HI96732** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual CAL Check™ standards and testing reagents sold separately	
Reagents and Standards	**HI96732-11**	CAL Check™ standard cuvettes
	HI93732-01	reagents for 100 tests
	HI93732-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96713 • HI96717

Phosphate Portable Photometers

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Phosphates are present in a number of products that are used by humans everyday. Some examples of the effects of phosphates are enhancing the flavor and tartness of cola drinks, as a buffering agent in controlling pH in antifreeze and delaying darkening of cut potatoes used in making french fries.

Phosphates are also extensively used in detergents and cleaning fluids because of their ability to soften water and remove soil deposits.

The largest use of phosphates is in the conversion of the mineral apatite, which is a mixture of calcium phosphate and other calcium compounds that are used in fertilizers.

Phosphates are particularly important for the growth and development of plant roots, and hence are one of the most common fertilizers used in agriculture.

However, high concentrations of phosphates in agricultural runoff can cause environmental pollution, as they are a primary cause of eutrophication. Local laws govern the use of phosphates and the discharge levels into streams.

Phosphates are also utilized in detergents and are needed in small quantities for heating systems.

For these reasons, it is necessary to closely monitor the phosphate levels present in both municipal and industrial wastewater.

The HI96713 measures phosphate (PO_4^{3-}) content in water, wastewater and sea water in the 0.00 to 2.50 mg/L (ppm) range.

The HI96717 measures percent phosphate (PO_4^{3-}) content in water samples in the 0.0 to 30.0 mg/L (ppm) range.

Specifications	HI96713 Phosphate LR	HI96717 Phosphate HR
Range	0.00 to 2.50 mg/L (ppm)	0.0 to 30.0 mg/L (ppm)
Resolution	0.01 mg/L	0.1 mg/L
Accuracy @ 25°C (77°F)	±0.04 mg/L ±4% of reading	±1.0 mg/L ±4% of reading
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 610 nm	silicon photocell with narrow band interference filter @ 525 nm
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the ascorbic acid method	Amino Acid Method, adapted from Standard Method for the Examination of Water and Wastewater

Ordering Information	**HI96713** and **HI96717** are supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96713C** and **HI96717C** include photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, scissors, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately		
Reagents and Standards	HI96713	**HI96713-11**	CAL Check™ standard cuvettes
		HI93713-01	reagents for 100 tests
		HI93713-03	reagents for 300 tests
	HI96717	**HI96717-11**	CAL Check™ standard cuvettes
		HI93717-01	reagents for 100 tests
		HI93717-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96706

Phosphorus Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Phosphorus in water is monitored because it causes corrosion when present at high levels. It is also an essential parameter for the growth of microorganisms and algae, which are often unwanted in tanks and reserves of water.

Phosphorus is also an essential element for plant growth, and for this reason, is needed in large amounts.

The HI96706 measures the phosphorus (P) content in water samples in the 0.0 to 15.0 mg/L (ppm) range.

The HI96706 uses an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

Specifications	HI96706 Phosphorus	
Range	0.0 to 15.0 mg/L (ppm)	
Resolution	0.1 mg/L	
Accuracy @ 25°C (77°F)	± 0.3 mg/L ±4% of reading	
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	Amino Acid Method, adapted from Standard Method for the Examination of Water and Wastewater	
Ordering Information	**HI96706** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual CAL Check™ standards and testing reagents sold separately **HI96706C** includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, scissors, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately	
Reagents and Standards	**HI96706-11**	CAL Check™ standard cuvettes
	HI93706-01	reagents for 100 tests
	HI93706-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96750

Potassium Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Potassium, a chemical element, is commonly found in nature. It is present in soil and drinking water and is also an essential element for the growth of plants and animals.

Potassium concentration is important in determining the quality of soil in many greenhouse, agriculture and horticulture applications. Potassium salts are also a common component of fertilizers.

The HI96750 measures the potassium (K) content in water samples in the 0.0 to 10.0 mg/L (ppm) for low range and 10 to 100 mg/L (ppm) for medium range. The HI96750 uses the Tetraphenylborate Method. The reaction between potassium and reagents causes turbidity in the sample.

The HI96750 uses an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

Specifications	HI96750 Potassium	
	Potassium LR (P1)	Potassium MR (P2)
Range	0.0 to 10.0 mg/L (ppm)	10 to 100 mg/L (ppm)
Resolution	0.1 mg/L	1 mg/L
Accuracy @ 25°C (77°F)	±1.5 mg/L ±7% of reading	±15 mg/L ±7% of reading
Light Source	light emitting diode	
Light Detector	silicon photocell with narrow band interference filter @ 466 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	Tetraphenylborate method causes turbidity in the sample	
Ordering Information	**HI96750** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96750C** includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, 1000 mL automatic pipette, tips, scissors, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately	
Reagents and Standards	**HI96750-11**	CAL Check™ standard cuvettes
	HI93750-01	reagents for 100 tests
	HI93750-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96705 • HI96770

Silica Portable Photometers

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Silica is found in all natural waters in the dissolved mineral form. Silica is only slightly soluble in water; solubility, and therefore the form of silica in water, depends on the pH level of the water and on the minerals containing silica in contact with water.

Silica's presence in industrial applications is undesirable since it causes scaling. In particular, high pressure turbines are highly affected by this factor. Heating systems and reverse osmosis plants also require monitoring of silica.

The HI96705 meter measures the silica (SiO_2) content in water and wastewater in the 0.00 to 2.00 mg/L (ppm) range. The HI96770 measures silica (SiO_2) content from 0 to 200 mg/L (ppm).

Specifications	HI96705 Silica		HI96770 Silica HR
Range	0.00 to 2.00 mg/L (ppm)		0 to 200 mg/L (ppm)
Resolution	0.01 mg/L		1 mg/L
Accuracy @ 25°C (77°F)	±0.03 mg/L ±3% of reading		±1 mg/L ±5% of reading
Light Source	tungsten lamp		light emitting diode
Light Detector	silicon photocell with narrow band interference filter @ 610 nm		silicon photocell with narrow band interference filter @ 466 nm
Power Supply	9V battery		
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder		
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing		
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")		
Weight	360 g (12.7 oz.)		
Method	adaptation of the ASTM D859, heteropoly blue method		adaptation of the USEPA method 370.1 for drinking, surface and saline waters, domestic and industrial wastes and Standard Method 4500-SiO_2 C
Ordering Information	**HI96705** and **HI96770** are supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instructions. CAL Check™ standards and testing reagents sold separately **HI96705C** and **HI96770C** include photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, scissors, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately		
Reagents and Standards	HI96705	**HI96705-11**	CAL Check™ standard cuvettes
		HI93705-01	reagents for 100 tests
		HI93705-03	reagents for 300 tests
	HI96770	**HI96770-11**	CAL Check™ standard cuvettes
		HI93770-01	reagents for 100 tests
		HI96770-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96737

Silver Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Small quantities of silver are bacteriostatic; and it is at times used in disinfection of pools and spas, as well as in water filters.

The presence of silver in water is generally indicative of pollution, mainly from film manufacturers, film processors and surface finishers. In fact, silver levels are closely monitored in these sectors since its presence can cause discoloration of the skin, eyes and mucous membranes.

The HI96737 measures the silver content in water and wastewater in the 0.000 to 1.000 mg/L (ppm) range.

This instrument uses an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

The cuvette has a very important role because it is an optical element, and thus, requires particular attention. It is important that both the measurement and the blank (zeroing) cuvettes are optically identical to provide the same measurement conditions.

Specifications	HI96737 Silver	
Range	0.000 to 1.000 mg/L (ppm)	
Resolution	0.001 mg/L	
Accuracy @ 25°C (77°F)	±0.005 mg/L ±10% of reading	
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 575 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the PAN method	
Ordering Information	**HI96737** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately	
Reagents and Standards	**HI96737-11**	CAL Check™ standard cuvettes
	HI93737-01	reagents for 50 tests
	HI93737-03	reagents for 150 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96751

Sulfate Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Sulfate is widely present within natural waters in different concentrations. Sulfate concentration is to be kept within a strict range for drinking water, especially since this value can be high near mine drainage points.

Sulfate is also rigorously tested in the production of beverages such as beer, due to its significant effect upon odor and taste.

The HI96751 measures the sulfate content in water samples in the 0 to 150 mg/L (ppm) range. The method to measure sulfate is by measuring precipitate formed when barium chloride is added to the solution.

The instrument uses an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

The cuvette has an important role because it is an optical element, and thus, requires particular attention. It is important that both the measurement and the blank (zeroing) cuvettes are optically identical to provide the same measuring conditions.

Specifications	HI96751 Sulfate	
Range	0 to 150 mg/L (ppm)	
Resolution	1 mg/L	
Accuracy @ 25°C (77°F)	±1 mg/L ±5% of reading	
Light Source	light emitting diode	
Light Detector	silicon photocell with narrow band interference filter @ 466 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the turbidimetric method; sulfate is precipitated with barium chloride crystals and light absorbance of the suspension is measured	
Ordering Information	**HI96751** is supplied with sample cuvettes with caps (2), 9V battery, instrument quality certificate and instructions. CAL Check™ standards and testing reagents sold separately **HI96751C** includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, scissors, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately	
Reagents and Standards	**HI96751-11**	CAL Check™ standard cuvettes
	HI93751-01	reagents for 100 tests
	HI93751-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96731

Zinc Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Zinc is normally introduced into drinking water through industrial effluents, especially due to dezincification of brass and deterioration of galvanized iron.

In addition to drinking water, zinc is measured in surface finishing, boilers and cooling towers, water conditioning and effluent waters.

The HI96731 measures the zinc content in water and wastewater in the 0.00 to 3.00 mg/L (ppm) range.

The meter uses an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

The cuvette has a very important role because it is an optical element, and thus, requires particular attention. It is important that both the measurement and the blank (zeroing) cuvettes are optically identical to provide the same measurement conditions.

Specifications	HI96731 Zinc	
Range	0.00 to 3.00 mg/L (ppm)	
Resolution	0.01 mg/L	
Accuracy @ 25°C (77°F)	±0.03 mg/L ±3% of reading	
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 575 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the Standard Methods for the Examination of Water and Wastewater, 20th edition, Zincon method causes a brownish-green tint in the sample	
Ordering Information	**HI96731** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. **HI96731C** includes HI96731 photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, scissors, cuvette wiping cloth, instrument quality certificate, instruction manual and rigid carrying case. CAL Check™ standards and testing reagents sold separately	
Reagents and Standards	**HI96731-11**	CAL Check™ standard cuvettes
	HI93731-01	reagents for 100 tests
	HI93731-03	reagents for 300 tests

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96101

Bromine, Chlorine, Cyanuric Acid, Iron Iodine and pH Portable Photometer

- CAL Check™
  - Alerts users of calibration status
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Bromine, Free and Total Chlorine, Cyanuric Acid, Iron, Iodine and pH content in water and wastewater samples. The reagents are in powder and liquid form depending on the parameter, and are supplied in dropper bottles and packets.

The meter uses an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

The cuvette has a very important role because it is an optical element, and thus, requires particular attention. It is important that both the measurement and blank (zeroing) cuvettes are optically identical to provide the same measuring conditions.

Specifications

HI96101 Bromine, Chlorine, Cyanuric Acid, Iodine, Iron LR and pH

Parameter Specifications		**pH (P1)**	**Chlorine [Free (P2) & Total (P3)]**
	Range	6.5 to 8.5 pH	0.00 to 5.00 mg/L (ppm)
	Resolution	0.1 pH	0.01 mg/L under 3.50 mg/L; 0.10 mg/L over 3.50 mg/L
	Accuracy @ 25°C (77°F)	±0.1 pH	±0.03 mg/L ±3% of reading
		Cyanuric Acid (P4)	**Iodine (P5)**
	Range	0 to 80 mg/L (ppm)	0.0 to 12.5 mg/L (ppm)
	Resolution	1 mg/L	0.1 mg/L
	Accuracy @ 25°C (77°F)	±1 mg/L ±15% of reading	±0.1 mg/L ±5% of reading
		Bromine (P6)	**Iron LR (P7)**
	Range	0.00 to 10.00 mg/L (ppm)	0.00 to 1.60 mg/L (ppm)
	Resolution	0.01 mg/L	0.01 mg/L
	Accuracy @ 25°C (77°F)	±0.08 mg/L ±3% of reading	±0.01 mg/L ±8% or reading
Additional Specifications	Light Source	tungsten lamp	
	Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
	Power Supply	9V battery	
	Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
	Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
	Weight	360 g (12.6 oz.)	
	Method	**Bromine:** adaptation of the EPA, DPD method; **Chlorine:** adaptation of the USEPA method and Standard Method 4500-Cl G; **Cyanuric Acid:** adaptation of the turbidimetric method; **Iodine:** adaptation of the EPA, DPD method; **Iron LR:** adaptation of the TPTZ method; **pH:** Phenol Red method	

Ordering Information

HI96101 is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual.

CAL Check™ standards and testing reagents sold separately

HI96101C includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, scissors, cuvette wiping cloth, 9V battery, instruction manual and rigid carrying case.

Reagents sold separately

Reagents and Standards

HI96701-11	CAL Check™ standard cuvettes (free Cl)
HI93701-01	reagents for 100 tests (free Cl)
HI96710-11	CAL Check™ standard cuvettes (pH)
HI93710-01	reagents for 100 tests (pH)
HI96711-11	CAL Check™ standard cuvettes (total Cl)
HI93711-01	reagents for 100 tests (total Cl)
HI96716-11	CAL Check™ standard cuvettes (bromine)
HI93716-01	reagents for 100 tests (bromine)
HI96718-11	CAL Check™ standard cuvettes (iodine)
HI93718-01	reagents for 100 tests (iodine)
HI96722-11	CAL Check™ standard cuvettes (cyanuric acid)
HI93722-01	reagents for 100 tests (cyanuric acid)
HI96746-11	CAL Check™ standard cuvettes (iron)
HI93746-01	reagents for 50 tests (iron)

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96104

pH, Free and Total Chlorine and Cyanuric Acid Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Specifically designed for swimming pool and spa applications, the HI96104 measures pH, free and total chlorine and cyanuric acid content. Chlorine is the most common water disinfectant used in many swimming pools and spas.

In swimming pools, spas and similar applications, cyanuric acid helps to stabilize the chlorine and prevent breakdown of chlorine, especially in sunlight. Frequent testing of both cyanuric acid and pH will help to minimize chlorine consumption.

The reagents are in powder and liquid form depending on the parameter and are supplied in dropper bottles and packets.

Reagents and Standards

HI96701-11	CAL Check™ standard cuvettes (free Cl)
HI93701-01	reagents for 100 tests (free Cl)
HI93701-03	reagents for 300 tests (free Cl)
HI96710-11	CAL Check™ standard cuvettes (pH)
HI93710-01	reagents for 100 tests (pH)
HI93710-03	reagents for 300 tests (pH)
HI96711-11	CAL Check™ standard cuvettes (total Cl)
HI93711-01	reagents for 100 tests (total Cl)
HI93711-03	reagents for 300 tests (total Cl)
HI96722-11	CAL Check™ standard cuvettes (cyanuric acid)
HI93722-01	reagents for 100 tests (cyanuric acid)
HI93722-03	reagents for 300 tests (cyanuric acid)

Specifications — HI96104 pH, Chlorine and Cyanuric Acid

Parameter Specifications		**pH (P1)**	**Cl, Free (P2)**
	Range	6.5 to 8.5 pH	0.00 to 5.00 mg/L (ppm)
	Resolution	0.1 pH	0.01 mg/L under 3.50 mg/L; 0.10 mg/L above 3.50 mg/L
	Accuracy @ 25°C (77°F)	±0.1 pH	±0.03 mg/L (ppm) ±3% of reading
		Chlorine, Total (P3)	**Cyanuric Acid (P4)**
	Range	0.00 to 5.00mg/L (ppm)	0 to 80 mg/L (ppm)
	Resolution	0.01 mg/L under 3.50 mg/L; 0.10 mg/L above 3.50 mg/L	1 mg/L
	Accuracy @ 25°C (77°F)	±0.03 mg/L ±3% of reading	±1 mg/L ±15% of reading
Additional Specifications	Light Source	tungsten lamp	
	Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
	Power Supply	9V battery	
	Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
	Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
	Weight	360 g (12.7 oz.)	
	Method	**pH:** phenol red method; **Cl:** adaptation of the EPA recommended DPD method 330.5; **Cyanuric Acid:** adaptation of the Turbidimetric method	

Ordering Information

HI96104 is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual.

CAL Check™ standards and testing reagents sold separately

HI96104C includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, scissors, cuvette wiping cloth, 9V battery, instruction manual and rigid carrying case.

Reagents sold separately

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96725

Chlorine, Cyanuric Acid and pH Portable Photometer

for Legionella Protection

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

The HI96725 measures 4 parameters that are crucial in monitoring for preventive maintenance or disinfection.

Legionella species is the agent that causes human Legionnaires' disease as well as the lesser form, Pontiac Fever. Transmission is facilitated by the inhalation of mist droplets containing the Legionella bacteria.

Common sources of Legionella include cooling towers used in industrial cooling water systems as well as in large central air conditioning systems, domestic hot water systems, fountains, and similar disseminators that draw from a public water supply. Natural sources include freshwater ponds and creeks.

Since Legionella is especially harmful to people with weakened immune systems, it should be actively checked for in the water systems of hospitals and nursing homes.

Specifications

		HI96725 Chlorine, Cyanuric Acid and pH	
Parameter Specifications		**Chlorine, Free (P1)**	**Chlorine, Total (P2)**
	Range	0.00 to 5.00 mg/L (ppm)	0.00 to 5.00 mg/L (ppm)
	Resolution	0.01 mg/L under 3.50 mg/L; 0.10 mg/L above 3.50 mg/L	0.01 mg/L under 3.50 mg/L; 0.10 mg/L above 3.50 mg/L
	Accuracy @ 25°C (77°F)	±0.03 mg/L ±3% of reading	±0.03 mg/L ±3% of reading
		Cyanuric Acid (P3)	**pH (P4)**
	Range	0 to 80 mg/L (ppm)	6.5 to 8.5 pH
	Resolution	1 mg/L	0.1 pH
	Accuracy @ 25°C (77°F)	±1 mg/L ±15% of reading	±0.1 pH
Additional Specifications	Light Source	tungsten lamp	
	Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
	Power Supply	9V battery	
	Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
	Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
	Weight	360 g (12.7 oz.)	
	Method	**Chlorine:** adaptation of the EPA recommended DPD method 330.5; **Cyanuric Acid:** adaptation of the Turbidimetric method; **pH:** Phenol Red method	

Ordering Information

HI96725 is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual.
CAL Check™ standards and testing reagents sold separately

HI96725C includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, scissors, cuvette cleaning cloth, 9V battery, instruction manual and rigid carrying case.
Reagents sold separately

Reagents and Standards

HI96701-11	CAL Check™ standard cuvettes (free Cl)
HI93701-01	reagents for 100 tests (free Cl)
HI93701-03	reagents for 300 tests (free Cl)
HI96710-11	CAL Check™ standard cuvettes (pH)
HI93710-01	reagents for 100 tests (pH)
HI93710-03	reagents for 300 tests (pH)
HI96711-11	CAL Check™ standard cuvettes (total Cl)
HI93711-01	reagents for 100 tests (total Cl)
HI93711-03	reagents for 300 tests (total Cl)
HI96722-11	CAL Check™ standard cuvettes (cyanuric acid)
HI93722-01	reagents for 100 tests (cyanuric acid)
HI93722-03	reagents for 300 tests (cyanuric acid)

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96710

Free and Total Chlorine and pH Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Hanna has developed the HI96710 to measure pH, free chlorine and total chlorine – three critical parameters to ensure good water quality.

In swimming pools, spas and similar applications, Cyanuric Acid helps to stabilize the chlorine and prevent its breakdown, especially in sunlight. Frequent testing of both cyanuric acid and pH will help to minimize chlorine consumption.

Chlorine combines with water to form hypochlorous acid (HOCl) and hydrochloric acid.

$$Cl_2 + H_2O \longleftrightarrow HOCl + HCl$$

It is the hypochlorous acid produced in the reaction that provides the disinfecting and potent oxidant oxidizing characteristic of chorine solutions. The amount of hypochlorous acid produced in chlorinated water is highly dependent upon the pH value of the solution.

$$\underset{\text{hypochlorous acid}}{HOCl} \longleftrightarrow \underset{\text{hygrogen ion}}{H^+} + \underset{\text{hypochlorite}}{OCl^-}$$

The HOCl is in equilibrium with hydrogen ion and the hypochlorite ion (OCl^-); Any changes in the pH of the solution will cause equilibrium to change. HOCl decreases in OCl^- increases as the pH increases. At low pH, almost all the free chlorine is of the molecular form HOCl; at a pH of around 7.5, the ratio between HOCl and OCl^- is 50:50.

The ionic form of chlorine (OCl^-) hypochlorite is a slow-acting sanitizer, while the molecular form is a fast-acting sanitizer, since HOCl acts 80 to 100 times faster than OCl^-.

pH	Molecular Chlorine	Hypochlorous Acid	Hypochlorite Ion
Effect of pH on the hypochlorous acid present in water			
4	0.5	99.5	0
5	0	99.5	0.5
6	0	96.5	3.5
7	0	72.5	27.5
8	0	21.5	78.5
9	0	1.0	99.0
10	0	0.1	99.9

Specifications — HI96710 Free and Total Chlorine and pH

		pH (P1)	Chlorine, Free (P2)	Chlorine, Total (P3)
Parameter Specifications	Range	6.5 to 8.5 pH	0.00 to 5.00 mg/L (ppm)	
	Resolution	0.1 pH	0.01 mg/L under 3.50 mg/L 0.10 mg/L above 3.50 mg/L	
	Accuracy @ 25°C (77°F)	±0.1 pH	±0.03 mg/L ±3% of reading	
Additional Specifications	Light Source	tungsten lamp		
	Light Detector	silicon photocell with narrow band interference filter @ 525 nm		
	Power Supply	9V battery		
	Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder		
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing		
	Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")		
	Weight	360 g (12.6 oz.)		
	Method	**pH:** phenol red method; **Chlorine:** adaptation of the EPA recommended DPD method		

Ordering Information

HI96710 is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual.
CAL Check™ standards and testing reagents sold separately

HI96710C includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, scissors, cuvette wiping cloth, 9V battery, instruction manual and rigid carrying case.
Reagents sold separately

Reagents and Standards

HI96701-11	CAL Check™ standard cuvettes (free Cl)	**HI93710-03**	Reagents for 300 tests (pH)
HI93701-01	powder reagents for 100 tests (free Cl)	**HI96711-11**	CAL Check™ standard cuvettes (total Cl)
HI93701-03	powder reagents for 300 tests (free Cl)	**HI93711-01**	Reagents for 100 tests (total Cl)
HI96710-11	CAL Check™ standard cuvettes (pH)	**HI93711-03**	Reagents for 300 tests (total Cl)
HI93710-01	reagents for 100 tests (pH)		

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96711

Chlorine, Free and Total Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

The HI96711 meter measures the free and total chlorine (Cl_2) portable parameters content in water and wastewater.

This meter uses an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

Specifications — HI96711 Free and Total Chlorine

Range	**Chlorine, Free (P1)**	**Chlorine, Total (P2)**	
	0.00 to 5.00 mg/L (ppm)		
Resolution	0.01 mg/L from 0.00 to 3.50 mg/L (ppm); 0.10 mg/L above 3.50 mg/L (ppm)		
Accuracy @ 25°C (77°F)	±0.03 mg/L ±3% of reading		
Light Source	tungsten lamp		
Light Detector	silicon photocell with narrow band interference filter @ 525 nm		
Power Supply	9V battery		
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder		
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing		
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")		
Weight	360 g (12.7 oz.)		
Method	adaptation of the USEPA method 330.5 and Standard Method 4500-Cl G		
Ordering Information	**HI96711** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96711C** includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, scissors, cuvette cleaning cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately		
Reagents and Standards	HI96711	**HI96701-11**	CAL Check™ standard cuvettes (free Cl)
		HI93701-01	reagents for 100 tests (free Cl)
		HI93701-03	reagents for 300 tests (free Cl)
		HI96711-11	CAL Check™ standard cuvettes (total Cl)
		HI93711-01	reagents for 100 tests (total Cl)
		HI93711-03	reagents for 300 tests (total Cl)

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96724

Free and Total Chlorine Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

The HI96724 measures the free and total chlorine content in water samples in the 0.00 to 5.00 mg/L (ppm) range. The method is an adaptation of the USEPA Method 330.5 for wastewater, and Standard Method 4500-CL G for drinking water, both of which use DPD to react with the sample.

The HI 96724 incorporates an advanced optical system based on a special tungsten lamp and a narrow band interference filter that allows the most accurate and repeatable readings. The instrument is factory calibrated, and the electronic and optical design minimizes the need for frequent calibration.

The meter uses an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

The cuvette has a very important role because it is an optical element, and thus, requires particular attention. It is important that both the measurement and blank (zeroing) cuvettes are optically identical to provide the same measuring conditions.

Specifications	HI96724 Free and Total Chlorine	
Range	0.00 to 5.00 mg/L (ppm)	
Resolution	0.01 mg/L from 0.00 to 3.50 mg/L; 0.10 mg/L above 3.50 mg/L	
Accuracy @ 25°C (77°F)	±0.03 mg/L ±3% of reading	
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of the USEPA method 330.5 and Standard Method 4500-Cl G	
Ordering Information	**HI96724** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96724C** includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, scissors, cuvette cleaning cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately	
Reagents and Standards	**HI93701-F**	reagents for 300 tests (free Cl)
	HI93701-T	reagents for 300 (free Cl) and 100 (total Cl) tests
	HI93711-D3	DPD3 reagent for 200 tests
	HI96724-11	CAL Check™ Standard Cuvettes

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96734

Free and Total Chlorine, High Range Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Chlorine is the most cost-effective disinfectant and is used extensively in dialysis clinics. Its use varies from light application in surface sanitation, to heavy duty disinfection of medical devices, to removal of microorganism infections in piping systems. The advantage of chlorine over peroxide type disinfectants is that chlorine not only is a strong oxidant, it also is capable of breaking tough chemical bonds found in cell walls or biofilms. Correct and effective use of chlorine requires understanding of the chemical nature of the disinfectant.

The HI96734 photometer uses an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

The cuvette has a very important role because it is an optical element, and thus, requires particular attention. It is important that both the measurement and blank (zeroing) cuvettes are optically identical to provide the same measuring conditions.

Specifications		HI96734 Free and Total Chlorine, HR	
		Chlorine, Free HR (P1)	**Chlorine, Total HR (P2)**
Parameter Specifications	Range	0.00 to 10.00 mg/L	
	Resolution	0.01 mg/L from 0.00 to 3.50 mg/L; 0.10 mg/L above 3.50mg/L	
	Accuracy @ 25°C (77°F)	±0.03 mg/L ±3% of reading	
Additional Specifications	Light Source	tungsten lamp	
	Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
	Power Supply	9V battery	
	Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
	Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
	Weight	360 g (12.7 oz.)	
	Method	adaptation of the USEPA method 330.5 and Standard method 4500-CL G (DPD)	
Ordering Information	**HI96734** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instructions. CAL Check™ standards and testing reagents sold separately **HI96734C** includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, scissors, cuvette cleaning cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately		
Reagents and Standards	**HI93734-01**	reagents for 100 tests	
	HI93734-03	reagents for 300 tests	
	HI96734-11	CAL Check™ standard cuvettes	

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96771

Free Chlorine Ultra High Range Portable Photometer

- Up to 500 ppm chlorine range
- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

The HI96771 has been developed to check chlorine dosing in disinfection processes with ultra high concentrations of chlorine. Thanks to the extended range from 0 to 500 mg/L (ppm), it is ideal for the food industry, such as in fruit and vegetable washing.

The HI96771 meter measures the free chlorine (Cl_2) content in water samples and chlorine high range. In the high range mode, The HI96771 measures chlorine concentrations up to 500 mg/L. The methods are an adaptation of Standard Methods for the Examination of Water and Wastewater, 20th edition, 4500-Cl G.

The meter uses an exclusive positive-locking system to ensure that the cuvette is in the same position every time it is placed into the measurement cell. It is designed to fit a cuvette with a larger neck, making it easier to add both sample and reagents. The cuvette is made from special optical glass to obtain the best results.

Specifications	HI96771 Free Chlorine and Ultra High Range	
Range	**Free Cl (P1)**	**Cl, UHR (P2)**
	0.00 to 5.00 mg/L (ppm)	0 to 500 mg/L (ppm)
Resolution	0.01 mg/L from 0.00 to 3.50 mg/L; 0.10 mg/L above 3.50 mg/L	1 mg/L from 0 to 200 mg/L; 10 mg/L above 200 mg/L
Accuracy @ 25°C (77°F)	±0.03 mg/L ±3% of reading	±3 mg/L ±3% of reading
Light Source	tungsten lamp	
Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
Power Supply	9V battery	
Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
Weight	360 g (12.7 oz.)	
Method	adaptation of Standard Methods for the Examination of Water and Wastewater, 20th edition, 4500-Cl	
Ordering Information	**HI96771** is supplied with sample cuvettes (2) with caps, 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately **HI96771C** includes photometer, CAL Check™ standards, sample cuvettes (2) with caps, 9V battery, scissors, cuvette cleaning cloth, instrument quality certificate, instruction manual and rigid carrying case. Reagents sold separately	
Reagents and Standards	**HI93701-01**	reagents for 100 tests (free Cl)
	HI93701-03	reagents for 300 tests (free Cl)
	HI95771-01	reagents for 100 tests (UHR)
	HI95771-03	reagents for 300 tests (UHR)
	HI96771-11	CAL Check™ standards

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96736

Total Hardness and pH Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

The HI96736 is a multiparameter portable photometer that measures total hardness and pH.

The HI96736 meter uses an exclusive positive-locking system to ensure that the cuvette is in the same place every time it is placed into the measurement cell.

The cuvette has a very important role because it is an optical element, and thus, requires particular attention. It is important that both the measurement and blank (zeroing) cuvettes are optically identical to provide the same measuring conditions.

Specifications		HI96736 Total Hardness and pH	
Parameter Specifications		**Total Hardness (P1)**	**pH (P2)**
	Range	0.00 to 4.70 mg/L (ppm)	6.5 to 8.5 pH
	Resolution	0.01 mg/L	0.1 pH
	Accuracy @ 25°C (77°F)	±0.11 mg/L ±5% of reading	±0.1 pH
Additional Specifications	Light Source	tungsten lamp	
	Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
	Power Supply	9V battery	
	Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
	Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
	Weight	360 g (12.6 oz.)	
	Method	**Total Hardness:** adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th Edition, colorimetric method; **pH:** phenol red method	
Ordering Information		**HI96736** is supplied with sample cuvettes with caps (2), 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately	
Reagents and Standards	**HI96710-11**	CAL Check™ standard cuvettes (pH)	
	HI93710-01	reagents for 100 tests (pH)	
	HI93710-03	reagents for 300 tests (pH)	
	HI96719-11	CAL Check™ standard cuvettes (hardness)	
	HI93719-01	reagents for 100 tests (hardness)	
	HI93719-03	reagents for 300 tests (hardness)	

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96741

Total Hardness and Iron, Low Range Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

In domestic water, iron can alter taste, making it unpleasant to drink. It can also stain laundry, damage kitchenware and favor the growth of certain bacteria. However, low levels of iron are critical in beverage production.

The iron concentration in water needs to be monitored since it can become harmful above certain levels.

Hardness, on the other hand, is indicative of the presence of calcium and magnesium in water. By passing through various layers of soil and rocks, rain water dissolves some of the mineral substances.

Hardness can cause pipe rusting in water heating and cooling systems, reverse osmosis and demineralization plants. It can also increase the consumption of soaps and detergents in industrial washing machines or laundries.

The HI96741 can provide critical measurements of low range iron and total hardness (magnesium and calcium).

Specifications

		HI96741 Total Hardness and Iron, LR	
Parameter Specifications		**Mg Hardness**	**Ca Hardness**
	Range	0.00 to 2.00 mg/L	0.00 to 2.70 mg/L
	Resolution	0.01 mg/L	0.01 mg/L
	Accuracy @ 25°C (77°F)	±0.11 mg/L ±5% of reading	±0.11 mg/L ±5% of reading
		Total Hardness (P1)	**Iron, LR (P2)**
	Range	0.00 to 4.70 mg/L	0 to 1.60 mg/L
	Resolution	0.01 mg/L	0.01 mg/L
	Accuracy @ 25°C (77°F)	±0.11 mg/L ±5% of reading	±0.01 mg/L ±8% of reading
Additional Specifications	Light Source	tungsten lamp	
	Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
	Power Supply	9V battery	
	Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
	Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
	Weight	360 g (12.7 oz.)	
	Method	**Total Hardness:** adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th ed. colorimetric method. **Iron LR:** Adaptation of the TPTZ method.	
Ordering Information		**HI96741** is supplied with sample cuvettes with caps (2), 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately	

Reagents and Standards

HI96719-11	CAL Check™ standard cuvettes (hardness)
HI93719-01	reagents for 100 tests (hardness)
HI93719-03	reagents for 300 tests (hardness)
HI96746-11	CAL Check™ standard cuvettes (iron)
HI93746-01	reagents for 100 tests (iron)
HI93746-03	reagents for 300 tests (iron)

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96742

Iron, Low Range and Manganese Low Range Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Neither iron nor manganese are considered dangerous, but high concentrations of these metals in water can create a bittersweet or astringent taste.

The presence of iron in supplied water is undesirable due to the staining effect on laundry and porcelain.

Manganese, in high concentrations, can produce corrosion and scaling in pipes, which is a serious industrial concern.

The solution for these applications is the Hanna HI96742, a handheld photometer to measure low range iron and manganese.

Specifications — HI96742 Iron, LR and Manganese

		Iron, LR (P1)	Manganese, LR (P2)
Parameter Specifications	Range	0 to 1.60 mg/L (ppm)	0 to 300 µg/L (ppb)
	Resolution	0.01 mg/L	1 µg/L
	Accuracy @ 25°C (77°F)	±0.01 mg/L ±8% of reading	±2 µg/L ±3% of reading
Additional Specifications	Light Source	tungsten lamp	
	Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
	Power Supply	9V battery	
	Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder.	
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
	Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
	Weight	360 g (12.7 oz.)	
	Method	**Iron LR:** adaptation of TPTZ method; **Manganese LR:** adaptation of the 1-(2-pyridylazo)-2-naphthol PAN method.	
Ordering Information	**HI96742** are supplied with sample cuvettes with caps (2), 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately		
Reagents and Standards	**HI96746-11**	CAL Check™ standard cuvettes (iron)	
	HI93746-01	reagents for 100 Tests (iron)	
	HI93746-03	reagents for 300 Tests (iron)	
	HI96748-11	CAL Check™ standard cuvettes (manganese)	
	HI93748-01	reagents for 100 Tests (manganese)	
	HI93748-03	reagents for 300 Tests (manganese)	

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96745

Total Chlorine, Hardness, Iron Low Range and pH Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

Chlorine and pH are two of the most closely monitored parameters in water quality tests. Hardness is also an important parameter, attentively regulated to reduce waste or ensure proper functioning of equipment. Iron can cause an unpleasant taste or stain kitchenware or laundry.

The HI96745 is a powerful instrument to keep all these parameters under control. The reagents are in liquid or powder form and are supplied in bottles or in packets.

Reagents and Standards

HI96701-11	CAL Check™ standard cuvettes (free Cl)
HI93701-01	reagents for 100 tests (free Cl)
HI93701-03	reagents for 300 tests (free Cl)
HI96710-11	CAL Check™ standard cuvettes (pH)
HI93710-01	reagents for 100 tests (pH)
HI93710-03	reagents for 300 tests (pH)
HI96711-11	CAL Check™ standard cuvettes (total Cl)
HI93711-01	reagents for 100 tests (total Cl)
HI93711-03	reagents for 300 tests (total Cl)
HI93719-11	CAL Check™ standard cuvettes (hardness)
HI93719-01	reagents for 100 tests (hardness)
HI93719-03	reagents for 300 tests (hardness)
HI96746-11	CAL Check™ standard cuvettes (iron)
HI93746-01	reagents for 100 tests (iron)
HI93746-03	reagents for 300 tests (iron)

Specifications

HI96745 Chlorine, Total Hardness, Iron Low Range and pH

Parameter Specifications		**pH (P1)**	**Chlorine, Free (P2); Chlorine, Total (P3)**
	Range	6.5 to 8.5 pH	0.00 to 5.00 mg/L (ppm)
	Resolution	0.1 pH	0.01 mg/L under 3.50 mg/L; 0.10 mg/L above 3.50 mg/L
	Accuracy @ 25°C (77°F)	±0.1 pH	±0.03 mg/L ±3% of reading
		Total Hardness (P4)	**Iron, Low Range (P5)**
	Range	0.00 to 4.70 mg/L (ppm)	0 to 1.60 mg/L (ppm)
	Resolution	0.01 mg/L	0.01 mg/L
	Accuracy @ 25°C (77°F)	±0.11 mg/L ±5% of reading	±0.01 mg/L ±8% of reading
Additional Specifications	Light Source	tungsten lamp	
	Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
	Power Supply	9V battery	
	Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
	Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
	Weight	360 g (12.7 oz.)	
	Method	**pH:** phenol red method; **Cl:** Adaptation of the USEPA method and Standard Method 4500-Cl G method; **Total Hardness:** adaptation of the Standard Methods for the examination of Water and Wastewater, 18th ed., calgamite colorimetric method; **Iron LR**: adaptation of the TPTZ method method.	
Ordering Information		**HI96745** is supplied with sample cuvettes (2) with caps, battery, instrument quality certificate and instructions. CAL Check™ standards and testing reagents sold separately	

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

HI96752

Calcium and Magnesium Portable Photometer

- CAL Check™
  - Enables users to check validity of calibration
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- GLP Features
  - Meets Good Laboratory Practices

The HI96752 measures two important parameters in agricultural and hydroponic applications.

The HI96752 measures calcium concentrations from 0 to 400 mg/L and magnesium from
0 to 150 mg/L, and the values are displayed directly on the large LCD to eliminate the need for conversion tables.

This handy and portable meter with a low cost-per-test is an ideal hi-tech alternative to chemical test kits.

Accurate and cost-effective, this two-in-one portable photometer is factory calibrated to measure only calcium and magnesium, providing an instrument that is easy to use in the lab or on the field.

Specifications		HI96752 Calcium and Magnesium	
		Calcium (P1)	**Magnesium (P2)**
Parameter Specifications	Range	0 to 400 mg/L (ppm)	0 to 150 mg/L (ppm)
	Resolution	1 mg/L	1 mg/L
	Accuracy @ 25°C (77°F)	±10 mg/L ±5% of reading	±3 mg/L ±3% of reading
Additional Specifications	Light Source	light emitting diode	
	Light Detector	silicon photocell with narrow band interference filter @ 466 nm	
	Power Supply	9V battery	
	Auto-off	after ten minutes of non-use in measurement mode; after one hour of non-use in calibration mode; with last reading reminder	
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
	Dimensions	193 x 104 x 69 mm (7.6 x 4.1 x 2.7")	
	Weight	360 g (12.7 oz.)	
	Method	**Calcium:** adaptation of oxalate method; **Magnesium:** adaptation of the calmagite method	
Ordering Information		**HI96752** is supplied with sample cuvettes with caps (2), 9V battery, instrument quality certificate and instruction manual. CAL Check™ standards and testing reagents sold separately	
Reagents and Standards	**HI93752-01**	reagents for 100 Tests (50 each)	
	HI93752-03	reagents for 300 Tests (150 each)	
	HI937520-01	reagents for 100 tests (magnesium)	
	HI937520-03	reagents for 300 tests (magnesium)	
	HI937521-01	reagents for 50 tests (calcium)	
	HI937521-03	reagents for 150 tests (calcium)	
	HI96752-11	CAL Check™ standard cuvettes (calcium)	
	HI96754-11	CAL Check™ standard cuvettes (magnesium)	

Standard reagents begin on page 10.70; CAL Check™ standard reagents begin on page 10.71

Test	Reagent Kit	No. of Tests
Alkalinity	**HI93755-01** **HI93755-03**	100 300
Aluminum	**HI93712-01** **HI93712-03**	100 300
Ammonia HR	**HI93733-01** **HI93733-03**	100 300
Ammonia MR	**HI93715-01** **HI93715-03**	100 300
Ammonia LR	**HI93700-01** **HI93700-03**	100 300
Bromine	**HI93716-01** **HI93716-03**	100 300
Calcium	**HI937521-01** **HI937521-03**	50 150
Calcium and Magnesium	**HI93752-01** **HI93752-03**	100 (50 each) 300 (150 each)
Chloride	**HI93753-01** **HI93753-03**	100 300
Chlorine Dioxide	**HI93738-01** **HI93738-03**	100 300
Chlorine UHR	**HI95771-01** **HI95771-03**	100 300
Chlorine, Free	**HI93701-01** **HI93701-03** **HI93701-F** (liquid)	100 300 300
Chlorine, Free and Total HR	**HI93734-01** **HI93734-03**	100 300
Chlorine, Free ULR	**HI95762-01** **HI95762-03**	100 300
Chlorine, Total	**HI93711-01** **HI93711-03** **HI93701-T** (liquid)	100 300 300
Chlorine, Total ULR	**HI95761-01** **HI95761-03**	100 300
Chromium VI HR	**HI93723-01** **HI93723-03**	100 300
Chromium VI LR	**HI93749-01** **HI93749-03**	100 300
Copper HR	**HI93702-01** **HI93702-03** **HI93702T-01** (total) **HI93702T-03** (total)	100 300 100 300
Copper LR	**HI95747-01** **HI95747-03**	100 300
Cyanide	**HI93714-01** **HI93714-03**	100 300
Cyanuric Acid	**HI93722-01** **HI93722-03**	100 300
Detergents, Anionic	**HI95769-01**	40
Fluoride HR	**HI93739-01** **HI93739-03**	100 300
Fluoride LR	**HI93729-01** **HI93729-03**	100 300
Glycine Powder	**HI93703-52**	100
Hardness, Calcium	**HI93720-01** **HI93720-03**	100 300

Test	Reagent Kit	No. of Tests
Hardness (Magnesium) and Total Hardness	**HI93719-01** **HI93719-03**	100 300
Hardness, Total HR Hardness, Total MR Hardness, Total LR Hardness, Total LR+MR+HR	**HI93735-02** **HI93735-01** **HI93735-00** **HI93735-0**	100 100 100 100
Hydrazine	**HI93704-01** **HI93704-03**	100 300
Iodine	**HI93718-01** **HI93718-03**	100 300
Iron HR	**HI93721-01** **HI93721-03**	100 300
Iron LR	**HI93746-01** **HI93746-03**	100 300
Manganese HR	**HI93709-01** **HI93709-03**	100 300
Manganese LR	**HI93748-01** **HI93748-03**	50 150
Magnesium	**HI937520-01** **HI937520-03**	50 150
Molybdenum	**HI93730-01** **HI93730-03**	100 300
Nickel HR	**HI93726-01** **HI93726-03**	100 300
Nickel LR	**HI93740-01** **HI93740-03**	50 150
Nitrate	**HI93728-01** **HI93728-03**	100 300
Nitrite HR	**HI93708-01** **HI93708-03**	100 300
Nitrite LR	**HI93707-01** **HI93707-03**	100 300
Oxygen, Dissolved (DO)	**HI93732-01** **HI93732-03**	100 300
Ozone	**HI93757-01** **HI93757-03**	100 300
pH	**HI93710-01** **HI93710-03**	100 300
Phosphate HR	**HI93717-01** **HI93717-03**	100 300
Phosphate LR	**HI93713-01** **HI93713-03**	100 300
Phosphorus	**HI93706-01** **HI93706-03**	100 300
Potassium	**HI93750-01** **HI93750-03**	100 300
Silica HR	**HI96770-01** **HI96770-03**	100 300
Silica LR	**HI93705-01** **HI93705-03**	100 300
Silver	**HI93737-01** **HI93737-03**	50 150
Sulfate	**HI93751-01** **HI93751-03**	100 300
Zinc	**HI93731-01** **HI93731-03**	100 300

CAL Check™ Standard Reagents

Single Parameter

Instrument	CAL Check™ Standards Set	Parameter
HI96700	**HI96700-11**	Ammonia
HI96701	**HI96701-11**	Free Chlorine
HI96702	**HI96702-11**	Copper
HI96704	**HI96704-11**	Hydrazine
HI96705	**HI96705-11**	Silica
HI96706	**HI96706-11**	Phosphorus
HI96707	**HI96707-11**	Nitrite
HI96708	**HI96708-11**	Nitrite
HI96709	**HI96709-11**	Manganese
HI96712	**HI96712-11**	Aluminum
HI96713	**HI96713-11**	Phosphate
HI96714	**HI96714-11**	Cyanide
HI96715	**HI96715-11**	Ammonia
HI96716	**HI96716-11**	Bromine
HI96717	**HI96717-11**	Phosphate
HI96718	**HI96718-11**	Iodine
HI96719	**HI96719-11**	Hardness, Magnesium
HI96720	**HI96720-11**	Hardness, Calcium
HI96721	**HI96721-11**	Iron
HI96722	**HI96722-11**	Cyanuric Acid
HI96723	**HI96723-11**	Chromium VI
HI96724	**HI96724-11**	Free/Total Chlorine
HI96726	**HI96726-11**	Nickel
HI96727	**HI96727-11**	Color of Water
HI96728	**HI96728-11**	Nitrate
HI96729	**HI96729-11**	Fluoride
HI96730	**HI96730-11**	Molybdenum
HI96731	**HI96731-11**	Zinc
HI96732	**HI96732-11**	Dissolved Oxygen
HI96733	**HI96733-11**	Ammonia
HI96737	**HI96737-11**	Silver
HI96738	**HI96738-11**	Chlorine Dioxide
HI96739	**HI96739-11**	Fluoride
HI96740	**HI96740-11**	Nickel
HI96746	**HI96746-11**	Iron
HI96747	**HI96747-11**	Copper
HI98748	**HI96748-11**	Manganese
HI96749	**HI96749-11**	Chromium VI
HI96750	**HI96750-11**	Potassium
HI96751	**HI96751-11**	Sulfate
HI96753	**HI96753-11**	Chloride
HI96761	**HI96761-11**	Total Chlorine
HI96762	**HI96762-11**	Trace Free Chlorine
HI 96769	**HI96769-11**	Anionic Detergents
HI96770	**HI96770-11**	Silica
HI96771	**HI96771-11**	Ultra High Range Free Chlorine
HI96786	**HI96786-11**	Nitrate

Multiparameter

Instrument	CAL Check™ Standards Set	Parameter
HI96101	**HI96716-11** **HI96701-11** **HI96711-11** **HI96722-11** **HI96718-11** **HI96746-11** **HI96710-11**	Bromine Free Chlorine Total Chlorine Cyanuric Acid Iodine Iron pH
HI96104	**HI96710-11** **HI96701-11** **HI96711-11** **HI96722-11**	pH Free Chlorine Total Chlorine Cyanuric Acid
HI96710	**HI96701-11** **HI96711-11** **HI96710-11**	Free Chlorine Total Chlorine pH
HI96711	**HI96701-11** **HI96711-11**	Free Chlorine Total Chlorine
HI96725	**HI96701-11** **HI96711-11** **HI96722-11** **HI96710-11**	Free Chlorine Total Chlorine Cyanuric Acid pH
HI96734	**HI96734-11**	Free Chlorine Total Chlorine
HI96735	**HI96735-11**	Hardness
HI96736	**HI96719-11** **HI96710-11**	Total Hardness pH
HI96741	**HI96719-11** **HI96746-11**	Total Hardness Iron
HI96742	**HI96746-11** **HI96748-11**	Iron Manganese
HI96743	**HI96746-11** **HI96710-11**	Iron pH
HI96744	**HI96710-11** **HI96719-11** **HI96746-11**	pH Hardness, calcium Hardness, Magnesium Iron
HI96745	**HI96701-11** **HI96711-11** **HI96719-11** **HI96746-11** **HI96710-11**	Free Chlorine Total Chlorine Hardness, Magnesium Iron pH
HI96752	**HI96752-11** **HI96754-11**	Calcium Magnesium

HI83746

Photometer for the Determination of Concentration of Reducing Sugars

Determination of the concentration of reducing sugars (RS) is one of the most important measurements to be made during the winemaking process. Following the increase of RS during maturation of grapes can help decide when to start harvest. Having the highest possible sugar content is important because this is the main parameter that defines the commercial value of grapes. On the other hand, during the alcoholic fermentation process the decrease of sugars can be followed to decide when fermentation is complete; otherwise winemakers can take corrective actions if the content of RS is too low to obtain the desired alcohol degree or sweetness.

The predominant RS in grape products are glucose and fructose (hexoses). After reaction with excess alkaline cupric tartrate (Fehling reagents), the RS content can be determined colorimetrically. The Fehling method is not an exact determination but an index of the RS concentration; the reaction depends upon the amount and type of RS present. When the reducing sugar content is known at the beginning of fermentation, the potential alcohol degree can be estimated by multiplying the sugar concentration (in g/L) by 0.06.

Phenols interfere in the Fehling reaction and therefore red wine must be decolorized prior to analysis. Wine also contains non-fermentable reducing sugars like pentose, which will also be analyzed by this method.

Typical content of reducing sugars in must and wine

Must	sweet must	20-25 %	200-250 g/L
	normal	10-20 %	100-200 g/L
	in fermentation	4-12.5 %	40-125 g/L
Wine	sweet	2.5-12.5 %	25-125 g/L
	semi sweet	0.8-2.5 %	8-25 g/L
	almost dry	0.2-0.8 %	2-8 g/L
	dry	0-0.2 %	0-2 g/L

Specifications	HI83746
Range	0.00 to 50.00 g/L (ppt)
Resolution	0.25 g/L
Accuracy @ 25°C/77°F	± 0.50 g/L ±5% of reading
Precision	±0.015 @ 0.350 g/L
Light Source	tungsten lamp
Light Detector	silicon photocell with narrow band interference filter @ 610 nm
Method	Fehling
Environment	0 to 50°C; RH max 95% non-condensing
Battery Type	1.5V AA batteries (4)/ 12 VDC adapter
Auto Shut-off	after 15 minutes of non-use
Dimensions	224 x 87 x 77 mm (8.7 x 3.3 x 3.1")
Weight	512 g (17.6 oz.)
Ordering Information	**HI83746-01** (115V) and **HI83746-02** (230V) is supplied with glass cuvettes and caps (4), reagents for about 20 tests (HI83746-20), HI93703-59 Charcoal, 200 µL automatic pipette with two plastic tips, 1000 µL automatic pipette with plastic tips (2), instruction sheet for automatic pipette, spoon, funnel, filter paper (25), cuvette wiping cloth, 12 VDC adapter, batteries, instructions and Instrument quality certificate, rigid carrying case.
Optional Reagents	**HI83746-20** reducing sugar reagent set (20 tests)
	HI93703-59 charcoal for decoloration of red wine (about 100 tests)
	HI839800 COD test tube heater (required)

The HI83746 requires the HI839800 Test Tube Heater

HI83748

Photometer for the Determination of Tartaric Acid in Wine

Tartaric acid and tartrate play an important role in the stability of wines. They can be present in wine and juice in various forms, like tartaric acid (H2T), potassium bitartrate (KHT) or calcium tartrate (CaT). The ratio of these depends mainly on the pH of the wine. The percentage of tartrate present as bitartrate (HT-) is maximum at pH 3.7.

The formation of crystalline deposits (tartrate casse) is a phenomenon of wine aging that does not meet customer acceptance. It is therefore important to test for and reduce the potential for bottle precipitation. For example, by adjusting the pH of the wine, winemakers can significantly influence the potential of casse formation.

Potassium concentrations in wine can range from 600 to 2500 mg/L (ppm) in certain red wines. Although the potassium bitartrate is soluble in water, alcohol and low temperatures decrease its solubility. Especially during the alcoholic fermentation, potassium bitartrate becomes increasingly insoluble, resulting in super-saturation and precipitation. The KHT stability can be restored by chilling (with or without seeding). Wines with initial pH values below pH 3.65 can show a reduction in pH during cold stabilization because of the generation of one free proton for each KHT precipitated. The pH may drop as much as 0.2 pH units.

Calcium concentrations can range from 6 to 165 mg/L (ppm) and may complex with tartrate or oxalate to form crystalline precipitates. Calcium tartrate instabilities occur normally from four to seven months after fermentation and are not dependent on temperature.

Sulphates, proteins, gum and polyphenols can form stable complexes with tartrate, thus inhibiting casse formation. The complexes are mainly between polyphenols and tartaric acid in red wine, and proteins in white wine. This explains why, as pigment polymerization occurs, the holding capacity of tartaric acid diminishes, resulting in delayed casse. The sulfate instead does not complex with potassium from 50% in white wines up to 100% in red ones.

Tartaric acid concentrations in wine range normally from 1.5 to 4.0 g/L. This acid concentration should not be confused with total or titratable acidity of wines that are often expressed as tartaric acid content too. Although it is the tartaric acid that is the predominant acid present (up to 60% of the total acidity), others like malic, citric and several volatile acids contribute significantly to total acidity.

Specifications	HI83748	
Range	0.0 to 5.0 g/L (ppt)	
Resolution	0.1 g/L	
Accuracy @ 25°C/77°F	±0.1 g/L ±5% of reading	
Light Source	tungsten lamp	
Manual Precision	SD ±0.1 g/L @ 2.0 g/L	
Light Detector	silicon photocell with narrow band interference filter @ 525 nm	
Method	the reaction between tartaric acid and the reagents causes a yellow/orange red tint in the sample.	
Environment	0 to 50°C; RH max 95% non-condensing	
Battery Type	1.5V AA batteries (4) / 12 VDC adapter	
Auto Shut-off	after 15 minutes of non-use	
Dimensions	225 x 85 x 80 mm (8.7 x 3.3 x 3.1")	
Weight	500 g (17.6 oz.)	
Ordering Information	**HI83748-01** (115V) and **HI83748-02** (230V) are supplied with sample cuvettes and caps (2), reagents for 5 manual tests (HI83748A-0, HI83748B-0), 200 µL automatic pipette, plastic tips for 200 µL automatic pipette (2), 5 mL syringe with tip, cuvette wiping cloth, 12 VDC adapter, batteries, instructions, instrument quality certificate and rigid carrying case.	
Reagent Sets	**HI83748-20**	tartaric acid reagents set for wine (20 tests)
	HI83748-20	200 µL automatic pipette with instruction sheet

HI83730

Photometer for the Determination of Peroxide Value in Olive Oils

Peroxides are the primary products of oil oxidation. Their identification gives useful information about oil conservation and rancidity. HI83730 allows a fast and simple analysis of peroxides in oil in accordance with the EC 2568/91 method.

The HI83730 is an instrument that benefits from Hanna's years of experience as a manufacturer of analytical instruments. It has an advanced optical system based on a special tungsten lamp and a narrow band interference filter that allows the most accurate and repeatable readings.
All instruments are factory calibrated.

The auto-diagnostic feature of this meter ensures optimal measurement conditions for highly precise readings. The light level is automatically adjusted each time a zero-measurement is made, and the lamp is temperature controlled to avoid overheating.

Oil Peroxides Content	
<10 meq O_2/kg	excellent conservation
10-15 meq O_2/kg	good conservation
<10 meqO_2/kg	refined oil
>20 meqO_2/kg	rancid oil

Specifications	HI83730
Range	0.0 to 25.0 meq O_2/kg
Resolution	0.5 meq O_2/kg
Accuracy @ 25°C/77°F	±0.5 meq O_2/kg
Light Source	tungsten lamp
Light Detector	silicon photocell with narrow band interference filter @ 466 nm
Method	adaptation of EC 2568/91 method and following amendments
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Power Supply	1.5V AA batteries (4) / 12 VDC adapter
Auto Shut-off	after 15 minutes of non-use
Dimensions	224 x 87 x 77 mm (8.8 x 3.4 x 3")
Weight	512 g (18 oz.)
Ordering Information	**HI83730-01** (115V) and **HI83730-02** (230V) are supplied with reagents for 10 tests, 1 mL syringes (4), scissors, vial wiping cloth, batteries, AC adapter, instructions and a rigid carrying case.
Reagent Sets	**HI83730-20** peroxide in olive oil reagents kit (21 manual tests)

Table of Contents

Chemical Oxygen Demand

Introduction

Wastewater needs to be monitored closely to prevent environmental pollution and human illness.

Oxygen Demand and COD

Chemical Oxygen Demand (COD) is a measure of the biologically available and inert oganic matter that is susceptible to oxidation by a strong oxidizing agent.

The Hanna COD method is based on the well established closed dichromate-reflux colorimetric method. The colorimetric measurement of COD is faster and easier to perform than the titrimetric analysis; additional reagents are not required. The sample is added to the reagent vial and digested under closed reflux conditions and allowed to cool before measurement is taken. Reference standards can be made using potassium hydrogen phthalate (KHP), 1 mg of KHP is equal to 1.175 mg COD.

The US Environmental Protection Agency (EPA) specifies that the dichromate reflux method is the only method acceptable for reporting purposes. The advantage in using this method includes certifiable results as well as high accuracy.

COD Testing Applications

COD is used as a measurement of pollutants. It is normally measured in both municipal and industrial wastewater treatment plants and gives an indication of the efficiency of the treatment process. COD is measured on both influent and effluent water. The efficiency of the treatment process is normally expressed as COD removal, measured as a percentage of the organic matter purified during the cycle. COD has further applications in power plant operations, chemical manufacturing, commercial laundries, pulp and paper mills, agriculture and animal waste runoff, environmental studies and general education. Hanna equipment can be used in the laboratory or for on-site testing. The measurement procedure has been designed for ease of use by personnel at any skill level.

Wastewater monitoring examples:

COD Influent	COD Effluent	COD Removal
1214	451	62%
948	328	63%
1341	307	77%

Beyond COD: Nitrogen and Phosphorus

The goal in wastewater treatment is not only COD reduction, but also to control nitrogen and phosphorus, which are responsible for eutrophication phenomena in natural environments. COD, nitrogen, and phosphorus control are performed not only to obey environmental protection laws, but also to optimize plant costs.

Effective monitoring and control of parameters such as ammonia, nitrate, total nitrogen and total reactive phosphorus allow plant managers to profile and improve the health of aquatic ecosystems. By accurately monitoring levels of each specific pollutant, operational parameters can be adjusted to maintain high efficiency of biodegradation treatments while also minimizing costs.

Nitrogen

When a treatment plant uses processes like nitrification and denitrification, it is important to monitor and maintain the equilibrium between ammonia nitrogen, nitrate and total nitrogen during the bio-treatment. The nitrogen level is important because it relates to the quantity of oxygen provided in the nitrification area. Ammonia is also controlled because it can become very toxic for the bacteria responsible for denitrification.

Nitrification

$$NH_3 + O_2 \xrightarrow[\text{bacteria}]{\text{nitrosomonas}} NO_2^- + 3H^+ + 2e^-$$

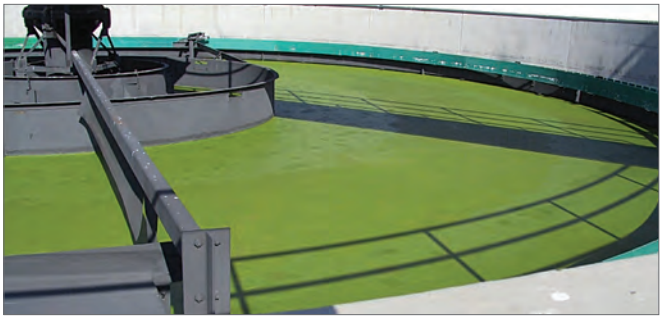
$$NO_2^- + H_2O \xrightarrow[\text{bacteria}]{\text{nitrobacter}} NO_3^- + 2H^+ + 2e^-$$

Denitrification

$$3NO_3^- + 10e^- + 12H^+ \longrightarrow N_2 + 6H_2O$$

Phosphorus

Phosphorus is measured during both biological and chemical dephosphorization. An excessive amount of phosphate discharged in superficial waters or in bio-treatment tanks causes an increase of algae and system eutrophication.



HI83224

COD Meter and Multiparameter Photometer

11.4

The HI83224* is a multiparameter bench photometer that includes 15 methods for the measurement of ammonia, COD, chlorine, nitrate, nitrogen and phosphorus.

The HI83224 features a powerful interactive user support system that assists you before, during and after analysis. On-screen tutorials guide users through set-up, calibration and measurement procedures while context sensitive help screens are available at a push of a button.

HI83099

COD Laboratory Photometer

11.6

The HI83099 is one of the most versatile photometers on the market. In addition to COD, this meter measures 44 of the most important water quality parameters. The HI83099 operates in three different ranges to cover virtually every COD application.

HI839800

COD Test Tube Heater with 25 Vial Capacity

11.10

The HI839800 COD reactor is an easy to use test tube heater with intuitive operation and durable construction. The reactor's aluminum block features a 25-vial capacity and a well for a reference temperature probe.

HI83224

COD Meter and Multiparameter Photometer

with Bar Code Recognition of Sample Vials

Application Designed Photometers

- Measures ammonia, chlorine, COD, nitrate, nitrogen and phosphorus
- Three operation modes: automatic, semi-automatic and manual
- Bar coded pre-dosed reagent vials
- On screen step-by-step tutorial
- Logs up to 200 samples
- Context sensitive help screen at a touch of a button
- USB connection

The HI83224 is a multiparameter bench top photometer that features 15 methods for measurement of ammonia, COD, chlorine, nitrate, nitrogen and phosphorus.

This meter features automatic recognition of bar coded samples. The HI83224 scans each vial inserted into the vial holder and automatically identifies the sample method and range. This feature eliminates errors and simplifies the testing process.

The HI83224 also features a powerful interactive user support system that assists users before, during and after analysis. On-screen tutorials guide users through set-up, calibration and measurement procedures while context sensitive help screens are available at a push of a button.

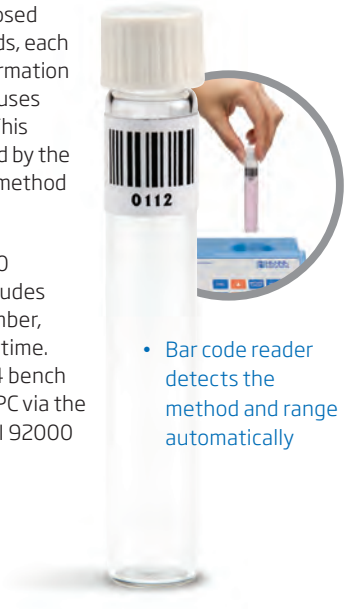
HI83224 uses a new series of pre-dosed reagent vials for 13 of the 15 methods, each bar coded with specific reagent information at our factory. The chlorine method uses supplied vials and powder packets. This information is automatically scanned by the HI83224 to assure that the vial and method are the same.

HI83224 can log and recall up to 200 individual readings. Stored data includes parameter, test results, sample number, lot number, instrument id, date and time. For data management, the HI83224 bench photometer can be connected to a PC via the optional HI920013 USB cable and HI 92000 Windows® compatible software.

Bar code identification avoids vial confusion and wrong samples

Sample vials inserted into the HI83224 are identified using bar codes. The bar codes for different methods are shown in the table below. For parameters that don't use a bar coded reagents, the vials supplied with the instrument should be used. The bar code has 4 digits. The first 2 digits are for parameter identification and the second 2 digits are for reagent lot ID.

HI83224 has a powerful interactive help system that assists the user during the analysis process. At a touch of a button, users can get detailed help tailored to the current information on the LCD. A tutorial mode is also available and can be accessed via the setup menu.



- Bar code reader detects the method and range automatically

Part Code	Method	Vial bar code
HI94764A-25	ammonia, LR	01xx
HI94764B-25	ammonia HR	02xx
HI93701-01	chlorine, free	–
HI93711-01	chlorine, total	–
HI94766-50	nitrate	05xx
HI94767A-50	nitrogen, total LR	16xx; 06xx
HI94767B-50	nitrogen, total HR	17xx; 07xx
HI94754A-25	oxygen demand, chemical (COD) LR	12xx
HI94754B-25	oxygen demand, chemical (COD) MR	13xx
HI94754C-25	oxygen demand, chemical (COD) HR	24xx
HI94758A-50	phosphorus, reactive	30xx
HI94758B-50	phosphorus, acid hydrolyzable	31xx
HI94758C-50	phosphorus, total	32xx
HI94763A-50	phosphorus, reactive HR	33xx
HI94763B-50	phosphorus, total HR	34xx

Note: xx represents the reagent lot code.

HI740217
Lab Safety Shield

HI740216
Test Tube Cooling Rack

For safety, the optional HI740217 safety shield and HI740216 test tube cooling rack for the HI839800 are strongly recommended.

Some analytical methods require digestion of the sample. For digestion of the vials, use the Hanna HI839800 reactor only.

Specifications	HI83224
Light Source	tungsten lamps with narrow band interference filters
Light Detector	silicon photocell
Data Logging	up to 200 samples
Environment	0 to 50°C (32 to 122°F); RH max 90% non-condensing
Power Supply	230 VAC or 115 VAC power adapter
Dimensions	235 x 212 x 143 mm (9.2 x 8.34 x 5.62")
Weight	2.3 kg (5.1 lb)
Ordering Information	**HI83224-01** (115V) and **HI83224-02** (230V) are supplied with sample vials (10), vial cleaning cloths (4), scissors and instruction manual.

COD Test	Range	Resolution	Accuracy	Method	Reagent Code
COD LR	0 to 150 mg/L (as O_2) 0 to 150 mg/L 0 to 150 mg/L	1 mg/L 1 mg/L 1 mg/L	±5 mg/L or ±5 % of reading** ±5 mg/L or ±5% of reading** ±5 mg/L or ±5% of reading**	dichromate EPA‡ dichromate mercury-free◊◊ dichromate ISO◊	**HI94754A-25** (25 tests) **HI94754D-25** (25 tests) **HI94754F-25** (25 tests)
COD MR	0 to 1500 mg/L (as O_2) 0 to 1500 mg/L 0 to 1500 mg/L	1 mg/L 1 mg/L 1 mg/L	±15 mg/L or ±4 % of reading** ±15 mg/L or ±4% of reading** ±15 mg/L or ±4% of reading**	dichromate EPA‡ dichromate mercury-free◊◊ dichromate ISO◊	**HI94754B-25** (25 tests) **HI94754E-25** (25 tests) **HI94754G-25** (25 tests)
COD HR	0 to 15000 mg/L (as O_2)	10 mg/L	±150 mg/L or ±3 % of reading**	dichromate	**HI94754C-25** (25 tests)

Test	Range	Resolution	Accuracy*	Method	Reagent Code
Ammonia LR	0.00 to 3.00 mg/L (as NH_3–N)	0.01 mg/L	±0.10 mg/L or ±5 % of reading**	Nessler	**HI94764A-25** (25 tests)
Ammonia HR	0 to 100 mg/L (as NH_3–N)	1 mg/L	±1 mg/L or ±5 % of reading**	Nessler	**HI94764B-25** (25 tests)
Chlorine, Free**	0.00 to 5.00 mg/L	0.01 mg/L below 0.99 mg/L; 0.1 mg/L above 0.99 mg/L	±0.03 mg/L or ±4 % of reading**	DPD	**HI93701-01** (100 tests) **HI93701-03** (300 tests)
Chlorine, Total**	0.00 to 5.00 mg/L	0.01 mg/L below 0.99 mg/L; 0.1 mg/L above 0.99 mg/L	±0.03 mg/L or ±4 % of reading**	DPD	**HI93711-01** (100 tests) **HI93711-03** (300 tests)
Nitrate	0.0 to 30.0 mg/L (as NO_3–N)	0.1 mg/L	±1.0 mg/L or ±5 % of reading** @20°C	chromotropic acid	**HI94766-50** (50 tests)
Nitrogen, Total LR	0.0 to 25.0 mg/L (as N)	0.1 mg/L	±1.0 mg/L or ±5 % of reading** @20°C	chromotropic acid	**HI94767A-50** (50 tests)
Nitrogen, Total HR	10 to 150 mg/L (as N)	1 mg/L	±3 mg/L or ±4 % of reading**	chromotropic acid	**HI94767B-50** (50 tests)
Phosphorus, Acid Hydrolyzable	0.00 to 1.60 mg/L (as P)	0.01 mg/L	±0.05 mg/L or ±5 % of reading**	ascorbic acid	**HI94758B-50** (50 tests)
Phosphorus, Reactive	0.00 to 1.60 mg/L (as P)	0.01 mg/L	±0.05 mg/L or ±5 % of reading**	ascorbic acid	**HI94758A-50** (50 tests)
Phosphorus, Reactive HR	0.0 to 32.6 mg/L (as P)	0.1 mg/L	±0.5 mg/L or ±5 % of reading**	vanadomolybdophosphoric acid	**HI94763A-50** (50 tests)
Phosphorus, Total	0.00 to 1.15 mg/L (as P)	0.01 mg/L	±0.05 mg/L or ±6 % of reading**	ascorbic acid	**HI94758C-50** (50 tests)
Phosphorus, Total HR	0.0 to 32.6 mg/L (as P)	0.1 mg/L	±0.5 mg/L or ±5 % of reading**	vanadomolybdophosphoric acid	**HI94763B-50** (50 tests)

Notes:
‡ Method with chromium-sulfuric acid is officially recognized by EPA for wastewater analysis.
◊ The HI94754F-25 and HI94754G-25 method follows the official method ISO 15705.
◊◊ This method is recommended for general purpose analysis with no chloride interference.
* @ 25°C (77°F) unless otherwise stated
** Whichever is greater

HI83099

COD Meter and Multiparameter Photometer

- Easy COD measurement
- Outstanding measurement quality
- Compact, multiparameter meter
- PC compatible
- 47 methods

The HI83099 is one of the most versatile photometers on the market. In addition to COD, this meter measures 44 of the most important water quality parameters using liquid or powder reagents. The amount of reagent is precisely dosed to ensure maximum reproducibility.

The HI83099 bench photometer can be connected to a PC via a USB cable. The optional HI92000 Windows® Compatible Software helps users manage their data.

The HI83099 features a powerful interactive user support to assist during each step of the analysis process. A tutorial mode is also available in the setup menu.

ADP
Application Designed Photometers

Specifications	HI83099
Light Source	tungsten lamps with narrow band interference filters
Light Life	the life of the instrument
Light Detector	silicon photocell
Environment	0 to 50°C (32 to 122°F); RH max 90% non-condensing
Power Supply	external 12 VDC power adapter or built-in rechargeable battery
Dimensions	235 x 200 x 110 mm (9.2 x 7.87 x 4.33")
Weight	0.9 kg (2 lbs.)
Ordering Information	**HI83099-01** (115V) and **HI83099-02** (230V) is supplied with glass cuvettes with caps (4), cell protective cap, batteries, 12 VDC adapter, sample preparation kit (for turbidity or concentrated samples), cloth for wiping cuvettes, 60mL glass bottle for DO analysis, scissors, and instructions.

COD Test	Range	Method	Reagent Code
COD LR	0 to 150 mg/L	dichromate EPA‡ dichromate mercury-free◊◊ dichromate ISO◊	**HI93754A-25** **HI93754D-25** **HI93754F-25**
COD MR	0 to 1500 mg/L	dichromate EPA‡ dichromate mercury-free◊◊ dichromate ISO◊	**HI93754B-25** **HI93754E-25** **HI93754G-25**
COD HR	0 to 15000 mg/L	dichromate	**HI93754C-25**

Water Quality Test	Range	Method	Reagent Code†
Alkalinity	0 to 500 mg/L (ppm) as $CaCO_3$	bromocresol green	**HI93755-01**
Aluminum	0.00 to 1.00 mg/L	aluminon	**HI93712-01**
Ammonia MR	0.00 to 10.00 mg/L	Nessler	**HI93715-01**
Ammonia LR	0.00 to 3.00 mg/L	Nessler	**HI93700-01**
Bromine	0.00 to 8.00 mg/L	DPD	**HI93716-01**
Calcium	0 to 400 mg/L	oxalate	**HI937521-01**
Chlorine Dioxide	0.00 to 2.00 mg/L	chlorophenol red	**HI93738-01**
Chlorine, Free	0.00 to 2.50 mg/L	DPD	**HI93701-01***
Chlorine, Total	0.00 to 3.50 mg/L	DPD	**HI93711-01***
Chromium VI HR	0 to 1000 µg/L	diphenylcarbohydrazide	**HI93723-01**
Chromium VI LR	0 to 300 µg/L	diphenylcarbohydrazide	**HI93749-01**
Color of Water	0 to 500 PCU	colorimetric platinum cobalt	–
Copper HR	0.00 to 5.00 mg/L	bicinchoninate	**HI93702-01**
Copper LR	0 to 1000 µg/L	bicinchoninate	**HI95747-01**
Cyanuric Acid	0 to 80 mg/L	turbidimetric	**HI93722-01**
Fluoride	0.00 to 2.00 mg/L	SPADNS	**HI93729-01**
Hardness, Calcium	0.00 to 2.70 mg/L	calmagite	**HI93720-01**
Hardness, Magnesium	0.00 to 2.00 mg/L	EDTA	**HI93719-01**
Hydrazine	0 to 400 µg/L	p-dimethylaminobenzaldehyde	**HI93704-01**
Iodine	0.0 to 12.5 mg/L	DPD	**HI93718-01**
Iron HR	0.00 to 5.00 mg/L	phenantroline	**HI93721-01**
Iron LR	0 to 400 µg/L	TPTZ	**HI93746-01**
Magnesium	0 to 150 mg/L	calmagite	**HI937520-01**
Manganese HR	0.0 to 20.0 mg/L	periodate	**HI93709-01**
Manganese LR	0 to 300 µg/L	PAN	**HI93748-01**
Molybdenum	0.0 to 40.0 mg/L	mercaptoacetic acid	**HI93730-01**
Nickel HR	0.00 to 7.00 g/L	photometric	**HI93726-01**
Nickel LR	0.000 mg/L to 1.000 mg/L	PAN	**HI93740-01**
Nitrate	0.0 to 30.0 mg/L	cadmium reduction	**HI93728-01**
Nitrite HR	0 to 150 mg/L	ferrous sulfate	**HI93708-01**
Nitrite LR	0.00 to 1.15 mg/L	diazotization	**HI93707-01**
Oxygen, Dissolved (DO)	0.0 to 10.0 mg/L	Winkler	**HI93732-01**
Ozone	0.00 to 2.00 mg/L	DPD	**HI93757-01**
pH	6.5 to 8.5 pH	phenol red	**HI93710-01**
Phosphate HR	0.0 to 30.0 mg/L	amino acid	**HI93717-01**
Phosphate LR	0.00 to 2.50 mg/L	ascorbic acid	**HI93713-01**
Phosphorus	0.0 to 15.0 mg/L	amino acid	**HI93706-01**
Potassium HR	20 to 200 mg/L	turbidimetric tetraphenylborate	**HI93750-01**
Potassium MR	10 to 100 mg/L	turbidimetric tetraphenylborate	**HI93750-01**
Potassium LR	0.0 to 20.0 mg/L	turbidimetric tetraphenylborate	**HI93750-01**
Silica	0.00 to 2.00 mg/L	heteropoly blue	**HI93705-01**
Silver	0.000 to 1.000 mg/L	PAN	**HI93737-01**
Sulfate	0 to 150 mg/L	turbidimetric	**HI93751-01**
Zinc	0.00 to 3.00 mg/L	zincon	**HI93731-01**

HI3898

Chloride Test Kit

Quick Chloride Tests

The HI3898 is a chloride concentration test kit developed according to the ISO 15705:2002 method.

This very important test is recommended by ISO, since an excessive presence of chloride can interfere with the COD analysis.

This test gives a fast YES/NO reply to the question if chloride will interfere with the COD analysis. If chloride concentration is greater than the official maximum level, the solution turns yellow and the sample needs to be diluted before performing the COD test, otherwise if the solution is orange-brown, the sample doesn't need to be diluted.

The maximum level allowed is 1000 ppm of Cl^- following ISO methods, or 2000 ppm of Cl^- for US EPA, APHA, AWWA and WEF methods.

Specifications	HI3898
Range	1000 ppm Cl^- (ISO) 2000 ppm Cl^- (EPA)
Analysis Method	visual evaluation
Sample Volume	2 mL
Number of Tests	100
Dimensions	120 x 110 x 90 mm (4.7 x 4.3 x 3.5")
Weight	200 g (7.0 oz.)

Ordering Information

HI3898 is supplied with 25 mL chloride titrant (4), chloride Indicator 7 mL (1), glass cuvette with plastic stopper (1) and calibrated syringe with tip (2).

Notes:
‡ Method with chromium-sulfuric acid is officially recognized by EPA for wastewater analysis.
◊ The HI93754F-25 and HI93754G-25 method follows the official method ISO 15705.
◊◊ This method is recommended for general purpose analysis with no chloride interference.
* For Chlorine, liquid reagents also available.

HI83214

COD Meter and Multiparameter Photometer

for Wastewater Analysis

- Easy COD measurement
  - The HI83214 multiparameter photometer is pre-calibrated to measure COD levels at three ranges at the touch of a button
- Outstanding measurement quality
  - An advanced optical system assures high accuracy measurements throughout the entire range
- Save space in your laboratory.
  - The compact size of the HI83214 allows users to eliminate the clutter of bulky and costly spectrophotometers

The HI83214 multiparameter photometer is a compact instrument featuring different ranges and methods, suitable for a wide range of applications.

The HI83214 is designed and built to perform COD analysis in accordance with EPA 410.4 and ISO 15705:2002 standards. Ensuring accurate and repeatable results, it is the ideal tool for documenting waste treatment processes.

Besides the fundamental parameter of COD, HI83214 also measures total ammonia, free and total chlorine, nitrate, nitrogen and total reactive phosphorus.

The HI83214 allows for a complete wastewater analysis in a single, powerful instrument.

Specifications	HI83214
Light Source	tungsten lamps with narrow-band interference filters
Light Detector	silicon photocell
Environment	0 to 50°C (32 to 122°F); RH max 90% non-condensing
Power Supply	external 12 VDC power adapter or built-in rechargeable battery
Dimensions	235 x 200 x 110 mm (9.2 x 7.87 x 4.33")
Weight	0.9 kg (2 lbs.)

COD Test	Range	Method	Reagent Code
COD LR	0 to 150 mg/L	dichromate EPA‡ dichromate mercury-free◊◊ dichromate ISO◊	**HI93754A-25** **HI93754D-25** **HI93754F-25**
COD MR	0 to 1500 mg/L	dichromate EPA‡ dichromate mercury-free◊◊ dichromate ISO◊	**HI93754B-25** **HI93754E-25** **HI93754G-25**
COD HR	0 to 15000 mg/L	dichromate	**HI93754C-25**

Parameter	Range	Method	Reagent Code
Ammonia, LR	0.00 to 3.00 mg/L	Nessler	**HI93764A-25**
Ammonia, HR	0 to 100 mg/L	Nessler	**HI93764B-25**
Chlorine, Free	0.00 to 5.00 mg/L	DPD	**HI93701-01, HI93701-03**
Chlorine, Total	0.00 to 5.00 mg/L	DPD	**HI93711-01, HI93711-03**
Nitrate	0.0 to 30.0 mg/L	chromotropic acid	**HI93766-50**
Nitrogen, Total	0.0 to 25.0 mg/L	chromotropic acid	**HI93767A-50**
Nitrogen, Total HR	10 to 150 mg/L	chromotropic acid	**HI93767B-50**
Phosphorus, Reactive	0.00 to 5.00 mg/L	ascorbic acid	**HI93758A-50**
Phosphorus, Acid Hydrolyzable	0.00 to 5.00 mg/L	ascorbic acid	**HI93758B-50**
Phosphorus, Total	0.00 to 3.50 mg/L	ascorbic acid	**HI93758C-50**
Phosphorus, Reactive HR	0.0 to 100.0 mg/L	vanadomolybdophosphoric acid	**HI93763A-50**
Phosphorus, Total HR	0.0 to 100.0 mg/L	vanadomolybdophosphoric acid	**HI93763B-50**

Ordering Information	**HI83214-01** (115V) and **HI83214-02** (230V) is supplied with glass cuvettes (5), 9V batteries (2), 12 VDC adapter and instructions

ADP
Application Designed Photometers

Notes:
‡ Method with chromium-sulfuric acid is officially recognized by EPA for wastewater analysis.
◊ The HI93754F-25 and HI93754G-25 method follows the official method ISO 15705.
◊◊ This method is recommended for general purpose analysis with no chloride interference.

Certified COD Reagents

Hanna COD reagents are available in the following formats:

Each box of 25 vials is supplied with a Hanna certificate of quality.

The reagents are traceable to NIST SRM® 930.

COD Test	Range	Method	Reagent Code
COD LR	0 to 150 mg/L	dichromate EPA‡ dichromate mercury-free°° dichromate ISO°	**HI93754A-25** **HI93754D-25** **HI93754F-25**
COD MR	0 to 1500 mg/L	dichromate EPA‡ dichromate mercury-free°° dichromate ISO°	**HI93754B-25** **HI93754E-25** **HI93754G-25**
COD HR	0 to 15000 mg/L	dichromate	**HI93754C-25**

- Three measurement ranges to satisfy every need
  - As COD levels vary depending on the application and process measuring points, Hanna offers reagents to cover three separate ranges. Simply choose the best range for the application:
    low range: 0 to 150 mg/L O_2
    medium range: 0 to 1500 mg/L O_2
    high range: 0 to 15000 mg/L O_2
- Accurate and repeatable measurements
  - Hanna COD reagents have been developed in accordance with Standard Methods 5220D, USEPA 410.4 and ISO 15705:2002 methods.
- Pre-dosed vials
  - Hanna vials contain approximately 3 mL of pre-dosed reagent. The operator just needs to add a small quantity of the sample.

  Quick and accurate measurements
  - With pre-dosed vials, test preparation time is dramatically reduced. There is no time-consuming reagent preparation procedure or glassware cleaning.
- Safe reagents
  - Hanna COD reagents are safe for operators and the environment. Vials and caps have been designed to avoid accidental reagent spills. Due to the pre-dosed reagents, the amount of chemicals and handling time is minimized.

HI740216 Test Tube Cooling Rack

Notes:
* Method with chromium-sulfuric acid is officially recognized by EPA for wastewater analysis.
** Method follows the official method ISO 15705.
*** This method is recommended for general purpose analysis with no chloride interference.

HI839800

COD Test Tube Heater

with 25 Vial Capacity

- Low temperature alert
  - Alerts the user that the temperature is below the set value
- High temperature alert
  - Alerts the user that the temperature is above the set value
- Countdown timer
  - Shows time remaining until the heating element shuts off

The HI839800 COD reactor is constructed of durable materials. The aluminum block incorporates a 25-vial capacity and a well for a reference temperature probe.

The HI839800 COD reactor is an easy to use test tube heater. Its well-marked user interface provides intuitive operation. The reactor is equipped with two predefined temperature settings: 105 °C and 150 °C. COD and total phosphorus digestions are conducted at 150 °C, and total nitrogen digestions are at the 105 °C.

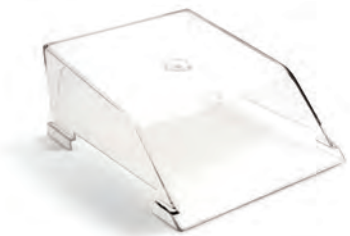
In addition, the HI839800 has 3 LED's for visual indication. A green LED indicates power, a blinking red LED warns the user of a hot heater block (above 50°C), and a yellow LED indicates heating.

A three hour countdown timer is also incorporated to control timed digestions. When the countdown timer expires, a beep will sound and the heating element will turn off.

The reactor contains a thermal fuse that prevents overheating by turning off the heating element.

Block temperature is continuously displayed on the LCD even when there is no active temperature program running.

Outer casing stays cool to the touch!



HI740217
Lab Safety Shield

HI740216
Test Tube Cooling Rack

Specifications	HI839800
Temperature of Reaction	105°C or 150°C (221°F or 302°F)
Temperature Stability	±0.5°C (±0.9°F)
Temperature Range	-10°C to 160°C (14°F to 320°F)
Accuracy	±2°C (±3.6°F)
Capacity	25 vials (dia 16 x 100 mm), one receptacle for a stainless steel reference thermometer
Warm-up Time	10-15 minutes, depending on selected temperature
Operating Mode	timed (0 to 180 minutes) or infinity mode
Block	aluminum
Environment	5 to 50°C (41 to 122°F)
Power Supply (fuse protected)	HI839800-01: 115 VAC; 60 Hz; 250 W; HI839800-02: 230 VAC; 50 Hz; 250 W
Dimensions	190 x 300 x 95 mm (7.5 x 11.8 x 3.7")
Weight	approximately 4.8 kg (10.6 lb.)
Ordering Information	**HI839800-01** (115V) and **HI839800-02** (230V) is supplied with power cable and instructions.

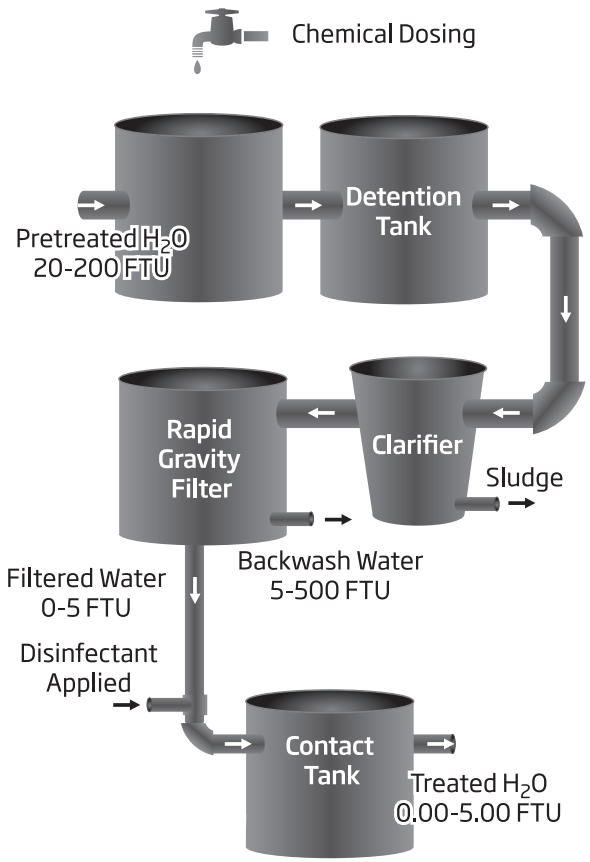
Table of Contents

Turbidity of water is an optical property that causes light to be scattered and absorbed, rather than transmitted. The scattering of the light that passes through a liquid is primarily caused by the suspended solids. The higher the turbidity, the greater the amount of scattered light. Even a very pure fluid will scatter light to a certain degree, no solution will have zero turbidity.

There are different measurement standards used based on applications, and with these standards are applied units. The ISO standard adopted the FNU (Formazin Nephelometric Unit) while the EPA uses the NTU (Nephelometric Turbidity Unit). Other units include the JTU (Jackson Turbidity Unit), FTU (Formazin Turbidity Unit), EBC (European Brewery Convention Turbidity Unit) and diatomaceous earth (mg/L SiO_2).

	JTU	FTU (NTU/FNU)	SiO_2 (mg/L)
JTU	1	19	2.5
FTU (NTU/FNU)	0.053	1	0.13
SiO_2 (mg/L)	0.4	7.5	1

Treatment Process of Drinking Water



Purification of Drinking Water

Turbidity is one of the most important parameters used to determine the quality of drinking water. Public water suppliers are required to treat their water to remove turbidity. In the United States, for systems that use conventional or direct filtration methods, turbidity cannot be higher than 1.0 nephelometric turbidity units (NTU) at the plant outlet, and all samples for turbidity must be less than or equal to 0.3 NTU for at least 95 percent of the samples in any month. Adequately treated surface water does not usually present a turbidity problem. The World Health Organization indicates 5 NTU as the reference turbidity value of water for trade. This value has been established based on the aesthetic characteristics of water. From a hygienic point of view, 1 NTU is the recommended value. Many drinking water utilities strive to achieve levels as low as 0.1 NTU.

Turbidity is an indicator and will not give results for a specific pollutant. It will, however, provide information on the degree of overall contamination. The flow chart for the water treatment process of drinking water shows the turbidity reference values for each phase.

Monitoring for Natural Water Supplies

In natural water, turbidity measurements are taken to gauge general water quality and its compatibility in applications where there are aquatic organisms. It has been found that there is a strong correlation between the turbidity level and the BOD value. Moreover, by definition, turbidity obstructs light, thus reducing the growth of marine plants, eggs and larvae, which are usually found in the lower levels of an aquatic ecosystem.

Wastewater Treatment and Turbidity

Historically, turbidity is one of the main parameters monitored in wastewater. In fact, the monitoring and treatment process was once solely based on the control of turbidity. Currently, the measurement of turbidity at the end of the wastewater treatment process is necessary to verify that the values are within regulatory standards. Generally speaking, the turbidity value has to be between 0 and 50 FTU, with an accuracy of ±3 FTU, depending on the phase of the wastewater treatment process. By monitoring the turbidity level, it can be determined if the different stages of the process, particularly in the filtration and purification stages, have been completed correctly.

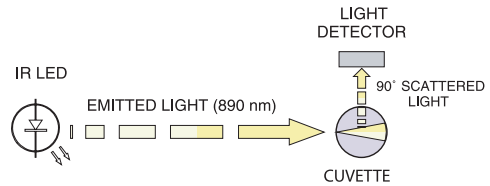
The Hanna Solution

There are three analytical test methods for turbidity: ISO 7027 "Water Quality: Determination of Turbidity", USEPA Method No. 180.1, "Turbidity", and Seawater and Wastewater No. 2130, "Turbidity".

Specific wavelengths are recommended for each method. For the USEPA and Standard Methods, the wavelength in the visible range of the spectrum is recommended, where the European system, ISO 7027 requires an infrared light source.

The Infrared Method (ISO 7027)

HI88713 and HI98713 operate by passing a beam of infrared light through a vial containing the sample to be tested. The light source is a High Emission Infrared LED. A sensor, positioned at 90° with respect to the direction of the light, detects the amount of light scattered by the undissolved particles present in the sample. A microprocessor converts these readings into FTU (FNU) values.



The USEPA (Environmental Protection Agency) Approved Method

Instruments featuring EPA approved methods are designed to meet or exceed the criteria specified by the USEPA Method 180.1 and Standard Method 2130 B.

Turbidity Bench Meters Principle of Operation

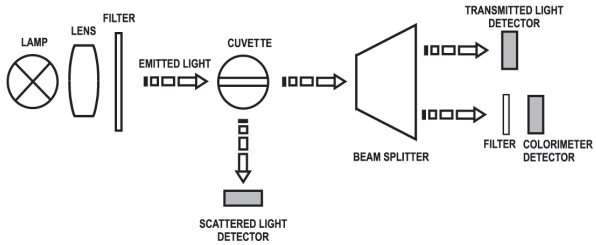
The USEPA Method 180.1 specify the key parameters for the optical system to measure turbidity for drinking, saline and surface water, in a 0 to 40 NTU range, using the nephelometric method.

The HI83414 and HI88703 are designed to meet or exceed the criteria specified by the USEPA Method 180.1 and Standard Method 2130 B. The light beam that passes through the sample is scattered in all directions. The intensity and pattern of the scattered light is affected by many variables, such as wavelength of the incident light, particle size and shape, refractive index and color. The optical system includes a tungsten filament lamp, a scattered light detector (90°) and a transmitted light detector (180°).

In the ratio turbidimeter range, the microprocessor of the instrument calculates the NTU value from the signals that reach the two detectors by using an effective algorithm. This algorithm corrects and compensates for interferences of color, making the HI83414 and HI88703 color-compensated. The optical system and measuring technique also compensate for the lamp intensity fluctuations– minimizing the need for frequent calibration.

In the non-ratio turbidimeter range, the NTU value is calculated from the signal on the scattered light detector (90°). This method offers a high linearity on the low range but is more sensitive to lamp intensity fluctuations.

The lower detection limit of a turbidimeter is determined by stray light. Stray light is the light detected by the sensors that is not caused by light scattering from suspended particles. The optical systems of HI83414 and HI88703 are designed to have very low stray light, providing accurate results for low turbidity samples.



Portable Turbidity Meters Principal of Operation

The USEPA Method 180.1 specifies the key parameters for the optical system to measure turbidity for drinking, saline and surface water in a 0 to 40 NTU range, using the nephelometric method. The HI93414 and HI98703 Portable Turbidimeters meet or exceed the criteria specified by the USEPA Method 180.1 and Standard Method 2130 B.

The ISO 7027 standard specifies the key parameters for the optical system to measure turbidity for drinking and surface water, using the formazin-based metric method. The HI98713 portable turbidimeter meets or exceeds the criteria specified by the ISO 7027 standard.

The light beam that passes through the sample is scattered in all directions. The intensity and pattern of the scattered light is affected by many variables like wavelength of the incident light, particle size, shape, refractive index and color.

The HI93414 and HI98703's optical system includes a tungsten filament lamp, a scattered light detector (90°) and a transmitted light detector (180°). For the colorimeter range the optical system is based on the turbidimeter tungsten lamp and a separate detector with a narrow band interference filter @ 525 nm to guarantee both high performance and reliable results for colorimetric measurements.

The HI98713's optical system includes an infrared LED, a scattered light detector (90°) and a transmitted light detector (180°). By using an effective algorithm, the instrument's microprocessor calculates the FTU value from the signals that reach the two detectors. This algorithm corrects and compensates for interferences of color, making the HI98713 turbidimeter color-compensated.

The optical system and measuring technique allow the compensation of lamp intensity (HI98703, HI93414) or LED intensity (HI98713) fluctuations, minimizing the need for frequent calibration.

The lower detection limit of a turbidimeter is determined by the so-called "stray light". Stray light is the light detected by the sensors that is not caused by light scattering from suspended particles. The optical system of HI98713 turbidimeter is designed to have very low stray light, providing accurate results for low turbidity samples when special care is taken.

EPA Compliant Meters

	Turbidity	pH	Free Chlorine	Total Chlorine	Bromine (Br)	Iodine (I)	Cyanuric Acid (CYAC)	Iron, LR (Fe, LR)	Ratio Mode	Non-Ratio Mode	FNU Mode	FAU Mode	NTU Ratio Mode	NTU Non-Ratio Mode	Max. Calibration Points	CAL Check™	Logging	EPA Compliant	ISO	GLP	PC Connectivity	Fast Tracker™	Backlit LCD	Auto-off	Page
HI83414	•		•	•					•	•					5	•	•	•		•	•		•	•	12.5
HI88703	•								•	•					5		•	•		•	•		•	•	12.8
HI93414	•		•	•											4	•	•	•		•	•	•	•	•	12.9
HI98703	•														4		•	•		•	•	•	•	•	12.11

ISO Compliant Meters

HI88713	•										•	•	•	•	5		•		•	•	•		•		12.13
HI98713	•														4		•		•	•	•	•	•	•	12.14
HI93703	•														3				•	•				•	12.15

Application Specific Meters

HI93102	•	•	•	•	•	•	•	•							2		•	•						•	12.12
HI83749	•								•						4		•	•		•	•	•	•	•	12.16
HI847492	•														4		•			•	•	•	•	•	12.17

HI83414

Turbidity and Free/ Total Chlorine Meter

EPA Compliant

- EPA standards
  - Meets USEPA requirements
- CAL Check™
  - Alerts users of calibration status
- Five point calibration
  - Up to 5 point turbidity calibration
- Connectivity
  - PC interface via USB
- Logging
  - Log and recall up to 200 measurements
- GLP features
  - Meets Good Laboratory Practices

Test the most important drinking water parameters

HI83414 is a highly accurate dual parameter instrument that reflects Hanna's years of experience. The HI83414 successfully combines turbidity and colorimetric measurements to test the most important parameters of drinking water: turbidity and free/total chlorine. This meter is specially designed for water quality measurements, providing reliable and accurate readings on low turbidity and chlorine values. The HI83414 meets and exceeds the requirements of USEPA and Standard Methods for turbidity and colorimetric measurements.

Calibration

A two, three, four or five-point calibration can be performed by using the supplied (<0.1, 15, 100, 750 and 2000 NTU) standards. If user-prepared standards are used, the calibration points can be modified. Free or total chlorine measurements can be made in the 0.00 to 5.00 mg/L (ppm) range.

CAL Check™

With the powerful CAL Check™ function, reliable performance can be validated at any moment by using the exclusive Hanna ready-made, NIST traceable standards. A one-point calibration can be performed using the same CAL Check™ standard.

Optical system

This instrument features an optical system to guarantee accurate results, assure long-term stability and minimize stray light and color interferences. They also compensate for variations in intensity of the lamp for less frequent calibration.

The 525 nm interference filter of the colorimeter assures accurate and repeatable results. Repeatability of the measurements are ensured with 25 mm round cuvettes made from special optical glass.

Measurements

Turbidity measurements can be made in the 0.00 to 4000 NTU (Nephelometric Turbidity Units) range when ratiometric measurements are used and in the 0.00 to 40.0 NTU range when non-ratio method is used. The HI83414 has an EPA compliance reading mode which rounds the reading to meet EPA reporting requirements. Alternative EBC and Nephelos measuring units are available. Depending on the measured sample and needed accuracy, normal measurement, continuous measurement or signal averaging measurement can be selected.

Good Laboratory Practice

The HI83414 features complete GLP (Good Laboratory Practice) functions that allow traceability of the calibration conditions. The last calibration points, time and date can be checked.

User-friendly interface with contexual help

This meter also incorporates a user-friendly interface with an easy-to-understand, graphic LCD. All messages are in plain text, making them easy to read. Comprehensive contextual help is available at the press of a button. All messages and help screens are available in several languages. Confirmation and error acoustic signals help the user during instrument operation. Furthermore, a tutorial mode of operation guides the user step by step through the analysis process.

Data logging

The logging function offers complete measurement information. Up to 200 measurements can be stored in the internal memory and consulted at any time. For further storage or analysis options, data can be downloaded to a PC using the USB port.

Standardization

The nephelometric turbidity meter is designed to be routinely standardized with a known light scattering standard. As with all analytical standards or reference materials, a turbidity standard should be able to perform the following: provide traceability, demonstrate the accuracy of results, calibrate the equipment and methodology, monitor user performance, validate tests and facilitate comparability; this ensures that when the correct procedures have been followed, the same analysis of the same materials will produce results that agree with each other whenever they are performed.

Standards and reference materials should be produced and characterized in a technically competent manner and should be homogenous, stable, certified and have available a known uncertainty of measurement. Presently, there are at least two standards recognized and approved by the USEPA, Standard Methods, ASTM and other regulatory agencies; these are formazin and AMCO AEPA-1.

Formazin is an aqueous suspension of an insoluble polymer formed by the condensation reaction between hydrazine sulphate and hexamethylenetetramine. Although formazin was suggested as a turbidity standard as early as 1926, it has many limitations, such as its high toxicity, low shelf life, quick rate of settling and easy agglomeration. Also, the diluent for formazin standards must be turbidity-free water. This is often difficult to obtain, particularly in a field situation.

AMCO AEPA-1 Standard

Fortunately, since 1982, there is a standard available which overcomes the shortcomings of formazin. This has been developed by the American company, Advanced Polymer Systems, and is a suspended mixture of styrene divinylbenzene polymer spheres. These standards have the following characteristics:

Stability: AMCO APEA-1 turbidity standards are a stabilized suspension of cross linked styrene divinylbenzene copolymer microbeads in ultrapure water. These beads are chemically inert and keep their chemical balance in a water medium regardless of concentration.

The size scatter of the beads only ranges from 0.06 to 0.2 microns. This small size accounts for random Brownian movement of these beads in suspension, keeping them in constant motion and totally dispersed within the ultra pure water matrix.

Physical properties: Particle size, uniform shape and refractive index make these spheres ideal to characterize light absorption and scatter for 90° behavior in the UV-VIS range. In addition, the bead's spherical shape and size impedes the agglomeration or precipitation of the standard. For these reasons, the AMCO AEPA-1 standards are very stable.

Reliability: These standards are prepared and bottled in a clean room facility. They are tested for accuracy and stability, fully validated before bottling, and free from any toxic or carcinogenic chemicals or compounds.

Hanna turbidity calibration standards are prepared from NIST traceable primary standard reference materials. All prepared standards are compared to formazin turbidity standard solutions. The values reported on Hanna Certificate of Analysis are the results obtained on the date of analysis. The evaluation of these data is based on Standard Methods.

Typical sources of turbidity in drinking water include the following:

- Waste discharge
- Run-off from watersheds, especially those that are disturbed or eroding
- Algae or aquatic weeds and products of their breakdown in water reservoirs, rivers, or lakes
- Humic acids and other organic compounds resulting from decay of plants, leaves, etc. in water sources
- High iron concentrations which give water a rust-red coloration (mainly in ground water and ground water under the direct influence of surface water)
- Air bubbles and particles from the treatment process

Simply stated, turbidity is the measure of relative clarity of a liquid. Clarity is important when producing drinking water for human consumption, and in many manufacturing uses.

Once considered as a mostly aesthetic characteristic of drinking water, significant evidence exists that controlling turbidity is a competent safeguard against pathogens in drinking water.

Turbidity measurement is a quick and inexpensive test that can help operators diagnose and treat water problems. Proper calibration technique and the use of high quality turbidity standards, such as the AMCO AEPA standards, ensure that measurements can be fully validated, are in compliance with regulatory requirements, are traceable to Primary Reference Materials and, most importantly, are comparable. The user can be certain that their measurements, irrespective of instrument, are all traceable in an unbroken chain to the same NIST Primary Standard.

HI83414 Turbidity Specifications

Non-Ratio Mode	Range	0.00 to 9.99; 10.0 to 40.0 NTU; 0.0 to 99.9; 100 to 268 Nephelos; 0.00 to 9.80 EBC
	Resolution	0.01; 0.1 NTU; 0.1; 1 Nephelos; 0.01 EBC
Ratio Mode	Range	0.00 to 9.99; 10.0 to 99.9; 100 to 4000 NTU; 0.0 to 99.9; 100 to 26800 Nephelos; 0.00 to 9.99; 10.0 to 99.9; 100 to 980 EBC
	Resolution	0.01; 0.1; 1 NTU; 0.1; 1 Nephelos; 0.01; 0.1, 1 EBC
Range Selection		automatic
Accuracy		±2% of reading plus 0.02 NTU (0.15 Nephelos; 0.01 EBC); ±5% of reading above 1000 NTU (6700 Nephelos; 245 EBC)
Repeatability		±1% of reading or 0.02 NTU (0.15 Nephelos; 0.01 EBC) whichever is greater
Stray Light		< 0.02 NTU (0.15 Nephelos; 0.01 EBC)
Light Detector		silicon photocell
Method		nephelometric method (90°) or ratio nephelometric method (90° & 180°), adaptation of the USEPA method 108.1 and standard method 2130 B
Measuring Mode		normal, average, continuous
Turbidity Standards		<0.1, 15, 100, 750 and 2000 NTU
Calibration		two, three, four or five-point calibration

HI83414 Free and Total Chlorine Specifications

Range	0.00 to 5.00 mg/L (ppm)
Resolution	0.01 mg/L (ppm) from 0.00 to 3.50 mg/L (ppm) ; 0.10 above 3.50 mg/L (ppm)
Accuracy @25°C/77°F	±0.02 mg/L @ 1.00 mg/L
Detector	silicon photocell with 525 nm narrow band interference filters
Method	adaptation of the USEPA Method 330.5 and Standard Method 4500-Cl G.
Standards	1.00 mg/L (ppm) free chlorine; 1.00 mg/L)ppm) total chlorine
Calibration	one-point calibration

HI83414 General Specifications

Light Source/ Life	tungsten filament lamp / greater than 100,000 readings
Display	40 x 70 mm graphic LCD (64 x 128 pixels) with backlight
Log Memory	200 records
PC Interface	USB
Environment	0 to 50°C (32 to 122°F); max 95% RH non-condensing
Power Supply	115/130 Vac; 50/60 Hz, auto-off after 15 minutes of non-use
Dimensions	230 x 200 x 145 mm (9.0 x 7.9 x 5.7")
Weight	2.5 kg (88 oz.)
Ordering Information	**HI83414-01** (115V) and **HI83414-02** (230V) are supplied with sample cuvettes and caps (5), calibration cuvettes for turbidity (HI88703-11) and colorimeter (HI93414-11), silicone oil (HI98703-58), cuvette wiping cloth, scissors, power cord and instruction manual.

See page 12.18 for reagents and accessories

HI88703

Precision Turbidity Benchtop Meter

EPA Compliant

- Two measuring ranges
  - Ratio turbidity, non-ratio turbidity
- EPA standard
  - Meets USEPA requirements
- GLP features
  - Meets Good Laboratory Practices
- Five point calibration
  - Up to five-point turbidity calibration
- Connectivity
  - USB PC connectivity
- Logging
  - Log up to 200 measurements
- HELP features
  - Contextual help and tutorial mode

The HI88703 turbidity benchtop meter is specially designed for water quality measurements, providing reliable and accurate readings on low turbidity ranges.

This instrument has an EPA compliance reading mode which rounds the reading to meet EPA reporting requirements. Alternative EBC and Nephelos measuring units are available. Depending on the measured sample and needed accuracy, normal, continuous or signal averaging measurement can be selected.

A two, three, four or five-point calibration could be performed by using the supplied standards. When user-prepared standards are used, calibration points can be modified.

The HI88703 features complete GLP (Good Laboratory Practice) functions that allow traceability of the calibration conditions. The last calibration points, time and date can be checked.

Up to 200 measurements can be stored in internal memory. Data can be transferred to a PC via optional HI920013 USB cable and HI92000 Windows® compatible software.

Specifications		HI88703
Non-ratio Mode	Range	0.00 to 9.99; 10.0 to 40.0 NTU; 0.0 to 99.9; 100 to 268 Nephelos; 0.00 to 9.80 EBC
	Resolution	0.01; 0.1 NTU; 0.1; 1 Nephelos; 0.01 EBC
Ratio Mode	Range	0.00 to 9.99; 10.0 to 99.9; 100 to 4000 NTU 0.0 to 99.9; 100 to 26800 Nephelos 0.00 to 9.99; 10.0 to 99.9; 100 to 980 EBC
	Resolution	0.01; 0.1; 1 NTU; 0.1; 1 Nephelos; 0.01; 0.1, 1 EBC
Additional Specifications	Range Selection	automatic
	Accuracy	±2% of reading plus 0.02 NTU (0.15 Nephelos; 0.01 EBC); ±5% of reading above 1000 NTU (6700 Nephelos; 245 EBC)
	Repeatability	±1% of reading or 0.02 NTU (0.15 Nephelos; 0.01 EBC) whichever is greater
	Stray Light	< 0.02 NTU (0.15 Nephelos; 0.01 EBC)
	Light Detector	silicon photocell
	Light Source/ Life	tungsten filament lamp / greater than 100,000 readings
	Display	40 x 70 mm graphic LCD (64 x 128 pixels) with backlight
	Method	nephelometric method (90°) or ratio nephelometric method (90° & 180°), adaptation of the USEPA method 180.1 and standard method 2130 B
	Measuring Mode	normal, average, continuous
	Turbidity Standards	<0.1, 15, 100, 750 and 2000 NTU
	Calibration	two, three, four or five-point calibration
	Log Memory	200 records
	PC Interface	USB
	Environment	0 to 50°C (32 to 122°F); max 95% RH non-condensing
	Power Supply	230/115 Vac; 50/60 Hz; auto-off after 15 minutes of non-use
	Dimensions	230 x 200 x 145 mm (9 x 7.9 x 5.7")
	Weight	2.5 kg (88 oz.)
Ordering Information		**HI88703-01** (115V) and **HI88703-02** (230V) is supplied with sample cuvettes and caps (5), calibration cuvettes (HI88703-11), silicone oil (HI98703-58), cuvette wiping cloth, power cord and instruction manual.

See page 12.18 for reagents and accessories

HI93414

Turbidity and Free/ Total Chlorine Portable Meter

EPA Compliant

- CAL Check™
  - Alerts users of calibration status
- Four-point calibration
  - Up to 4 point turbidity calibration
- Connectivity
  - USB and RS232 PC connectivity
- GLP features
  - Meets Good Laboratory Practices
- Logging
  - Logging for up to 200 readings
- Backlight
  - User-friendly, backlit display
- Battery indicator
  - Battery % on startup

The HI93414 measures the most important parameters of drinking water: turbidity and free/total chlorine. Designed for water quality measurements, HI93414 provides reliable and accurate readings on low turbidity and chlorine values. The HI93414 meets and exceeds the requirements of USEPA and Standard Methods both for turbidity and colorimetric measurements.

This instrument incorporates an optical system which guarantees accurate results. The optical system, consisting of a tungsten filament lamp, three detectors (scattered, transmitted for turbidimeter range and one for colorimeter range), and a narrow band interference filter @ 525 nm assures long-term stability and minimizes stray light and color interferences. It also compensates for variations in intensity of the lamp, limiting the need for frequent calibration. The 25 mm round cuvettes, made from special optical glass, guarantee repeatability and consistency of measurements.

Turbidity measurements can be made in the 0.00 to 1000 NTU (Nephelometric Turbidity Units) range. The instrument has an EPA compliance reading mode which rounds readings to meet EPA reporting requirements. Depending on the measured sample and needed accuracy, normal measurement, continuous measurement or signal averaging measurement can be selected. Free or total chlorine measurements can be made in the 0.00 to 5.00 mg/L (ppm) range.

At startup, the meter displays the percentage of remaining battery life and, if too low, a "low battery" warning message is displayed.

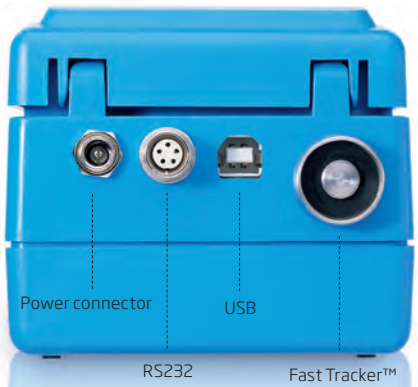
With the powerful CAL Check™ function, performance of the instrument can be validated at any time by using the exclusive Hanna ready-made NIST traceable standards. Calibration can be performed at any time for turbidity and colorimetric range. For turbidity, a two, three or four-point calibration is available using supplied (<0.1, 15, 100 and 750 NTU adjustable calibration points) or user-prepared standards. For colorimeter measurements, a one-point calibration can be performed.

The HI93414 has complete GLP (Good Laboratory Practice) functions that allow traceability of the calibration conditions. The last calibration points, time and date can be checked at the touch of a button. The HI93414 has a user-friendly interface with an easy-to-read, large LCD. Displayed codes guide the user step-by-step through routine operation and calibration. Confirmation and error acoustic signals aid the user during instrument operation.

For advanced field applications, the HI93414 is equipped with Fast Tracker™–Tag Identification System (T.I.S.) that makes data collecting and management simpler than ever. Fast Tracker™ allows users to record the time and location of a specific measurement or series of measurements.

With it's logging function, up to 200 measurements, along with its tagged locations, can be stored in internal memory and consulted at any time. Data can be later transferred to a PC via RS232 or USB interface and Hanna HI92000 software (optional).

Accurate, On-site Analysis



FastTracker™
location traceability

HI920005 Tag holders with tags (5)

CAL Check™ Calibration Validation

With Hanna's exclusive CAL Check™ validation function, users are able to verify the performance of the instrument at any time. Using Hanna's exclusive ready-made, NIST traceable standards, validation is user friendly and ensures proper calibration.

iButton® Tags are Easy to Install

Install tags near your sampling points for quick and easy iButton® readings. Each tag contains a computer chip with a unique identification code encased in stainless steel. You can install a practically unlimited amount of tags.

HI93414 Turbidity

Range	0.00 to 1000 NTU
Range Selection	automatic
Resolution	0.01 (0.00 to 9.99 NTU); 0.1 (10.0 to 99.9 NTU) 1 (100 to 1000 NTU)
Accuracy	±2% of reading plus 0.02 NTU
Repeatability	±1% of reading or 0.02 NTU, whichever is greater
Stray Light	< 0.02 NTU
Light Detector	silicon photocell
Method	ratio nephelometric method (90°), ratio of scattered and transmitted light; adaptation of the USEPA method 180.1 and standard method 2130 B
Measuring mode	normal, average, continuous
Turbidity Standards	<0.1, 15, 100 and 750 NTU
Calibration	two, three or four-point calibration

HI93414 Free and Total Chlorine

Range	0.00 to 5.00 mg/L
Resolution	0.01 mg/L (0.00 to 3.50 mg/L); 0.10 mg/L (above 3.50 mg/L)
Accuracy @25°C /77°F	±0.02 mg/L @ 1.00 mg/L
Detector	silicon photocell with 525 nm narrow band interference filter
Method	adaptation of the USEPA method 330.5 and standard method 4500-Cl G.
Standards	1 mg/L free chlorine, 1 mg/L total chlorine
Calibration	one-point calibration

HI93414 General Specifications

Light Source	tungsten filament lamp
Lamp Life	greater than 100,000 readings
Log Memory	200 records
Serial Interface	USB or RS 232
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Power Supply	1.5V AA alkaline batteries (4) or AC adapter; auto-off after 15 minutes of non-use
Dimensions / Weight	224 x 87 x 77 mm (8.8 x 3.4 x 3.0") / 512 g (18 oz.)
Ordering Information	**HI93414-01** (115V) and **HI93414-02** (230V) is supplied with sample cuvettes and caps (5), calibration cuvettes for turbidity (HI98703-11), calibration cuvettes for colorimeter (HI93414-11), silicone oil (HI98703-58), cuvette wiping cloth, scissors, batteries, AC adapter, instructions and rugged carrying case.

See page 12.19 for reagents and accessories

HI98703

Turbidity Meter

Fast Tracker™ Technology, EPA Compliant

- Four-point calibration
  - Up to four-point calibration
- Connectivity
  - USB and RS232 PC connectivity
- Logging
  - Log up to 200 records
- GLP features
  - Meets Good Laboratory Practices
- Backlight
  - User-friendly, backlit display
- Battery indicator
  - Battery % on startup

The HI98703 meets and exceeds the requirements of the USEPA Method 180.1 for wastewater and Standard Method 2130 B for drinking water. The instrument has an EPA compliance reading mode which rounds readings to meet EPA reporting requirements. Users will appreciate the accuracy and sensitivity of this instrument, particularly at very low turbidity levels.

This instrument incorporates complete GLP (Good Laboratory Practice) functions that allow traceability of the calibration conditions. The last calibration points, time and date can be checked at the touch of a button.

With its logging function, up to 200 measurements, along with its tagged locations, can be stored in internal memory and consulted at any time. Data can be later transferred to a PC via RS232 or USB interface and Hanna HI92000 software (optional).

Specifications	HI98703
Range	0.00 to 1000 NTU
Range Selection	automatic
Resolution	0.01 (0.00 to 9.99 NTU); 0.1 (10.0 to 99.9 NTU); 1 (100 to 1000 NTU)
Accuracy	±2% of reading plus 0.02 NTU
Repeatability	±1% of reading or 0.02 NTU, whichever is greater
Stray Light	< 0.02 NTU
Light Detector	silicon photocell
Light Source	tungsten filament lamp
Lamp Life	greater than 100,000 readings
Method	ratio nephelometric method (90°), ratio of scattered and transmitted light; adaptation of the USEPA method 180.1 and standard method 2130 B
Measuring mode	normal, average, continuous
Turbidity Standards	<0.1, 15, 100 and 750 NTU
Calibration	two, three or four-point calibration
LOG Memory	200 records
Serial Interface	USB or RS232
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Power Supply	1.5V AA alkaline batteries (4) or AC adapter; auto-off after 15 minutes of non-use
Dimensions / Weight	224 x 87 x 77 mm (8.8 x 3.4 x 3.0") / 512 g (18 oz.)
Ordering Information	**HI98703-01** (115V) and **HI98703-02** (230V) are supplied with sample cuvettes and caps (5), calibration cuvettes, silicone oil (HI98703-58), cuvette wiping cloth, batteries, AC adapter, instruction manual and rugged carrying case.

See page 12.19 for reagents and accessories

HI93102

Meter for Water Analysis

Turbidity, Cl_2, pH, Br, Fe, I and CYAC

- EPA standard
  - Meets the USEPA standards
- Custom calibration points
  - Advanced electronics allow operators to calibrate the meter
- Logging
  - Log and recall up to 25 different samples.

The most important parameters needed for water analysis, especially in drinking water, can be measured with Hanna's HI93102 portable meter. This instrument not only measures turbidity, but also pH, total and free chlorine, bromine, iodine, iron, and cyanuric acid (CYAC). Achieve laboratory results in the field quickly and easily.

Measurements are made quickly and repeatedly through a sophisticated, yet easy-to-use microprocessor. In colorimetric mode, users can select between factory pre-programmed calibration or calibrating the meter on their own, and measure either concentration or relative absorbance of the sample. Up to 25 measured samples can be stored in memory, together with time and date. Miniaturization of the electronics has made it possible to offer unsurpassed accuracy and quality in a portable unit weighing just one pound.

Specifications		HI93102	
Parameter Specifications		**Turbidity**	**Br–Bromine**
	Range	0.00 to 50.0 NTU†	0.00 to 8.00 mg/L (ppm)
	Resolution	0.01 (0.00 to 9.99) and 0.1 NTU (10.0 to 50.0)	0.01 mg/L (ppm)
	Accuracy @25°C	±0.5 NTU or ±5% of reading (whichever is greater)	±0.08 mg/L (ppm) ±3% of reading
		Free and Total Chlorine	**CYAC–Cyanuric Acid**
	Range	Free: 0.00 to 2.50 mg/L (ppm); Total: 0.00 to 3.50 mg/L (ppm)	0 to 80 mg/L (ppm)
	Resolution	0.01 mg/L (ppm)	1 mg/L (ppm)
	Accuracy @25°C	±0.03 mg/L (ppm) ±3% of reading	±1 mg/L (ppm) ±15% of reading
		I–Iodine	**Fe LR–Iron LR**
	Range	0.0 to 12.5 mg/L (ppm)	0.00 to 1.00 mg/L (ppm)
	Resolution	0.1 mg/L (ppm)	0.01 mg/L (ppm)
	Accuracy @25°C	±0.1 mg/L (ppm) ±5% of reading	±0.02 mg/L (ppm) ±3% of reading
		pH	
	Range	5.9 to 8.5 pH	
	Resolution	0.1 pH	
	Accuracy @25°C	±0.1 pH	
Additional Specifications	Turbidity Calibration	two-point; selectable between 0.00 - 50.0 FTU (0.00 and 20.0 FTU recommended)	
	Light Source / Detector	pure green LED / silicon photocell (2)	
	Battery Type / Life	1.5V AA (4) / approximately 60 hours of continuous use or 1000 measurements; automatic shut-off selectable after 10, 20, 30, 40, 50 or 60 minutes of non-use	
	Environment	0 to 50°C (32 to 122°F); RH max 95% (non condensing)	
	Dimensions / Weight	220 x 82 x 66 mm (8.7 x 3.2 x 2.6") / 510 g (1.1 lb.)	
Ordering Information		**HI93102** is supplied with measurement cuvette cap, batteries and instruction manual.	

† 1 NTU (Nephelometric Turbidity Unit) = FTU (Formazine Turbidity Unit)
* set of 300 tests available, -03
** set of 150 tests available, -03

See page 12.20 for reagents and accessories

HI88713

Turbidity Benchtop Meter

ISO Compliant

- Backlight
  - Graphic display, backlit LCD
- Five-point calibration
  - Up to 5 point calibration
- GLP features
  - Meets Good Laboratory Practices
- Logging
  - Log up to 200 records
- Help features
  - Contextual help and tutorial mode
- Connectivity
  - USB PC connectivity

The HI88713 turbidity bench meter meets and exceeds the requirements of the ISO 7027 standard.

The HI88713 is based on an optical system which guarantees accurate results, long-term stability and minimizes stray light and color interferences. It also compensates for variations in intensity of the LED, limiting the need for frequent calibration.

Depending on the measured sample and needed accuracy, normal, continuous or signal averaging measurement can be selected.

A two, three, four or five-point calibration can be performed using the supplied standards. Calibration points can be modified when user-prepared standards are used.

The HI88713 turbidity bench meter has complete GLP (Good Laboratory Practice) functions that allow traceability of the calibration conditions.

The HI88713 turbidity bench meter has a user-friendly interface with an easy-to-understand, graphic LCD. Comprehensive contextual help is available at the touch of a button. Furthermore, a tutorial mode of operation guides the user step by step through the analysis process.

Up to 200 measurements can be stored in internal memory. Data can be transferred to a PC via optional HI920013 USB cable and HI92000 Windows® compatible software.

Specifications		HI88713
FNU Mode	Range	0.00 to 1000 FNU
	Resolution	0.01 (0.00 to 9.99 FNU); 0.1 (10.0 to 99.9 FNU); 1 (100 to 1000 FNU)
	Accuracy	±2% of reading plus stray light
FAU Mode	Range	10.0 to 4000 FAU
	Resolution	0.1 (10.0 to 99.9 FAU); 1 (100 to 4000 FAU)
	Accuracy @25°C/77°F	± 10% of reading
NTU Ratio Mode	Range	0.00 to 4000 NTU; 0.00 to 980 EBC
	Resolution	0.01 (0.00 to 9.99 NTU); 0.1 (10.0 to 99.9 NTU); 1 (100 to 4000 NTU) / 0.01 (0.00 to 9.99 EBC); 0.1 (10.0 to 99.9 EBC); 1 (100 to 980 EBC)
	Accuracy	±2% of reading plus stray light; ±5% of reading above 1000 NTU
NTU Non-ratio Mode	Range	0.00 to 1000 NTU; 0.00 to 245 EBC
	Resolution	0.01 (0.00 to 9.99 NTU); 0.1 (10.0 to 99.9 NTU); 1 (100 to 1000 NTU) / 0.01 (0.00 to 9.99 EBC); 0.1 (10.0 to 99.9 EBC); 1 (100 to 245 EBC)
	Accuracy @25°C/77°F	±2% of reading plus stray light
Additional Specifications	Range Selection	automatic
	Repeatability	±1% of reading or stray light, whichever is greater
	Stray Light	< 0.1 NTU (0.05 EBC)
	Light Detector	silicon photocell
	Light Source	IR LED
	Method	ISO 7027 method
	Measuring Mode	normal, average, continuous.
	Turbidity Standards	<0.1, 15, 100, 750 FNU and 2000 NTU
	Calibration	two, three, four or five-point calibration
	Log Memory	200 records
	Serial Interface	USB
	Environment	0°C to 50°C (32 to 122°F); max 95% RH non-condensing
	Power Supply	12 Vdc
	Dimensions / Weight	230 x 200 x 145 mm (9 x 7.9 x 5.7") / 2.5 Kg (88 oz.)
Ordering Information		**HI88713-01** (115V) and **HI88713-02** (230V) are supplied with sample cuvettes and caps (6), calibration cuvettes (HI88713-11), silicone oil (HI98703-58), cuvette wiping cloth, power adapter and instruction manual.

See page 12.19 for reagents and accessories

HI98713

Portable Turbidity Meter

with Fast Tracker™ Technology, ISO

- Four-point calibration
  - Two, three or four-point calibration
- Connectivity
  - USB and RS 232 PC connectivity
- Logging
  - Log up to 200 records
- GLP features
  - Meets Good Laboratory Practices
- Backlight
  - User-friendly, backlit LCD display

The HI98713 meets and exceeds the requirements of the ISO 7027 for water quality and provides reliable and accurate readings on low turbidity values. An algorithm calculates and converts the detector's output in FNU. Depending on the user's accuracy needs, normal, continuous, or signal averaging can be selected.

The Infrared Method (ISO 7027) optical system consists of an infrared LED and two detectors (for scattered and transmitted light). This method ensures long term stability and minimizes stray light and color interferences. The HI98713 also compensates for variations in intensity of the LED, minimizing the need for frequent calibration.

This instrument incorporates complete GLP (Good Laboratory Practice) functions that allow traceability of the calibration conditions. The last calibration points, time and date can be checked at the touch of a button.

With its logging function (up to 200 measurements) along with it's tagged locations, can be stored in internal memory and consulted at any time. Data can be later transferred to a PC via RS232 or USB interface and Hanna HI 92000 software (optional).

Exclusive Fast Tracker™

For advanced field applications, the HI98713 is equipped with Fast Tracker™–Tag Identification System (T.I.S.) that makes data collecting and management simpler than ever. Fast Tracker™ allows users to record the time and location of a specific measurement or series of measurements.

Specifications	HI98713
Range	0.00 to 1000 FNU
Range Selection	automatic
Resolution	0.01 (0.00 to 9.99 FNU); 0.1 (10.0 to 99.9 FNU); 1 (100 to 1000 FNU)
Accuracy	±2% of reading plus 0.1 FNU
Repeatability	±1% of reading or 0.01 FNU, whichever is greater
Stray Light	< 0.1 FNU
IR Detector	silicon photocell
Light Source	860 nm infrared LED
Lamp Life	greater than 100,000 readings
Method	adaptation of ISO 7027, ratio method with 90° and 180° detector
Turbidity Standards	<0.1, 15, 100 and 750 FNU
Calibration	two, three or four-point calibration
Log Memory	200 records
Serial Interface	USB or RS232
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Power Supply	1.5V AA alkaline batteries (4) or AC adapter; auto-off after 15 minutes of non-use
Dimensions / Weight	224 x 87 x 77 mm (8.8 x 3.4 x 3.0") / 512 g (18 oz.)
Ordering Information	**HI98713-01** (115V) and **HI98713-02** (230V) is supplied with sample cuvettes and caps (5), calibration cuvettes, silicone oil (HI98703-58), cuvette wiping cloth, batteries, AC adapter, instructions and rugged carrying case.

See page 12.19 for reagents and accessories

HI93703

Turbidity Meter

ISO Compliant

- Easy-to-read LCD
- Water-resistant keypad
- Positive-locking system ensures cuvette is firmly placed in the cell
- Auto shut-off

The HI93703 turbidity meter is a portable, microprocessor-based instrument used to determine the turbidity of water and wastewater with high precision in the field as well as in the laboratory.

The HI93703 covers a 0 to 1000 FTU range in two scales: 0.00 to 50.00 FTU and 50 to 1000 FTU. The auto-ranging feature sets the appropriate range for the measurement.

The HI93703 has been designed according to the ISO7027 International Standard, consequently the turbidity unit is the FTU (Formazine Turbidity Unit). FTU is equivalent to the other internationally recognized unit: NTU (Nephelometric Turbidity Unit).

The meter is very simple to use: all operations can be carried out with only four keys and troubleshooting functions can be performed with displayed error code guides.

The one-point calibration at 10 FTU* can be easily performed using the available standard.

Hanna has chosen 10 FTU * as the calibration point because it is the value that best fits the water turbidity measurements in different applications, from drinking water to wastewater treatment.

HANNA instruments uses the primary standard AMCO-AEPA-1 to avoid all formazine-related problems. Formazine is a very toxic, unstable substance, which requires particular care: its standards have to be prepared only a few minutes before performing the calibration, and can-not be reused because of their short life.

Hanna Instruments standards are extremely stable, can be reused, and last up to six months if free from contamination.

The HI93703 can be used with both standards.

*HI93703 has been designed according to the ISO 7027 International Standard, consequently the turbidity unit is the FTU (Formazine Turbidity Unit). FTU is equivalent to the other internationally recognized unit: NTU (Nephelometric Turbidity Unit).

Specifications	HI93703
Range	0.00 to 1000 FTU*
Resolution	0.01 (0.00 to 50.00 FTU); 1 (50 to 1000 FTU)
Accuracy @25°C/77°F	±0.5 FTU or ±5% of reading (whichever is greater)
Calibration	three points (0 FTU, 10 FTU and 500 FTU*)
Light Source / Life	infrared LED / Life of instrument
Light Detector	silicon photocell
Battery Type / Life	1.5V AA (4) /approximately 60 hours of continuous use or 900 measurements; auto-off after 5 minutes of non-use
Environment	0 to 50°C (32 to 122°F); RH max 95% (non condensing)
Dimensions	220 x 82 x 66 mm (8.7 x 3.2 x 2.6")
Weight	510 g (1.1 lb.)
Ordering Information	**HI93703** is supplied complete with glass cuvette, batteries and instructions. **HI93703C**, includes meter, HI731313 maintenance kit (consisting of: cuvettes with caps (2), HI93703-0 AMCO-AEPA-1 0 FTU calibration solution (30 mL), HI93703-10 AMCO-AEPA-1 10 FTU calibration solution (30 mL), HI93703-5 AMCO-AEPA-1 500 FTU calibration solution (30 mL) and cuvette wiping cloth), batteries, rugged carrying case and instructions.

See page 12.20 for reagents and accessories

HI83749

Portable Turbidity Meter

and Bentonite Monitoring

- GLP Features
  - Meets Good Laboratory Practices
- Backlight
  - Backlit LCD
- Connectivity
  - PC interface via USB

Wines with low phenol contents, such as rosé, light reds and whites should be checked for protein stability before bottling. Hanna offers a quick test meter to verify the risk of future protein haze formation. If protein instability is detected, a subsequent test can help define the right amount of bentonite to be added for improving protein stability. It is important not to overdose bentonite to avoid stripping wine flavor, body, and significant loss of color, especially in young red wines. Moreover, adding only the necessary amount of bentonite to obtain the desired protein stability also saves costs.

The HI83749 measures turbidity of samples from 0.00 to 1200 NTU (Nephelometric Turbidity Units) and is USEPA compliant. In the USEPA measurement mode the instrument rounds the readings to meet USEPA reporting requirements.

Specifications	HI83749
Range	0.00 to 1200 NTU
Range Selection	automatic
Resolution	0.01 (0.00 to 9.99 NTU); 0.1 (10.0 to 99.9 NTU); 1 (100 to 1200 NTU)
Accuracy @25°C/77°F	±2% of reading plus 0.05 NTU
Repeatability	±1% of reading of 0.02 NTU, whichever is greater.
Stray Light	< 0.05 NTU
Light Source	tungsten filament lamp
Light Detector	silicon photocell
Method	ratio nephelometric method
Display	60 x 90 mm backlit LCD
Calibration	two, three or four points
LOG Memory	200 records
Serial Interface	RS 232 or USB 1.1
Environment	0 to 50°C (32 to 122°F); max 95% RH non-condensing
Battery Type	1.5V AA batteries (4) / 12 VDC adapter
Auto Shut-off	after 15 minutes of non-use
Dimensions	224 x 87 x 77 mm (8.8 x 3.4 x 3.0")
Weight	512 g (18.0 oz.)
Ordering Information	**HI83749-01** (115V) and **HI83749-02** (230V) are supplied with sample cuvettes and caps (6), calibration cuvettes (4), bentocheck reagent, silicone oil (HI98703-58), 1000 µL automatic pipette with two tips and instructions sheet, 25 mL glass vials with caps (4), 1 mL syringe with two tips, funnel, filter paper (25), cuvette cleaning cloth, 12 VDC adapter, batteries, instructions and rugged carrying case.
Reagents and Standards	**HI83749-11** Turbidity Calibration Set **HI83749-20** Bentocheck Solution

See page 12.20 for reagents and accessories

* NTU (Nephelometric Turbidity Units)

HI847492

Haze Meters

for Beer Quality Analysis

- Connectivity
  - PC compatible via USB
- GLP Features
  - Meets Good Laboratory Practices
- Logging
  - Log-on-demand
- Backlight
  - Large, backlit LCD

No more judging by eye!

The HI847492 is auto-diagnostic meter designed to measure the haze in beer. Each instrument features a different measuring unit or light source to comply with different standard requirements.

HI847492 is designed according to the ASBC (American Society of Brewing Chemists) standard for haze in beer measurements.

These instruments compensate beer color to guarantee accurate readings during the brew process. The optical system consists of an LED and multiple detectors. A two, three or four-point calibration can be easily performed at any time using the supplied or user-prepared standards.

These meters have all the necessary GLP (Good Laboratory Practice) features to allow maximum traceability of data. Features include a real time clock, log on demand (up to 200 measurements), and Fast Tracker™ –Tag Identification System.

These meters also incorporate a continuous measurement mode to measure the settling rate of suspended matter, and a signal average (AVG) mode to accumulate multiple readings, giving a final average value. The average mode is particularly useful to measure samples with suspended particles with different dimensions.

All three meters feature a user-friendly interface, with a large backlit LCD. Acoustic signals and display codes to guide the user step-by-step through routine operations.

Why this instrument is so important...

Beer haze may be defined as an insoluble or semi-soluble particulate matter which is small enough to form a colloidal suspension in beer. These particles scatter transmitted light and are observed as a degradation in the transparency of the beer.

The beer clarity is a parameter constantly controlled in a brewery, and to assure a consistent product quality, the brewmaster needs more than visual inspection.

Several substances can cause haze in beer, but the most frequently encountered problem is due to a cross-linking of polyphenol and protein.

A range of stabilization treatments are available for avoiding haze problems. The products have to be controlled on several steps during the brewing process, in particular after filtration and before the beer enters the single tanks.

Beer Haze Table

Grade	EBC	ASBC
Brilliant	0.0 to 0.5	0.0 to 34.5
Almost Brilliant	0.5 to 1.0	34.5 to 69
Very Slightly Hazy	1.0 to 2.0	69 to 138
Slightly Hazy	2.0 to 4.0	138 to 276
Hazy	4.0 to 8.0	276 to 552
Very Hazy	> 8.0	> 552

Methods

Many methods were used to measure turbidity over the years. The Jackson Candle Turbidimeter was used to measure turbidity as Jackson turbidity units (JTU). The method is visual and is not considered very accurate. To obtain more accurate readings, a nephelometer should be used as a turbidity reading instrument.

HI847492 reports the measurements in FTU (Formazin Turbidity Units). FTU units are equal to NTU units (Nephelometric Turbidity Units). The conversion table between these measurement units is shown below.

	NTU/ FNU/FTU	EBC	ASBC	HELM
1 NTU/1 FNU/1 FTU	1	0.25	17.25	10
1 EBC	4	1	69	40
1 ASBC	0.058	0.014	1	0.579
1 HELM	0.1	0.025	1.725	1

Specifications	HI847492
Range	0.00 to 1000 FTU
Range Selection	automatic
Resolution	0.01 (0.00 to 9.99 FTU); 0.1 (10.0 to 99.9 FTU); 1 (100 to 1000 FTU)
Accuracy	±2% of reading plus 0.05 FTU
Repeatability	±1% of reading or 0.02 FTU, whichever is greater
Stray Light	< 0.1 FTU
Light Source	LED @ 580 nm
Light Detector	silicon photocell
Method	ratio nephelometric method.
Display	60 x 90 mm backlit LCD
Calibration	two, three or four-point calibration
Log Memory	200 records
Serial Interface	RS232 or USB
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Power Supply	1.5V AA alkaline batteries (4) or AC adapter
Auto-off	after 15 minutes of non-use
Dimensions	224 x 87 x 77 mm (8.8 x 3.4 x 3.0")
Weight	512 g (18 oz.)
Ordering Information	**HI847492-01** (115V) and **HI847492-02** (230V) is supplied with sample cuvettes and caps (6), calibration cuvettes (4), 25 mL glass vials with caps (4), cuvette cleaning cloth, batteries, AC adapter, instrument quality certificate, instructions and rugged carrying case.
Accessories	**HI847492-11** Calibration standard cuvette

See page 12.20 for reagents and accessories

Solutions and Accessories

HI83414 Solutions and Accessories

Reagent Code	Description
HI93414-11	CAL Check™ calibration standards for free and total chlorine
HI93701-01	free chlorine (Cl_2) reagent kit, 100 tests
HI93701-03	free chlorine (Cl_2) reagent kit, 300 tests
HI93711-01	total chlorine (Cl_2) reagent kit, 100 tests
HI93711-03	total chlorine (Cl_2) reagent kit, 300 tests
HI88703-11	turbidity calibration standards (<0.1, 15, 100, 750 and 2000 NTU)

Accessory Code	Description
HI93703-50	cuvette cleaning solution, 230 mL
HI98703-58	silicone oil, 15 mL
HI731318	cuvette wiping cloth (4)
HI731331	glass cuvettes, large (4)
HI731335N	caps for cuvettes, large (4)
HI740234	replacement lamp for EPA turbidimeter
HI92000	Windows® compatible software
HI920013	USB cable for PC connection

HI88703 Solutions and Accessories

Reagent Code	Description
HI88703-11	turbidity calibration standards (<0.1, 15, 100, 750 and 2000 NTU)

Accessory Code	Description
HI93703-50	cuvette cleaning solution, 230 mL
HI98703-58	silicone oil, 15 mL
HI731318	cuvette wiping cloth (4)
HI731331	glass cuvettes, large (4)
HI731335N	caps for cuvettes, large (4)
HI740234	replacement lamp for EPA turbidimeter
HI92000	Windows® compatible software
HI920013	USB cable for PC connection

HI93414 Solutions and Accessories

Reagent Code	Description
HI93414-11	CAL Check™ calibration standards for free and total chlorine
HI93701-01	free Chlorine (Cl_2) reagent kit, 100 tests
HI93701-03	free Chlorine (Cl_2) reagent kit, 300 tests
HI93711-01	total Chlorine (Cl_2) reagent kit, 100 tests
HI93711-03	total Chlorine (Cl_2) reagent kit, 300 tests
HI98703-11	turbidity calibration standards (<0.1, 15 100 and 750 NTU)

Accessory Code	Description
HI920005	tag holders with tags (5)
HI93703-50	cuvette cleaning solution, 230 mL
HI98703-58	silicone oil, 15 mL
HI731318	cuvette wiping cloth (4)
HI731331	glass cuvettes, large (4)
HI731335N	caps for cuvettes, large (4)
HI740234	replacement lamp for EPA turbidimeter
HI92000	Windows® compatible software
HI920013	USB cable for PC connection
HI920011	5 to 9 pin RS232 connection cable

HI98703 Solutions and Accessories

Reagent Code	Description
HI98703-11	turbidity calibration standards (<0.1, 15 100 and 750 NTU)

Accessory Code	Description
HI920005	tag holders with tags (5)
HI93703-50	cuvette cleaning solution, 230 mL
HI98703-58	silicone oil, 15 mL
HI731318	cuvette wiping cloth (4)
HI731331	glass cuvettes, large (4)
HI731335N	caps for cuvettes, large (4)
HI740234	replacement lamp for EPA turbidimeter
HI92000	Windows® compatible software
HI920013	USB cable for PC connection
HI920011	5 to 9 pin RS232 connection cable

HI88713 Solutions and Accessories

Reagent Code	Description
HI88713-11	turbidity calibration standards (<0.1, 15, 100, 750 FNU and 2000 NTU)

Accessory Code	Description
HI93703-50	cuvette cleaning solution, 230 mL
HI98703-58	silicone oil, 15 mL
HI731318	cuvette wiping cloth (4)
HI731331	glass cuvettes, large (4)
HI731335N	caps for cuvettes, large, turbidity (4)
HI92000	Windows® compatible software
HI920013	USB cable for PC connection
HI920011	5 to 9 pin RS232 connection cable

HI98713 Solutions and Accessories

Reagent Code	Description
HI98713-11	turbidity calibration standards (<0.1, 15 100 and 750 FNU)

Accessory Code	Description
HI920005	tag holders with tags (5)
HI93703-50	cuvette cleaning solution, 230 mL
HI98703-58	silicone oil, 15 mL
HI731318	cuvette wiping cloth (4)
HI731331	glass cuvettes, large (4)
HI731335N	caps for cuvettes, large (4)
HI92000	Windows® compatible software
HI920013	USB cable for PC connection
HI920011	5 to 9 pin RS232 connection cable

HI93703 Standards and Accessories

Reagent Code	Description
HI93703-0	AMCO-AEPA-1 calibration solution, 0 FTU, 30 mL bottle
HI93703-05	AMCO-AEPA-1 calibration solution, 500 FTU, 30 mL bottle
HI93703-10	AMCO-AEPA-1 calibration solution at 10 FTU, 30 mL bottle

Accessory Code	Description
HI731313	maintenance kit: rugged carrying case containing HI93703-0, HI93703-05 and HI93703-10 calibration standards, cuvettes with caps (2) and cuvette wiping cloth
HI93703-50	cuvette cleaning solution, 230 mL
HI98703-58	silicone oil, 15 mL
HI731318	cuvette wiping cloth (4)
HI731321	spare glass cuvettes, small (4)

HI93102 Solutions and Accessories

Reagent Code	Description
HI93102-0	AMCO-AEPA-1 calibration solution, 0 NTU, 30 mL bottle
HI93102-20	AMCO-AEPA-1 calibration solution, 20 NTU, 30 mL bottle
HI93701-01	free chlorine (Cl_2) reagent kit, 100 tests
HI93701-03	free chlorine (Cl_2) reagent kit, 300 tests
HI93710-01	pH reagent kit, 100 tests
HI93710-03	pH reagent kit, 300 tests
HI93711-01	total chlorine (Cl_2) reagent kit, 100 tests
HI93711-03	total chlorine (Cl_2) reagent kit, 300 tests
HI93716-01	bromine (Br) reagent kit, 100 tests
HI93716-03	bromine (Br) reagent kit, 300 tests
HI93718-01	iodine (I) reagent kit, 100 tests
HI93718-03	iodine (I) reagent kit, 300 tests
HI93722-01	cyanuric acid (CYAC) reagent kit, 100 tests
HI93722-03	cyanuric acid (CYAC) reagent kit, 300 tests
HI93746-01	iron (Fe) low range reagent kit, 100 tests
HI93746-03	iron (Fe) low range reagent kit, 300 tests

Accessory Code	Description
HI920005	tag holders with tags (5)
HI93703-50	cuvette cleaning solution, 230 mL
HI731318	cuvette wiping cloth (4)
HI731321	spare glass cuvettes, small (4)

HI83749 Solutions and Accessories

Reagent Code	Description
HI83749-11	turbidity calibration kit (<0.10, 10, 100, 500 NTU)
HI83749-20	bentocheck, 100 mL
HI93701-01	free chlorine (Cl_2) reagent kit, 100 tests
HI93701-03	free chlorine (Cl_2) reagent kit, 300 tests
HI93711-01	total chlorine (Cl_2) reagent kit, 100 tests
HI93711-03	total chlorine (Cl_2) reagent kit, 300 tests

Accessory Code	Description
HI920005	tag holders with tags (5)
HI740220	25 mL glass vial with cap (2)
HI731341	1000 µL automatic pipette
HI731351	1000µL automatic pipette tips (25)
HI740233	filter paper type II (100)
HI740142P	1 mL graduated syringe (10)
HI740144P	1 mL graduated syringe tips (10)
HI93703-50	cuvette cleaning solution, 230 mL
HI98703-58	silicone oil, 15 mL
HI731318	cuvette wiping cloth (4)
HI731331	glass cuvettes, large (4)
HI731335N	caps for cuvettes, large (4)
HI740234	replacement lamp for EPA turbidimeter
HI92000	Windows® compatible software
HI920013	USB cable for PC connection

HI847492 Solutions and Accessories

Reagent Code	Description
HI847492-11	calibration standard cuvette (<0.10, 15, 100 and 800 FTU)

Accessory Code	Description
HI920005	tag holders with tags (5)
HI93703-50	cuvette cleaning solution, 230 mL
HI98703-58	silicone oil, 15 mL
HI731318	cuvette wiping cloth (4)
HI731331	glass cuvettes, large (4)
HI731335N	caps for cuvettes, large (4)
HI92000	Windows® compatible software
HI920013	USB cable for PC connection

Table of Contents

Hanna Digital Refractometers

Introduction

Refractive Index is an optical characteristic of a substance and the dissolved particles in it.

The refractive index of a substance is strongly influenced by temperature and the wavelength of light used to measure it. Therefore, care must be taken to control or compensate for temperature differences and wavelength. The refractive index measurements are usually reported at a reference temperature of 20° C (68°F), and considered to be room temperature.

Refractive index is defined as the ratio of the speed of light in a vacuum to the speed of light in the substance. A result of this property is that light will "bend," or change direction, when it travels through a substance with a different refractive index. This is called refraction.

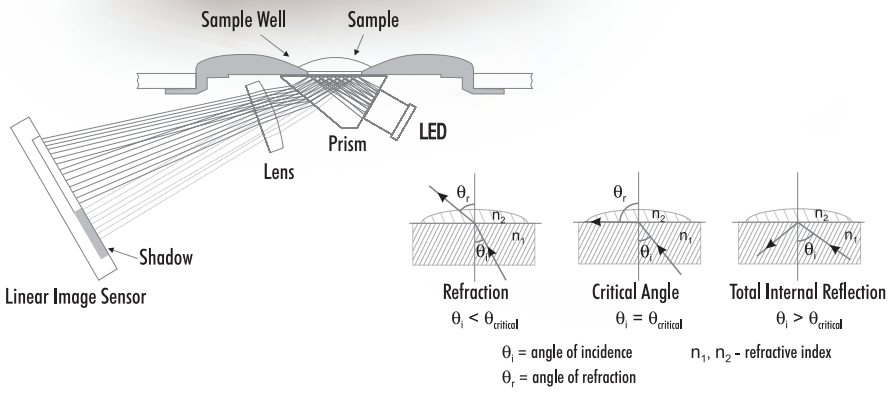
When passing from a material with a higher to lower refractive index, there is a critical angle at which an incoming beam of light can no longer refract, but will instead be reflected off the interface between the two substances. This is called total internal reflection.

The critical angle can be used to easily calculate the refractive index according to the equation:

$$\sin(\Theta_{critical}) = n_2 / n_1$$

Where n_2 is the refractive index of the lower-density medium; n_1 is the refractive index of the higher-density medium.

A digital refractometer uses an LED to pass light through a prism in contact with the sample. An image sensor determines the critical angle at which the light is no longer refracted through the sample. Specialized algorithms then apply temperature compensation to the measurement and convert the refractive index to the specified parameter.



- Automatic Temperature Compensation
  - For exceptionally accurate measurements
- Easy measurement
  - Place a few drops of the sample in the well and press the READ key
- BEPS
  - (Battery Error Prevention System) alerts the user in the event that low battery power could adversely affect readings
- IP65 water protection
  - Built to perform under harsh laboratory and field conditions
- Single-point calibration
  - Calibrate with distilled or deionized water
- Small sample size
  - Sample size can be as small as 2 metric drops
- Stainless steel sample well
  - Easy to clean and corrosion-resistant
- ABS thermoplastic casing
- Startup
  - When powered on, the meter displays battery life and the set measurement units
- Unit selection
  - Pressing the RANGE key quickly cycles through the units of measurement (if applicable)

- Battery life on display

- Easy-to-clean stainless steel sample well

- Easy measurement

Digital Refractometers

13.4

for Measurement of Sugar in Wine

Hanna offers five wine refractometers to meet the various requirements throughout the wine industry. The HI96811, HI96812, HI96813, HI96814 and HI96816 Digital Wine Refractometers are rugged, lightweight and waterproof for measurements in the lab or field.

Digital Refractometers

13.6

for Sugar Analysis throughout the Food Industry

Hanna offers five sugar refractometers to meet the requirements of the food industry. The HI96800 refractive index/Brix, HI96801 Brix (sucrose), HI96802 Fructose, HI96803 Glucose and HI96804 Invert Sugar digital refractometers are rugged, portable and water-resistant for measurements in the lab or field.

These optical instruments employ the measurement of the refractive index to determine parameters pertinent to sugar concentration analysis.

HI96831 • HI96832
Digital Refractometers

13.12

for Ethylene and Propylene Glycol Analysis

The HI96831 Ethylene Glycol and HI96832 Propylene Glycol Digital Refractometers are rugged, portable, water-resistant devices that utilize the measurement of refractive index to determine the percent volume and freezing point of ethylene or propylene glycol based solutions.

HI96811 • HI96812 • HI96813
HI96814 • HI96816

Digital Refractometers

for Measurement of Sugar in Wine

- Dual-level LCD
  - Dual-level LCD displays measurement and temperature readings simultaneously
- ATC
  - Automatic Temperature Compensation
- BEPS
  - Alerts the user of low battery power that could adversely affect readings.
- IP65 water protection
  - Built to perform under harsh laboratory and field conditions.
- Quick, accurate results
  - Readings are displayed in approximately 1.5 seconds
- One-point calibration
  - Calibrate with distilled or deionized water
- Small sample size
  - Sample size can be as small as 2 metric drops
- Automatic shut-off
  - After three minutes of non-use
- Stainless steel sample well
  - Easy to clean and corrosion-resistant
- Easy measurement
  - Place a few drops of the sample in the well and press the READ key
- ABS thermoplastic casing

Five instruments for Wine Analysis

Hanna offers five wine refractometers to meet the various requirements throughout the wine industry. The HI96811, HI96812, HI96813, HI96814 and HI96816 Digital Wine Refractometers are rugged, lightweight and waterproof for measurements in the lab or field.

Refractive Index

These optical instruments employ the measurement of the refractive index to determine parameters pertinent to the wine industry.

The actual measurement of the refractive index is simple and quick and provides the vintner a standard accepted method for sugar content analysis. Samples are measured after a simple user calibration with deionized or distilled water. Within seconds, the instrument measures the refractive index of the grape must. These digital refractometers eliminate the uncertainty associated with mechanical refractometers and are ideal for fast, reliable measurements.

Instrument Descriptions

HI96811, **HI96813** and **HI96814** convert the refractive index of the sample to sucrose concentration in units of percent by weight, % Brix (also referred to as °Brix). The conversion used is based on the ICUMSA Methods Book (International Commission for Uniform Methods of Sugar Analysis). Since the majority of sugar in grape juice is fructose and glucose and not sucrose, the reading is sometimes referred to as "Apparent Brix".

HI96812 has units of °Baumé. The °Baumé scale is based on density and was originally designed to measure the mass of sodium chloride in water. °Baumé is used in winemaking to measure the sugar in must. The HI96812 converts the % Brix reading to °Baumé based on the table found in the Official Methods of Analysis of AOAC International, 18th Edition. One °Baumé is approximately equal to 1.8 % Brix, and 1°Baumé is roughly equivalent to 1% alcohol when the wine is fully fermented.

In addition to % Brix, **HI96814** includes two other scales used in the wine industry: °Oechsle and °KMW.

°Oechsle (°Oe) is mainly used in the German, Swiss and Luxenbourgish winemaking industry to measure the sugar content of must. The °Oe scale is based on specific gravity at 20°C (S.G.(20/20)) and is the first 3 digits following the decimal point. One °Oe is roughly equal to 0.2 % Brix.

°Oe = [(S.G.(20/20)) - 1] x 1000

°Klosterneuburger Mostwaage (°KMW) is used in Austria to measure the sugar content of must. °KMW is related to °Oe by the following equation:
°Oe = °KMW x [(0.022 x °KMW) + 4.54]

1 °KMW is roughly equivalent to 1% Brix or 5 °Oe. °KMW is also known as °Babo.

"Potential" or "probable" alcohol is an estimation of the alcohol content (% vol/vol) in finished wine based on the conversion between sugar and alcohol. This conversion depends on many factors, such as the type of grapes, the grape maturity, the growing region and yeast fermentation efficiency and temperature.

The **HI96813** allows the user to tailor the instrument to their specific needs based on their experience, since no fixed conversion factor is universally applicable. The first conversion is based on the % Brix value and an adjustable conversion factor between 0.50 and 0.70 (0.55 is a common value).

Potential alcohol (% v/v) = (0.50 to 0.70) x % Brix

One drawback of the above equation is that it does not take into account the nonfermentable sugars and extract. A second equation was also added that takes these factors into account and can give a more accurate estimate of the alcohol content in the finished wine. This

conversion is named "C1" on the meter, and uses the following equation:

Potential Alcohol (%V/V) = 0.059 x [(2.66 x °Oe) - 30] (C1)

The **HI 96816** potential alcohol curve is based on the tables found in the European Economic Community Commission Regulation No 2676/90 of September 17, 1990, Determining Community Methods for the Analysis of Wine and International Organization of Vine and Wine (OIV). The potential alcohol curve is based on the following equation:

Potential alcohol (%v/v) = g/L of Sugar / 16.83

Specifications		HI96811	HI96812	HI96813	HI96814	HI96816
Sugar Content	Range	0 to 50% Brix	0 to 28°Baumé	0 to 50% Brix; 0 to 25% V/V Potential Alcohol	0 to 50% Brix; 0 to 230°Oechsle; 0 to 42°KMW	4.9 to 56.8% V/V potential alcohol; 10 to 75% Brix*
	Resolution	0.1% Brix	0.1°Baumé	0.1% Brix; 0.1% V/V Potential Alcohol	0.1% Brix; 1°Oechsle 0.2°KMW	0.1 %V/V Potential Alcohol
	Accuracy (@25°C/77°F)	±0.2% Brix	±0.1°Baumé	±0.2°Baumé; ±0.2 %V/V Potential Alcohol	±0.1% Brix; 1°Oechsle ±0.2°KMW	±0.2 %V/V Potential Alcohol
Temperature	Range	0 to 80°C (32 to 176°F)				
	Resolution	±0.1°C (0.1°F)				
	Temperature Compensation	automatic between 10 and 40°C (50 to 104°F)				
Additional Specifications	Measurement Time	approximately 1.5 seconds				
	Minimum Sample Volume	100 µL (to cover prism totally)				
	Light Source	yellow LED				
	Sample Cell	stainless steel ring and flint glass prism				
	Auto-off	after three minutes of non-use				
	Enclosure Rating	IP65				
	Battery Type / Battery Life	9V / approximately 5000 readings				
	Dimensions / Weight	192 x 102 x 67 mm (7.6 x 4.01 x 2.6") / 420 g (14.8 oz.)				
Ordering Information		**HI96811**, **HI96812**, **HI96813**, **HI96814** and **HI96816** are supplied with battery and instruction manual.				

* hidden range

HI96800 • HI96801 • HI96802
HI96803 • HI96804

Digital Refractometers

for Sugar Analysis Throughout the Food Industry

- Ideal for the analysis of:
  - Fruits, energy drinks, puddings, soy milk, juices, jam, marmalade, honey, soups, jelly, tofu and condiments
- Dual-level LCD
  - The dual-level LCD displays measurement and temperature readings simultaneously
- ATC
  - Automatic Temperature Compensation
- Easy measurement
  - Place a few drops of the sample in the well and press the READ key
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- IP65 water protection
  - Built to perform under harsh laboratory and field conditions
- Quick, accurate results
  - Readings are displayed in approximately 1.5 seconds
- One-point calibration
  - Calibrate with distilled or deionized water
- Small sample size
  - Sample size can be as small as 2 metric drops
- Automatic shut-off
  - After three minutes of non-use
- Stainless steel sample well
  - Easy to clean and corrosion-resistant
- ABS thermoplastic casing

Five instruments for Sugar Analysis

Hanna offers five sugar refractometers to meet the requirements of the food industry. The HI96800 Refractive Index/Brix, HI96801 % Brix (sucrose), HI96802 Fructose, HI96803 Glucose and HI96804 Invert Sugar digital refractometers are rugged, portable and water-resistant for measurements in the lab or field.

These optical instruments employ the measurement of the refractive index to determine parameters pertinent to sugar concentration analysis.

Refractive Index

The actual measurement of refractive index is simple, quick and provides the operator a standard accepted method for sugar content analysis. Samples are measured after a simple user calibration with deionized or distilled water. Within seconds these instruments measure the refractive index, apply any necessary calculations and display the results in the selected unit. These digital refractometers eliminate the uncertainty associated with mechanical refractometers and are easily portable for measurements in the field.

Features

These five instruments utilize internationally recognized references for unit conversion and temperature compensation and employ methodology recommended in the ICUMSA Methods Book (internationally recognized body for sugar analysis).

Temperature (in °C or °F) is displayed simultaneously with the measurement on the large dual-level display along with icons for low power and other helpful messages.

5 Digital Refractometers for Sugar Analysis to Choose from

HI96800

Measures the refractive index in aqueous solutions. Readings can also be displayed with sucrose temperature compensation (nD_{20}) or % Brix.

HI96801

Measures the refractive index to determine the % Brix of sugar in aqueous solutions. The refractive index of the sample is converted to % Brix concentration units.

HI96802

Measures the refractive index to determine the % fructose in aqueous solutions. The refractive index of the sample is converted to % mass (% w/w) concentration units.

HI96803

Measures the refractive index to determine the % glucose in aqueous solutions. The refractive index of the sample is converted to % mass (% w/w) concentration units.

HI96804

Measures the refractive index to determine the % invert sugar in aqueous solutions. The refractive index of the sample is converted to % mass (% w/w) concentration units.

Making a Standard % Brix Solution

To make a Brix Solution, follow the procedure below:

- Place container (such as a glass vial or dropper bottle that has a cover) on an analytical balance.
- Tare the balance.
- To make an X % Brix solution, weigh out X grams of high purity sucrose (CAS #: 57-50-1) directly into the container.
- Add distilled or deionized water to the container so the total weight of the solution is 100 g.

Note: Solutions above 60% Brix need to be vigorously stirred or shaken and heated in a water bath. Remove solution from bath when sucrose has dissolved. The total quantity can be scaled proportionally for smaller containers but accuracy may be sacrificed.

Example with 25% Brix:

% Brix	25
g Sucrose	25.000
g Water	75.000
g Total	100.000

Specifications		HI96800	HI96801	HI96802	HI96803	HI96804
Sugar Content	Range	1.3300 to 1.5080 nD; 1.3330 to 1.5040 nD_{20}; 0.0 to 85.0% Brix	0 to 85% Brix	0 to 85% mass (% w/w fructose)	0 to 85% mass (% w/w glucose)	0 to 85% mass (% w/w invert sugar)
	Resolution	0.0001 nD; 0.0001 nD_{20}; 0.1 % Brix	0.1 % Brix	0.1 % mass	0.1 % mass	0.1 % mass
	Accuracy (@25°C/77°F)	±0.0005 nD; ±0.0005 nD_{20}; ±0.2% Brix	±0.2% Brix	±0.2% mass	±0.2% mass	±0.2% mass
Temperature	Range	0.0 to 80.0°C (32.0 to 176.0°F)				
	Resolution	0.1°C (0.1°F)				
	Accuracy (@25°C/77°F)	±0.3°C (±0.5°F)				
Additional Specifications	Temperature Compensation	automatic between 10 and 40°C (50 to 104°F)				
	Measurement Time	approximately 1.5 seconds				
	Minimum Sample Volume	100 µL (to cover prism totally)				
	Light Source	yellow LED				
	Sample Cell	stainless steel ring and flint glass prism				
	Auto-off	after three minutes of non-use				
	Enclosure Rating	IP65				
	Battery Type / Battery Life	9V / approximately 5000 readings				
	Dimensions / Weight	192 x 102 x 67 mm (7.6 x 4.01 x 2.6") / 420 g (14.8 oz.)				
Ordering Information		**HI96800, HI96801**, **HI96802**, **HI96803** and **HI96804** are supplied with battery and instruction manual.				

HI96821

Digital Refractometer

for Sodium Chloride Measurement Throughout the Food Industry

- Ideal for the analysis of:
  - Salad dressings, cheeses, condiments, pickles, canned foods, jarred foods, milk, juices, energy drinks, soups, brines and whey
- Dual-level LCD
  - The dual-level LCD displays measurement and temperature readings simultaneously
- ATC
  - Automatic Temperature Compensation
- Easy measurement
  - Place a few drops of the sample in the well and press the READ key
- BEPS
  - Alerts the user of low battery power that could adversely affect readings.
- IP65 water protection
  - Built to perform under harsh laboratory and field conditions
- Quick, accurate results
  - Readings are displayed in approximately 1.5 seconds.
- Single-point calibration
  - Calibrate with distilled or deionized water
- Small sample size
  - Sample size can be as small as 2 metric drops
- Automatic shut-off
  - After three minutes of non-use
- Stainless steel sample well
  - Easy to clean and corrosion resistant
- ABS thermoplastic casing

Ideal for the food industry

Hanna offers the HI96821 digital sodium chloride refractometer to meet the requirements of the food industry. This optical instrument employs the measurement of the refractive index to determine sodium chloride concentration in aqueous solutions used in food preparation. It is not intended for seawater salinity measurements.

Refractive index

The measurement of refractive index is simple and quick and provides the user an accepted method for sodium chloride analysis. Samples are measured after a simple user calibration with deionized or distilled water. Within seconds the instrument measures the refractive index of the solution, apply the necessary calculations and display the results in the selected unit. The digital refractometer eliminates the uncertainty associated with mechanical refractometers and is portable for measurements where you need them.

Features

The instrument utilizes internationally recognized references for unit conversion and temperature compensation. It can display the measurement of NaCl concentration 4 different ways: g/100 g, g/100 mL, Specific Gravity, and °Baumé.

Temperature (in °C or °F) is displayed simultaneously with the measurement on the large dual level display along with icons for Low Power and other helpful message codes.

Easy to Operate

Startup Screens

When the HI96821 is turned on, all of the LCD segments will be displayed follwed by the percentage of battery life remaining.

Calibration

Perform a quick and easy calibration after startup:

1. Using a pipette, completely cover the prism in the sample well with distilled or deionized water.
2. Press the ZERO key.

Unit Selection

Just press the RANGE key to cycle through the HI96821's units of measurement (g/100 g, g/100 mL, Specific Gravity and °Baumé).

Measurement

Achieve fast, accurate results:

1. Using a plastic pipette, drip sample onto the prism surface until the well is full.
2. Press the READ key and the results are displayed in the selected units.

Making a Standard Sodium Chloride Solution

To make a standard NaCl solution (g/100 g), follow the procedure below:

- Place a container (such as a glass vial or dropper bottle that has a cover) on an analytical balance.
- Tare the balance.
- To make an X NaCl solution weigh out X grams of high purity dried Sodium Chloride (CAS #: 7647-14-5: MW 58.44) directly into the container.
- Add distilled or deionized water to the container so the total weight of the solution is 100 g.

Example with g/100 g NaCl:

g/100 g NaCl	10
g Nacl	10.000
g Water	90.000
g Total	100.000

Specifications		**HI96821**
g/100 g	Range	0 to 28
	Resolution	0.1
	Accuracy (@25°C/77°F)	±0.2
g/100 mL	Range	0 to 34
	Resolution	0.1
	Accuracy (@25°C/77°F)	±0.2
Specific Gravity (S.G.)	Range	1.000 to 1.216
	Resolution	0.001
	Accuracy (@25°C/77°F)	±0.002
°Baumé	Range	0 to 26
	Resolution	0.1
	Accuracy (@25°C/77°F)	±0.2
Temperature	Range	0 to 80°C (32 to 176°F)
	Resolution	0.1°C (0.1°F)
	Accuracy (@25°C/77°F)	±0.3°C (±0.5°F)
Additional Specifications	Temperature Compensation	automatic between 10 and 40°C (50 to 104°F)
	Measurement Time	approximately 1.5 seconds
	Minimum Sample Volume	100 µL (to cover prism totally)
	Light Source	yellow LED
	Sample Cell	stainless steel ring and flint glass prism
	Auto-off	after three minutes of non-use
	Enclosure Rating	IP65
	Battery Type / Battery Life	9V / approximately 5000 readings
	Dimensions / Weight	192 x 102 x 67 mm (7.6 x 4.01 x 2.6") / 420 g (14.8 oz.)
Ordering Information	**HI96821** is supplied with battery and instruction manual.	

HI96822

Digital Refractometer

for Natural or Artificial Seawater Analysis

- Dual-level LCD
  - The dual-level LCD displays measurement and temperature readings simultaneously
- ATC
  - Automatic Temperature Compensation
- Easy measurement
  - Place a few drops of the sample in the well and press the READ key
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- IP65 water protection
  - Built to perform under the harsh field conditions associated with environments containing seawater.
- Quick, accurate results
  - Readings are displayed in approximately 1.5 seconds
- Single-point calibration
  - Calibrate with distilled or deionized water
- Small sample size
  - Sample size can be as small as 2 metric drops.
- Automatic shut-off
  - After three minutes of non-use
- Stainless steel sample well
  - Easy to clean and corrosion-resistant
- ABS thermoplastic casing

Ideal for Seawater Analysis

Hanna's HI96822 Digital Refractometer is a rugged, portable, water resistant device that utilizes the measurement of the refractive index to determine the salinity of natural and artificial seawater, ocean water or brackish intermediates. The HI96822 reflects Hanna's years of experience as a manufacturer of analytical instruments. This digital refractometer eliminates the uncertainty associated with mechanical refractometers and is durable and compact enough to be used at home, in the lab, or out in the field.

The HI96822 is an optical device that is quick and easy to use. After a simple user calibration with distilled or deionized water, a seawater sample can be introduced into the sample well.

Within seconds, the refractive index and temperature are measured and converted into one of three popular measurement units: Practical Salinity Units (PSU), parts per thousand (ppt), or specific gravity (S.G. (20/20)). All conversion algorithms are based upon respected scientific publications using the physical properties of seawater (not sodium chloride).

The Importance of Salinity Measurement Throughout a Variety of Applications

Salinity is a critical measurement in many applications, such as aquaculture, environmental monitoring, aquariums, desalination plants, well water, and many more. Until now, the available technology to measure salinity has relied on mechanical instruments, such as hydrometers and mechanical refractometers, or on high-tech conductivity meters. While easy to use, getting a reading on a mechanical refractometer can be difficult since they are highly susceptible to changes in temperature. Hydrometers, though inexpensive, are clumsy and inaccurate as well.

The Hanna HI96822 is the solution to all these issues. It is lightweight, easy to use, cost-efficient, and extremely accurate. With the ability to read in three of the most widely used salinity units (PSU, ppt, and Specific Gravity), it is the ideal instrument for any application.

Easy to Operate

Start-up Screens

When the HI96822 is turned on, all of the LCD segments will be displayed follwed by the percentage of battery life remaining.

Calibration

Perform a quick and easy calibration after start-up:

1. Using a plastic pipette, completely cover the prism in the sample well with distilled or deionized water.
2. Press the ZERO key.

Unit Selection

Just press the RANGE key to cycle through the HI96822's units of measurement. PSU, ppt, Specific Gravity (20/20).

Measurement

Achieve fast, professional results:

1. Using a plastic pipette, drip sample onto the prism surface until the well is full.
2. Press the READ key and the results are displayed in the selected units.

Some specific examples of the importance of salinity:

Aquaculture: Young salmon start their lives in fresh water. As they mature, they reach a stage ("smolt") when they transition to salt water. When farming salmon, it is critically important to maintain proper salinity levels at each life stage to prevent unnecessary stress that could negatively affect growth and development.

Salinity is a vital parameter to monitor accurately when raising eggs and larval fish, optimizing juvenile and adult growth, and culturing live food such as rotifers and artemia.

Aquaria: Whether it is the world-renowned, eight million gallon Georgia Aquarium, or a 20 gallon reef tank at home, salinity is a crucial parameter to measure. In closed systems such as these, salinity is easily affected. As water evaporates, it leaves the salt behind, raising the salinity. When evaporated water is replaced with fresh water, the salinity is lowered. The potential for disaster is inherent in both situations. Use Hanna's digital refractometer to accurately measure salinity and to help prevent any mishaps.

Environment: Salinity is almost always a required measurement when doing any kind of environmental monitoring or pollution studies. Salinity has the ability to affect many processes, such as respiration, reproduction, and growth development. If monitoring for the effect of pollution, it is important to make sure a salinity variation is not having an additional influence.

Well Water: In coastal areas, the freshwater aquifer (or water table) is adjacent to salt water. This aquifer often supplies the drinking water for the local population. If too many wells are sunk, or too much water is drawn from the aquifer, the water table may sink so low that salt water incursion occurs and the water table has become contaminated.

Specifications		HI96822
PSU	Range	0 to 50
	Resolution	1
	Accuracy (@25°C/77°F)	±2
ppt	Range	0 to 150
	Resolution	1
	Accuracy (@25°C/77°F)	±2
Specific Gravity (S.G.)	Range	1.000 to 1.114
	Resolution	0.001
	Accuracy (@25°C/77°F)	±0.002
Temperature	Range	0 to 80°C (32 to 176°F)
	Resolution	0.1°C (0.1°F)
	Accuracy (@25°C/77°F)	±0.3°C (0.5°F)
Additional Specifications	Temperature Compensation	automatic between 0 and 40°C (32 to 104°F)
	Measurement Time	approximately 1.5 seconds
	Minimum Sample Volume	100 µL (to cover prism totally)
	Light Source	yellow LED
	Sample Cell	stainless steel ring and flint glass prism
	Auto-off	after three minutes of non-use
	Enclosure Rating	IP65
	Battery Type / Life	9V / approximately 5000 readings
	Dimensions	192 x 102 x 67 mm (7.6 x 4.01 x 2.6")
	Weight	420 g
Ordering Information	**HI96822** is supplied with battery and instruction manual.	

HI96831 • HI96832

Digital Refractometers

for Ethylene and Propylene Glycol Analysis

- Dual-level LCD
  - The dual-level LCD displays measurement and temperature readings simultaneously
- ATC
  - Automatic Temperature Compensation
- Easy measurement
  - Place a few drops of the sample in the well and press the READ key
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- IP65 water protection
  - Built to perform under harsh laboratory and field conditions.
- Quick, accurate results
  - Readings are displayed in approximately 1.5 seconds
- Single-point calibration
  - Calibrate with distilled or deionized water
- Small sample size
  - Sample size can be as small as 2 metric drops.
- Automatic shut-off
  - After three minutes of non-use
- Stainless steel sample well
  - Resists corrosion from salt water.
- ABS thermoplastic casing

The HI96831 Ethylene Glycol and HI96832 Propylene Glycol Digital Refractometers are rugged, portable, water-resistant devices that utilize the measurement of refractive index to determine the percent volume and freezing point of ethylene or propylene glycol based solutions.

These digital refractometers eliminate the uncertainty associated with mechanical refractometers. HI96831 and HI96832 samples are measured after a simple user calibration with distilled or deionized water. Within seconds, the refractive index and temperature are measured and converted into one of two measurement units; % volume or freezing point. These meters use internationally recognized references for unit conversion and temperature compensation for glycol solutions (e.g. CRC Handbook of Chemistry and Physics, 87th Edition).

Specifications		HI96831 Ethylene Glycol	HI96832 Propylene Glycol
% Volume (% v/v)	Range	0 to 100%	0 to 100%
	Resolution	0.1 %	0.1 %
	Accuracy (@25°C/77°F)	±0.2 %	±0.3 %
Freezing Point (FP)	Range	0 to -50 °C (32 to -58 °F)	0 to -51 °C (32 to -59.8 °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)
Temperature	Range	0 to 80 °C (32 to 176 °F)	
	Resolution	0.1 °C (0.1 °F)	
	Accuracy (@25°C/77°F)	±0.3 °C (±0.5 °F)	
Additional Specifications	Temperature Compensation	automatic between 0 and 40°C (32 to 104°F)	
	Measurement Time	approximately 1.5 seconds	
	Minimum Sample Volume	100 µL (to cover prism totally)	
	Light Source	yellow LED	
	Sample Cell	stainless steel ring and flint glass prism	
	Auto-off	after three minutes of non-use	
	Enclosure Rating	IP65	
	Battery Type / Battery Life	9V / approximately 5000 readings	
	Dimensions / Weight	192 x 102 x 67 mm (7.6 x 4.01 x 2.6") / 420 g (14.8 oz.)	
Ordering Information	**HI96831** and **HI96832** are supplied with battery and instruction manual.		

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About Thermometers

Precise process control is one of the most important factors in maintaining high quality in production, just as precision and accuracy are the key to research. Temperature is a crucial variable in both production and research.

Glass and metal thermometers use thermal expansion to measure temperature. This method uses a physical law which gives a false sense of reliability, since one assumes the measurement is "true" because he or she can see how it works. This system is no longer suitable for many reasons and their accuracy and range are very limited. Glass construction is fragile and can be dangerous to a person's health, as well as to the environment. For these reasons, an alternative way of measuring temperature has become necessary. Hanna electronic thermometers are designed to withstand mechanical stress and extreme environments while maintaining high accuracy.

Electronic thermometers have provided the versatility, speed and accuracy requested by operators in all areas of temperature measurement. Speed is important when the reactions being monitored change rapidly. Small, compact sensors are preferable for tightly arranged areas, such as electronics and other miniature applications. Electronic thermometers allow users to monitor maximum, minimum and even average temperatures.

Dedicated research teams, precision process control, integrated production facilities and an overall team effort is required to meet the demanding applications of our users. Hanna's extensive professional thermometer line constitutes the true dedication Hanna commits to thermometer design and production.

Measurement Unit

Temperature is one of the most common physical properties in our everyday life. It is defined as the property of a body that determines the transfer of heat to or from other bodies. Physically, temperature affects variations in the macroscopic parameters of a body such as volume and pressure, among others.

The fundamental temperature scale is the absolute, thermodynamic or Kelvin scale. The Kelvin (K) unit of thermodynamic temperature, is the fraction 1/273.16 of thermodynamic temperature of the triple point of water. The triple point of water is a standard fixed point at which ice, liquid water, and water vapor are in equilibrium.

Two empirical temperature scales are in common use: the Celsius and Fahrenheit scales. These scales are based on two fixed points.

The Celsius (formally Centigrade) temperature scale uses the Celsius (°C) units, defined as 1/100th of the difference between the temperature of boiling (100°C) and freezing points (0°C) of water. The relationship between the Kelvin and Celsius scales is given by:

$$K = °C + 273.15$$

The Fahrenheit scale uses Fahrenheit (°F) units, where the temperature of boiling water is taken at 212°F, and the temperature of the freezing point at 32°F. The scale originally used the temperature of a mixture of ice and common salt as 0°F, and the inventor's approximate body temperature as 96°F. The relationship between the Fahrenheit and Celsius scales is calculated by:

$$°F = °C \bullet 9/5 + 32$$

Achieving Thermometer Accuracy

Even though it is easy to show resolutions of 0.1°C with digital thermometers, there is no relationship between resolution and accuracy of measurements.

Here is a list of the main causes that can have an effect on accuracy in temperature measurements:

- Instrument
  - The instrument may have an extended scale and 19,000 points of measurement may be obtained. Within these 19,000 points, the instrument may perform differently because of internal linearity.
- Electronic components
  - The internal electronics have a drift that depends on the ambient temperature. For this reason, the accuracy of the instrument is stated at a specific temperature of 20 or 25°C, and the drift has to be specified for each degree of variation with respect to the reference temperature.
- LCD
  - Liquid crystals have an operating limitation which is a function of temperature. Their normal range is between 0 and 50°C, but there are components capable of performing between -20 and 70°C.
- Batteries
  - Instrument battery power supply also has limitations of use.
- Temperature sensor
  - This is a separate accuracy, which is to be added to the instrument's error.

Also, if the probe supplied is connected to the meter during factory calibration, the probe error is eliminated but will reappear if the probe is replaced.

With all the possible forces influencing accuracy, calibration verification is essential. Hanna's CAL Check™ can verify an accurate calibration quickly and easily.

Importance of Accuracy

Up to a few years ago, accuracy was not a very critical aspect and tolerances of a few degrees did not jeopardize a process. From the time that hazard analysis and critical control points (HACCP) programs became a necessity, measurement accuracy has become a discriminating factor. Due to health risk factors, now an error of a few tenths of a degree can decide whether food can still be kept or must be discarded. In 1990, Hanna began to produce thermometers for our customers' HACCP programs to comply with new governmental regulations. Soon after, Hanna became the market leader in Europe as a result of the technological solutions offered to our users.

User Calibration of Typical Thermometers

To calibrate typical thermometers you need:

- For thermocouple thermometers
  - A simulator of the emf (electromotive force) generated by the thermocouple
- For thermometers with NTC/PTC sensor
  - At least two thermostatic baths
- For Pt100 thermometers
  - A resistance simulator
- For infrared thermometers
  - A heat source (panel) at controlled temperature

Few users can afford this investment in time and materials for checking their thermometers' accuracy. Hanna's exclusive CAL Check™ is a quick and cost effective way to verify accuracy.

Hanna CAL Check™ Calibration Feature

As previously described, the electronic components of an instrument shift with time. Hanna has made it possible for users, with the simple touch of a button, to verify whether the response of the instrument is within the tolerance limit of ±0.02°C.

The CAL Check™ system acts by substituting the sensor with an internal resistor which corresponds to 0°C; thus simulates the response that the temperature probe would have at 0°C.

Standardization

Hanna has designed a series of pre-calibrated temperature probes with a maximum error of 2°C for trouble-free replacement.

Thermocouple Thermometer Calibration

Although quite fast, thermocouple thermometers read with a response time much slower than other sensors and technologies. Unfortunately, the measurement of the thermocouple emf (electromotive force) loses accuracy because of the measuring system itself, based on the emf generated by the temperature difference between cold and hot junctions. The same emf may be generated under different conditions, for example:

- Hot junction at 100°C; cold junction at 20°C; difference: 80°C or Hot junction at 90°C; cold junction at 10°C; difference: 80°C

A temperature difference of 80°C is obtained with two different temperatures of the sample. It is, therefore, very important to

determine the cold junction temperature very precisely. The ability to do this has a large effect on the accuracy of the measuring system. A thermocouple thermometer is made of two thermometers, one that measures the cold junction, and one for measuring the emf generated by the thermocouple. The cold junction is usually measured with an NTC type sensor, which has response times different from those of the thermocouple. Another crucial point is measuring the actual value of the cold junction, without any environmental influence and dispersions.

To partially solve this problem, Hanna has devised the calibration of the instrument-thermocouple system by dipping the probe in melting ice, thus allowing the user to calibrate the measuring system at 0°C.

Thanks to this solution, it is now possible to use thermocouple thermometers for HACCP controls with an accuracy of ±0.3°C, which is the same performance of our Pt100 or NTC thermometers, but with a higher response time.

Calibration Test Keys

To check the calibration status of the instrument, calibrated keys have been prepared in the range from -18 to 70°C. These keys reproduce the value of the sensor at different temperatures. Simply disconnect the measuring probe, replace it with the key and ensure that the instrument reads the simulated value.

Hanna calibrates all thermometers with a standard probe. All NTC temperature probes are inspected and calibrated with standard instruments. During quality inspection, our technicians make sure that the reading errors are within the stated accuracies.

In addition, Hanna provides users with the necessary tools to verify that your thermometers read accurate values. Our complete line of electronic thermometers provides fast and precise measurements down to a tenth of a degree Celsius.

Hanna thermometers may be divided into four main categories: thermistor thermometers, thermocouple thermometers, Pt100 thermometers and infrared thermometers.

Thermistor Thermometers

The thermistor is a semi-conductor device whose resistivity (r) varies as a function of temperature (T):

$$R = R_0 [1 + a (T-T_0)]$$

where

R = resistance of temp. at T **T = temp at the end of measurement**
R_0 = resistance of temp. at T_0 **T_0 = temp at the beginning of measurement**

Temperature resistance coefficient is the parameter that determines if the resistivity variation is positive (as with the Positive Temperature Coefficient, or PTC sensors) or negative (as with the Negative Temperature Coefficient, or NTC thermistors). It is possible to determine the temperature by applying a potential difference and measuring the resistance.

Thermistor sensors are suitable for a temperature range of -50 to 150°C (-58 to 302°F). Higher temperatures may damage the semi-conductor sensor. Accurate temperature measurements are possible (tenths of degree) due to the high sensitivity of the sensor.

Thermocouple Thermometers

The thermocouple consists of the junction of two wires of different metals. At a given temperature, a potential difference results at the opposite extremes of the two wires (Seebeck effect), with the respective variations linearly related within small intervals. It is therefore possible to determine the temperature given the potential difference and characteristics of the two metals. The measurement end of the thermocouple probe is called the hot junction, while the connection of the thermocouple to the meter is the cold junction. An error is introduced as the cold junction is exposed to the ambient temperature. This error can be eliminated by physically putting the cold junction into an ice bath and forcing a reference temperature of 0°C, or by electronically compensating for the cold junction temperature effect. There are various types of thermocouples, identified by an ANSI code using a letter of the alphabet. The K type is the most commonly used themocouple.

Pt100 Thermometers

The operating principle of resistance thermometers is based on the increase of electric resistance of metal conductors (RTD: Resistance Temperature Detectors) with temperature.

This physical phenomenon was discovered by Sir Humphry Davy in 1821. In 1871, Sir William Siemens described the application of this property using platinum, thereby introducing an innovation in the manufacturing of temperature sensors. Platinum resistance thermometers have been used as an international standard for measuring temperatures between hydrogen triple point at 13.81 K and the freezing point of antimony at 630.75°C (1167.26°F).

Among the various metals to be used in the construction of resistance thermometers, platinum (Pt), a noble metal, is the one that can measure temperatures throughout a wide range; from -251°C (-419.8°F) to 899°C (1650.2°F), with a linear behavior.

Platinum RTD thermometers were common in the seventies but have now been replaced with thermistor sensors because of their smaller dimensions and faster response to temperature changes. The most common RTD sensor using platinum is the Pt100, which means a resistance of 100Ω at 0°C with a temperature coefficient of 0.00385Ω per degree Celsius. For a higher price one can buy platinum sensors with 250, 500 or 1000/ (Pt1000).

The main disadvantage of RTD probes is the resistance of the connection cable. This resistance prevents the use of standard two-wire cables for lengths over a few meters, since it affects the accuracy of the reading. For this reason, to obtain high levels of accuracy in industrial and laboratory applications, the use of a three or four-wire system is recommended.

For all its Pt100 thermometers and probes, Hanna has chosen the multiple-wire technology for higher accuracy.

Infrared Thermometers

All objects emit a radiant energy in the infrared (IR) spectrum that falls between visible light and radio waves.

The origins of IR measurements can be traced back to Sir Isaac Newton's prism and the separation of sunlight into colors and electromagnetic energy. In 1800, the relative energy of each color was measured, but it was not until early 20th century that IR energy was quantified. It was then discovered that this energy is proportional to the 4th power of the object's temperature.

IR instrumentation using this formula has been around for over 50 years. They almost exclusively use an optic device that detects the heat energy generated by the object that the sensor is aimed at. This is then amplified, linearized and converted into an electronic signal which in turn shows the surface temperature in Celsius or Fahrenheit degrees.

Infrared measurements are particularly suitable for areas where it is difficult or undesirable to take surface measurements using conventional contact sensors. Applications for IR meters include non-destructive testing of foodstuffs, moving machinery, and high temperature surfaces.

An ideal surface for IR measurements is a black body or radiator with an emissivity of 1.0. Emissivity is the ratio of the energy radiated by an object at a certain temperature to that emitted by a perfect radiator at the same temperature.

The shinier or more polished the surface, the less accurate the measurements. For example, the emissivity of most organic material and rough or painted surfaces is in the 0.95 region and hence, suitable for IR measurements.

On the other hand, surfaces of highly polished or shiny material, such as mirrors or aluminum, may not be appropriate for this application without using some form of filtration. This is due to other factors, namely, reflectivity and transmissivity. The former is a measure of an object's ability to reflect infrared energy while the latter is its ability to transmit it.

Another important and practical concern with IR measurements is the field of view. Infrared meters measure the average temperature of all objects in their field of view. To obtain an accurate result, it is important that the object completely fills the instrument's field of view and there are no obstacles between the meter and the object. The distance-to-target ratio, or the optic coefficient, is therefore an important consideration.

Reference Temperatures

In 1990, NIST established 17 fixed points of the International Temperature Scale (ITS-90) related to reproducible physical phenomena in nature. The ITS-90 Fixed Points are shown in the chart below:

Equilibrium state	K	°C
Vapor pressure point of helium	3 to 5	-270.15 to -268.19
Triple point of hydrogen	13.8033*	-259.346*
Boiling point of hydrogen at a pressure of 33.330.6 Pa	17.042*	-256.108*
Boiling point of equilibrium hydrogen	20.28*	-252.87*
Triple point of neon	27.102	-246.048
Triple point of oxygen	54.361	-218.789
Triple point of argon	83.8058	-189.3442
Triple point of mercury	234.3156	-38.8344
Triple point of water	273.16	0.01
Triple point of gallium	302.9146	29.7646
Melting point of indium	429.7485	156.5985
Melting point of tin	505.078	231.928
Melting point of zinc	692.677	419.527
Melting point of aluminum	933.473	660.323
Melting point of silver	1234.93	961.78
Melting point of gold	1337.33	1064.18
Melting point of copper	1357.77	1084.62

* Given for e-H2 , which is hydrogen at the equilibrium concentration of the ort and para molecular forms.

HI935007N

K-Type Thermocouple Thermometer with Direct Measurement Probe

14.27

The HI935007N extends the range of portable Hanna thermometers by measuring temperatures as high as 900°C. Their attractive price point makes it possible for every operator to carry his or her own professional instrument.

The fixed HI766C penetration probe with 1 m (3.3') flexible cable is also supplied with the instrument. Advanced battery management features include a display of remaining battery power at startup, low battery warning and BEPS battery error prevention system.

HI93510 • HI93510N

Thermistor Thermometer

14.31

The HI93510 is a high performance, waterproof thermometer tailor made for lab and field use. The LCD displays the highest and lowest readings in the cycle along with the current temperature. To freeze the reading for easy recording, simply press the HOLD button. Celsius or Fahrenheit range can be selected at the touch of a button. Battery level is shown at startup and a low battery warning with BEPS assures long periods of trouble free use.

The HI93510N offers all the features of the HI93510 plus a CAL button to allow the operator to calibrate the meter and probe in an ice bath at 0°C. This will assure the removal of the combined meter and probe interchange error. In addition to calibration capabilities, HI93510N has a user-activated backlit display.

HI93501N • HI93501NS

Thermistor Thermometer for the Food Industry

14.29

The HI93501N is a waterproof thermometer designed to be used daily in food applications such as industrial kitchens and catering. The "S" version also adds a stability indicator bargraph and HOLD button to freeze readings on the LCD.

The included HI762PWL penetration probe can be replaced with an assortment of HI762 probes for specific applications.

The display indicates the remaining battery power at startup then continuously checks the battery level and warns the user with ample time to change the battery. When low battery power may affect your results, the meter will shut down and ensure that accuracy is not compromised.

	K-type	K,J,T - type	Range	CAL Button	CAL Check™	PC Compatibility	BEPS	HOLD Feature	Waterproof	Autoranging	Logging	Alarm	Interchangeable Probe	Multiple Channels	Backlit LCD	Stability Bargraph	Page
Thermocouple Thermometers																	
HI935005	•		°C/°F				•	•	•				•				14.8
HI935005N	•		°C/°F	•			•	•	•				•		•		14.8
HI935002	•		°C/°F				•	•	•				•	•			14.9
HI93531	•		°C/°F				•	•	•				•				14.10
HI93531N	•		°C/°F	•			•	•	•				•		•		14.10
HI93531R	•		°C/°F	•		•	•	•	•				•		•		14.10
HI93532	•		°C/°F				•	•	•				•	•			14.11
HI93532R	•		°C/°F	•		•	•	•	•				•	•	•		14.11
HI93530	•		°C/°F				•	•	•				•				14.12
HI93530N	•		°C/°F	•			•	•	•				•		•		14.12
HI9063	•		°C/°F				•	•	•	•			•				14.13
HI93551		•	°C/°F				•	•	•				•				14.14
HI93551N		•	°C/°F	•			•	•	•				•				14.14
HI93542		•	°C/°F				•	•	•				•	•			14.15
HI93552R		•	°C/°F	•		•	•	•	•				•	•	•		14.15
HI935007N	•		°C		•		•		•	•							14.27
Thermistor Thermometers																	
HI9241			°C		•		•		•				•				14.28
HI93501N			°C		•		•		•				•				14.29
HI93501NS			°C		•		•	•	•				•			•	14.29
HI93503			°C		•		•	•	•				•			•	14.30
HI93510			°C/°F				•	•	•				•				14.31
HI93510N			°C/°F	•			•	•	•				•		•		14.31
Infrared Thermometers																	
HI99551			°C/°F					•									14.37
HI99556			°C/°F					•					•				14.37
Pt100 Thermometers																	
HI955501			°C							•			•				14.38
HI955502			°C							•							14.38
Temperature Dataloggers																	
HI141			°C/°F			•	•		•		•	•		•			14.40
HI140			°C/°F			•	•		•		•	•					14.41
HI143			°C/°F			•					•	•					14.42

HI935005 • HI935005N

K-Type Thermocouple Thermometers

- HOLD
  - HOLD Function
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- Battery indicator
  - Battery life indicator at startup
- Backlight
  - Backlit display (N version)
- Waterproof
  - Compact, heavy-duty and waterproof

The HI935005 series meters are waterproof, K-type thermometers offering accurate temperature measurements in a wide range, as well as 1600 hours of battery life.

These units display current temperature along with the minimum and maximum values achieved during the measuring session on the LCD.

The HOLD button freezes the display to allow the user time to record readings. The °C/°F button switches between the Celsius and Fahrenheit temperature scale. The CLR button restarts the evaluation of high and low values.

The HI935005N features a user-activated backlight for low or no light conditions. A CAL button allows the operator a simple one-point calibration in an ice bath at 0°C when probe interchange occurs.

The instruments are equipped with BEPS (Battery Error Prevention System), which alerts the user in the event that low battery power could adversely affect readings.

A wide variety of interchangeable probes are available to meet your specific needs. Optional rubber boots are available.

Specifications	HI935005	HI935005N
Range	-50.0 to 199.9°C and 200 to 1350°C; -58.0 to 399.9°F and 400 to 2462°F	
Resolution	0.1°C (-50.0 to 199.9°C) and 1°C (outside); 0.1°F (-58.0 to 399.9°F) and 1°F (outside)	
Accuracy	±0.2% f.s. (for 1 year, excluding probe error)	
Probe	HI766 series K-type thermocouple (not included)	
CAL Button	N/A	yes
Backlit LCD	N/A	yes
Battery Type / Life	1.5V AA (3) / approximately 1600 hours of continuous use (with backlight off); HI935005 only: auto-off selectable after 8 or 60 minutes of non-use (can be disabled)	
Environment	-10 to 50°C (14 to 122°F); RH max 100%	
Dimensions	150 x 80 x 36 mm (5.9 x 3.1 x 1.4")	
Weight	235 g (8.3 oz.)	
Ordering Information	**HI935005** and **HI935005N** are supplied with batteries, protective case and instructions	
Probes	**HI766C**	Penetration, stainless steel K-type thermocouple temperature probe with 1 m cable
	HI766D	Air/gas, stainless steel K-type thermocouple temperature probe with 1 m (3.3') cable
	HI766E1	General purpose/penetration, stainless steel K-type thermocouple temperature probe with 1 m (3.3') cable

Thermocouple probes begin on page 14.16

HI935002

Dual-channel, K-Type Thermocouple Thermometer

- Multiple input channels
  - Dual input channels
- HOLD
  - HOLD function
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- Battery indicator
  - Battery life indicator at startup
- Waterproof
  - Compact, heavy-duty and waterproof

HI935002 is a 2-channel, waterproof, K-type thermometer that offers accurate temperature measurements in a wide range, as well as 1600 hours of battery life.

These units display current temperature along with the minimum and maximum temperature for each channel achieved during the measuring session. The difference between each channel can be shown, or a relative value can be set on each channel and variances around that value can be monitored.

The HOLD button freezes the display to allow the user time to record readings.

The instruments are equipped with BEPS (Battery Error Prevention System), which alerts the user in the event that low battery power could adversely affect readings.

Specifications	HI935002	
Range	-50.0 to 199.9°C and 200 to 1350°C; -58.0 to 399.9°F and 400 to 2462°F	
Resolution	0.1°C (-50.0 to 199.9°C) and 1°C (outside); 0.1°F (-58.0 to 399.9°F) and 1°F (outside)	
Accuracy	±0.2% f.s. (for 1 year, excluding probe error)	
Probe	HI766 series K-type thermocouple (not included)*	
Battery Type / Life	1.5V AA (3) / approx. 1600 hours of continuous use	
Environment	-10 to 50°C (14 to 122°F); RH max 100%	
Dimensions	150 x 80 x 36 mm (5.9 x 3.1 x 1.4")	
Weight	235 g (8.3 oz.)	
Ordering Information	**HI935002** is supplied with batteries and instructions.	
Probes	**HI766C**	Penetration, stainless steel K-type thermocouple temperature probe with 1 m cable
	HI766D	Air/gas, stainless steel K-type thermocouple temperature probe with 1 m (3.3') cable
	HI766E1	General purpose/penetration, stainless steel K-type thermocouple temperature probe with 1 m (3.3') cable

*K-type thermocouple probes should be ordered separately to meet your specific application.

Thermocouple probes begin on page 14.16

HI93531 • HI93531N • HI93531R

0.1° Resolution K-Type Thermocouple Thermometers

- HOLD
  - HOLD function
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- Battery indicator
  - Battery life indicator at startup
- Backlight
  - Backlit display (N and R versions)
- Waterproof
  - Compact, heavy-duty and waterproof
- Connectivity
  - PC and printer compatible (R version)

These waterproof thermometers feature 0.1° resolution in the -149.9 to 999.9°C (-24.9 to 999.9°F) range, making them ideal for precise temperature measurements. The instruments display the current temperature along with the minimum and maximum extremes achieved.

The HOLD button freezes the display to allow the user time to record readings. The °C/°F button switches between the Celsius and Fahrenheit temperature scale. The CLR button restarts the evaluation of high and low values.

The HI93531N and HI93531R feature a user-activated backlight for low or no light conditions. The CAL button allows a simple one-point calibration in an ice bath at 0°C when probe interchange occurs. The HI93531R adds RS232 output that allows for data transfer to a PC or printer.

The instruments are equipped with BEPS (Battery Error Prevention System), which alerts the user in the event that low battery power could adversely affect readings.

Specifications	HI93531	HI93531N	HI93531R
Range	-200.0 to 999.9°C; 1000 to 1371°C -328.0 to 999.9°F; 1000 to 2500°F		
Resolution	0.1°C (-149.9 to 999.9°C); 0.2°C (-200.0 to -150.0°C); 1°C (outside) 0.1°F (-24.9 to 999.9°F); 0.2°F (-249.9 to -25.0°F); 0.3°F (-328.0 to -250.0°F); 1°F (outside)		
Accuracy	±0.5°C (-100.0 to 999.9°C); ±1°C (outside); ±1°F (-148.0 to 999.9°F); ±1.5°F (outside) (for 1 year, excluding probe error)		
Probe	HI766 series K-type thermocouple (not included)*		
CAL Button	N/A	yes	yes
Backlit LCD	N/A	yes	yes
RS232	N/A	N/A	yes
Battery Type / Life	1.5V AA (3) / approximately 500 hours of continuous use (with backlight off); auto-off after 60 minutes of non-use (can be disabled) Auto-off after 8-60 minutes (HI93532R)		
Environment	-10 to 60°C (14 to 122°F); RH max 100%		
Dimensions	150 x 80 x 36 mm (5.9 x 3.1 x 1.4")		
Weight	235 g (8.3 oz.)		
Ordering Information	**HI93531**, **HI93531N** and, **HI93531R** are supplied with batteries and instructions.		
Probes*	**HI766C**	Penetration, stainless steel K-type thermocouple temperature probe with 1 m cable	
	HI766D	Air/gas, stainless steel K-type thermocouple temperature probe with 1 m (3.3') cable	
	HI766E1	General purpose/penetration, stainless steel K-type thermocouple temperature probe with 1 m (3.3') cable	

*K-type thermocouple probes should be ordered separately to meet your specific application.

Thermocouple probes begin on page 14.16

HI93532 • HI93532R

Dual-input, K-Type Thermocouple Thermometers

- HOLD
  - HOLD function
- Multiple input channels
  - Dual input
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- Battery indicator
  - Battery life indicator at start-up
- Waterproof
  - Compact, heavy-duty and waterproof
- Backlight
  - Backlit display (N and R versions)
- Connectivity
  - PC and printer compatible (R version)

Conditions often require the measurement of two samples at the same time. The HI93532 series feature two built-in channels for two K-type probe connectors.

These thermometers display current temperature along with the high and low values in either channel. You can also see the difference between the two channels simultaneously with the high and low of the difference.

The HOLD button freezes the display to allow the user time to record readings.

The HI93532R feature a user-activated backlight for low or no light conditions. The CAL button allows the operator to perform a simple one-point calibration in an ice bath at 0°C when probe interchange occurs.

The HI93532R adds RS232 output that allows for data transfer to a PC or printer.

The instruments are equipped with BEPS (Battery Error Prevention System), which alerts the user in the event that low battery power could adversely affect readings.

Specifications	HI93532	HI93532R
Range	-200.0 to 999.9°C; 1000 to 1371°C; -328.0 to 999.9°F; 1000 to 2500°F	
Resolution	0.1°C (-149.9 to 999.9°C); 0.2°C (-200.0 to -150.0°C); 1°C (outside) 0.1°F (-24.9 to 999.9°F); 0.2°F (-249.9 to -25.0°F); 0.3°F (-328.0 to -250.0°F); 1°F (outside)	
Accuracy	±0.5°C (-100.0 to 999.9°C); ±1°C (outside); ±1°F (-148.0 to 999.9°F); ±1.5°F (outside) (for 1 year, excluding probe error)	
Probe	HI766 series K-type thermocouple (not included)*	
CAL Button	N/A	yes
Backlit LCD	N/A	yes
RS232	N/A	yes
Battery Type / Life	1.5V AA (3) / approximately 500 hours of continuous use (with backlight off); auto-off after 60 minutes of non-use (can be disabled); auto-off after 8 minutes (HI93532R)	
Environment	-10 to 60°C (14 to 122°F); RH max 100%	
Dimensions	150 x 80 x 36 mm (5.9 x 3.1 x 1.4")	
Weight	235 g (8.3 oz.)	
Ordering Information	**HI93532**, **HI93532N** and **HI93532R** are supplied with batteries and instructions.	
Probes*	**HI766C**	Penetration, stainless steel K-type thermocouple temperature probe with 1 m cable
	HI766D	Air/gas, stainless steel K-type thermocouple temperature probe with 1 m (3.3') cable
	HI766E1	General purpose/penetration, stainless steel K-type thermocouple temperature probe with 1 m (3.3') cable

*K-type thermocouple probes should be ordered separately to meet your specific application.

Thermocouple probes begin on page 14.16

HI93530 • HI93530N

0.1° Resolution K-Type Thermocouple Thermometers

- HOLD
  - HOLD function
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- Battery indicator
  - Battery life indicator at startup
- Waterproof
  - Waterproof casing
- Backlight
  - Backlit display (N version)

The HI93530 and HI93530N are waterproof thermometers that can read with a resolution of 0.1 in the -149.9 to 999.9°C (-24.9 to 999.9°F) range.

The HOLD button freezes the display to allow the user time to record readings. The °C/°F button switches between the Celsius and Fahrenheit temperature scale.

For high accuracy, the HI93530N features a CAL button to allow the operator a simple one-point calibration in an ice bath at 0°C when probe interchange occurs.

The HI93530N also incorporates a user-activated backlight for low or no light conditions.

Remaining battery power is displayed at startup, and these instruments are equipped with BEPS (Battery Error Prevention System), which alerts the user in the event that low battery power could adversely affect readings.

Several interchangeable probes are available to meet your specific needs. Optional rubber boots are also available.

Specifications	HI93530	HI93530N
Range	-200.0 to 999.9°C; 1000 to 1371°C; -328.0 to 999.9°F; 1000 to 2500°F	
Resolution	0.1°C (-149.9 to 999.9°C); 0.2°C (-200.0 to -150.0°C); 1°C (outside) 0.1°F (-24.9 to 999.9°F); 0.2°F (-249.9 to -25.0°F); 0.3°F (-328.0 to -250.0°F); 1°F (outside)	
Accuracy	±0.5°C (-100.0 to 999.9°C); ±1°C (outside); ±1°F (-148.0 to 999.9°F); ±1.5°F (outside) (for 1 year, excluding probe error)	
Probe	HI766 K-type thermocouple (not included)	
CAL Button	N/A	yes
Backlit LCD	N/A	yes
Battery Type / Life	1.5V AA (3) / approximately 500 hours of continuous use (with backlight off); auto-off after 60 minutes of non-use (can be disabled)	
Environment	-10 to 60°C (14 to 122°F); RH max 100%	
Dimensions	150 x 80 x 36 mm (5.9 x 3.1 x 1.4")	
Weight	235 g (8.3 oz.)	

Ordering Information		
	HI93530 and **HI93530N** are supplied with batteries and instructions.	
Probes	**HI766C**	Penetration, stainless steel K-type thermocouple temperature probe with 1 m cable
	HI766D	Air/gas, stainless steel K-type thermocouple temperature probe with 1 m (3.3') cable
	HI766E1	General purpose/penetration, stainless steel K-type thermocouple temperature probe with 1 m (3.3') cable

Thermocouple probes begin on page 14.16

HI9063

Heavy-duty K-Type Thermocouple Thermometer

- HOLD
  - HOLD function
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- Battery indicator
  - Battery life indicator at startup
- Waterproof
  - Waterproof casing

The HI9063 K-type thermocouple thermometer features auto-ranging, enhanced accuracy, and displays current temperature along with the high and low extremes achieved during the measuring session on the LCD.

The HOLD button freezes the display to allow the user time to record readings. The °C/°F button switches between the Celsius and Fahrenheit temperature scale. The CLEAR button assigns the reading to high and low temperature values.

The HI9063 is equipped with BEPS (Battery Error Prevention System), which alerts the user in the event that low battery power could adversely affect readings.

Specification	HI9063	
Range	-50.0 to 1350°C; -58.0 to 2462°F	
Resolution	0.1°C (up to 199.9°C); 1°C (outside); 0.1°F (up to 399.9°F); 1°F (outside)	
Accuracy	±0.2% F.S. (for 1 year, excluding probe error)	
Probe	HI766 series K-type thermocouple (not included)	
Battery Type / Life	1.5V AA (4) / approximately 2000 hours of continuous use	
Environment	-10 to 50°C (14 to 122°F); RH max 100%	
Dimensions	196 x 80 x 60 mm (7.7 x 3.1 x 2.4")	
Weight	500 g (1.1 lbs.)	
Ordering Information	**HI9063** is supplied with batteries and instructions.	
Probes	**HI766C**	Penetration, stainless steel K-type thermocouple temperature probe with 1 m cable
	HI766D	Air/gas, stainless steel K-type thermocouple temperature probe with 1 m (3.3') cable
	HI766E1	General purpose/penetration, stainless steel K-type thermocouple temperature probe with 1 m (3.3') cable

Thermocouple probes begin on page 14.16

HI93551 • HI93551N

K, J, T-Type Thermocouple Thermometers

- HOLD
  - HOLD function
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- Battery indicator
  - Battery life indicator at startup
- Waterproof
  - Waterproof casing

These instruments offer the ability to take temperature measurements with different types of thermocouples and are equipped with a single button that switches between K-type, J-type or T-type thermocouples.

The HOLD button freezes the display to allow the user time to record readings. The CLR button restarts the evaluation of high and low values.

These thermometers display the current temperature along with the high and low extremes achieved during measurement.

For high accuracy, the HI93551N features a CAL button to allow the operator a simple one-point calibration in an ice bath at 0°C when probe interchange occurs.

The instruments are equipped with BEPS (Battery Error Prevention System), which alerts the user in the event that low battery power could adversely affect readings.

Specifications		HI93551	HI93551N
Range	K	-200.0 to 999.9°C and 1000 to 1371°C; -328.0 to 999.9°F and 1000 to 2500°F	
	J	-200.0 to 999.9°C; -328.0 to 999.9°F and 1000 to 1832°F	
	T	-200.0 to 400.0°C; -328.0 to 752.0°F	
Resolution	K	0.1°C (-149.9 to 999.9°C); 0.2°C (-200.0 to -150.0°C); 1°C (1000 to 1371°C); 0.1°F (-24.9 to 999.9°F); 0.2°F (-249.9 to -25.0°F); 0.3°F (-328.0 to -250.0°F); 1°F (1000 to 2500°F)	
	J	0.1°C (-200.0 to 999.9°C); 0.1°F (-149.9 to 999.9°F); 0.2°F (-328.0 to -150.0°F); 1°F (1000 to 1832°F)	
	T	0.1°C (-149.9 to 400.0°C); 0.2°C (-200.0 to -150.0°C); 0.1°F (0.0 to 752.0°F); 0.2°F(-270.0 to -0.1°F); 0.3°F (-328.0 to -270.1°F)	
Accuracy		±0.5°C (-100.0 to 999.9°C); ±1°C (outside); ±1°F (-148.0 to 999.9°F); ±1.5°F (outside) (for 1 year, excluding probe error)	
Probe		HI766 series K-type thermocouple (not included)	
CAL Button		N/A	yes
Backlit LCD		N/A	N/A
RS232		N/A	N/A
Battery Type / Life		1.5V AA (3) / approximately 500 hours of continuous use (with backlight off); auto-off after 60 minutes of non-use (can be disabled); auto-off after 8 minutes (HI93551R)	
Environment		-10 to 60°C (14 to 122°F); RH max 100%	
Dimensions / Weight		150 x 80 x 36 mm (5.9 x 3.1 x 1.4") / 235 g (8.3 oz.)	
Ordering Information		**HI93551** and **HI93551N** are supplied with batteries, instructions and protective case.	
Probes	**HI766C**	Penetration, stainless steel K-type thermocouple temperature probe with 1 m cable	
	HI766D	Air/gas, stainless steel K-type thermocouple temperature probe with 1 m (3.3') cable	
	HI766E1	General purpose/penetration, stainless steel K-type thermocouple temperature probe with 1 m (3.3') cable	

Thermocouple probes begin on page 14.16

HI93542 • HI93552R

Dual-channel, K, J, T-Type Thermocouple Thermometers

- HOLD
  - HOLD function
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- Battery indicator
  - Battery life indicator at startup
- Waterproof
  - Waterproof casing
- Backlight
  - Backlit display (HI93552R)
- Connectivity
  - PC and printer compatible (HI93552R)

The HI93542 and HI93552R are dual-channel waterproof K, J, and T-type thermocouple thermometers that can switch between thermocouple types at the touch of a button.

At any time, users can switch views to see all information on either channel, display current temperature or average along with the high and low values. Users can also see the difference between the two channels simultaneously, along with the high and low of the difference.

The HOLD button freezes the display to allow the user time to record readings. The °C/°F button switches between the Celsius and Fahrenheit temperature scale. The CLEAR button restarts the evaluation of high and low values.

For high accuracy, the HI93552R features a CAL button to allow the operator a simple one-point calibration in an ice bath at 0°C when probe interchange occurs.

The HI93552R also adds an RS232 output that allows for data transfer to a PC or printer.

The instruments are equipped with BEPS (Battery Error Prevention System), which alerts the user in the event that low battery power could adversely affect readings.

Specifications		HI93542	HI93552R
Range	K	-200.0 to 999.9°C and 1000 to 1371°C; -328.0 to 999.9°F and 1000 to 2500°F	
	J	-200.0 to 999.9°C; -328.0 to 999.9°F and 1000 to 1832°F	
	T	-200.0 to 400.0°C; -328.0 to 752.0°F	
Resolution	K	0.1°C (-149.9 to 999.9°C); 0.2°C (-200.0 to -150.0°C); 1°C (1000 to 1371°C); 0.1°F (-24.9 to 999.9°F); 0.2°F (-249.9 to -25.0°F); 0.3°F (-328.0 to -250.0°F); 1°F (1000 to 2500°F)	
	J	0.1°C (-200.0 to 999.9°C); 0.1°F (-149.9 to 999.9°F); 0.2°F (-328.0 to -150.0°F); 1°F (1000 to 1832°F)	
	T	0.1°C (-149.9 to 400.0°C); 0.2°C (-200.0 to -150.0°C); 0.1°F (0.0 to 752.0°F); 0.2°F(-270.0 to -0.1°F); 0.3°F (-328.0 to -270.1°F)	
Accuracy		±0.5°C (-100.0 to 999.9°C); ±1°C (outside); ±1°F (-148.0 to 999.9°F); ±1.5°F (outside) (for 1 year, excluding probe error)	
Probe		HI766 series K-type thermocouple (not included)	
CAL Button		N/A	yes
Backlit LCD		N/A	yes
RS232		N/A	yes
Battery Type / Life		1.5V AA (3) / approximately 500 hours of continuous use (with backlight off); auto-off: after 60 minutes of non-use (HI93542); selectable after 8 or 60 minutes of non-use (HI93552) (can be disabled for all models)	
Environment		-10 to 60°C (14 to 122°F); RH max 100%	
Dimensions		150 x 80 x 36 mm (5.9 x 3.1 x 1.4")	
Weight		235 g (8.3 oz.)	
Ordering Information		**HI93542** and **HI93552R** are supplied with batteries, instructions and protective case.	
Probes	**HI766C**	Penetration, stainless steel K-type thermocouple temperature probe with 1 m cable	
	HI766E1	General purpose/penetration, stainless steel K-type thermocouple temperature probe with 1 m (3.3') cable	

Thermocouple probes begin on page 14.16

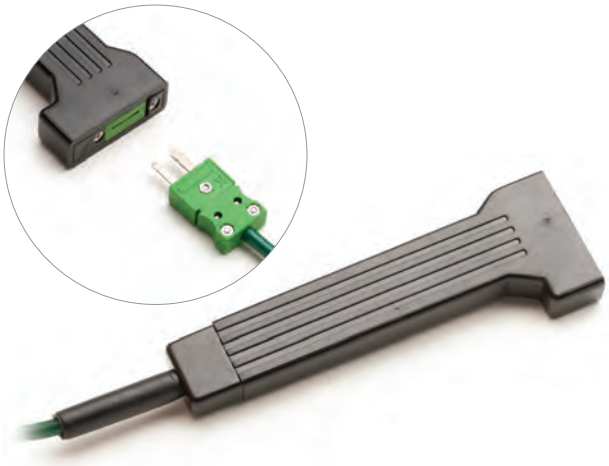
HI766

HI766 K-Type Thermocouple Probes

HI766PX Series, Probes with Detachable Handle

The HI766PX series are K-type thermocouple temperature probes to be used with thermocouple thermometers. These probes are ideal for measuring samples at very high temperatures, such as in industrial applications.

All probes are made of stainless steel for long life and easy cleaning. The HI766PX series includes a wide range of probes for measurement of liquids, air, gas and penetration in semisolids, as well as curved, planed or hard-to-reach surfaces. In addition, models are available with interchangeable or fixed handles for maximum versatility.



HI766HD, Probe Handle

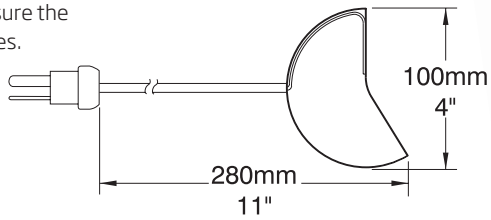
A rugged, PVC handle with a 1 meter (3.3') cable. It is provided with a female connector, which allows the connection of any HI766Px probe.

HI766EX, Extension Cable

A coiled cable which extends the probe cable by 1 m (3.3') , with two connectors at the two ends (1 male and 1 female).

HI766PA, Roller Surface Probe

This probe is designed to measure the temperature of convex surfaces.

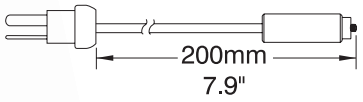


Specifications

Code	Application	Max. Temperature	Response Time (90% of final value)	Probe Length	Probe
HI766PA	convex surfaces, moving rollers	320°C (600°F)	7 seconds	280 mm (11')	stainless steel

HI766PB, Surface Probe

Temperature probe for measurements on surfaces.



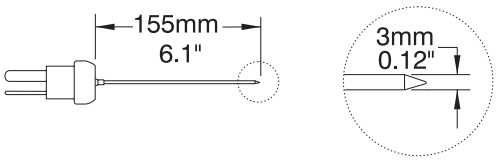
Specifications

Code	Application	Max. Temperature	Response Time (90% of final value)	Probe Dimensions	Probe
HI766PB	hot solids, furnaces, molds	650°C (1200°F)	8 seconds	L 200 mm x dia 16 mm (7.9 x 0.6")	stainless steel

HI766 K-Type Thermocouple Probes

HI766PC, Penetration Probe

K-type thermocouple probe with sharp tip for penetration of semi-solid samples.

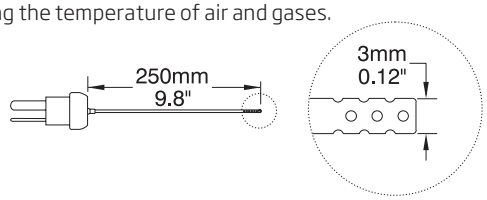


Specifications

Code	Application	Max. Temperature	Response Time (90% of final value)	Probe Dimensions	Probe
HI766PC	semi-solids, meat, rubber	900°C (1650°F)	15 seconds	L 155 mm x dia 3 mm (6.1 x 0.12")	stainless steel

HI766PD, Probe for Air and Gas

K-type thermocouple probe for measuring the temperature of air and gases.

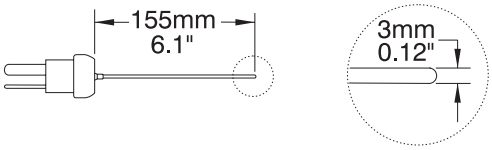


Specifications

Code	Application	Max. Temperature	Response Time (90% of final value)	Probe Dimensions	Probe
HI766PD	air, gases	300°C (570°F)	20 seconds	L 250 mm x dia 3 mm (9.8 x 0.12")	stainless steel

HI766PE1, General Purpose Probe

General purpose, penetration probe.

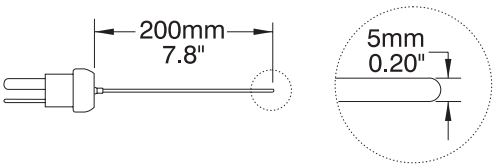


Specifications

Code	Application	Max. Temperature	Response Time (90% of final value)	Probe Dimensions	Probe
HI766PE1	liquids, air, gases	900°C (1650°F)	6 seconds	L 155 mm x dia 3 mm (6.1 x 0.12")	stainless steel

HI766PE2, General Purpose Probe

General purpose, penetration probe.



Specifications

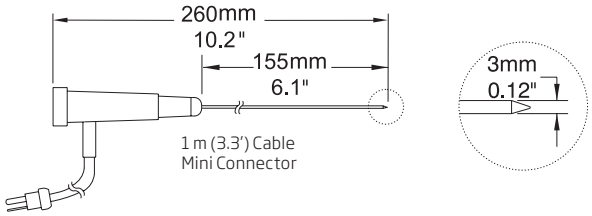
Code	Application	Max. Temperature	Response Time (90% of final value)	Probe Dimensions	Probe
HI766PE2	liquids, air, gases	900°C (1650°F)	6 seconds	L 200 mm x dia 5 mm (7.8 x 0.2")	stainless steel

HI766

HI766 K-Type Thermocouple Probes with Handle

HI766C, Penetration Probe

K-type thermocouple probe with sharp tip for penetration of semi-solid samples.

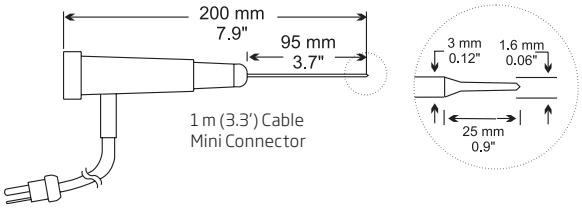


Specifications

Code	Application	Max. Temperature	Response Time (90% of final value)	Probe Dimensions	Probe	Cable Color
HI766C	semi-solids, meat, rubber	900°C (1650°F)	15 seconds	L 155 mm x dia 3 mm (6.1 x 0.12")	stainless steel	green
HI766CL	semi-solids, meat, rubber	900°C (1650°F)	15 seconds	L 310 mm x dia 5 mm (12.2 x 0.19")	stainless steel	green

HI766C1, Ultra-Fast Penetration Probe

Penetration probe with fast response time.

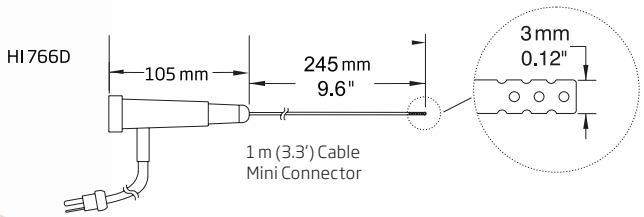


Specifications

Code	Application	Max. Temperature	Response Time (90% of final value)	Probe Dimensions	Probe	Cable Color
HI766C1	semi-solids, food	300°C (570°F)	4 seconds	L 95 mm x dia 1.6 mm (3.7 x 0.06")	stainless steel	green

HI766D Probe for Air and Gas

K-type thermocouple probe for measuring the temperature of air and gases.



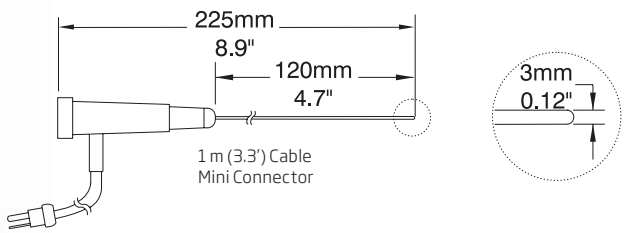
Specifications

Code	Application	Max. Temperature	Response Time (90% of final value)	Probe Dimensions	Probe	Cable Color
HI766D	air, gases	300°C (570°F)	20 seconds	L 245 mm x dia 3 mm (9.6 x 0.12")	stainless steel	green

HI766 K-Type Thermocouple Probes with Handle

HI766E1, General Purpose Probe

General purpose, penetration probe.

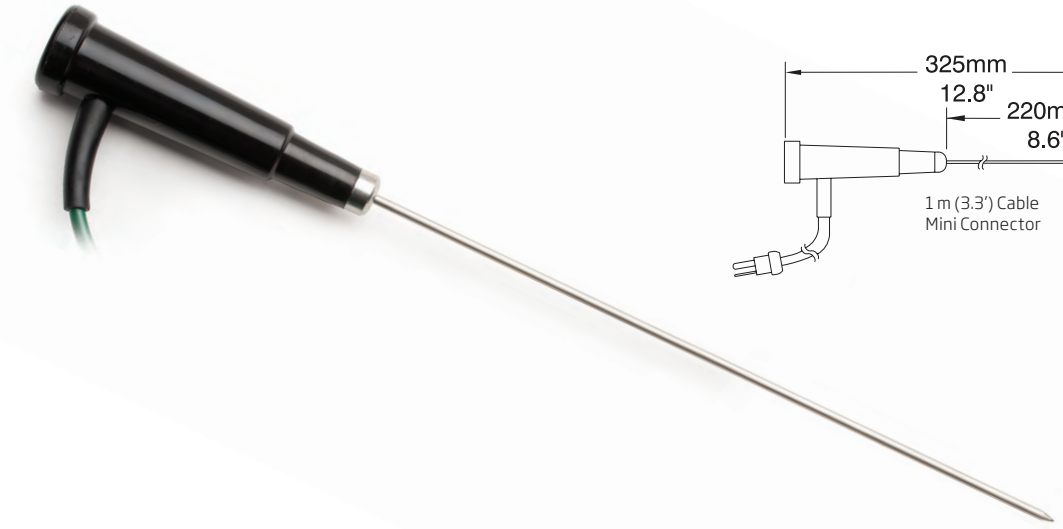


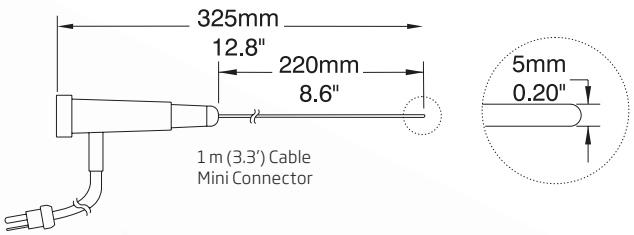
Specifications

Code	Application	Max. Temperature	Response Time (90% of final value)	Probe Dimensions	Probe	Cable Length
HI766E1	liquids, air, gases	900°C (1650°F)	6 seconds	L 120 mm x dia 3 mm (4.7 x 0.12")	stainless steel	1 m (3.3')

HI766E2, General Purpose Probe

General purpose, penetration probe.





Specifications

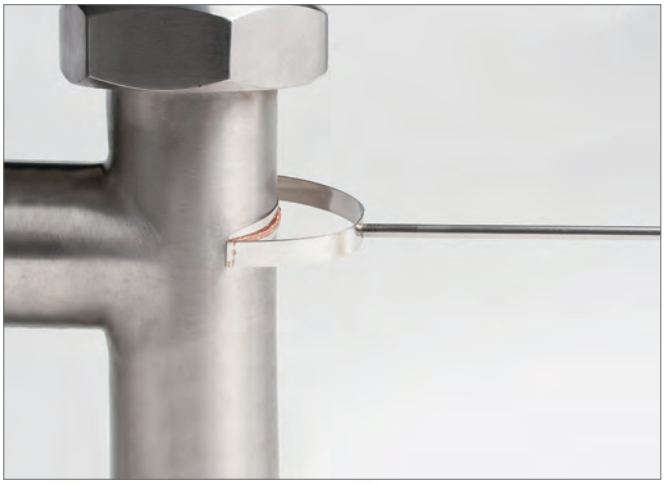
Code	Application	Max. Temperature	Response Time (90% of final value)	Probe Dimensions	Probe	Cable Length
HI766E2	liquids, air, gases	900°C (1650°F)	6 seconds	L 220 mm x dia 5 mm (8.5 x 0.2")	stainless steel	1 m (3.3')

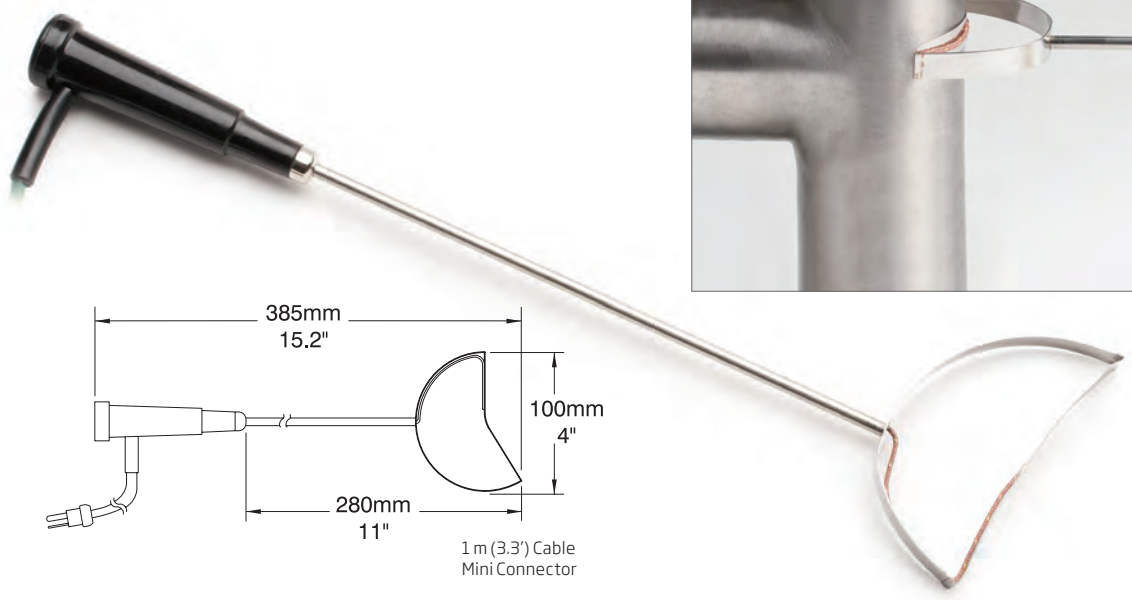
HI766

HI766 K-Type Thermocouple Surface Probes

HI766A, Roller Surface Probe

This probe is designed to measure the temperature of convex surfaces.





Specifications

Code	Application	Max. Temperature	Response Time (90% of final value)	Probe Dimensions	Probe
HI766A	convex surfaces, moving rollers	320°C (600°F)	7 seconds	280 mm (11') (probe length)	stainless steel

HI766B, Surface Probe

Temperature probe for measurements on surfaces.

Specifications

Code	Application	Max. Temperature	Response Time (90% of final value)	Probe Dimensions	Probe
HI766B	hot solids, furnaces, molds	650°C (1200°F)	8 seconds	L 200 mm x dia 16 mm (7.9 x 0.6")	stainless steel

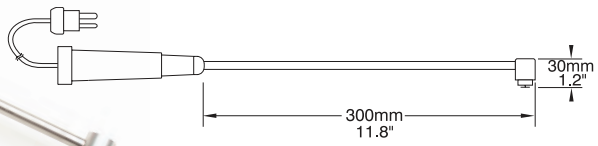
HI766 K-Type Thermocouple Surface Probes

The following probes are designed to ensure optimal contact with surfaces of different shapes and dimensions.

When using these probes, the handle temperature must never exceed 150°C (302°F) to avoid possible damage to the probe.

HI766B1, 90° Angle Surface Probe

Probe for measuring the temperature of 90° angle surfaces.

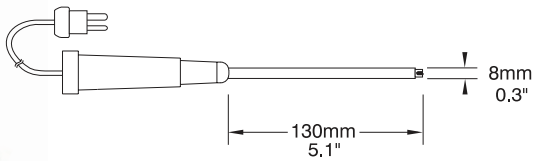


Specifications

Code	Application	Max. Temperature	Response Time (90% of final value)	Probe Dimensions	Probe	Sensor
HI766B1	hard to reach surfaces	450°C (840°F)	8 seconds	L 300 mm x dia 30 mm (11.8 x 1.2")	stainless steel	spring-loaded

HI766B2, Surface Probe

Probe for measuring the temperature of round surfaces.

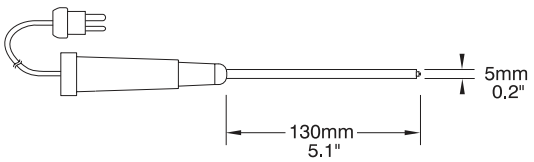


Specifications

Code	Application	Max. Temperature	Response Time (90% of final value)	Probe Dimensions	Probe	Sensor
HI766B2	solids, furnaces, molds	900°C (1650°F)	3 seconds	L 130 mm x dia 8 mm (5.1 x 0.3")	stainless steel	spring-loaded

HI766B3, Small Surface Probe

Probe for measuring the temperature of small surfaces.



Specifications

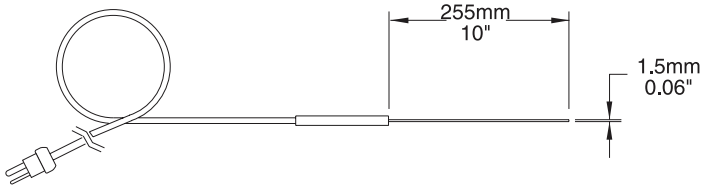
Code	Application	Max. Temperature	Response Time (90% of final value)	Probe Dimensions	Probe	Sensor
HI766B3	small surfaces	200°C (390°F)	6 seconds	L 130 mm x dia 5 mm (5.1 x 0.2")	stainless steel, insulated tube	spring-loaded

HI766

HI766 K-Type Thermocouple Probes for Specific Applications

HI766F, High Temperature Probe

Probe with flexible sheath without handle, designed to measure high temperatures.

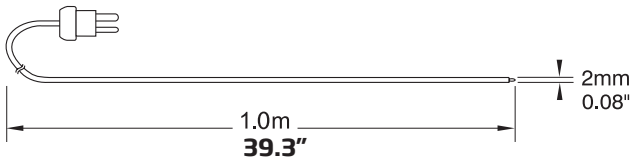


Specifications

Code	Application	Max. Temperature	Response Time (90% of final value)	Probe Dimensions	Probe	Cable Length
HI766F	high temperature	1100°C (2000°F)	4 seconds	L 255 mm x dia 1.5 mm (10 x 0.06")	AISI 316 stainless steel	1 m (3.3')

HI766F1, Wire Temperature Probe

Wire probe, designed to access hard to reach places. Probe does not incorporate a handle.



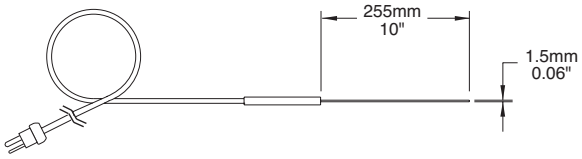
Specifications

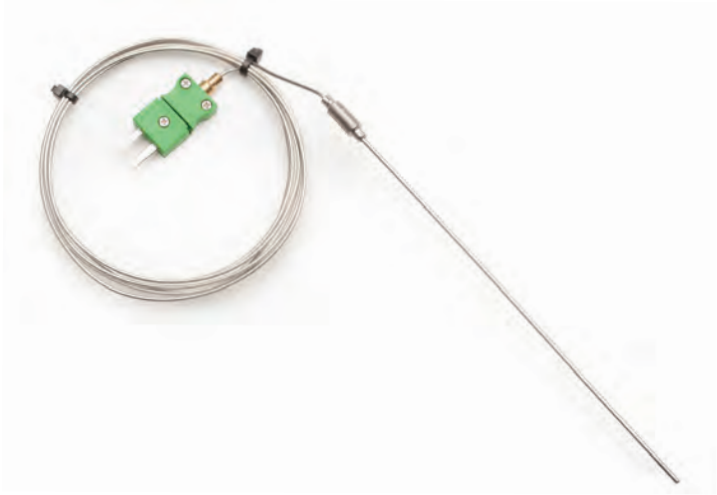
Code	Application	Max. Temperature	Response Time (63.2% F.S.)	Probe Dimensions	Sensor	Wire length
HI766F1	hard to reach areas	480°C (900°F)	1 second	dia 2 mm (0.08")	exposed wires	1 m (3.3')
HI766F1/5	hard to reach areas	480°C (900°F)	1 second	dia 2 mm (0.08")	exposed wires	5 m (16.4')

HI766 K-Type Thermocouple Probes for Specific Applications

HI766Z, Wire Temperature Probe

Wire probe, designed to measure temperature inside ovens.



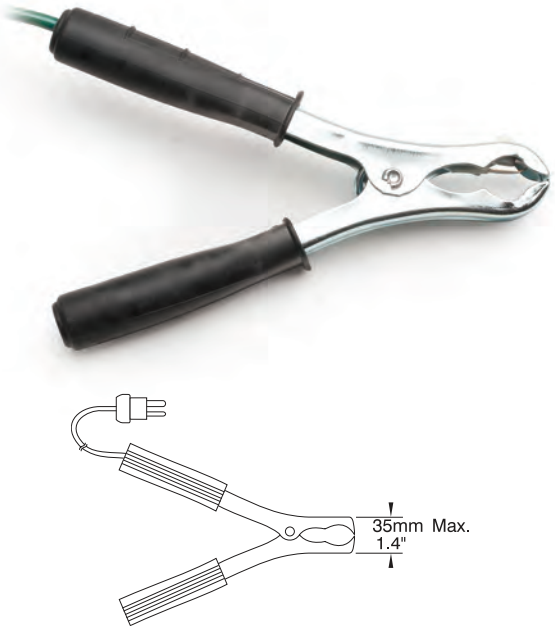


Specifications

Code	Application	Max Temperature	Response Time (90% of final value)	Probe Dimensions	Sensor	Cable Length
HI766Z	ovens	1100°C (2000°F)	4 seconds	L 255 mm x dia 1.5 mm (10 x 0.06")	stainless steel	1.7 m (5.6')
HI766Z/3	ovens	1100°C (2000°F)	4 seconds	L 255 mm x dia 1.5 mm (10 x 0.06")	stainless steel	3 m (9.9')
HI766Z/7	ovens	1100°C (2000°F)	4 seconds	L 255 mm x dia 1.5 mm (10 x 0.06")	stainless steel	7 m (22.9')

HI766TV1, Pipe Clamp Probe

Probe for measuring the temperature of pipes and tubes.



Specifications

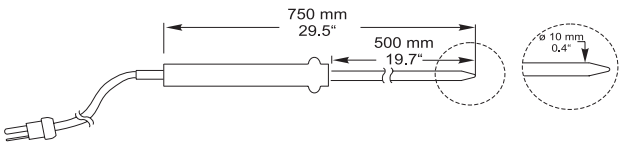
Code	Application	Max. Temperature	Response Time (90% of final Value)	Clamp Opening Diameter	Sensor
HI766TV1	pipes, tubes	200°C (390°F)	8 seconds	max 35 mm (1.4")	housed inside the clamp

HI766

HI766 K-Type Thermocouple Probes for Specific Applications

HI766TR1, Penetration Probe

K-type thermocouple probe with sharp tip for penetration of semi-solid samples.

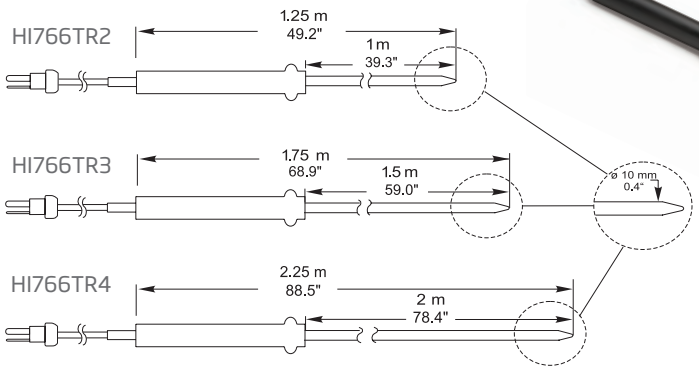


Specifications

Code	Application	Max Temperature	Response Time (90% of final value)	Probe Dimensions	Sensor
HI766TR1	semi-solids, liquids	250°C (482°F)	10 seconds	L 500 mm x dia 10 mm (19.7 x 0.4")	stainless steel

HI766TR2, HI766TR3, HI766TR4 Penetration Probes

K-type thermocouple probes with sharp tip for penetration of semi-solid samples.



Specifications

Code	Application	Max Temperature	Response Time (90% of final value)	Probe Length	Sensor
HI766TR2	semi-solids, liquids	250°C (482°F)	10 seconds	1 m (3.3')	stainless steel
HI766TR3	semi-solids, liquids	250°C (482°F)	10 seconds	1.5 m (5')	stainless steel
HI766TR4	semi-solids, liquids	250°C (482°F)	10 seconds	2 m (6.6')	stainless steel

Hanna Thermometers for the Food Sector

Operators in the food sector need an extensive range of products in order to guarantee the quality and safety of food supplied to the public while maintaining compliance with local and federal laws. In order to satisfy the need for quality, safety, and compliance, Hanna manufactures a vast range of products with the necessary accuracy and reliability to check the quality of food in all phases of preparation and distribution.

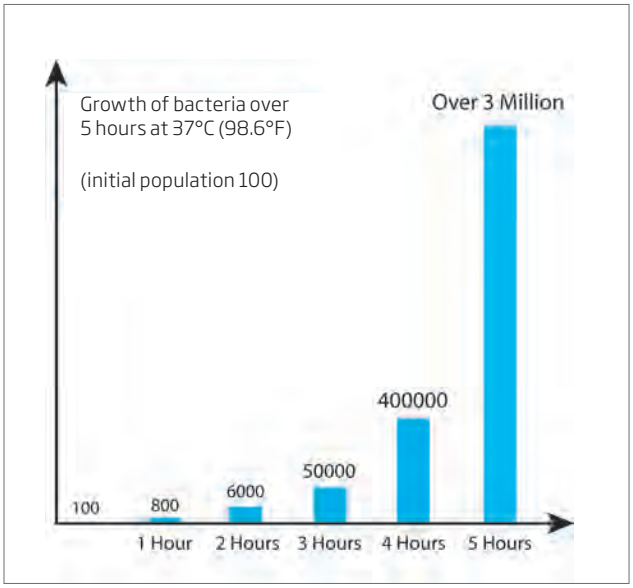
Many of Hanna's portable and pocket thermometer lines have become synonymous with temperature control in restaurants and catering facilities.

For the adverse measurement conditions found in food production areas, typically with high humidity and condensation problems, Hanna has manufactured a substantial array of waterproof meters.

To satisfy the requirements of HACCP, Hanna supplies a complete range of thermometers and pH meters to check goods from production to transport and from catering to storage. Documentation is a must in certain production cycles and important for HACCP programs. For this Hanna offers a range of logging meters. These are stand-alone meters that can measure and log the parameters without any supervision. Shock-resistant protective boots are available for many of our instruments.

Temperature

Temperature of food is constantly monitored to keep growth of pathogens and microorganisms under control. Temperature is important in production to ensure that the food is not spoiled and the quality is not compromised, therefore enhancing it's value. Food needs to be kept at the correct temperature while stored, displayed, and on the move. If temperature is not properly controlled, bacteria can grow to dangerous levels in just a few hours.



The table below lists recommended temperatures for different products. It is vital to monitor and document the temperature to which food has been exposed.

Product	Temp.	Product	Temp.
Chunks of Meat	≤ 7°C	Smoked Fish	≤ 7°C
Minced Meat	≤ 4°C	Frozen Food	≤ -18°C
Innards	≤ 3°C	Milk	≤ 7°C
Frozen Chicken	≤ -12°C	Fruit and Vegetables	≤ 10°C
Deep-freeze Chicken	≤ -18°C	Eggs	≤ 8°C
Fresh Fish	≤ 2°C	Dried Fruit	≤ 25°C

Products and their recommended storage temperatures

Temperature plays an important role in the processing and preparation of edible products containing meat

Meat

The temperature of meat at slaughterhouses is a vital quality control test and needs to be checked at various points of production. Fresh meat should be stored at about 2°C (35.6°F).

For deep-freeze meat in storage, it should have an internal temperature around -22°C (-7.6°F) with the surface temperature reaching -35°C (-31°F). In order to thaw the meat properly, the surrounding temperature should be 7°C (44.6°F).

Ham and Sausages

The temperature of salted meat stored for several months is around 2°C (35.6°F). Afterwards, the product is rinsed and dried at around 25°C (77°F) prior to maturing at a preset temperature for a particular product. For sausages, the mixed ingredients are cooked at a certain temperature and then cooled at around 5 to 15°C (41 to 59°F).

Beverages

The temperature of spring or deep well waters that are extracted for beverage production must be continuously monitored to ensure purity. During the production of soft drinks, syrup is pasteurized before being added, to prevent bacteriological problems. In order to prepare fruit juices, fruit pulp is heated to just below boiling point for a few seconds to reduce the presence of microorganisms. During both of these processes, accurate temperature monitoring is crucial.

Temperature control also plays a crucial role in beer production. For example, malt has to be heated to 75°C (167°F) during the mash

process. Once the mash is cooled, the vessel is heated above boiling point to prepare the mash for a strainer; later the mash is heated to up to 120°C (248°F) for a few seconds to pasteurize it. The type of yeast then used for the fermentation process is also temperature dependent. By controlling the fermentation temperature, operators can determine the time needed for the product to fully develop. Temperature is also controlled during filtration, which is needed in order to remove particles and improve the taste and longevity of beer. In order to remove protein, beer is cooled down to almost 0°C (32°F). As with many other products on the market, beer is pasteurized at around 60°C (140°F) after it has been bottled to eliminate the presence of microorganisms.

Milk and Dairy Products

Milk is checked for impurities and bacteria upon collection. During storage, the temperature of milk is normally kept below 5°C (41°F). In order to slow down cream formation, milk is homogenized at about 60°C (140°F).

The pasteurization of milk results in the reduction of microorganisms by 95% and is attained by raising the temperature to over 72°C (161.6°F). For UHT (ultra heat treated), milk is heated to 135/150°C (275/302°F) in a pressurized vessel for a few seconds. If the process is repeated for several minutes, all microorganisms, including spores, are destroyed and the sterilized milk will have a 12 month shelf life. For cheese, temperature needs to be adjusted before and during various processes, for example, when rennet is added.

Temperature in the maturation chamber also determines the period of maturation needed. Likewise, temperature is important in the production of butter. For example, skimmed milk is separated from cream at around 55°C (131°F) and the cream is then cooled to about 8°C (46.4°F). The temperature of incoming milk is raised to 45°C (113°F) before the addition of a culture for yogurt manufacturing. In order to denature the whey proteins, milk is raised to very high temperatures. The incubation temperature is maintained for a few hours prior to its cooling to about 10°C (50°F).

Bread and Pasta

The temperature of stored grain in silos is controlled to ensure that premature fermentation does not occur. During pasta production, water at about 25°C (77°F) is added to wheat flour during fermentation of dough for bread-making, the temperature is kept at around 30°C (86°F). The oven temperature for baking should be around 260°C (500°F) and once baked, bread is cooled to room temperature. For semi-finished products that can be flash-baked, the dough has to be stored at very low temperatures.

Chocolate

Fermentation of cocoa beans is started by increasing the temperature to about 50°C (122°F). At different stages of chocolate manufacturing such as crystallization, accurate temperature measurement is a must. Once the chocolate is ready, the storage temperature should be monitored to ensure that it stays in the 15°C (59°F) range.

Coffee

In order to invoke an aroma, coffee beans are heated up to 200°C (392°F). During roasting, the temperature is closely monitored. In order to provide a long shelf life, the finished product is frozen at -40°C (-40°F) prior to drying. To produce a good coffee, it is important to ensure that the temperature of coffee machines does not exceed 80°C (176°F).

Sanitization of Machinery

The temperature of cleansing agents, together with their concentration, have a significant bearing on how effectively the machinery is sanitized. The temperature for fermentation vessels can range from room temperature to 40°C (104°F). For milk and yogurt, tanks may reach 70°C (158°F) and as high as 150°C (302°F) for steam sterilizers. In addition, regulatory bodies recommend a certain minimum temperature for cleaning agents to be effective; this can vary from 24°C (75.2°F) for iodine and ammonia and 49°C (120.2°F) for chlorine.

HI935007N

K-Type Thermocouple Thermometer with Penetration Probe

- CAL Check ™
  - Alerts users of calibration status
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- Battery indicator
  - Battery level indicator at startup
- Waterproof
  - Compact, heavy-duty and waterproof

The HI935007N is a portable thermometer that measures temperatures as high as 1350°C. The resolution remains 0.1 up to 199.9°C and automatically changes to 1.0 above.

The fixed HI766C penetration probe with 1 m (3.3') flexible cable is also supplied with the instrument.

With the optional protective rubber boot, the HI935007N can be used anywhere with maximum impact protection. These features along with a wide measurement range, make HI935007N extremely popular in catering, food preparation and restaurants.

the HI935007N's attractive price makes it possible for every operator to carry his or her own professional instrument.

Advanced battery management features include a display of remaining battery power at startup, low battery warning and BEPS (Battery Error Prevention System), which alerts the user in the event that low battery power could adversely affect readings, as well as auto-shut off capability to preserve battery life.

Specifications	HI935007N
Range	-50.0 to 199.9°C; 200 to 1350°C
Resolution	0.1°C (up to 199.9°C); 1°C (outside)
Accuracy	±0.2% full scale (excluding probe error)
Probe	HI766C penetration, stainless steel K-type thermocouple temperature probe with 1 m (3.3) cable (fixed)
Battery Type	1.5V AAA (3) / approximately 1000 hours of continuous use; auto-off after 8 minutes of non-use
Environment	-10 to 50°C (14 to 122°F); RH max 100%
Dimensions	152 x 58 x 30 mm (6.0 x 2.3 x 1.2")
Weight	205 g (7.2 oz.)
Ordering Information	**HI935007N** is supplied with HI766C fixed temperature probe, batteries, instructions and hard carrying case.

HI9241

Thermistor Thermometer with Pre-Calibrated Probe

- CAL Check ™
  - Alerts users of calibration status
- BEPS
  - Alerts the user of low battery power that could adversely affect reading
- Battery indicator
  - Battery level indicator at startup
- Waterproof
  - Compact, heavy-duty and waterproof

HI9241 features a new streamlined design with bottom probe connection. This instrument measures a wide range from -50.0 to 150.0°C with exceptional accuracy. This meter is simple to operate and is supplied complete with the user-replaceable HI765PW general purpose penetration probe.

Users may exchange the probe with any in the HI765 series without requiring recalibration. A diverse assortment of HI765 probes and cable lengths are available. Probes can be ordered with different handle colors to prevent cross-contamination.

Advanced battery management features include a display of remaining battery power at startup, low battery warning and BEPS (Battery Error Prevention System), which alerts the user in the event that low battery power could adversely affect readings.

Users can check the meter's accuracy at any time with Hanna calibration keys. Simply plug the key into the meter's probe input and if the display value does not match those of the key, the meter is due for recalibration.

Specifications	HI9241	
Range	-50.0 to 150.0°C	
Resolution	0.1°C	
Accuracy	±0.4°C (excluding probe error)	
Probe	HI765PW general purpose/penetration, stainless steel thermistor temperature probe with white handle and 1 m (3.3') cable (included)	
Battery Type/Life	1.5V AAA (3) /approximately 2000 hours of continuous use; auto-off after 8 minutes of inactivity	
Environment	-10 to 50°C (14 to 122°F); RH max 100% non-condensing	
Dimensions	152 x 58 x 30 mm (6.0 x 2.3 x 1.2")	
Weight	205 g (7.2 oz.)	
Ordering Information	**HI9241** is supplied with HI765PW temperature probe, batteries, instructions and rugged carrying case.	
Probes	**HI765PW**	General purpose/penetration, stainless steel thermistor temperature probe with white handle and 1 m (3.3') cable
	HI765A	Air/gas, stainless steel thermistor temperature probe with white handle and 1 m (3.3') cable
	HI765L	Air/liquid, stainless steel thermistor temperature probe with white handle and 1 m (3.3') cable
	HI765W	Thermistor wire, stainless steel temperature probe with 1 m cable

Thermistor probes begin on page 14.32; calibration test keys begin on page 14.36

HI93501N • HI93501NS

Thermistor Thermometers

- CAL Check™
  - Alerts users of calibration status
- HOLD
  - HOLD feature (HI93501NS)
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- Battery indicator
  - Battery level indicator at startup
- Waterproof
  - Compact, heavy-duty and waterproof

The HI93501N is a waterproof thermometer designed for daily use in food applications such as industrial kitchens and catering. The "S" version also adds a stability indicator bargraph and HOLD button to freeze readings on the LCD.

The HI762PWL penetration probe is included. A diverse assortment of HI762 probes and cable lengths are available. Probes can be ordered with different handle colors to prevent cross-contamination.

The display indicates the remaining battery power at startup then continuously checks the battery level and warns the user with ample time to change the battery.

The instruments are equipped with BEPS (Battery Error Prevention System), which alerts the user in the event that low battery power could adversely affect readings.

Users can check the meter's accuracy at any time with Hanna calibration keys. Simply plug the key into the meter's probe input and if the display value does not match those of the key, the meter is due for recalibration.

Specifications	HI93501N • HI93501NS	
Range	-50.0 to 150.0°C	
Resolution	0.1°C	
Accuracy	±0.4°C for 1 year (excluding probe error)	
Probe	HI762PWL penetration, stainless steel thermistor temperature probe with white handle and 1 m (3.3') cable (included)	
Battery Type / Life	1.5V AAA (3) / approximately 2000 hours of continuous use; auto-off after 8 minutes of non-use	
Environment	-10 to 50°C (14 to 122°F); RH max 100%	
Dimensions	152 x 58 x 30 mm (6.0 x 2.3 x 1.2")	
Weight	205 g (7.2 oz.)	
Ordering Information	**HI93501N** and **HI93501NS** are supplied with HI762PWL temperature probe, batteries, instructions and rugged carrying case.	
Probes	**HI762A**	Air/gas, stainless steel thermistor temperature probe with white handle and 1 m (3.3') cable
	HI762L	Air/liquid, stainless steel thermistor temperature probe with white handle and 1 m (3.3') cable
	HI762W	Thermistor, stainless steel wire temperature probe with 1 m cable

Thermistor probes begin on page 14.32; calibration test keys begin on page 14.36

HI93503

Waterproof Thermometer

with Pre-Calibrated Interchangeable Probe

- CAL Check™
  - Alerts users of calibration status
- HOLD
  - HOLD Feature
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- Battery indicator
  - Battery level indicator at startup
- Waterproof
  - Compact, heavy-duty and waterproof

The HI93503 features a new streamlined design with bottom probe connection. This instrument measures a wide range from -50.0 to 150.0°C with exceptional accuracy. This meter is simple to operate and supplied with the user-replaceable HI765PWL penetration probe.

The HI93503 also features a HOLD button to freeze the display to allow the user time to record readings, and a stability indicator.

Exchange the probe with any other model in the HI765 series without requiring recalibration. A diverse assortment of HI765 probes and cable lengths are available. Probes can be ordered with different handle colors to prevent cross-contamination.

The instrument is also equipped with BEPS (Battery Error Prevention System), which alerts the user in the event that low battery power could adversely affect readings.

Users can check the meter's accuracy at any time with Hanna calibration keys. Simply plug the key into the meter's probe input and if the display value does not match those of the key, the meter is due for recalibration.

Specifications	HI93503	
Range	-50.0 to 150.0°C	
Resolution	0.1°C	
Accuracy	±0.4°C (excluding probe error)	
Probe	HI765PWL penetration, stainless steel thermistor temperature probe with white handle and 1 m (3.3') cable (included)	
Battery Type / Life	1.5V AAA (3) /approximately 2000 hours of continuous use. auto-off after 8 minutes of inactivity	
Environment	-10 to 50°C (14 to 122°F); RH max 100%	
Dimensions	152 x 58 x 30 mm (6.0 x 2.3 x 1.2")	
Weight	205 g (7.2 oz.)	
Ordering Information	**HI93503** is supplied with HI765PWL temperature probe, batteries, instructions and hard carrying case.	
Probes	**HI765PW**	General purpose/penetration, stainless steel thermistor temperature probe with white handle and 1 m (3.3') cable
	HI765A	Air/gas, stainless steel thermistor temperature probe with white handle and 1 m (3.3') cable
	HI765L	Air/liquid, stainless steel thermistor temperature probe with white handle and 1 m (3.3') cable
	HI765W	Thermistor wire, stainless steel temperature probe with 1 m cable

Thermistor probes begin on page 14.32; calibration test keys begin on page 14.36

HI93510 • HI93510N

Thermistor Thermometers

- HOLD
  - HOLD Feature
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- Battery indicator
  - Battery level indicator at startup
- Backlight
  - Backlit display (N version)
- Waterproof
  - Compact, heavy-duty and waterproof

The HI93510 is a waterproof thermometer tailored for the lab and field. The LCD displays the highest and lowest readings in the cycle along with the current temperature. To freeze the reading for easy recording, simply press the HOLD button. Celsius or Fahrenheit range can be selected at the touch of a button.

The HI93510N offers all the features of the HI93510 plus a CAL button to allow the operator to calibrate the meter and probe in an ice bath at 0°C. This will assure the removal of the combined meter and probe interchange error. In addition to calibration capabilities, HI93510N has a user-activated backlit display.

A diverse assortment of HI762 probes and cable lengths are available. Probes can be ordered with different handle colors to prevent cross-contamination.

Advanced battery management features include a display of remaining battery power at startup, low battery warning and BEPS (Battery Error Prevention System), which alerts the user in the event that low battery power could adversely affect readings.

Specifications	HI93510	HI93510N
Range	-50.0 to 150.0°C; -58.0 to 302.0°F	
Resolution	0.1°C; 0.1°F (-58.0 to 230.0°F) and 0.2°F (outside)	
Accuracy	±0.4°C; ±0.8°F (for 1 year, excluding probe error)	
Probe	HI762BL air/liquid, stainless steel thermistor temperature probe with black handle and 1 m (3.3') cable (included)	
CAL Button	N/A	yes
Backlit LCD	N/A	yes
Battery Type / Life	1.5V AA (3) / approximately 2000 hours of continuous use (with backlight off); HI93510 only: auto-off selectable after 8 or 60 minutes of non-use (can be disabled)	
Environment	-10 to 50°C (14 to 122°F); RH max 100%	
Dimensions	150 x 80 x 36 mm (5.9 x 3.1 x 1.4")	
Weight	235 g (8.3 oz.)	
Ordering Information	**HI93510** and **HI93510N** are supplied with HI762BL temperature probe, batteries and instructions.	
Probes	**HI762L**	Air/liquid, stainless steel thermistor temperature probe with white handle and 1 m (3.3') cable
	HI762A	Air/gas, stainless steel thermistor temperature probe with white handle and 1 m (3.3') cable

Thermistor probes begin on page 14.32; calibration test keys begin on page 14.36

HI762

HI762 Thermistor Probes

The HI762 temperature probes can be identified by the grey cap on the top of the handle and have the following specifications:

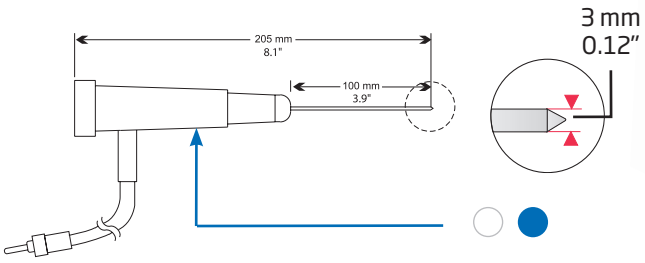
HI762 Probes	
Range	-50 to 150°C (-58 to 302°F)
Sensor	NTC thermistor
Accuracy	±0.2°C (±0.4°F)
Probe Handle	ABS
Interchange Error	±0.2°C (±0.4°F)
Probe	AISI 316 stainless steel
Response Time (90% of final value)	6 seconds

The HI762 series with NTC thermistor sensor offers a wide range of probes for measuring liquids, air and gases, and for penetration in semi-solids.

Models are available with a 1, 2 or 10 meter cable, and have colored handles for easy identification when measuring different samples.

HI762P

General purpose, penetration probe with colored handle.

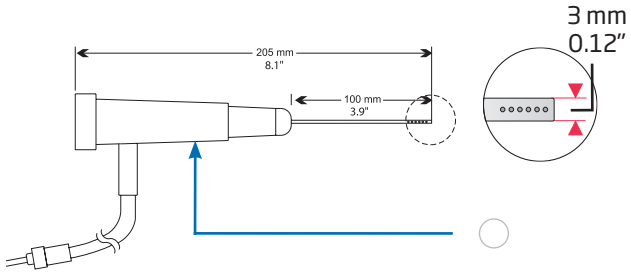


Specifications

1 m (3.3') Cable	2 m (6.6') Cable	Handle Color
HI762PW	–	white
HI762PBL	–	blue

HI762A

Thermistor probe for measuring the temperature of air and gases.



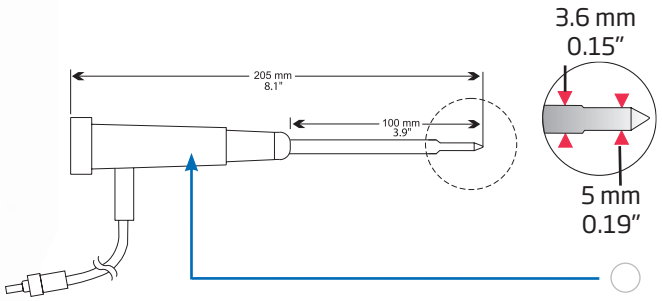
Specifications

1 m (3.3') Cable	2 m (6.6') Cable	Handle Color
HI762A	–	white

HI762 Thermistor Probes

HI762PWL

Thermistor probe with sharp tip for penetration of semi-solid samples.

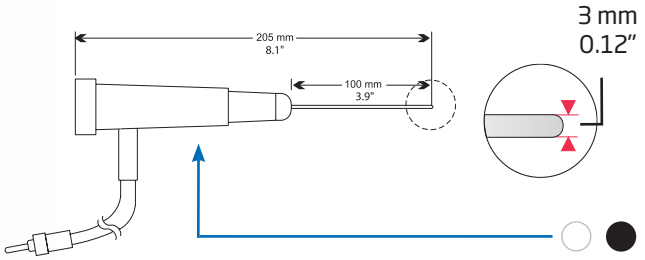


Specifications

1 m (3.3') Cable	2 m (6.6') Cable	10 m (32.8') Cable	Handle Color
HI762PWL	–	–	white

HI762L

Air, liquid probe.

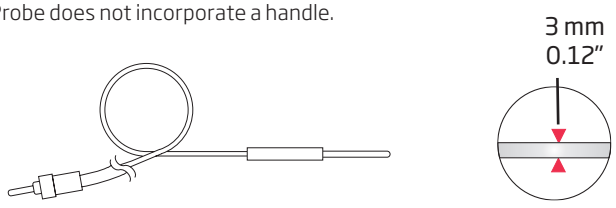


Specifications

1 m (3.3') Cable	2 m (6.6') Cable	10 m (32.8') Cable	Handle Color
HI762L	**HI762L/2**	**HI762L/10**	white
HI762BL	–	–	black

HI762W

Wire probe, designed to access hard to reach places.
Probe does not incorporate a handle.



Specifications

1 m (3.3') Cable	2 m (6.6') Cable	10 m (32.8') Cable	Handle Color
HI762W	–	**HI762W/10**	–

HI765

HI765 Thermistor Probes

The HI765 temperature probes are provided with a PTC thermistor sensor, and have the following specifications:

HI765 Specifications

Range	-50 to 150°C (-58 to 302°F)
Accuracy	±0.2°C (±0.4°F)
Sensor	PTC thermistor
Probe Handle	ABS
Interchange Error	±0.2°C (±0.4°F)
Probe	AISI 316 stainless steel
Response Time (90% of final value)	8 seconds

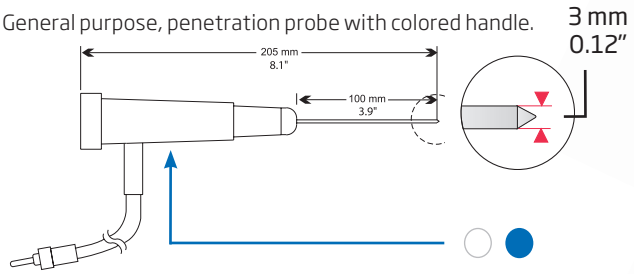
All probes are pre-calibrated with a maximum error of ±0.2°C (±0.4°F).

The HI765 series can be identified by the white cap on the top of the handle. This series offers a wide range of probes for measuring liquids, air and gases, and for penetration in semi-solids.

Models are available with a cable length of 1 or 10 meters and have colored handles for easy identification during measurements of different samples.

HI765P

General purpose, penetration probe with colored handle.

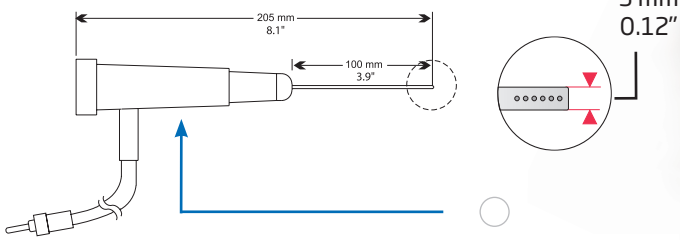


Specifications

1 m (3.3') Cable	10 m (32.8') Cable	Handle Color
HI765PW	**HI765PW/10**	white
HI765PBL	–	blue

HI765A

Thermistor probe for measuring the temperature of air and gases.



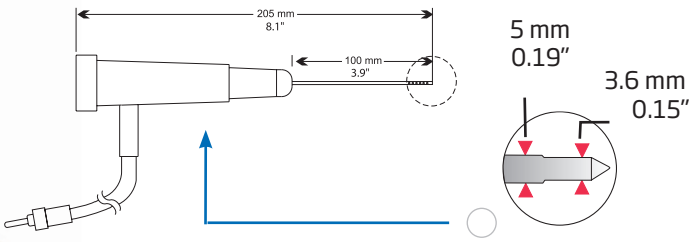
Specifications

1 m (3.3') Cable	10 m (32.8') Cable	Handle Color
HI765A	**HI765A/10**	white

HI765 Thermistor Probes

HI765PWL

Thermistor probe with sharp tip for penetration of semi-solid samples.

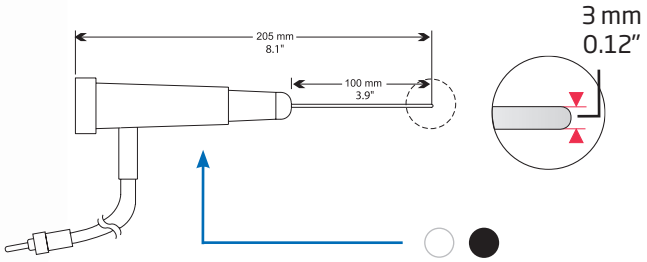


Specifications

1 m (3.3') Cable	2 m (6.6') Cable	Handle Color
HI765PWL	–	white

HI765L

Air, liquid probe.

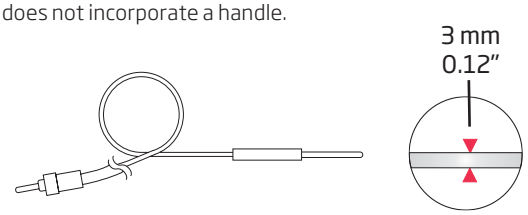


Specifications

1 m (3.3') Cable	10 m (32.8') Cable	Handle Color
HI765L	–	white
HI765BL	–	black

HI765W

Wire probe, designed to access hard-to-reach places.
Probe does not incorporate a handle.



Specifications

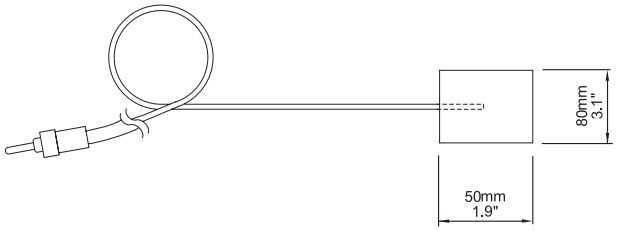
1 m (3.3') Cable	10 m (32.8') Cable
HI765W1	**HI765W/10**

HI765

HI765 Thermistor Probes

HI765BP

Thermistor probe without handle, designed to measure the temperature of stacked goods.



Specifications

1 m (3.3') Cable	2 m (6.6') Cable
HI765BP1	–

Calibration Test Keys for Thermistor Thermometers

For measurements that are always reliable, thermometers must be calibrated periodically.

Hanna test keys offer a fast and simple way of checking the accuracy of your instruments.

Connect the key to the probe input. If the reading on the display differs more than 0.4°C (0.8°F) from the key rated value, your thermometer should be recalibrated at our technical service center.

Test Keys for Thermometers Using HI762 Probes

HI762-18C	Test key at -18°C	**HI762-004F**	Test key at -0.4°F
HI762000C	Test key at 0°C	**HI762032F**	Test key at 32°F
HI762070C	Test key at 70°C	**HI762158F**	Test key at 158°F

For periodic verification of your thermometer's calibration, it is recommended to check at least two points.
Choose the test keys with the nominal values closest to the temperature usually measured.

Test Keys for Thermometers Using HI765 Probes

HI765-18C	Test key at -18°C	**HI765-004F**	Test key at -0.4°F
HI765000C	Test key at 0°C	**HI765032F**	Test key at 32°F
HI765070C	Test key at 70°C	**HI765158F**	Test key at 158°F

For periodic verification of your thermometer's calibration, it is recommended to check at least two points.
Choose the test keys with the nominal values closest to the temperature usually measured.

HI99551 • HI99556

Infrared Thermometers for the Food Industry

- HOLD
  - HOLD Feature
- Battery indicator
  - Battery life indicator on startup
- Optional external probe can also be used (HI99556)

The HI99551 and HI99556 thermometers employ infrared technology to measure surface temperatures. Infrared readings are extremely fast, with a response time typically around one second.

One big advantage of these meters is the non-intrusive nature of measurements. This feature is particularly attractive for food distribution, retailing and markets, since it translates practicality into savings by leaving products intact, especially those sealed or pre-wrapped.

In order to measure the temperature, simply turn on the meter and point to the product or target. Readings are displayed on the LCD. This type of non-intrusive measurement is also useful when the surface temperature is too high to approach, for difficult to reach places or for hygiene requirements.

If you must check the core temperature in addition to surface measurement, the HI99556 is the ideal solution for you. Simply attach an optional external probe to the meter and you have a 2-in-1 infrared-thermistor thermometer.

A HOLD function freezes the display to allow the user time to record readings.

Specifications		HI99551-00 / HI99556-00	HI99551-10 / HI99556-10
Range	IR	-10 to 300°C	-20.0 to 199.9°C
	Probe (HI99556 only)	-40 to 150°C	-40 to 150.0°C
Resolution	IR	1°C	0.1°C
	Probe (HI99556 only)	1°C	0.1°C
Accuracy	IR	±2% of reading or ±2°C	±2% of reading or ±2°C
	Probe (HI99556 only)	±0.5°C (-20 to 120°C); ±0.5°C +1% reading (outside)	±0.5°C (-20 to 120°C); ±0.5°C +1% reading (outside)
IR Sensor Response Time		1 second	
IR Sensor Optic Coefficient		3:1 (ratio of distance to target diameter)	
Minimum Distance		30 mm (1.2")	
Probe (HI99556 only)		HI765PW general purpose/penetration, stainless steel thermistor temperature probe with white handle and 1 m (3.3') cable (included)	
Battery Type / Life		9V / approximately 150 hours of continuous use	
Environment		0 to 50°C (32 to 122°F); RH max 95%	
Dimensions		143 x 80 x 38 mm (5.6 x 3.2 x 1.5")	
Weight		320 g (11.3 oz.)	
Ordering Information		**HI9955 [x] - [ ][y][ ]** **x = 1** meter with IR sensor **x = 6** meter with IR sensor and HI765PW probe (40 to 150°C range) **y = 00** IR range from -10 to 300°C **y = 10** IR range from -20 to 199.9°C	
Probes		**HI765PW** General purpose/penetration, stainless steel thermistor temperature probe with white handle and 1 m (3.3') cable	

Thermistor probes begin on page 14.32; calibration test keys begin on page 14.36

HI955501 • HI955502

4-wire Pt100 Thermometers

- Auto-ranging
- Available with interchangeable or fixed probe
- Economical
- Missing probe indictor (HI955501)
- Optional protective boot

Pt100 models are widely recognized as the most accurate, with the best stability, repeatability and linearity among thermometers. Add to this the 4-wire system that is practically impervious to lead-wire length error, and you have a powerful tool to measure temperature accurately.

The HI955501 works with the HI768 series of Pt100 temperature probes, while the HI955502 model is supplied with a fixed general-purpose probe.

The HI955501 also features a missing probe indicator to alert the user if no temperature probe is detected.

Both the HI955501 and HI955502 measure temperatures with 0.1°C resolution in the -199.9 to 199.9°C range and then automatically switch to 1°C from 200 to 850°C. Press RANGE and the resolution switches to 1°C at any time.

A compact, ergonomic design and a wrist-strap make it easy to carry them anywhere in the lab or plant. To protect the meter during field measurements, a Hanna shockproof boot is recommended.

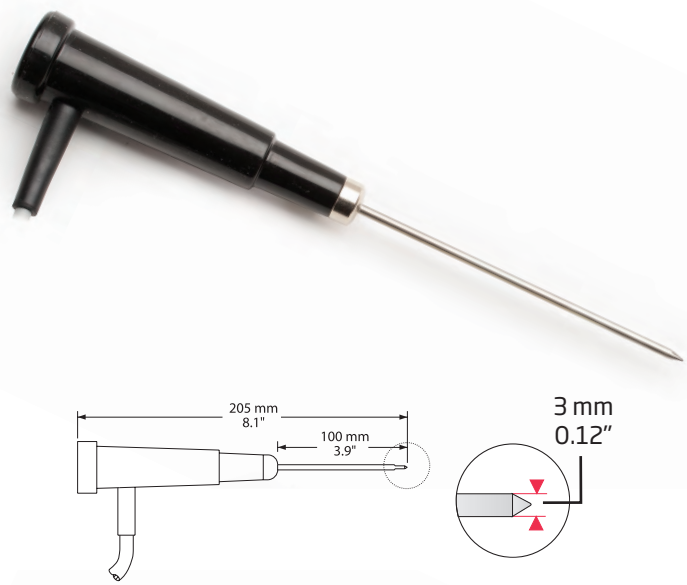
Shown with optional HI710007 protective rubber boot

Specifications	HI955501	HI955502
Range	-199.9 to 199.9°C; -200 to 850°C	
Resolution	0.1°C (-199.9 to +199.9°C); 1°C (-200 to 850°C)	
Accuracy	±0.2°C and ±1 digit (-120.0 to 199.9°C); ±1°C and ±1 digit (-170 to 450°C); ±1% f.s. and ±1 digit (outside) (for 1 year, excluding probe error)	
Probe	HI768 series stainless steel Pt100 temperature probe with 1 m (3.3') cable (not included)	HI768P general purpose/penetration, stainless steel Pt100 temperature probe (fixed) with 1 m (3.3') cable (included)
Battery Type / Life	9V / approximately 150 hours of continuous use	
Environment	0 to 50°C (32 to 122°F); RH max 95%	
Dimensions	143 x 80 x 38 mm (5.6 x 3.2 x 1.5")	
Weight	320 g (11.3 oz.)	
Ordering Information	**HI955501** is supplied with battery and instructions. **HI955502** is supplied with HI768P fixed temperature probe, battery and instructions.	
Probes	**HI768A**	Air/gas, stainless steel Pt100 temperature probe (fixed) with 1 m (3.3') cable
	HI768L	Air/liquid, stainless steel Pt100 temperature probe (fixed) with 1 m (3.3') cable
	HI768P	General purpose/penetration, Pt100 stainless steel temperature probe with 1 m (3.3') cable

Pt100 probes begin on page 14.39

HI768

HI768 Series: Pt100 Probes

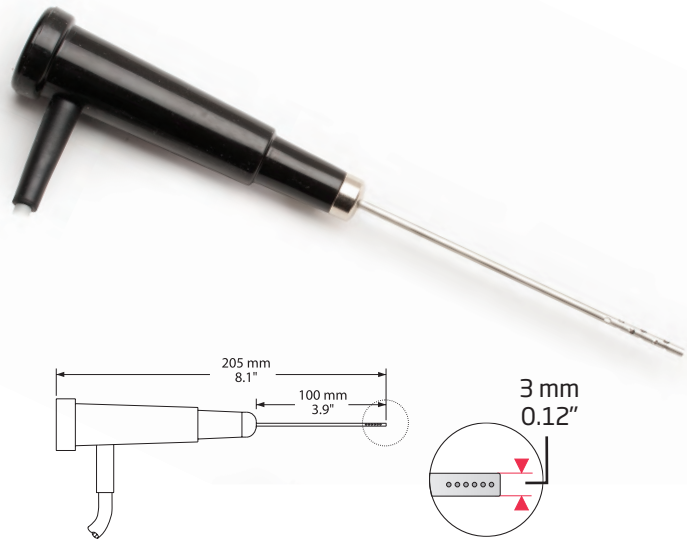


The HI768 series of temperature probes is provided with a Pt100 sensor and features the following specifications:

HI768 Specifications

Range	-30 to 350°C (-22 to 622°F)
Sensor	Pt100
Accuracy	±0.25°C (±0.5°F) ±3% of reading
Probe Handle	Carilon®
Interchange Error	±0.2°C (±0.4°F)
Probe	AISI 316 stainless steel
Response Time	30 seconds

HI768P, General Purpose/ Penetration Probe

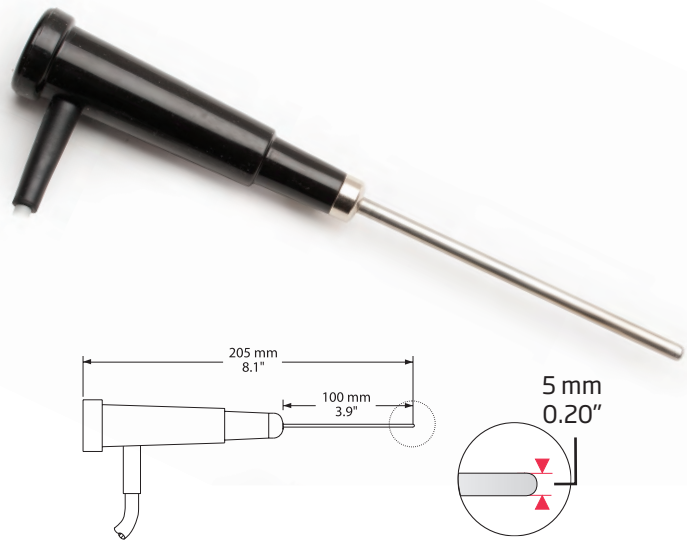


Pt100 probe for applications, such as air measurement and penetration of semi-solids.

Specifications

Code	Application	Probe Dimensions	Handle Color	Cable Length
HI768P	general purpose/ penetration	L 205 mm x dia 3 mm (0.12")	green	1 m (3.3')

HI768A



Pt100 probe for measuring the temperature of air and gases.

Specifications

Code	Application	Probe Dimensions	Cable Length
HI768A	air, gases	L 205 mm x dia 3 mm (0.12")	1 m (3.3')

HI768L

Pt100 probe for applications, such as liquid and air.

Specifications

Code	Application	Probe Dimensions	Cable Length
HI768L	liquid, air	L 205 mm x dia 5 mm (0.20")	1 m (3.3')

HI141

Temperature Dataloggers

- BEPS (Battery Error Prevention System)
  - Alerts the user of low battery power that could adversely affect readings
- Multiple input channels
  - One or two channels with internal or external sensor
- Logging
  - Non-volatile storage of logging
- Waterproof
  - Waterproof casing

The HI141 series is a family of temperature dataloggers with either one or two channels, internal or external temperature sensors and an optional LCD. External temperature sensor models feature one or two stainless steel sensors on a 1 m (3.3') cable for direct insertion. the HI141 can store up to 16,000 temperature samples in a protected, non-volatile EEPROM memory. The logging interval can be set from once per second to once per 24 hour period, and logging delay can be set anywhere up to 199 hours. The MIN or MAX temperature between logging intervals can also be stored. All of your collected data is tamper-proof and stored into serial numbered lots.

The HI141000 Windows® compatible software supports communication between the logger and the PC through the HI141001 infrared transmitter.

The waterproof housing can include a convenient hanging hook (simply add an "H" to the end of the code). For a typical 1 minute logging interval, the battery will last about 4 years.

Specifications		Display	Molded Eye for Hanging	Sensor(s)	Cable Length (if applicable)	Range
Model Specific	**HI141AH**		•	1 internal	–	-40.0 to 80.0°C / -40.0 to 176.0°F
	HI141BH		•	1 external	1 m (3.3')	-40.0 to 125.0°C / -40.0 to 257.0°F
	HI141CH	•	•	1 internal	–	-20.0 to 70.0°C / -40.0 to 158.0°F
	HI141DH	•	•	1 external	1 m (3.3')	-40.0 to 125.0°C / -40.0 to 257.0°F
	HI141EH		•	1 internal 1 external	1 m (3.3')	-40.0 to 80.0°C / -40.0 to 175.0°F -40.0 to 125.0°C / -40.0 to 257.0°F
	HI141FH		•	2 external	1 m (3.3')	-40.0 to 125.0°C / -40.0 to 257.0°F
	HI141GH	•	•	1 internal 1 external	1 m (3.3')	-20.0 to 70.0°C / -40.0 to 158.0°F -40.0 to 125.0°C / -40.0 to 257.0°F
	HI141JH	•	•	2 external	1 m (3.3')	-40.0 to 125.0°C / -40.0 to 257.0°F

All Models	Resolution	0.1°C (-40.0 to 100.0°C); 0.2°C (> 100.0°C) 0.1°F (-40.0 to 190.0°F); 0.3°F (> 190.0°F)
	Accuracy	±0.5°C (-40.0 to 0.0 and 70.0 to 100.0°C); ±0.4°C (0.0 to 70.0°C); ±1.0°C (> 100.0°C); ±1.0°F (-40.0 to 32.0 and 158.0 to 212.0°F); ±0.8°F (32.0 to 158.0°F); ±2.0°F (> 212.0°F)
	Environment	RH 100%
	Diameter	86.5 mm (3.4")
	Height	35 mm (1.4")
	Weight	150 g (5.5 oz.)

Ordering Information	All HI141 models are supplied with 3.6V Lithium AA battery, magnetic key and instructions.	
Accessories	**HI141000**	Windows® application software (required)
	HI141001	Infrared transmitter (required)
	HI740033	3.6 V AA lithium battery
	HI740221	Key for HI141 magnetic start

HI140

Temperature Dataloggers

- BEPS (Battery Error Prevention System)
  - Alerts the user of low battery power that could adversely affect readings
- Connectivity
  - Remotely controlled from the PC

HI140 loggers are not much larger than a PC mouse. They are housed in a smooth, yet tough ABS casing that is sealed against ingress of dust and water.

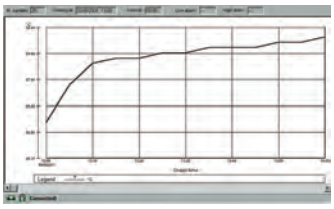
These dataloggers represent the most economical and secure way of monitoring temperature continuously over long periods of time. They can be placed with goods on the move, on supermarket shelves and in warehouses. They record the temperature at a given interval to make sure that perishable goods are not left unattended, such as on a loading dock on the other side of the world! For instance, users can check if fresh fish remained at unacceptable temperatures and for how long. They can provide that extra guarantee that goods never ventured out of limits of public safety.

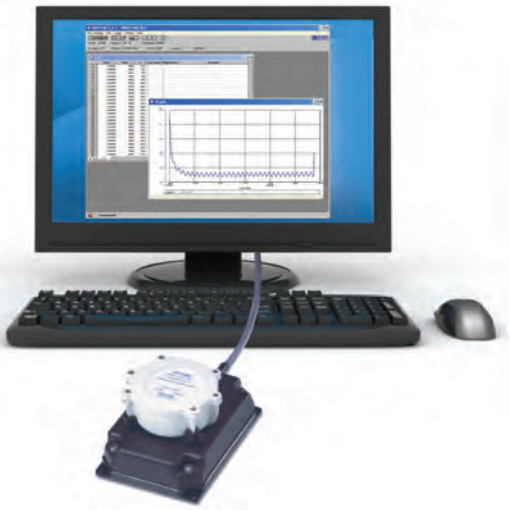
HI140 models feature different temperature ranges to make them more accurate for your specific needs. A green LED on the front of the meter notifies users of the logging status, while a red LED serves as an alarm indication when undesired temperatures have been encountered.

The HI140 can store up to 7600 measurements at selectable intervals from 1 minute to 24 hours. All parameters can be set through our Windows® compatible software. An infrared cradle eliminates the need to put a connector on the meter - an undesirable dirt-trap in the food market and source of problems due to wear and tear over time.

Logged data can be transferred to a PC by simply placing the instrument on the HI90140 interface and running the HI92140 software. Users need just one interface connected to the PC to handle all Hanna dataloggers, each identified by a unique ID code.

The instruments are equipped with BEPS (Battery Error Prevention System), which alerts the user in the event that low battery power could adversely affect readings.





- The HI140 logger is an excellent way to conform with HACCP requirements and guarantee safety throughout the food chain
- Through HI92140 application software (optional), all models can be programmed to read °C or °F
- Completely user friendly - set the parameters to best fit your application

Specifications

Model	Range	Resolution	Accuracy
HI140AH	-30.0 to 70.0°C / -22 to 158°F	0.5°C / 0.5°F	±1.5°C / ±3°F
HI140BH	-10.0 to 30.0°C / 14 to 86°F	0.2°C / 0.4°F	±0.5°C / ±1°F
HI140CH	-30.0 to 10.0°C / -22 to 50°F	0.2°C / 0.4°F	±0.5°C / ±1°F
HI140DH	20.0 to 60.0°C / 68 to 140°F	0.2°C / 0.4°F	±0.5°C / ±1°F
HI140GH	-5.0 to 15.0°C / 23 to 59°F	0.1°C / 0.2°F	±0.3°C / ±0.6°F
HI140HH	10 to 120°C / 50 to 248°F	1°C / 2°F	±2°C / ±4°F
Ordering Information	All HI140 models are supplied with batteries and instructions.		

All loggers have the following features: programmable high and low alarm thresholds; programmable logging interval from 1 min. to 23 hours and 59 min; logging delay start selectable from 0 min. to 23 hours and 59 min; programmable ID number; infrared communication with PC interface; programmable real time clock; 3 x 1.5V AA batteries (included) with approx. life of 4 years at 25°C; dimensions: dia 86.5 mm x h 35 mm; / weight: 150 g

HI143

T-Logger with Locking Wall Cradle

- Battery indicator
  - Battery life indicator on startup
- Connectivity
  - Logging start through PC
- Logging
  - Up to 4000 logged samples
- Security
  - Password protected

The HI143 is a temperature data logger with an internal NTC sensor. The HI143 is controlled via USB or RS232 on a PC with Hanna's Windows® compatible application software. Communication is made between the logger and the PC through the HI143001 transmitter with RS232, or HI143002 with USB connector. The supplied wall cradle makes it easy to lock the meter in place to prevent tampering, and the application software supports security passwords.

Specifications	HI143
Range	-30. to 70.0°C/-22.0 to 158.0°F
Resolution	0.1°C/0.1°F
Accuracy	±0.4°C (-20 to 60°C); ±0.6°C (outside); ±0.7°F (-4 to 140°C); ±1.1°F (outside)
Calibration	factory-calibrated
Data Logging	up to 4000 samples
Logging Interval	user selectable, from 1 minute to 24 hours
Battery Type / Life	CR2032 3V lithium ion / approximately 2 years
Protection	IP65 (water-resistant)
Dimensions	60 x 37 x 17 mm (2.4 x 1.5 x 0.7")
Ordering Information	**HI143** is supplied with CR2032 lithium battery, wall cradle, lock and instructions. **HI143-00** is supplied with HI143 logger, HI143001 RS232 communication cradle, Windows® compatible application software, CR2032 lithium battery, wall cradle, lock and instructions. **HI143-10** is supplied with HI143 logger, HI143002 USB communication cradle, Windows® compatible application software, CR2032 lithium battery, wall cradle, lock and instructions.

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Hygrometers: Relative Humidity Measurement

Introduction

The hygrometer is an instrument used to measure relative humidity (RH). Relative humidity is the quantity of water vapor present in the air. Hygrometers are often available in versions that also measure temperature–these are known as thermohygrometers.

Relative humidity is expressed as the ratio of the quantity of water vapor present in the air to the quantity at which the air would reach saturation (100%) at a given temperature.

Accurate and Efficient RH Measurement

Hanna offers a wide range of relative humidity (RH) meters. Calibration is performed at the factory using humidity chambers at 3 different points (14%, 50%, 80%). Each model has been designed around certain field applications and environments.

Principle of Operation

The measurement system of a hygrometer is made up of a meter connected to a probe that measures capacitance. The probe consists of a capacitor with a polymer or plastic dielectric material with a fixed dielectrical constant from 2 to 15. Changes in humidity cause the dielectric material to swell, changing the capacitor's geometry and causes a reduction in its capacitance. The capacitance variations in turn cause a frequency change in the instrument's electronics, resulting in a modulation which is a function of relative humidity. The frequency is then converted into voltage, which is converted into a relative humidity value displayed on the LCD.

The hygrometer's precision essentially depends on how insusceptible it is to the following three factors: "linearity error", "temperature error" and "calibration error".

"Linearity error" is caused by the typical non-linearity of RH sensors. Hanna hygrometers compensate for the effects of this error. It is advisable, however, to calibrate the meter periodically to reduce the probability of this error reoccurring.

The second factor is the "temperature error" caused by the variation of the hygroscopic properties of the sensor's dielectric material as a function of temperature. In fact, the ratio between the quantity of water vapor present in the dielectric and the relative humidity is not directly proportional, but varies with temperature.

The third factor is the "calibration error" caused by an incorrect calibration procedure.

Calibration

To calibrate a hygrometer, the RH probe is first immersed in the low RH chamber and allowed to stabilize. The meter is then calibrated at the RH value of the chamber being used. The procedure is repeated with the high RH chamber. RH is dramatically affected by temperature changes, most kits do not provide accurate calibration due to the difficulties in performing the calibration at a constant temperature. Climatic chambers that simulate different humidity levels are the ideal solution to calibrate hygrometers accurately. Hygrometers are also calibrated using two different levels of relative humidity in this calibration procedure, and then the accuracy is checked by simulating other RH values in the chamber.

Hanna service centers are equipped with calibration chambers to provide for the highest accuracy.

Dew Point

The dew point is defined as the temperature to which air must be cooled in order for condensation (saturation) to occur. The dew point is dependent on the concentration of water vapor present and the relative humidity. Hanna offers the HI9565, in addition to measuring relative humidity, automatically measures and displays the dew point as well.

HI7102 Calibration Chamber

HI9564 • HI9565

Thermohygrometers

with Dew Point and Calibration Data-Logging Probe

- HOLD feature
  - Current measurement is frozen on the display (min/max values are updated internally)
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- Backlight (HI9565 only)
  - Backlit LCD

The HI9564 and HI9565 are two portable thermohygrometers designed to provide peak performance in harsh environments. For poorly lit areas the HI9565 features a backlit LCD.

In addition to RH and temperature, the HI9565 will display the dew point with the press of a button. With this feature the HI9565 permits quick and effective environmental monitoring where a controlled microclimate is necessary; these environments include greenhouses, museums, clean rooms and laboratories.

These instruments also feature a HOLD button to freeze the reading on the display for manual recording (min/max values are updated internally). BEPS (Battery Error Prevention System) alerts the user in the event that low battery power could adversely affect readings.

The HI70602 RH probe features a built-in microchip that stores the calibration data. When the probe is connected to another hygrometer, the microchip transfers the stored calibration data and eliminates the need to recalibrate the instrument.

Both instruments feature auto-off after 20 minutes of inactivity, temperature readings in Celsius and Fahrenheit, and display codes to indicate anomalies and direct procedures.

Specifications		HI9564	HI9565
RH	Range	20.0 to 95.0% RH	20.0 to 95.0%
	Resolution	0.1% RH	0.1% RH
	Accuracy	±3 % RH (50 to 85 % RH and 15 to 40°C); ±5% RH (outside)	±3 % RH (50 to 85 % RH and 15 to 40°C); ±5% RH (outside)
Temperature	Range	0.0 to 60.0°C / 32 to 140.0°F*	0.0 to 60.0°C / 32 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
Dew Point	Range	–	-20.0 to 60.0°C / -4.0 to 140.0°F
	Resolution	–	0.1°C / 0.1°F
	Accuracy	–	±2°C /±4°F (50 to 85 % RH and 15 to 40°C); ±4.5°C /±9°F (outside)
Additional Specifications	Probe	HI70602 thin-film polymer capacitance (TFPC) humidity probe, ABS body, perforated cap, internal temperature sensor with DIN connector and 1 m (3.3') cable (included)	
	Battery Type / Life	9V / approximately 250 hours of continuous use; auto-off after 20 minutes of non-use (can be disabled)	
	Environment	0 to 60°C (32 to 140°F); RH max 98% non-condensing	
	Dimensions	164 x 76 x 45 mm (6.5 x 3 x 1.8 ")	
	Weight	340 g (12 oz.)	
Ordering Information	**HI9564** and **HI9565** are supplied with HI70602 relative humidity probe, battery and instructions.		

* Note: The meter measures temperature from -30 to 80°C, but the RH measurement can only be taken within the range 0 to 60 °C.

Accessories begin on page 15.5

HI93640

Compact Thermohygrometer

with Built-in Sensor

- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- Removable sintered cap
  - Protects the sensor from dust

The HI93640 is a compact, portable and versatile thermohygrometer that monitors relative humidity. This simple-to-use meter is ideal for use in the heating, ventilating and air conditioning (HVAC) field.

The built-in thin-film capacitance sensor assures accurate humidity measurements from 10 to 95% RH with a resolution of 0.1%.

The compact housing fits easily in your palm. The design of the rubber keys resists the ingress of dust and protects the instrument from accidental splashes.

A sintered cap can be placed on the sensor for protection in dusty environments. If faster response is desired, the cap can be removed.

The HI93640 is also equipped with BEPS (Battery Error Prevention System) which alerts the user in the event that low battery power could adversely affect readings.

Specifications		HI93640
RH	Range	10.0 to 95.0% RH
	Resolution	0.1% RH
	Accuracy	±3% RH (50 to 85 % RH); ±4% RH (outside)
Temperature	Range	0.0 to 60°C; 32.0 to 140°F
	Resolution	0.1°C / 0.1°F
	Accuracy	±0.5°C / ±1.0°F
Additional Specifications	Battery Type / Life	1.5 AA (3) / approximately 1000 hours of continuous use
	Environment	0 to 60°C (32 to 140°F); RH max 98% non-condensing
	Dimensions	190 x 80 x 36 mm (7.5 x 3.1 x 1.4")
	Weight	250 g (8.8 oz.)
Ordering Information	**HI93640** is supplied with built in RH sensor, protective sintered cap for RH sensor, battery and instructions.	

Accessories begin on page 15.5

HI8666

Relative Humidity and Temperature Transmitter

- Dual-range transmitter
- Removable sintered metal cap
- Quick tremoval for maintenance with minimal downtime
- Wall mounted

This solid-state transmitter plugs into its wall-mounted receptacle for on-site, continuous monitoring of relative humidity and temperature in critical or controlled environments.

The HI8666 has an excellent accuracy of ±2% RH and ±1% °C. Each 4-20 mA analog signal can be sent to remote panel meters, controllers or data acquisition systems. The signals are to be powered by separate external voltage sources.

Equipped with a removable sintered cap, the HI8666 sensor is well protected for the long run against the ingress of dust or unclean environments.

With the sintered cap installed, the sensor is protected from dust and debris prolonging the life of the sensor and the instrument and less maintenance is needed. However, the response time is slower. This is ideal in some applications, such as food and industrial applications where reliability rather than response time is the primary objective.

Specifications		HI8666
RH	Range	0% (4 mA) to 100% (20 mA)
	Accuracy	±2% (5% to 95% RH)
Temperature	Range	-20°C (4 mA) to 60°C (20 mA)
	Accuracy	±1% FS
Additional Specifications	Response Time	6 seconds without sintered cap; 60 seconds with sintered cap
	Power Supply	10-30 Vdc
	Output Signal	4 to 20 mA
	Environment	0 to 60°C (32 to 140°F)
	Panel Cutout	73 x 42 mm (2.9 x 1.6")
	Dimensions	79 x 49 x 150 mm (3.1 x 1.9 x 5.9")
	Weight	150 g (5.3 oz.)
Ordering Information	**HI8666** is supplied with built-in RH sensor, protective sintered cap for RH sensor, mounting brackets and instructions.	

Accessories

Relative Humidity Probe

Hanna humidity probes utilize a high-tech Thin-Film Polymer Capacitance (TFPC) humidity sensor. This sensor enables rapid response and high accuracy.

For rapid response, Hanna recommends a probe with a perforated cap. For industrial environments with dust and powders, a probe with a protective sintered cap is recommended.

HI70602 ABS Body with Perforated Cap

Probe	Cable length	Probe length	Connector	Sensors	Used with
HI70602	1 m (3.3')	170 mm (6.5")	DIN	RH (resistive) & °C	HI9564, HI9565

Calibration

HI7102	Calibration chamber for probes with sintered cap
HI7111/P	LiCl set (6 x 15g)
HI7121/P	NaCl set (6 x 33g)

Meter Protection

HI710008	Orange Shockproof rubber boot
HI710007	Blue Shockproof rubber boot

Probe Caps

HI710011	RH probe protective sintered cap

HI97500

Portable Lux Meter

- Waterproof
  - Rugged, waterproof case
- Battery indicator
  - Low-battery indicator

A lux meter can be used to measure illuminance, or the luminous flux in a given area. The HI97500, is a portable lux meter designed to perform light measurements simply and accurately. The instrument is supplied with a light sensor connected by a fixed 1.5 m coaxial cable to allow measurements to be taken from a distance without any interference from the operator.

By simply pressing the RANGE key, users can switch among three ranges to choose the best resolution according to the environment being tested. The HI97500 lux meter has a rugged and water-resistant body for frequent outdoor use.

The HI97500 features a low battery indicator and automatic shut-off that turns the meter of after 7 minutes of non-use.

Specifications	HI97500
Range	0.001 to 1.999 Klux 0.01 to 19.99 Klux 0.1 to 199.9 Klux
Resolution	0.001 Klux 0.01 Klux 0.1 Klux
Accuracy	±6% of reading ±2 digits
Sensor	human-eye-response silicon photodiode with 1.5 m coaxial cable (fixed)
Battery Type / Life	9V / approximately 200 hours of continuous use; auto-off after 7 minutes of non-use
Environment	0 to 50°C (32 to 122°F); RH 100%
Dimensions	164 x 76 x 45 mm (6.5 x 3.0 x 1.8")
Weight	180 g (6.3 oz.)
Ordering Information	**HI97500** is supplied with battery, protective case and instructions.

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Hanna BL Series

Accurate and Simple to Install

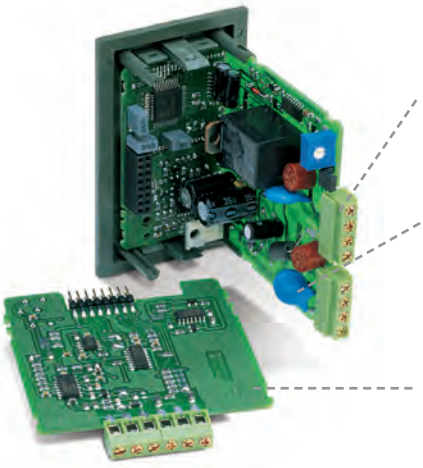
Traditionally, process monitoring has required considerable investment in system design, equipment, maintenance and training. With our mini controllers, we are able to offer a solution for industries that have to monitor a process economically. Hanna mini controllers are easy-to-use and allow accurate continuous monitoring and control of pH, ORP, EC/TDS, resistivity and level. These compact, in-line instruments are designed to consistently perform in most environments and conditions.

Our line of easy operation controllers have been specially designed for hydroponics, swimming pools, or applications where space or cost are a major concern. Thanks to their compact size, they can be mounted in confined spaces and right next to tanks or vats. The low cost of these meters will make it possible for processes that were manually maintained to be controlled automatically, saving considerable time and money.

Our redesigned mini controller series features a larger LCD for easy reading, manual output control for simple maintenance, an overtime control system, and a multi-colored LED to indicate meter condition (measurement, dosing, or alarm mode).

The BL931700 and BL932700 models are provided with a 4-20 mA analog output and input for remote control disabling.

- Fire-retardant casing
- Large LCD
- Selectable overdose protection system
- External disable feature
- Selectable control override
- Matching pin connection
- 4-20 mA analog output (specific models)



- Quick-connect terminal blocks
- 2 amp built-in fuse
- Removable modules for easy maintenance

Comparison Guide

Guide	pH	ORP	EC	TDS	Resistivity	Level	ATC	Resolution 1.0	Resolution 0.1	Resolution 0.01	Page
BL981411	•								•		16.5
BL931700	•									•	16.6
BL982411		•						•			16.7
BL932700		•						•			16.8
BL983313			•				•	•			16.9
BL983320			•				•		•		16.9
BL983322			•				•			•	16.9
BL983317			•				•			•	16.10
BL983327			•				•			•	16.10
BL983315				•			•		•		16.11
BL983319				•			•	•			16.11
BL983321				•			•			•	16.11
BL983329				•			•	•			16.11
BL983318				•			•			•	16.12
BL983324				•			•		•		16.13
BL983314					•		•		•		16.14
HI7871						•					16.15
HI7873						•					16.15
HI7874						•					16.16

Any system can be cost effectively monitored 24/7

BL mini controllers are the perfect solution for water analysis and control

pH Mini Controllers

Monitoring and controlling pH in water conditioning and industrial applications is essential for water quality and maintaining infrastructure (piping and equipment). In the case of industrial effluent, neutralization of acidic waste is vital for environmental safety and public health. In boiler feed water conditioning, a pH of 8.5 is necessary to prevent scaling and corrosion of critical components. Maintaining a pH of 7.4 is fundamental for proper and efficient sanitization in swimming pools and spas. The efficacy of sanitizers, such as chlorine, is dependent on a controlled pH value.

ORP Mini Controllers

ORP (oxidation reduction potential) is the most dependable and consistent indicator of the sanitizing effectiveness of your pool, spa, or water treatment. As oxidizers, chlorine, peroxide, and ozone are added, the ORP value increases, providing a clear indication of the cleansing power of the water. Typically, an ORP value of 650 to 700 mV at a pH of 7.2 indicates that your water is properly treated and all harmful bacteria are killed in less than 1 second. ORP is also essential in chemical processing where reducing agents are used and a negative ORP value indicates proper neutralization.

Conductivity Mini Controllers

In water, an increase in conductivity indicates an increase in water hardness and a decrease in purity. Conductivity monitoring and control is essential in reducing water hardness and maintaining water quality. Water with a conductivity value of 0 to 140 µS/cm is considered "very soft," while 640 to 840 µS/cm is considered "hard" water. An increase in conductivity indicates an increase in the amount of damaging dissolved solids (salts) present in water. Conductivity monitoring and control is essential in industrial applications such as feed water control, blow down activation in cooling towers and water management. In these applications, high conductivity will cause scaling and corrosion of piping and damage to critical components.

TDS Mini Controllers

A TDS (total dissolved solids) measurement is an important indicator of water quality. An increase in TDS indicates an increase in the amount of dissolved solids (salts) present in the water. TDS monitoring and control is imperative in industrial applications such as feed water control, blow down activation in cooling towers and water management. In these applications, high TDS will cause scaling and corrosion of piping and damage to critical components.

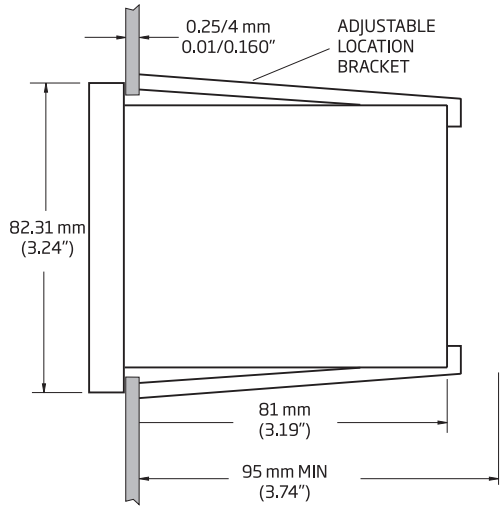
A TDS measurement is also an important indicator of the effectiveness of water conditioning, an increase in TDS indicates an increase in water hardness and a decrease in purity. This will affect the quality of drinking water, feed water and rinse water.
TDS monitoring and control is crucial in reducing water hardness and maintaining water quality and usability.

Resistivity Mini Controller

Resistivity, measured in Ω•M, is the optimal way to measure the quality of water produced by high purity systems, such as reverse osmosis (RO) systems and water conditioning equipment. As resistivity is the inverse of conductivity, it provides a more accurate characterization of water with very low conductive ability. As filter systems become less effective, the resistivity value will decrease, indicating a need for maintenance and/or replacement of filters and critical components. Properly functioning RO and water conditioning systems will consistently produce water with resistivity readings in the range of 16 to 18 MΩ•cm.

Hanna Mini Controllers

BL Series Mechanical Dimensions

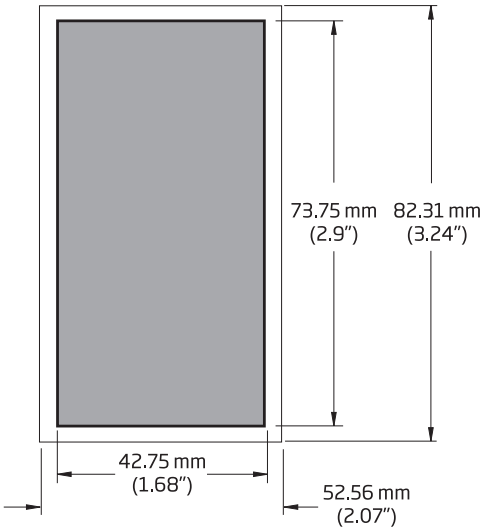


Side View

Side view of panel-mounted controllers.

Adjustable location brackets allow the controller to slide into the cutout and will hold the unit securely in place.

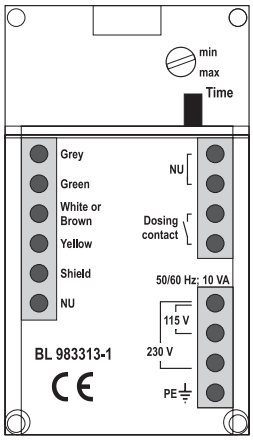
130 or 87 mm (depending on model) is the minimum amount of room required to install the meter with all wiring.



Front View

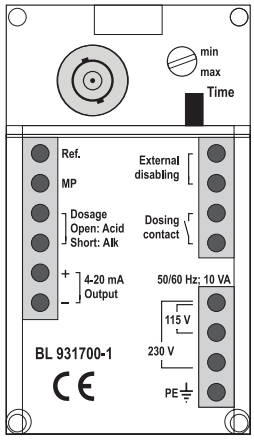
Front view of the panel-mounted units.

Dimensions show the cutout size for installation and also the outside dimensions of the panel.



Rear View

Rear view of the BL983313-1 with electrical connections.



Rear View

Rear view of the BL931700-1 with electrical connections.

BL981411

pH Mini Controller

- Easy to handle
- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

The BL981411 pH controller has been designed for easy, affordable installation in tight spaces, ideal for simple and effective process control. The unit is provided with high impedance pH input and can be used with any pH electrode with a standard BNC connector. Measurements are clearly displayed on the LCD, while the status LED indicates operating mode.

The BL981411 is also provided with a dosing relay. Selecting acid dosing will cause the relay to activate when the pH reading is higher than the setpoint. If the basic dosing is selected, the relay is activated when the pH reading falls below the setpoint.

Setpoint adjustment (from 0 to 14 pH) and calibration procedures are easily performed with trimmers on the front panel. Users can choose from automatic or manual dosing modes with a switch on the front panel. Manual control is particularly useful during maintenance operations, because it permits operators to enable or disable the dosing relay according to need. An overtime control system advises users when the relay is active too long, to help prevent overdosing.

Specifications	BL981411
Range	0.0 to 14.0 pH
Resolution	0.1 pH
Accuracy (@25°C/77°F)	±0.2 pH
Calibration	manual, through CAL (offset) trimmer
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 VDC
Dosing Selection	acid or alkaline contact open=acid dosage=relay ON if measurement > setpoint contact closed=alkaline dosage=relay ON if measurement < setpoint
Setpoint	adjustable from 0 to 14 pH
Overtime	adjustable, typically from 5 to approximately 30 minutes
Input Impedance	10^{12} Ohm
Power Supply	BL981411-0: 12 VDC adapter (included); BL981411-1: 115/230 VAC; 50/60Hz
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")
Weight	BL981411-0: 200 g (7.1 oz.); BL981411-1: 300 g (10.6 oz.)
Ordering Information	**BL981411-0** (12 VDC) and **BL981411-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.
Recommended Probe	**HI1001** PVDF body pH electrode with 1/2" NPT thread, BNC connector and 3 m (9.8') cable for continuous flow-thru monitoring (not included).

pH solutions begin on page 3.100

BL931700

pH Mini Controller

with 4-20 mA Recorder Output

- Easy-to-handle
- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

The BL931700 mini pH controller has been designed for easy, affordable installation in tight spaces to perform simple, yet effective process control. Thanks to its compact size, BL931700 can be installed right next to tanks or vats.

This versatile controller is ideal for a wide variety of applications, such as textiles, papers, photographic solutions, plating baths, chemicals and water treatment.

The BL931700 is provided with a selectable setpoint for acid or basic dosage.

Accuracy is ensured by two-point calibration, performed manually through trimmers on the front panel.

Users can choose automatic or manual dosing mode with a switch on the front panel. Manual control is particularly useful during maintenance operations, because it permits operators to enable or disable the dosing relay according to need. The overtime control system advises users when the relay is active for too long, helping to prevent overdosing.

In addition, this model features a 4-20 mA analog output for recorder connection.

Specifications	BL931700
Range	0.00 to 14.00 pH
Resolution	0.01 pH
Accuracy (@25°C/77°F)	±0.02 pH
Calibration	manual, through offset and slope trimmers
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 VDC
Dosing Selection	acid or alkaline contact open=acid dosage=relay ON if measurement > setpoint contact closed=alkaline dosage=relay ON if measurement < setpoint
Setpoint	adjustable from 0 to 14 pH
Overtime	adjustable, typically from 5 to approximately 30 minutes
Recorder Output	4 to 20 mA, accuracy ±0.20 mA, 500 Ω maximum load
Input Impedance	10^{12} Ohm
Power Supply	BL931700-0: 12 VDC adapter (included); BL931700-1: 115/230 VAC; 50/60Hz
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")
Weight	BL931700-0: 200 g (7.1 oz.); BL931700-1: 300 g (10.6 oz.)
Ordering Information	**BL931700-0** (12 VDC) and **BL931700-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.
Recommended Probe	**HI1001** PVDF body pH electrode with 1/2" NPT thread, BNC connector and 3 m (9.8') cable for continuous flow-thru monitoring (not included).

pH solutions begin on page 3.100

BL982411

ORP Mini Controller

- Easy to handle
- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

The BL982411 is an ORP mini controller for panel mounting, specially designed for swimming pools and spas. Thanks to its compact size, the BL982411 can be installed in small spaces. This controller is the ideal solution for those who have always checked ORP manually. With its automatic dosing, this mini controller will significantly reduce maintenance time.

The BL982411 can be used with any ORP electrode with a standard BNC connector. The status LED continuously indicates if the controller is in measurement, dosing or alarm mode.

The BL982411 is also provided with a relay for selecting the dosing direction, oxidizing or reducing.

Users can choose automatic or manual dosing mode with a switch on the front panel. Manual control is particularly useful during maintenance operations, because it permits operators to enable or disable the dosing relay according to need. The overtime control system advises users when the relay is active for too long, helping to prevent overdosage.

Specifications	BL982411
Range	0 to 1000 mV
Resolution	1 mV
Accuracy (@25°C/77°F)	±5 mV
Calibration	manual, with CAL trimmer
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 VDC
Dosing Selection	reducing or oxidizing, selectable on the back panel contact open=reductant dosage=relay ON if measure > setpoint contact closed=oxidant dosage=relay ON if measure < setpoint
Setpoint	adjustable, from 0 to 1000 mV
Overtime	adjustable, typically from 5 to approximately 30 minutes
Input Impedance	10^{12} Ohm
Power Supply	BL982411-0: 12 VDC adapter (included); BL982411-1: 115/230 VAC; 50/60Hz
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")
Weight	BL982411-0: 200 g (7.1 oz.); BL982411-1: 300 g (10.6 oz.)
Ordering Information	**BL982411-0** (12 VDC) and **BL982411-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.
Recommended Probe	**HI2001** PVDF body ORPelectrode with 1/2" NPT thread, BNC connector and 3 m (9.8') cable for continuous flow-thru monitoring (not included).

ORP solutions begin on page 3.106

BL932700

ORP Mini Controller

with 4-20 mA Recorder Output

- Easy to handle
- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

The BL932700 is an ORP mini controller that has been designed for easy, affordable installation in tight spaces, ideal for simple yet effective process control. As a result of its compact size, the BL932700 can be installed right next to tanks or vats.

This versatile controller is ideal for many applications, such as ORP monitoring of bleaching processes, wastewater treatment and swimming pools. the BL932700 permits automatic control of installations that were previously checked manually.

The instrument can be set for reducing or oxidizing dosage. Setpoint adjustment and calibration are simply performed through trimmers on the front panel. Users can choose automatic or manual dosing mode with a switch on the front panel. Manual control is particularly useful during maintenance operations, because it permits operators to enable or disable the dosing relay according to need.

The overtime control system advises users when the relay is active too long, helping to prevent overdosage. In addition, this model features a 4-20 mA analog output for recorder connection.

Specifications	BL932700
Range	±1000 mV
Resolution	1 mV
Accuracy (@25°C/77°F)	±5 mV
Calibration	manual, with CAL trimmer
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 VDC
Dosing Selection	reducing or oxidizing, selectable on the back panel contact open=reductant dosage=relay ON if measure > setpoint contact closed=oxidant dosage=relay ON if measure < setpoint
Setpoint	adjustable from -1000 to 1000 mV
Overtime	adjustable, typically from 5 to approximately 30 minutes
Recorder Output	4 to 20 mA, accuracy ±0.20 mA, 500 Ω maximum load
Input Impedance	10^{12} Ohm
Power Supply	BL932700-0: 12 VDC adapter (included); BL932700-1: 115/230 VAC; 50/60Hz
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")
Weight	BL932700-0: 200 g (7.1 oz.) BL932700-1: 300 g (10.6 oz.)
Ordering Information	**BL932700-0** (12 VDC) and **BL932700-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.
Recommended Probe	**HI2001** PVDF body ORPelectrode with 1/2" NPT thread, BNC connector and 3 m (9.8') cable for continuous flow-thru monitoring (not included).

ORP solutions begin on page 3.106

BL983313 • BL983320 • BL983322

EC Mini Controllers

Measuring in µS/cm

- Adjustable setpoint
- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

These Hanna mini controllers have been specially designed for water conditioning and growing applications. Compact in size, they can be mounted in confined spaces or even right next to the vat or barrel containing the chemicals. These meters permit automatic control of installations previously checked manually.

EC measurements are shown on the display and the multi-colored LED continuously indicates if the mini controller is in measurement, dosing, or alarm mode.

Users can choose automatic or manual dosing mode with a switch on the front panel. Manual control is particularly useful during maintenance operations, because it permits operators to enable or disable the dosing relay according to need. The overtime control system advices users when the relay is active for too long, helping to prevent overdosage.

Specifications	BL983313	BL983320	BL983322
Range	0 to 1999 µS/cm	0.0 to 199.9 µS/cm	0.00 to 19.99 µS/cm
Resolution	1 µS/cm	0.1 µS/cm	0.01 µS/cm
Accuracy (@25°C/77°F)	±2% F.S.	±2% F.S.	±2% F.S.
Setpoint	adjustable from 0 to 1999 µS/cm	adjustable from 0 to 199.9 µS/cm	adjustable from 0 to 19.99 µS/cm
Temperature Compensation	automatic from 5 to 50°C (41 to 122°F) with β =2%/°C		
Calibration	manual, with CAL trimmer		
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 VDC contact closed when measure > setpoint		
Overtime	adjustable, typically from 5 to approximately 30 minutes		
Power Supply	models "-0": 12 VDC adapter (included) models "-1": 115/230 VAC; 50/60Hz		
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")		
Weight	models "-0": 200 g (7.1 oz.) models "-1": 300 g (10.6 oz.)		
Ordering Information	**BL983313-0** (12 VDC), **BL983313-1** (115/230V), **BL983320-0** (12 VDC), **BL983320-1** (115/230V), **BL983322-0** (12 VDC) and **BL983322-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.		
Recommended Probe	**HI7634-00** EC/TDS probe with internal temperature sensor and 2 m (6.6') cable (not included).		

EC solutions begin on page 6.42

BL983317 • BL983327

EC Mini Controllers

Measuring in mS/cm

- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

The BL983317 and BL983327 are panel-mounted mini controllers with output relays that have been designed for easy, affordable installation in tight spaces, ideal for simple yet effective process control.

Both instruments are provided with automatic compensation for variations in temperature. The probe (not included) is easy to clean and requires very little maintenance. The calibration is performed manually at one point, through a trimmer.

All wiring and connections to external devices are done through the terminals on the rear panel. The multi-color LED continuously indicates if the controller is in measurement, dosing, or alarm mode.

Users can choose automatic or manual dosing mode by a switch on the front panel. Manual control is particularly useful during maintenance operations because it permits operators to enable or disable the dosing relay according to need. To help prevent overdosing, the overtime control system advises users when the relay is active too long.

Specifications	BL983317	BL983327
Range	0.00 to 10.00 mS/cm	
Resolution	0.01 mS/cm	
Accuracy (@25°C/77°F)	±2% F.S.	
Temperature Compensation	automatic from 5 to 50°C (41 to 122°F) with β =2%/°C	
Calibration	manual, with CAL trimmer	
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 VDC	
	contact closed when measure < setpoint	contact closed when measure > setpoint
Setpoint	adjustable from 0 to 10 mS/cm	
Overtime	adjustable, typically from 5 to approximately 30 minutes	
Power Supply	models "-0": 12 VDC adapter (included) models "-1": 115/230 VAC; 50/60Hz	
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")	
Weight	models "-0": 200 g (7.1 oz.) models "-1": 300 g (10.6 oz.)	
Ordering Information	**BL983317-0** (12 VDC), **BL983317-1** (115/230V), **BL983327-0** (12 VDC) and **BL983327-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.	
Recommended Probe	**HI7632-00** EC/TDS probe with internal temperature sensor and 2 m (6.6') cable (not included).	

EC solutions begin on page 6.42

BL983315 • BL983319
BL983321 • BL983329

TDS Mini Controllers

- Adjustable overtime control
- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

These instruments have been designed for TDS control in hydroponics, horticulture and water conditioning. Compact in size, they can be mounted in confined spaces or even right next to the vat or barrel containing the chemicals. These meters permit automatic control of installations that were previously checked manually.

Readings are shown on the display and the multi-colored LED continuously indicates if the mini controller is in measurement, dosing, or alarm mode.

Users can choose automatic or manual dosing mode with a switch on the front panel. Manual control is particularly useful during maintenance operations, because it permits operators to enable or disable the dosing relay according to your need.

The overtime control system advises users when the relay is active too long, helping to prevent overdosage.

Specifications	BL983315	BL983319	BL983321	BL983329
Range	0.0 to 199.9 mg/L (ppm)	0 to 1999 mg/L (ppm)	0.00 to 19.99 mg/L (ppm)	0 to 999 mg/L (ppm)
Resolution	0.1 mg/L (ppm)	1 mg/L (ppm)	0.01 mg/L (ppm)	1 mg/L (ppm)
Accuracy (@25°C/77°F)	±2% F.S.	±2% F.S.	±2% F.S.	±2% F.S.
TDS Conversion Factor	0.5	0.65	0.5	0.5
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 VDC Contact close when measure:			
	> setpoint	< setpoint	> setpoint	> setpoint
Setpoint	adjustable from 0 to 199.9 mg/L (ppm)	adjustable from 0 to 1999 mg/L (ppm)	adjustable from 0 to 19.99 mg/L (ppm)	adjustable from 0 to 999 mg/L (ppm)
Temperature Compensation	automatic from 5 to 50°C (41 to 122°F) with β =2%/°C			
Calibration	manual, with CAL trimmer			
Overtime	adjustable, typically from 5 to approximately 30 minutes			
Power Supply	models "-0": 12 VDC adapter (included) models "-1": 115/230 VAC; 50/60Hz			
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")			
Weight	models "-0": 200 g (7.1 oz.) models "-1": 300 g (10.6 oz.)			
Ordering Information	**BL983315-0** (12 VDC), **BL983315-1** (115/230V), **BL983319-0** (12 VDC), **BL983319-1** (115/230V), **BL983321-0** (12 VDC), **BL983321-1** (115/230V), **BL983329-0** (12 VDC) and **BL983329-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.			
Recommended Probe	**HI7634-00** EC/TDS probe with internal temperature sensor and 2 m (6.6') cable (not included).			

EC solutions begin on page 6.44

BL983318

TDS Mini Controllers

0 to 10,000 ppm

- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

The BL983318 is a mini controller that has been designed for easy, affordable installation in tight spaces, ideal for simple yet effective process control.

The BL983318 features automatic temperature compenstion and simple one-point calibration performed through the trimmer.

The multi-colored LED continuously indicates if the controller is in measurement, dosing, or alarm mode.

Wiring and external device connections are extremely simple to perform through the terminals on the rear of the instrument.

Users can choose automatic or manual dosing mode with a switch on the front panel. Manual control is particularly useful during maintenance operations because it permits operators to enable or disable the dosing relay according to need.

The overtime control system advises users when the relay is active too long, helping to prevent overdosage.

Specifications	BL983318
Range	0.00 to 10.00 g/L (ppt)
Resolution	0.01 g/L (ppt)
Accuracy (@25°C/77°F)	±2% F.S.
TDS Conversion Factor	0.5
Temperature Compensation	automatic from 5 to 50°C (41 to 122°F) with β=2%/°C
Calibration	manual, with CAL trimmer
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 VDC contact closed when measure > setpoint
Setpoint	adjustable from 0 to 10 ppt (g/L)
Overtime	adjustable, typically from 5 to approximately 30 minutes
Power Supply	BL983318-0: 12 VDC adapter (included) BL983318-1: 115/230 VAC; 50/60Hz
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")
Weight	BL983318-0: 200 g (7.1 oz.) BL983318-1: 300 g (10.6 oz.)
Ordering Information	**BL983318-0** (12 VDC) and **BL983318-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.
Recommended Probe	**HI7632-00** EC/TDS probe with internal temperature sensor and 2 m (6.6') cable (not included).

EC solutions begin on page 6.44

BL983324

TDS Mini Controllers

- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

The BL983324 is a panel-mounted TDS controller, designed for easy installation, configuration and maintenance.

The meter is provided with a dosing relay that is activated when the TDS reading exceeds the setpoint value.

Measurements are compensated for temperature variations and are shown on the display automatically.

A multi-colored LED on the front panel continuously indicates if the mini controller is in measurement, dosing, or alarm mode.

Wiring and external device connections are extremely simple to perform through the terminals on the rear of the instrument.

Users can choose automatic or manual dosing mode with a switch on the front panel. Manual control is particularly useful during maintenance operations, because it permits operators to enable or disable the dosing relay according to need.

The overtime control system advises operators when the relay is active too long, helping to prevent overdosage.

Specifications	BL983324
Range	0.0 to 49.9 mg/L (ppm)
Resolution	0.1 mg/L (ppm)
Accuracy (@25°C/77°F)	±2% F.S.
TDS Conversion Factor	0.5
Temperature Compensation	automatic from 5 to 50°C (41 to 122°F) with β=2%/°C
Calibration	manual, with CAL trimmer
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 VDC contact closed when measure > setpoint
Setpoint	adjustable from 0 to 49.9 mg/L (ppm)
Overtime	adjustable, typically from 5 to approximately 30 minutes
Power Supply	BL983324-0: 12 VDC adapter (included) BL983324-1: 115/230 VAC; 50/60Hz
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")
Weight	BL983324-0: 200 g (7.1 oz.) BL983324-1: 300 g (10.6 oz.)
Ordering Information	**BL983324-0** (12 VDC) and **BL983324-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.
Recommended Probe	**HI7634-00** EC/TDS probe with internal temperature sensor and 2 m (6.6') cable (not included).

EC solutions begin on page 6.44

BL983314

Resistivity Mini Controllers

- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

The BL983314 is a simple to operate resistivity controller designed for ultra pure water, reverse osmosis, and water conditioning applications. The BL983314 resistivity controller is also ideal for continuous monitoring of process solutions. Setpoint and calibration are manually adjusted with a trimmer and the alarm relay allows for simple control.

Readings are automatically temperature compensated, with three different coefficients (β=2.4, 3.5 or 4.5 %/°C). The alarm contact can be used for connection to an alarm, pump, solenoid or dosing system.

The relay contact is open when readings are higher than the setpoint, while for measurements lower than setpoint, the relay contact is closed. The hysteresis is typically 0.20 MΩ•cm from the setpoint.

Measurements are displayed on the LCD and the multi-colored LED continuously indicates if the controller is in measurement, dosing, or alarm mode. Users can choose automatic or manual dosing mode with a switch on the front panel. Manual control is particularly useful during maintenance operations, because it permits operators to enable or disable the dosing relay according to need.

The overtime control system advises users when the relay is active for too long, helping to prevent overdosage.

Specifications	BL983314
Range	0.00 to 19.90 MΩ•cm
Resolution	0.10 MΩ•cm
Accuracy (@25°C/77°F)	±2% F.S.
Temperature Compensation	automatic and linear from 5 to 50°C (41 to 122°F)
Temperature Coefficient	β=2.4 ; 3.5 ; 4.5 %/°C selectable through jumper on the rear panel
Calibration	factory calibrated
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 Vdc contact closed when measure < setpoint
Setpoint	adjustable from 0 to 19.90 MΩ•cm
Overtime	adjustable, typically from 5 to approximately 30 minutes
Power Supply	BL983314-0: 12 VDC adapter (included) BL983314-1: 115/230 VAC; 50/60Hz
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")
Weight	BL983314-0: 200 g (7.1 oz.) BL983314-1: 300 g (10.6 oz.)
Ordering Information	**BL983314-0** (12 VDC) and **BL983314-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.
Recommended Probe	**HI3314** resistivity probe with 2 m (6.6') cable (included)

HI7871 • HI7873

Mini Level Controllers

The HI7871 and HI7873 mini level controllers are ideal for liquid level control over distances of up to 100 m (330'). These instruments are highly compact and will fit in tight spaces.

These easy-to-use controllers are suited for nearly any liquid level application, such as industrial and municipal water treatment, nutrient tank control in farming, hydroponics, aquaculture and plating rinse baths.

The HI7871 features high and low level control, while the HI7873 includes an overflow alarm. Both instruments are connected to a two-wire transmitter (HI7874), which is ideal for level monitoring in remote applications.

A complete liquid level measuring system requires:

1) A controller (HI7871 or HI7873)
2) A bar holder with amplifier circuitry (HI7874)
3) A package of measuring bars (HI731324)
4) An undecal connector (HI7164)

Specifications	HI7871	HI7873
Transmission	max 100 m (330')	
Electrical Connection	HI7164 undecal connector (not included)	
Level Adjustment	high and low	high, low and overflow
Level Indication	high and low	high, low and overflow
Sensor Bars	three*	four **
Transmitter	HI7874 (not included)	HI7874 (not included)
Output Contact	one relay (2A/250 VAC, 30 VDC)	two relays (2A/250V, 30 VDC)
Power Supply	models "/115": 110/115 VAC; 50/60Hz models "/220": 220/240 VAC; 50/60Hz	
Environment	0 to 50°C (32 to 122°F); RH max 85% non condensing	
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")	
Weight	250 g (8.8 oz)	
Ordering Information	**HI7871/115** (115V) is supplied with mounting brackets and instructions. **HI7871/220** (220V) is supplied with mounting brackets and instructions. **HI7873/115** (115V) is supplied with mounting brackets and instructions. **HI7873/220** (220V) is supplied with mounting brackets and instructions. **HI731324** measuring bar set for level controller	

*HI7871 requires 3 bars, one each for low and high levels and the third as a consent sensor.
**HI7873 requires 4 bars with the additional bar used for overflow measurement.

HI7874
Level Transmitter with
HI 731324 Stainless Steel
Measuring Bars

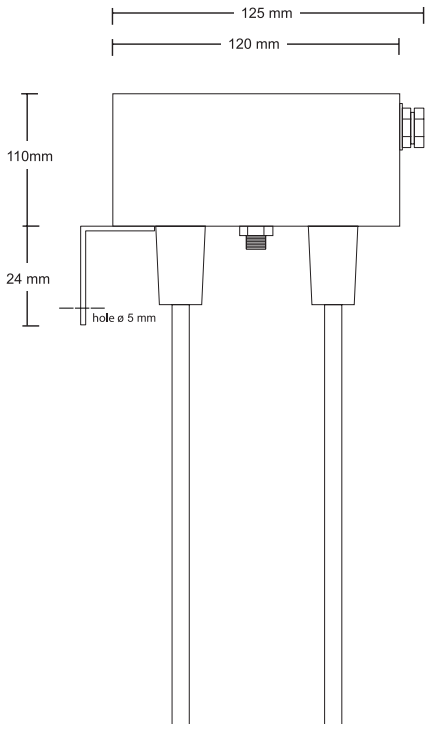
HI7874

Level Transmitter

Accurate level control is critical to many industrial applications, especially for process adjustments using aggressive chemicals. Our sensor bars are built with stainless steel for long life, even in harsh conditions. These transmitters are easy to install and ideal for monitoring tanks and water conditioning plants.

The HI7874 transmitter was designed in conjunction with the HI7871 and HI7873 level controllers. The transmitter is housed in a durable and waterproof ABS body and allows the user to easily adjust the length of the sensor bars according to the specific need.

The HI7874 is supplied with a sturdy mounting bracket for quick and easy installation.



HI7874

Level Transmitter with HI731324 Stainless Steel Measuring Bars

Specifications	HI7874
Transmission	max 100 m (330')
Electrical Connection	two-wire terminal
Level Adjustment	high, low and overflow
Sensor Bars	three or four (not included)
Power Supply	from level controller
Environment	0 to 50°C (32 to 122°F); RH max 100%
Weight	550 g (1.2 lbs.)
Ordering Information	**HI7874** is supplied with mounting bracket and instructions. **HI731324** measuring bar set for level controller

Table of Contents

Fertigation Control Systems

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	Time/volume Irrigation control programs	Irrigated sectors	Fertilization control by EC	Fertilization control by volume	pH correction	EC probes	pH probes	Agitators control	Filter control, differential presostate	Solar radiation sensor	Temperature sensor	Control/mixing of water sources	Wind speed sensor	Volum. counters	Tank level sensors	External back-up power control	On/off dosing valves	Motorized dosing valves	Pumps
HI8001/ HI8002	10	32	4		acid or alk.	3	2	•	2 and 2	•				1 irrig.	4 fertilizer, 1 acid/alk., 1 mixing, 5 external		•		1 irrigation
HI8051	10	24	4		acid or alk.	2	1	•	2 and 2		1	•		1 irrig, 4 fert.	1 external, pH correction, 4 fertilizer, 3 incoming water		•	1 pH correction, 4 fertilizer	3 Irrigation, 1 fertilizer

PCA Series Analyzers

Pages 17.10-17.13

	Total and Free Chlorine	pH	ORP	Temperature	Logging	Alarm	PC connection	Analog output	Password protection
PCA310	•				•	•	•	•	•
PCA320	•	•		•	•	•	•	•	•
PCA330	•	•	•	•	•	•	•	•	•

*applies to "L" models with LCD

Digital Panel Mount Controllers

Pages 17.14-17.26

	pH	ORP	Conductivity	TDS	Temperature	Logging	Alarm	(S)ingle or (D)ual setpoint	ON/OFF control	Proportional control	PID control	SSR relay	Digital output	(S)ingle or (D)ual Analog output	Password protection	Sensor Check™	Automatic cleaning
HI504	•	•			•	•	•	S or D	•		•			S or D	•	•	•
HI720			•		•	•	•	S or D	•		•		RS485	S or D	•	•	•
pH 502	•				•		•	S or D	•		•	•	RS485	S	•		
pH 500	•				•		•	S or D	•	•			RS232	S	•		
mV 600		•			•		•	S	•	•			RS232	S	•		
HI700			•		•		•	D	•		•		RS485	S	•		
HI710			•	•	•		•	D	•		•		RS485	S	•		

Analog Process Controllers

Pages 17.27-17.35

	pH	ORP	Conductivity	Dissolved Oxygen	Recorder output	Backlight	(S)ingle or (D)ual setpoint	Dosing outputs	Alarm	Self diagnostics	Selectable dosing control	Adjustable overdosing control
HI8510	•				•	•		1		•		
HI8710	•				•	•	S	1	•	•	•	•
HI8711	•				•	•	D	2	•	•	•	•
HI8720		•			•	•	S	1	•	•	•	•
HI8931			•		•	•	S	1	•	•	•	•
HI943500			•		•	•	S	1	•	•		
HI8410				•	•	•	S	1	•	•	•	•

Controller and Pump Systems

Pages 17.36-17.38

	pH	ORP	Proportional dosing	Dosning contacts	Alarm contact	Recorder output
BL 7916	•		•	1	1	•
BL 7917		•	•	1	1	•

Wall Mount Controllers

Pages 17.39-17.48

	pH	ORP	Conductivity	TDS	Temperature	Digital	Alarm	(S)ingle or (D)ual setpoint	ON/OFF control	Proportionall control	PID control	Digital output	Password protection	Boiler and colling tower applications	Agriculture applications
HI21	•				•	•	•	S or D	•	•		RS485	•		
HI22		•			•	•	•	S	•	•		RS485	•		
HI23			•		•	•	•	D	•		•	RS485	•		
HI9913	•		•				•	S		•			•		•
HI9935	•			•			•	S		•			•		•
HI9910	•						•	S		•			•		
HI9931			•				•	S		•			•		•
HI9934				•			•	S		•			•		•

Digital and Analog Transmitters

Pages 17.49-17.52

	pH	ORP	Conductivity	Output	Recorder output	ATC	LCD	Casing	Designed for HI8000 series
HI98143-01	•		•	0-1 V		•		IP54	
HI98143-04	•		•	0-4 V		•		IP54	
HI98143-20	•		•	4-20 mA		•		IP54	
HI98143-22	•		•	4-20 mA		•		IP54	•
HI8614N	•			4-20 mA	•	•		IP65	
HI8614LN	•			4-20 mA	•	•	•	IP65	
HI8936 series			•	4-20 mA	•	•		IP65	

HI8000 Series

Fertigation Control Systems

17.6

A wide variety of models are available to cover the requirements of specific fertigation applications.

HI8000 series models can be selected based on the irrigation and fertilization type.

Up to 10 irrigation programs can be set by the user with different irrigation parameters: irrigation periods, type of irrigation control, irrigated sectors and volume or irrigation time specified for each sector, conditions to start irrigation such as time, accumulated solar radiation, low level in tanks (hydroponic crops), temperature variations, linked to another program, priority of program, number of repetitions. For irrigation water, each program has a defined pH set point, EC set point (if the quantity of fertilizer is dosed according with conductivity), and receipt of fertilizers. Control of agitators is specified by programs according with the irrigation periods

PCA300 Series

Chlorine, pH ORP and Temperature Analyzers

17.10

The Hanna PCA300 series models are chlorine, pH, ORP and temperature process analyzers which continuously monitor a sample stream and control the dosing to adjust the chlorine content and pH.

From drinking and wastewater treatment to the pool and spa sanitation, the monitoring of chlorine levels has an important bearing on public health as well as ROI and efficiency for heating system and industrial applications.

HI504

pH/ORP Digital Controller with Sensor Check™

17.18

HI504 is a PID, PI, proportional or on/off pH/ORP controller with one or two set points. The measurement configuration settings and control of pH and ORP are saved separately and permits users to switch between pH and ORP without losing settings. The pH channel can be calibrated in 2 calibration points. The instrument has a full auto diagnostic procedure. Sensor Check™ is also available for pH and ORP probes.

HI8000 Series

Fertigation Control Systems

- Connectivity
  - PC compatible
- Alarm
  - Alarm and warning system
- Backlight
  - Backlit, LCD display

Wall Mount

Variety and customization of models

A wide variety of models are available to cover the requirements of specific fertigation applications. The HI 8000 series are fully customizable and upgradable on the hardware and program level.

HI8000 series models can be selected based on the irrigation and fertilization type of control along with the additional features that are proper for the specific application.

Some of the most important criteria in selection of controller type are: number of irrigated sectors: 8, 16, 24, 32; type of irrigation control: in volume or in time; type of fertilizer control: by EC, by Volume, ratiometric; type of pH correction: acid or alkaline; control of incoming water: one, two or three sources of water; control of dosing with venturi or motorized electrovalves; redundancy of the conductivity or pH probes; mounting solution: panel or wall mounted.

Panel Mount

Irrigation control

Irrigation control differs based on the type of control: by irrigation water volume or by irrigation time; the number of sectors that have to be irrigated, the available sources of water for irrigation – one or more with or without reusing the irrigation drain water.

Irrigation control is started by opening the irrigation valves and starting the main irrigation pump. The control of all these elements is performed by the controller based on concepts of irrigation programs.

Irrigation programs

Up to 10 irrigation programs can be set by the user with different irrigation parameters: irrigation periods, type of irrigation control, irrigated sectors and volume or irrigation time specified for each sector, conditions to start irrigation such as time, accumulated solar radiation, low level in tanks (hydroponic crops), temperature variations, linked to another program, priority of program, number of repetitions. For irrigation water, each program has a defined pH set point, EC set point (if the quantity of fertilizer is dosed according with conductivity), and receipt of fertilizers. Control of agitators is specified by programs according with the irrigation periods.

Irrigation water

The quality of irrigation water is assured by proper control of pH and the quantity of nutrients (fertilizers) present in irrigation water.

Fertilization control

Fertilizer can be dosed during irrigation using the Venturi tubes principal or with motorized valves. The control of the quantity of dosed fertilizer can be performed using the volume counters. The system supports dosing from up to 4 fertilizer tanks with specific receipts.

The concentration of the fertilizer in irrigation water can be controlled based on the conductivity reading, proportional with irrigation water based on the receipt or ratiometric, in which case the certain quantity of fertilizers are added with the amount of programmed water.

pH control

The pH control is performed in order to adjust the pH of water to the irrigation program set point.

The pH correction can be performed with alkaline or acid solution based on the characteristic of the incoming water.

The control of pH and EC is performed with PID, PI or proportional control. The tuning of the PID control can be accomplished by the user manually, or automatically by the PID auto-tuning feature.

Agitators and filter cleaning

The automatic control of agitators used in fertilizers tanks and filter cleaning system complete the needs of a standard fertigation system.

In order to keep the fertilizer concentration constant before and during the irrigation program, the fertilizers are mixed in their tanks based on the agitators program. The system can manage up to two filters mounted to protect the probes and in-line dosing elements.

With differential presostates, the filters are monitored and when necessary, the irrigation programs are automatically suspended and washer filter cleaning is started. This process removes any deposits and sediments that may appear on filters to increase the systems life.

Redundancy of EC and pH probes

For safety reasons, the systems can be equipped with 2 conductivity probes and two pH electrodes in redundancy so that the system can generate an alarm in the case of reading differences between them. A third conductivity probe can be mounted to verify and compensate the incoming water conductivity.

Logging system

The logging of the controller can be selected on three levels: input reading variations, statistics of reading (average of pH and EC) or events (start of programs, opening valves, ...).

Alarm system

The alarms of these systems are related to measured water quality parameters like conductivity and pH: out of range, differential reading between redundant probes; over dosing of conductivity or acid or alkaline correction solution, tanks at low level or no dosing detected

by counter movement. Similar alarms can be generated after the units self-diagnostic tests are run.

Sensor connections

All the sensors: EC, pH, temperature are connected to the controller via transmitters.

pH and EC are temperature compensated on the transmitter level. The output of analog transmitters can be calibrated at two points for pH and conductivity. Also, the controller offers a calibration in two points for pH and one point for conductivity.

User interface and digital connection

The user interface is based on an 4 x 20 character line LCD, organized for settings and consultancy. The UI has multi-language support.

The RS232 connection permits the connection to a PC.

Internal back-up system

The systems internal back-up power system offers a special feature; in the case of losing external power, the controller will stop the irrigations and memorize the irrigation programs that were not performed. The controller will start from the uncompleted programs after power has been restored. The programs will be executed based on their priority level with full respect of the quantity of irrigation water, pH level, and concentration of fertilizers.

Additional features that can be found are control of the external power supply and control of mixing of different water sources (clean water, drain irrigation water).

Two panel mount units used in a fertigation system

HI8001 (panel mount) and HI8002 (wall mount) models

The HI8001 and HI8002 fertigation controllers provide up to 10 programs to irrigate up to 32 sectors using time or volume irrigation control. Each irrigation program has one pH and one EC setpoint. The start condition of the program, the irrigation sectors and the time or volume for each sector are user defined. The irrigation water is pH corrected based on the pH control, with acid or alkaline solution and can contain nutrients for crops based on up to 4 fertilizer receipts. Correction of time or volume of irrigated water can be based on accumulated solar radiation or can be manually requested by user. Agitator control and filter cleaning control are performed automatically. The instruments read up to 3 EC probes, one to verify the incoming water EC, and the other two are in-line redundant for safety to measure the current irrigation water EC. The two pH electrodes are mounted in-line redundant for safety to read the irrigation water pH. The instruments provide an alarm system and logging organized on user selectable three levels.

HI8051 (panel mount) model

The HI8051 fertigation controller provides up to 10 irrigation programs to irrigate up to 24 sectors using time or volume control. Each irrigation program has one pH and one EC setpoint. The start condition of the program, the irrigation sectors and the time or volume for each sector are user defined. The irrigation water is pH corrected based on the pH control with acid or alkaline solution and can contain nutrients for crops based on up to 4 fertilizer receipts. Fertilizer dosing is performed based on the EC, volumetric or ratiometric control. Another important feature is the correction of irrigated water volume or time based on accumulated solar radiation or manually requested by user. Agitator control and filter cleaning control is performed automatically. The instrument reads up to 3 EC probes, one to verify the water incoming EC, and the other two redundant in-line for safety, to measure the current irrigation water EC. The two pH inputs are mounted in-line redundant for safety to read the irrigation water pH. This instrument provides an alarm system and logging organized on three user selectable levels. An important added feature is this models ability to mix 3 sources of incoming water. Fresh water, reused water and all dosing are performed based on the motorized valves that are activated by motors that allow different flows of the fertilizers, acid and alkaline solutions used for pH correction.

HI98143 pH/EC Transmitter

Models	HI8001/HI8002	HI8051
Irrigation control	Time/volume control, 10 programs/5 priority levels with up to 99 repetition	Time/volume control, 10 programs/5 priority levels with up to 99 repetition
Irrigation start condition	By Time, by solar radiation, by 5 external tank low level	By Time, by solar radiation, by 5 external tank low level
Fertilization control	By EC	By EC, By volume, Ratiometric
Fertilizers	Up to 4 valves	Up to 4 motorized valves
pH control/correction	Acid or alkaline	Acid or alkaline, motorized pump
Agitators control	Yes	Yes
Filter control/cleaning	2 differential presostate/2 filter cleaning relays	2 differential presostate/2 filter cleaning relays
Fertilizer tank levels/ counters control	Level	Level and counters
Irrigation counter	Yes	Yes
Acid/Alkaline tank level/ counter control	Level	Level and counter
EC inputs	Up to 3, 0.0 to 10 mS/cm	Up to 2, 0.0 to 10 mS/cm
pH inputs	Up to 2, 0.0 to 14.0 pH	1, 0.0 to 14.0 pH
Temperature Compensation	EC, pH	EC, pH
Solar radiation input	1; 0 to 2000 W/m2	No
Temperature	No	1
Wind speed	No	No
Engine power back-up	No	No
Irrigated sectors	Up to 32	Up to 24
Mixing source of water	No	Yes, 3 sources
PC connectivity	RS 232	
Alarms	Yes, user selectable levels	
Logging	Yes, three level	
Power Supply	115V/220V ±10% 50Hz/60Hz	
Environment	wall mounted: NEMA 4X specifications	
Dimensions	wallmounted: 280 x 330 x 165 mm (11.2 x 13.2 x 6.6"); panel mounted: 178 x 260 x 116 mm (7.1 x 10.4 x 4.6")	
Weight	wall mounted: 4.95 Kg (11 lb.); panel mounted: 3.4 Kg (7.5 lb.)	

Ordering Information

Each HI8000 Series model is supplied instructions.

Choose your configuration:

HI8001-0100U Fertigation controller with priorityfor pH and EC, panel mount, 8 sectors, English, 115V.

HI8001-0100D Fertigation controller with priorityfor pH and EC, panel mount, 8 sectors, English, 230V.

HI8001-0200U Fertigation controller with priority for pH and EC, panel mount, 16 sectors, English, 115V.

HI8001-0200D Fertigation controller with priority for pH and EC, panel mount, 16 sectors, English, 230V.

HI8001-0300U Fertigation controller with priority for pH and EC, panel mount, 16 sectors, English, 115V.

HI8001-0300D Fertigation controller with priority for pH and EC, panel mount, 16 sectors, English, 230V.

HI8001-0400U Fertigation controller with priority for pH and EC, panel mount, 32 sectors, English, 115V.

HI8001-0400D Fertigation controller with priority for pH and EC, panel mount, 32 sectors, English, 230V.

HI8002-0100U Fertigation controller with priority for pH and EC, wall mount, 8 sectors, English, 115V.

HI8002-0100D Fertigation controller with priority for pH and EC, wall mount, 8 sectors, English, 230V.

HI8002-0200U Fertigation controller with priority for pH and EC, wall mount, 16 sectors, English, 115V.

HI8002-0200D Fertigation controller with priority forpH and EC, wall mount, 16 sectors, English, 230V.

HI8002-0400U Fertigation controller with priority for pH and EC, wall mount, 32 sectors, English, 115V.

HI8002-0400D Fertigation controller with priority for pH and EC, wall mount, 32 sectors, English, 230V.

HI8051-0300U Acid based fertigation controller with dual pH control, differential EC control, actuator control, multiple dosing and irrigation pump control, panel mount, 24 sectors, English, 115V.

HI8051-0300D Acid based fertigation controller with dual pH control, differential EC control, actuator control, multiple dosing and irrigation pump control, panel mount, 24 sectors, English, 230V.

Required Accessories	**HI98143-22** pH/EC isolated transmitter, 4-20 mA sourcing current output *1 transmitter is needed in configuration with 1 EC probe and 1 pH probe (no probe redundancy feature)* *2 transmitters are needed in configuration with 2 EC probes and 2 pH probes (for probe redundancy feature)* *3 transmitters are needed in configuration with 3 EC probes and 2 pH probes (for probe redundancy feature and EC water incoming compensation)*
Recommended Accessories	**HI1001** "flow-thru", double junction pH electrode with BNC connector and 3 m (10') cable. *1 or 2 electrodes are needed (2 electrodes for probe redundancy feature)*
	HI3001 "flow-thru", 4 platinum ring EC probe with built-in temperature sensor & 3 m (10') cable. *1, 2 or 3 probes are needed (2 for probe redundancy feature; 3 for probe redundancy feature and EC water incoming compensation)*
	HI60542 Electrode Holder for Direct Pipe (Order according with the total amount of ordered probes)
	HI710005 115 VAC to 12VDC power adapter
	HI710006 230 VAC to 12VDC power adapter

For complete list of pH calibration and electrode solutions, see section 3;
for EC solutions, see section 6

PCA300 Family

Chlorine, pH, ORP and Temperature Analyzers

- Alarm
  - Alarm and warning system
- 2 point calibration
  - One to two-point calibration
- Backlight
  - Backlit, LCD display

In regards to swimming pool treatment, disinfection or sanitizing basically means to rid the pool of bather contamination, destroy bacteria, and control nuisance organisms like algae, which may occur in the pool, filtration equipment, and piping. Of the many techniques used (chlorine, bromine and iodine dosing systems), chlorine is the most common.

Chlorine

Chlorine is a strong oxidizing agent that destroys mostly organic pollutants and bacteria and can combine with nitrogen containing compounds, forming chloramines. When dosing chlorine for disinfection, only a portion of the dosed chlorine remains active to actually continue the disinfection process.

When free chlorine combines with a nitrogen containing compound it becomes a less efficient disinfectant called chloramines. The addition of these two parts gives total chlorine. The target is to keep free and total chlorine equal, and thus to maintain the combined chlorine concentration chloramines) near zero. The presence of chloramines is not desired because of the distinctive 'swimming pool' smell caused by combined chlorines like di-chloramines. Beside this unpleasant odor, chloramines can irritate the eyes and the mucous membranes.

Commercial chlorine for disinfection may be available as a gas (Cl_2), a liquid like sodium hypochlorite or bleach (NaOCl) or in a solid state like calcium hypochlorite, chloro-hydantoins or chloro-cyanuric acid compounds. These compounds, once dissolved in water do establish equilibrium between the hypochlorous acid (HOCl) and the hypochlorite ions (OCl^-). Although both forms are considered free chlorine, it is the hypochlorous acid that provides the strongest disinfecting and oxidising characteristic of chlorine solutions; the amount of hypochlorous acid in chlorinated water dependends upon the pH value of the solution. Changes in pH value will affect the HOCl equilibrium in relation to the hydrogen and hypochlorite ion; HOCl decreases and OCl^- increases as pH increases. At a low pH, almost all the free chlorine is in the molecular form HOCl and at a pH of around 7.5, the ratio between HOCl and OCl^- is 50:50. Since the ionic form OCl^- is a slow acting sanitizer while the molecular HOCl is a fast acting, it is important to regularly measure the pH. As a general rule a pH of about 7.2 is recommended to maintain fast acting disinfection conditions.

Measurement and Control Cycle

The PCA has a control time cycle that can be set by the user according with the dimensions of the controlled system. The control process, dosing commands and alarms can be performed according to this time cycle. The range of cycle timing is from 3 to 90 minutes.

Chlorine Control

Four chlorine level set points can be adjusted by the operator: a proportional dosing set point, two alarm set points and a minimum level for dosing. The proportional dosing factor (1/Δ) is user selectable with a delta between 0.1 and 2 pH. Chlorine dosing system controls a SPST relay. Each alarm can be enabled or disabled.

pH Control

Three pH level set points can be adjusted by the operator: a control set point and two alarm set points. The pH control mode is user selectable; on/off or proportional dosing. The proportional dosing factor (1/Δ) is user selectable with a delta between 0.1 and 2 pH. The on/off dosing hysteresis is user selectable between 0.05 and 2.00 pH. The pH dosing system controls a SPST relay.

Each pH, ORP and temperature alarm can be enabled or disabled, and two alarm levels can be set by the user also for temperature and ORP. Alarm condition controls a SPDT relay. The system error feature activates a relay to signal the need for operator intervention. System error condition controls a SPST relay.

Analog Output

Two current outputs of 4-20 mA or 0-20 mA are available to drive external devices such as chart recorders. The analyzer can drive two dosing pumps through the 4-20 mA outputs for chloride and acid/alkaline dosing. The analog output is fully programmable and can be proportional with chlorine concentration, pH, ORP or temperature value. The limits of the analog output is selectable for each parameter.

Logging

The analyzers can store up to 3500 readings (at least 7 days at 3 minutes sampling interval), that can be available for consulting or downloading. Logged records contain the time stamp, full information about the parameter values and the alarm status at the time.

Alarm and Warning System

Through the system, users have the ability to enable or disable the low and high level of alarms for all parameters. The system also offers overdosing protection that generates an alarm if something within the system is not working properly. The system will stop processes until the error is corrected by the user. Time is displayed on the main panel and time related reminders are available for "old calibration", "reagent expired", and "SIM expired". All these warnings are generated based on user settings.

Mounting

These controllers are offered in an easy to access, wall mounted casing that offers outstanding chemical, mechanical and temperature resistance.

Specifications		PCA310	PCA320	PCA330
Free and Total Chlorine	Range	0.00 to 5.00 mg/L (ppm)	0.00 to 5.00 mg/L (ppm)	0.00 to 5.00 mg/L (ppm)
	Resolution	0.01 mg/L (ppm)	0.01 mg/L (ppm)	0.01 mg/L (ppm)
	Accuracy	± 8% or ±0.05 mg/L whichever is greater	± 8% or ±0.05 mg/L whichever is greater	± 8% or ±0.05 mg/L whichever is greater
pH	Range	–	0.00 to 14.00 pH	0.00 to 14.00 pH
	Resolution	–	0.01 pH	0.01 pH
	Accuracy	–	±0.05 pH	±0.05 pH
ORP	Range	–	–	0 to 2000 mV
	Resolution	–	–	1 mV
	Accuracy	–	–	±1 mV
Temperature	Range	–	5.0 to 75.0 °C (41 to 167 °F)	5.0 to 75.0 °C (41 to 167 °F)
	Resolution	–	0.1 °C	0.1 °C
	Accuracy	–	±0.5°C	±0.5°C
Additional Specifications	Chlorine Calibration	one point		
	Chlorine Sampling Rate	adjustable from 3 to 90 minutes		
	Chlorine Dosage	proportional		
	Chlorine Delta	selectable from 0.1 to 5 mg/L (ppm)		
	pH Calibration	one or two point or in line calibration		
	pH Sampling Rate	adjustable from 3 to 120 seconds		
	pH Dosage	ON/OFF or proportional, relay or 4-20mA output		
	pH Delta	selectable from 0.1 to 2 pH (hysteresis adjustable from 0.05 to 2 pH)		
	Recorder Output	4-20mA, 0-20mA		
	PC Connectivity	RS485 port, galvanically isolated		
	Baud Rate	1200, 2400, 4800, 9600 bps		
	Data Logging	up to 3500 data points		
	Alarm Relay	SPDT contact with 5A, 230V resistive load		
	Dosing Relay	SPDT contact with 5A, 230V resistive load		
	System Error	SPDT contact with 5A, 230V resistive load		
	Inlet Pressure	0.07 to 4 bar with no external pressure regulator (for pressure exceeding four bar an external pressure regulator is required)		
	Sample Flow	100 to 300 mL/min		
	Sample Temperature	5 to 40°C (41 to 104°F)		
	Sample Inlet/Outlet Connection	12mm (1/2") male NPT fitting		
	Drain Connection	10mm (3/8") barb		
	Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz; 20 VA		
	Enclosure	NEMA-4X standard, molded fiberglass polyester with transparent Lexan window		
	Dimensions / Weight	318 x 267 x 159 mm (12.5 x 10.5 x 6.25") / 5 kg (11 lb.) without reagents		

Ordering Information

Each PCA300 series model is supplied with reagent bottles (2), reagent caps (2), 1 DPD compound powder, tubing and instructions.;

PCA310-1 Free & total chlorine analyzer/control (115V);

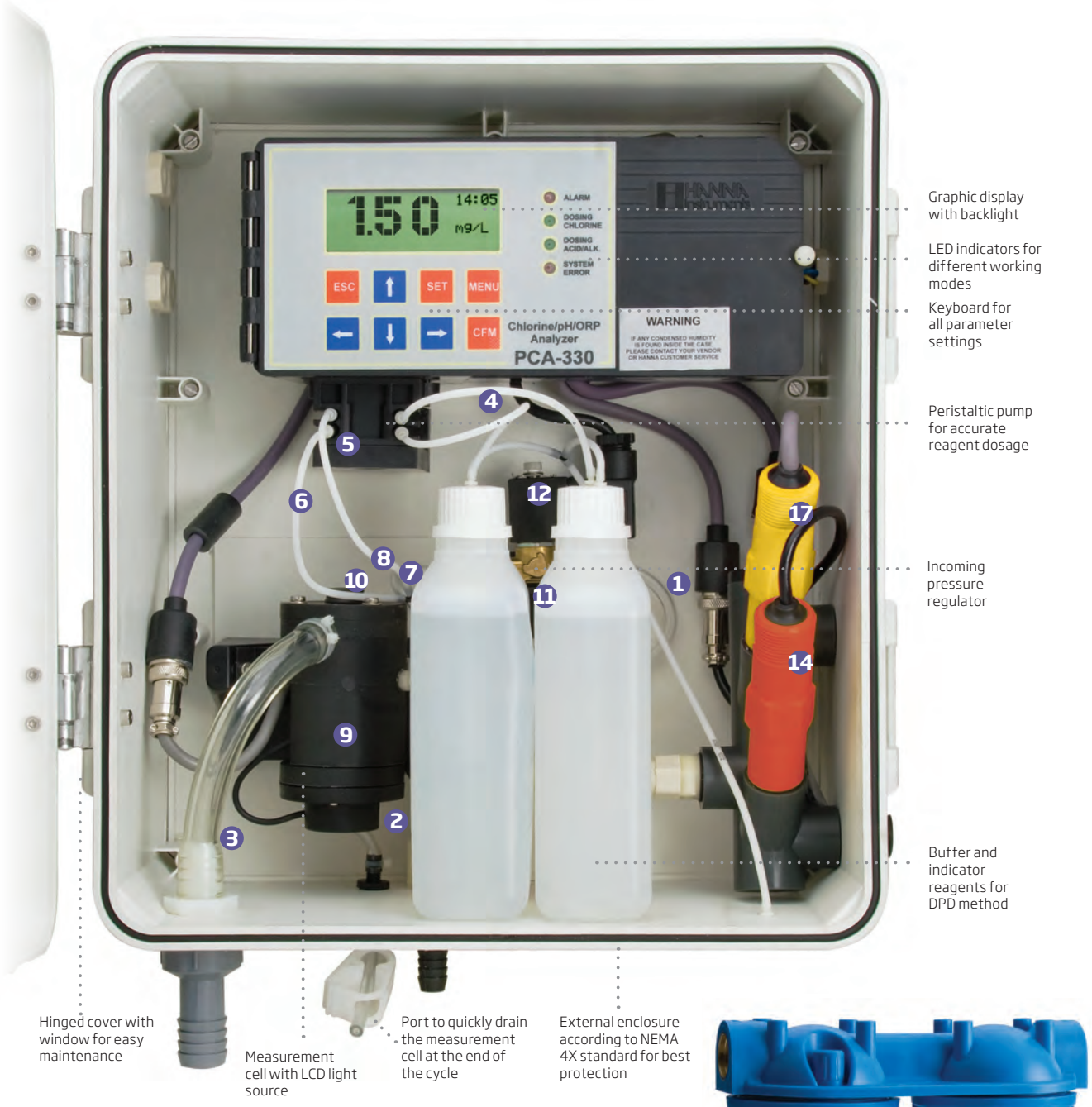
PCA310-2 Free & total chlorine analyzer/control (230V);

PCA320-1 Free & total chlorine analyzer/control, pH control, temperature (115V);

PCA320-2 Free & total chlorine analyzer/control, pH control, temperature (230V) ;

PCA330-1 Free & total chlorine analyzer/control, pH control, ORP monitoring, temperature (115V);

PCA330-2 Free & total chlorine analyzer/control, pH control, ORP monitoring, temperature (230V)


1.50 14:05
mg/L
ALARM
DOSING CHLORINE
DOSING ACID/ALK.
SYSTEM ERROR
ESC
SET
MENU
CFM
Chlorine/pH/ORP Analyzer
PCA-330
WARNING
1
2
3
4
5
6
7
8
9
10
11
12
14
17
Graphic display with backlight
LED indicators for different working modes
Keyboard for all parameter settings
Peristaltic pump for accurate reagent dosage
Incoming pressure regulator
Buffer and indicator reagents for DPD method
Hinged cover with window for easy maintenance
Measurement cell with LCD light source
Port to quickly drain the measurement cell at the end of the cycle
External enclosure according to NEMA 4X standard for best protection


13
15
16

PCA Parts and Solutions

Parts

HI70473	PCA tubing kit, pressure regulator to drain (2). Each kit includes: transparent Tygon tubes 86L x 3.2ID mm (3.4 x 0.1") (Length x Internal Diameter) **(1, 2)** and 105 x 9.5 mm (4.1 x 0.4") **(3)**
HI70474	PCA peristaltic pump tubing kit (6). Each kit includes: non-transparent C-flex tubes 55L x 0.8ID mm (2.1 x 0.03") **(5)**
HI70475	PCA peristaltic pump tubing kit (2). Each kit includes: non-transparent C-flex tubes 55L x 0.8ID mm (2.1 x 0.03") **(5)**
HI70476	PCA reagent bottle tubing kit (6). Each kit includes: non-transparent C-flex tubes 155L x 0.8ID mm (6.1 x 0.03") **(11)**
HI70477	PCA tubing set for measuring cell (2). Each set includes: non-transparent C-flex tube 50L x 0.8ID mm (2.0 x 0.03") **(8)** and Y strainer **(7)**
HI70478	PCA tubing kit, bottle to pump (6). Each kit includes: non-transparent C-flex tube 150L x 0.8ID mm (5.9 x 0.03") **(4)**
HI70479	PCA tubing kit, pump to Y strainer (6 pcs). Each kit includes: non-transparent C-flex tube 150L x 0.8ID mm (5.9 x 0.03") **(6)**
HI70482	PCA filters. The kit includes 0.5 µm and 50 µm filters **(13)**
HI70496	Replacement filter, 0.5 µm **(15)**
HI70497	Replacement filter, 50 µm **(16)**
HI70483	PCA complete tubing kit. The kit includes: non-transparent C-flex tubes **(4, 6)** 150L x 0.8ID (5.9 x 0.03") (4 pcs), non-transparent C-flex tubes **(5)** 55L x 0.8ID (2.1 x 0.03") (2 pcs), non-transparent C-flex tubes **(8)** 50L x 0.8ID (2.0 x 0.03") and Y strainer **(7)**
HI70484	PCA complete tubing kit (3). Each kit includes: non-transparent C-flex tubes **(4, 6)** 150L x 0.8ID (5.9 x 0.03") (4 pcs), non-transparent C-flex tubes **(5)** 55L x 0.8ID (2.1 x 0.03") (2 pcs), non-transparent C-flex tubes **(8)** 50L x 0.8ID (2.0 x 0.03"), Y strainer **(7)**
HI70485	PCA stirrer motor
HI70486	PCA stirring bar **(2)**
HI70487/N	Measuring cell **(9)**
HI70488	Electrovalve, 24VAC/60Hz **(12)**
HI70489	Electrovalve, 24VAC/50Hz **(12)**
HI70492	Electrode holder (PCA330)
HI70493	Closing cap for electrode holder

Electrodes

HI1005	Amplified pH electrode with Matching Pin and Pt100 **(14)** (PCA320/330 only)
HI2008	Amplified ORP electrode with Matching Pin **(17)** (PCA330 only)

Reagent Sets

HI70431	Total Chlorine reagent set for PCA (buffer citrate), 500 mL (2)
HI70481	Total chlorine reagent set for PCA, 500 mL (2) + 5 powder sachets (DPD)
HI70491	Total chlorine reagent set for PCA, 500 mL (2) + 5 poweder sachets (DPD)
HI70430	Free chlorine reagents set for PCA (the most stable), recommended for long term measurements, 500 mL (2) + 6 g powder
HI70480	Free chlorine reagents set for PCA, recommended for short term measurements, 500 mL (2) + 5 sachets (DPD)
HI70490	Free chlorine reagents set for PCA, 500 mL (2) + 5 sachets (DPD)
HI70452	DPD reagent,5 sachets

Solutions

HI70460	Total chlorine indicator solution for PCA, 500 mL*
HI70461	Total chlorine buffer solution for PCA, 500 mL
HI70450	Free chlorine indicator solution for PCA, 500 mL*
HI70451	Free chlorine buffer solution for PCA, 500 mL
HI7004L	pH 4.01 buffer solution, 500 mL
HI7006L	pH 6.86 buffer solution, 500 mL
HI7007L	pH 7.01 buffer solution, 500 mL
HI7009L	pH 9.18 buffer solution, 500 mL
HI7010L	pH 10.01 buffer solution, 500 mL
HI7020L	200-275 mV buffer solution, 500 mL
HI7091L	Pretreatment reducing solution, 500 mL
HI7092L	Pretreatment oxidizing solution, 500 mL
HI70300L	Storage solution, 500 mL
HI7082	3.5M KCL electrolyte, 30 mL
HI7061L	Electrode cleaning solution, 500 mL

Software

HI92500	Windows® compatible software

* After addition of 5 powder sachets (HI70452-0)

The Hanna line of process instrumentation offers different solutions to control processes in which parameters like pH, ORP, Conductivity, TDS are important. Digital controllers offer a full package of features for process control with high levels of configuration for control and measurement parameters. Hanna solutions are designed for both accuracy of the reading and safety of the control process. The matching pin, sensor check, cleaning programs, auto-diagnostics, hold mode, alarm and warning system are all solutions to the same problem: measurement and control of processes has to be performed in safety from the process control point of view.

Typical feedback systems are based on a control loop, including sensors, controllers with control algorithms and actuators. The purpose of this system is to try to regulate a variable parameter at a set point or reference value. Different types of feedback control algorithms are available: on/off, linear, proportional or PID controllers. Open-loop control systems do not make use of feedback, and run only in preset ways.

Closed-loop control systems typically operate at a fixed frequency. The frequency of changes to the drive signal is usually the same as the sampling rate. After reading each new sample from the sensor, the controller reacts to the controlled system changed state by recalculating and adjusting the actuators drive signal. The controlled system responds to this change, another sample is taken, and the cycle repeats. Eventually, the controlled system should reach the desired state and the controller will cease making changes. The above frequency is fixed based on a setting of the time cycle according with the time necessary to the controlled system to react to the actuator adjustment .

An on-off controller is a feedback controller that switches the actuators drive signal between two states. They are often used to control an actuator that accepts a binary input, for example an on/off valve. A common issue in most applications of on-off feedback control is the wear of actuators such as relays and control valves when the measurement is closed to the set point and the system is starting a continuous on/off switching on each cycle (similar with a continuous oscillation around the set point).

Therefore, practical on-off control systems are designed to include hysteresis, usually in the form of a dead-band, a region around the set point value in which no control action occurs. The width of dead-band may be adjustable or programmable.

Linear control

Linear control is the first solution to on/off control issues. Linear control systems use linear negative feedback to produce a control signal mathematically based on other variables, with a view to maintaining the controlled process within an acceptable operating range. The output from a linear control system into the controlled process may be in the form of a directly variable signal, such as a motorized valve that may be 0 or 100% open or anywhere in between. Sometimes this is not feasible and so, after calculating the current required corrective signal, a linear control system may repeatedly switch an actuator, such as a pump, motor or heater, fully on and then fully off again, regulating the duty cycle inside the time cycle using pulse-width modulation.

Proportional control

Proportional negative-feedback systems are based on the difference between the required set point and measured value. This difference is called the error. Correction is applied in direct proportion to the current calculated error, in the correct sense so as to tend to reduce the error. The amount of corrective action that is applied for a given error is set by the gain or sensitivity of the control system. At low gains, only a small corrective action is applied when errors are detected: the system may be safe and stable, but may be low in response on large changing conditions; errors will remain uncorrected for relatively long periods of time. If the proportional gain is increased, such systems become more responsive and errors are dealt with more quickly. There is an optimal value for the gain setting when the overall system is said to be critically damped. Increases in loop gain beyond this point will lead to oscillations in the process. To resolve the two problems of low response time on one side or system oscillation on the other side, many feedback control schemes include mathematical extensions to improve performance. The most common extensions lead to proportional-integral-derivative control, or PID control. The PID control is formed from three controllers that treat the error in different way: proportional, derivative and integrative.

Derivative action

The biggest problem with proportional control is to reach new desired outputs quickly and to avoid overshoot and minimize ripple once you get there. Responding quickly imposes a high proportional gain, but minimizing overshoot and oscillation requires a small proportional gain. Achieving both at the same time may not be possible in all systems.

The derivative part is concerned with the rate-of-change of the error with time: If the measured variable approaches the set point rapidly, then the actuator is backed off early to allow it to coast to the required level; if the measured value begins to move rapidly away from the set point, extra effort is applied—in proportion to that rapidity—to try to maintain it. If derivative action is over-applied, it can lead to oscillations as well.

Integral Action

The integral term magnifies the effect of long-term steady-state errors, applying ever-increasing effort until they reduce to zero. If the actuator action being applied does not bring the controlled parameter up to set point, for whatever reason, integral action increasingly moves the proportional band relative to the set point until the error is reduced to zero and the set point is achieved.

PID Tuning

PID control is a very powerful and high quality solution for many control processes. The biggest problem of PID controllers is the tuning of the controller in accordance with the controlled system/parameter. Tuning control is not an easy operation and the controller and controlled system have to permit this. High level instruments offer the auto-tuning of controllers that is oriented to the automation of the controller reaction and do not request common PID tuning.

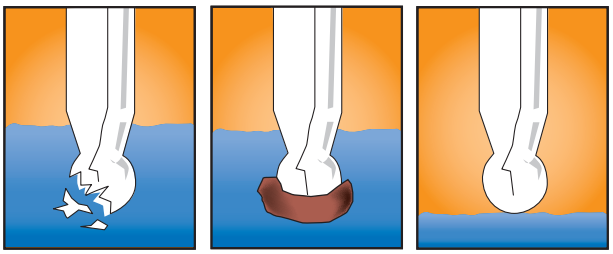
Input of the Controllers

Controllers are in contact with the process based on the sensors and actuators. The sensors are the inputs of the controller, the actuators are the outputs of the controller. In Hanna controllers, the common inputs are the pH, ORP, conductivity, TDS along with temperature for temperature compensation. The probes are connected directly to the controller, or in case of extreme distances between controller and probe, through the transmitters (analog/digital).

Sensor Check™

A pH control system consists of a pH electrode in contact with a test solution, a connection cable, and a meter for measurements and adjustments. The instrument is typically set to control acid or alkaline dosage for the purpose of maintaining a desired pH value. Many efforts have been devoted to such functions as dosage in pipes or tanks, on/off or proportional control, Automatic Temperature Compensation, the use of amplifiers for distances exceeding 15 meters, panel or wall-mounted models, etc. However, little effort has been applied to determining when and what occurs when an electrode fails.

Problems Detected by the Sensor Check™ System



Broken electrode | Dirty electrode | Electrode not immersed

For example, let's assume a process electrode is installed in a tank of wastewater containing hexavalent chromium. The set point pH value is 3.0 and, every time this value rises, pumps or solenoid valves are activated to dose sulfuric acid to maintain the set point. Let's also assume that the process electrode becomes damaged and the pH bulb is broken. Under normal conditions, the electrode will produce a potential equal to the difference between the buffer inside the glass bulb (pH 7.0) and the liquid being tested (pH 3.0), i.e. pH (7.0-3.0) x approx. 59.16 mV = 236.64 mV (value not compensated for temperature variations).

Once the glass bulb is broken, a short circuit occurs between the reference wire of the glass electrode (bulb) and the reference electrode; as a result the complete electrode potential is 0 mV. When the instrument receives a 0 mV signal, it will read approximately pH 7.0 and will immediately start to dose sulfuric acid in order to lower the pH level of the tank. If the controller does not possess a timed override function to shut down automatically, the system will keep dosing in an attempt to reach the 3.0 pH set point. This will continue until the acid container becomes empty by which time the process stream will be dangerously contaminated. Even if a timed override is programmed into the controller, this will only limit the contamination. If the electrode fails near to the set point, the controller could dose for several minutes before the override shuts down the system.

This is just one of many possible examples of overdosing and contamination as a result of an undetectable electrode failure.

In any given application, costly damage can be avoided by automatically and continually monitoring the condition of the process sensors. Hanna has devised such a system. **The Sensor Check™ system automatically checks the condition of the process electrode every 5 seconds to ensure proper function.**

A pH glass electrode is a high impedance device (tens of MΩ at high temperatures, and up to 1,000 MΩ for temperatures close to zero). The Sensor Check™ system repeatedly checks the impedance of the cable and electrode to ensure it does not fall below the average value of the system (at least 10 MΩ). If a lower value is detected, indicating electrode failure, the instrument stops all dosage and activates an alarm that alerts the operator. By doing so, the Sensor Check™ system makes over dosage and contamination as a result of electrode failure a thing of the past.

Additionally, the Sensor Check™ system monitors the condition of the reference electrode. The pH measuring half cell may be intact and work normally, but problems may occur related specifically to the reference portion of the electrode. The purpose of the reference half cell portion of the electrode is to supply a consistent and stable potential that is independent of the liquid being tested. This stable potential is the reference value by which the measuring portion of the electrode is compared. As a result the potential difference between the measuring half cell and the reference is the value used by the instrument to produce the pH reading. The reference electrode must make contact with the test solution to complete an electrochemical connection. Unlike the measuring cell which is hermetically separated by means of a glass bulb, the reference cell contains a permeable membrane (reference junction) which allows electrolyte to diffuse into the solution. This creates an ionic connection between the internal silver reference and test solution, completing the circuit.

Process Instrumentation

As with any electrochemical connection, the possibility of contamination is always a concern. When contamination occurs, the potential of the reference electrode changes and the pH reading is no longer reliable. In addition, exposure to dirt and particles in the process stream may clog the porous reference junction, isolating the reference from the test liquid. If this occurs the electrochemical connection is broken and the electrode is essentially "unplugged" from the test solution making a correct pH reading impossible. This is why regular cleaning of the electrode system is a necessity. As with the pH bulb, the reference junction produces a measurable resistance value which under normal conditions is approximately 1,000Ω.

The Hanna Sensor Check™ system monitors the reference junction every 5 seconds to ensure that the proper resistance is maintained. Users can program a maximum value for the resistance similar to setting the pH set point. When the resistance of the clogged junction exceeds the set value, the instrument can stop dosage, trigger an alarm or automatic cleaning cycle. These features are present in the HI504 series of process pH/ORP controllers.

Ground loop current effect on process pH/ORP electrodes

An electrochemical (combination) cell, such as a pH or ORP electrode, is comprised of 2 half cells; the measuring cell and the reference.

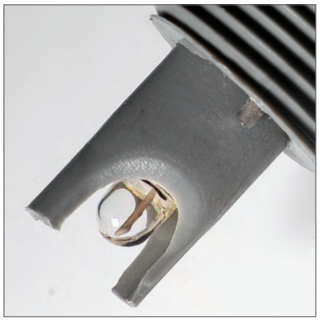
Both are essential for the cell to function and each has a specific purpose. The entire cell is considered galvanic in that no external power is supplied to the solution. In many respects, the electrochemical cell is very much like a "wet cell" battery. In order for the measuring half cell to produce a readable measurement of a test solution, it must be compared to a stable reference potential. It is absolutely crucial that the potential produced by the reference half cell is consistent and stable (approx. 210 mV) regardless of the properties of the test solution and the working conditions. The only changing potential, as a result of the solution under test, is produced by the glass bulb of the measuring cell. The reference electrode must also make contact with the test solution to complete an electrochemical connection. Unlike the measuring cell which is hermetically separated by means of a glass bulb, the reference cell contains a permeable membrane (reference junction) which allows electrolyte to leach out into the solution. This creates an ionic connection between the internal silver reference and test solution completing the circuit. Hence the reference is now electrochemically connected to the solution which makes it vulnerable to transient electrical currents that may be present in the process.

Unlike with a portable battery powered pH meter and electrode, the process system is not isolated from potential difference and the resulting current flow. It is possible, given that unwanted potentials exist in the process, that the silver/silver chloride wire of the reference is exposed to current flow thousands of times higher than normal. In theory, this should not happen since most process instruments are powered at low voltage and the transformer inside the instrument will galvanically isolate the two potentials between the "process" and ground of the electrical system. This depends, therefore, on the quality of the instrument's input transformer. Even with the best isolation, capacitance may be generated between the instrument and the process stream. In this case, the reference electrode influenced by the resulting EMF can no longer function properly and as a result, the pH reading is lost.

By introducing the matching pin, which acts as a ground connection, the EMF is rerouted through the pin and galvanically isolated from the internal mass of the instrument. The instrument must be equipped electrically to perform this function. Hence, the matching pin can only be used with controllers provided with a differential input and circuit.

Few electrode and instrumentation manufacturers have paid the necessary attention to the matching pin and as a result it has been up to the user to devise makeshift ground connections that may or may not work correctly.

Hanna has responded to this problem by designing a complete series of process electrodes, each equipped with an integrated potential matching pin.



Matching Pin: The Ground Loop Effect Solution

In process applications utilizing controllers and electrodes installed in-line or in tank, the potential matching pin is considered the "earth ground" connection and is used to prevent ground loop effects from causing erratic readings and damage to the system. In fact, it is a grounding device with a pin made of a material (usually stainless steel or titanium) inert to chemical attack. The matching pin essentially redirects the current from the reference cell of the process electrode (i.e. pH or ORP sensor). Potentials and transient current flow can be caused by "leakage" of improperly insulated electrical equipment (pumps and stirrers), electrostatic charges introduced by the motion of mixer blades, or the existence of electric fields (electrolysis) present in plating baths.

Calibration of a Typical Process Meter

In industrial applications, the calibration of a meter often poses difficulties due to the distance between the electrode and the instrument. In addition, accessing the electrode for calibration may prove to be a challenge if it is installed in a pressurized line or large tank in a continuous process. Stopping a process frequently for the purposes of regular calibration may prove inconvenient and costly.

In laboratory applications, the task of calibration is significantly different because the electrode and the instrument are close together and easily manageable. To provide the same level of manageability in a process application, Hanna has developed a remote calibration method which allows the maintenance technician or operator the capability to calibrate the process controller without having direct access to it or without removing the electrode from the installation.

Analog or digital transmitters

In order to increase the distance between the sensor and the controller, different solutions were implemented: to amplify the sensor signal, to transform the signal into another type of signal in current or voltage using the analog transmitters, or to convert the signal from analog to digital and to transfer the reading in digital format. Based on this consideration Hanna supports all of these solutions on the sensor level and input of the controllers.

Controller Output

As mentioned earlier, actuators are the outputs of the controllers. The output to actuators on the controller side can be performed using a relay or analog output. Each of them is driven by the controller in accordance with the control method used. For example, an on/off control is common to be performed with a relay, a linear control with an analog output, and a duty cycle command using a solid state relay. Hanna controllers feature all of these options.

Alarms and warning

Controllers are designed to keep the controlled system/parameter within a certain area of values. In the event that parameters have gone out of range, the controller signals an alarm on the user interface and on an output such as an on/off relay according with the alarm status. The status of the controller and the process can be monitored using the analog output connected to a recorder or on the controller LCD.

Due to the complexity and importance of the controlled systems, the controllers incorporate a self-diagnostic feature. With this feature, the controller has the ability to check the most important functions, and in the event of failures, to take the actions that are necessary to minimize the effects of the problems. Hanna controllers have implemented both levels of protection: self-diagnostic and control of output in the event of failures.

Hold feature

The Hold feature suspends the measurement and control of functions of the instrument. The control and control relays are also disabled. If the meter is in idle or control mode and displaying measurements, then the last measured value (both for temperature and pH, ORP or conductivity/concentration) is frozen on the display. The LCD displays the "Hold" message.

The instrument enters Hold mode during the calibration, setup, in progress cleaning or every time when this function is started by: calibration, setup, cleaning in place, the hold digital insulated input (there are two digital insulated inputs: one for hold mode and one for the advanced cleaning) when it is on; normally the signal level is polled at least every 4 seconds, the proper key combination (CFM and up arrow keys together) for service; the same key combination is used both to start and stop the hold mode (the key combination acts in the same way as the hold digital input, the daily programmable control timing, an error event, the hold start/stop RS485 command.

The display will show dashes if the meter is put into the Hold mode before any readings have taken place.

After the Hold mode expires, the meter exits the hold mode, but control and alarms remain disabled for a user-selectable delay (0 to 99 seconds). In this situation, measurements are normally acquired, displayed and recorded through the analog or RS485 output.

Analog output

Hanna controllers feature settable analog outputs. The analog output can be linked to the measured input or to the output of the PID controller. In the first case the analog output will be connected to a recorder and in the second case it will be used to drive external devices such as actuators in a control system. A feature of the recorder output configuration is the ability to zoom a specific measurement range, to offer a higher resolution on the recorder output. Additionally, values that are out of the defined analog output range can be used to signal the alarm condition that appears.

The analog output is communally working in current and the standard ranges are 0 to 20 mA or 4 to 20 mA. The measured range is divided proportional with the analog output range. In some conditions the analog output can be set in voltage with commune ranges between 0 to 5V or 0 to 2V. The voltage is not commonly to be used for long distances due to the drop in voltage on the connection and wires.

Password protection

The controllers can be mounted to monitor and control important processes where unqualified personnel intervention is not accepted. Hanna digital controllers feature a password protection solution that offers restricted access to important features like calibration, setup and consultancy of logged data. The password can be set and enabled/disabled during the normal operations.

Panel Mount or Wall Mount Instruments

Most process instruments for measuring and controlling pH, ORP and conductivity are designed for installation in panel enclosures. Panel configurations are necessary when installing a variety of control devices in a confined space.

Almost the entire range of Hanna panel mount instrumentation is available in stand alone wall mountable versions for quick and easy "plug and play" installation.

HI504

pH/ORP Digital Controller

with Sensor Check™

- Sensor Check™
  - Tells the user if there is something wrong with the electrode
- CAL Check™
  - Alerts users of calibration status
- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation
- Logging
  - Loging of up to 100 system events

HI504 Overview

HI504 is a PID, PI, proportional or on/off pH/ORP controller with one or two set points. The measurement configuration settings and control of pH and ORP are saved separately and permits users to switch between pH and ORP without losing settings. The pH channel can be calibrated in 2 calibration points. The instrument has a full auto diagnostic procedure. Sensor Check™ is also available for pH and ORP probes.

The temperature is continuously monitored using a temperature sensor (Pt100 or Pt1000 type) with automatic temperature compensation of pH.

One or two analog controller outputs (0-20 or 4-20 mA) can be configured for pH/ORP recording or controlling (only for models with PID), and relays can be used to control the process or be connected with alarm status.

Controller status is visable with LED's on the front panel and on the LCD display.

The controllers logging feature can save up to 6000 samples pH/°C or ORP and last 100 error, configuration, calibration and cleaning events. This information is accessible from a PC through RS485 and HI92500 software. The powerful HI92500 software has graphing capabilities and can print graphs directly or can be saved as a bitmap. Data can be exported in common spreadsheet formats.

Analog Output: Data Logging or PID Dosage Control

Models are available with one or two analog outputs. These outputs can be connected to a recorder for the catalogging of process data (pH/mV and temperature), or can be used for controlling dosing systems (pumps or electrovalves) using PID control.

Sensor Check™ pH/ORP

Sensor Check™ performs self-diagnostic and troubleshooting functions by continuously verifying the electrode status based on impedance movement of the glass and reference measurement. The internal circuit of the instrument executes two independent tests, one for the probe and one for the reference chamber, measuring the respective impedance values every 5 seconds. These tests last for a very short period to avoid electrolysis and polarization, which can be caused by a prolonged exposure to an electric current. The types of problems identified by Sensor Check™ are: pH electrode broken, reference electrode dirty, reference electrode or matching pin not immersed, clogged or dirty electrode junction, short-circuit between cables of pH and reference electrodes, signal problems from the cable or connector due to humid or dirty environments. The test is not limited to a simple signal that indicates an error in progress, but it reports the nature of the problem with a specific error code.

Programmable Cleaning Cycles

Heavy-duty applications often require almost continuous probe maintenance. Elements such as suspended solids, fat, oils, pigments and microorganisms can quickly deposit and soil the glass bulb of a pH probe, the sensor of an ORP probe or the reference junction. To solve these problems, the HI504 series has been equipped with an automatic cleaning system (simple or advanced, depending on model) with programmable cycles. The cleaning cycle is a simple wash with either water or detergent, programmed by setting the rinse time and the pause length. The advanced cleaning uses both water and detergent, and allows the user to program three stages, with the possibility to vary the sequence, the time, and the number of cycles. The advanced mode can also be triggered at any time from a remote control or through the isolated digital input on the rear panel, which can be connected to an external switch.

The controllers can also automatically activate both cleaning modes whenever Sensor Check™ reveals a soiled probe. A delay time can be set before restarting the reading after a cleaning cycle has taken place; this allows the probe to adjust to new operating conditions.

Logging of the Last 100 Events

With the HI504 series, it is possible to recall the sequence of the last 100 occurred events at any time: errors, calibrations performed, set parameter changes and cleaning cycles. Every code shown on the display corresponds to a certain type of event, error, or operation.

Programmable Hold System

The hold function allows the user to stop the regulating action of the controller for programmable time periods. It is possible to activate the hold periods in correspondence to programmed operations, such as plant maintenance and cleaning procedures.

Fail Safe Alarm System

Hanna's exclusive Fail Safe Alarm System protects against problems caused by power supply failure or signal interruption, which are typical risks in industrial environments. The system acts both on a hardware and a software level. The alarm relay functions in a normally closed condition, and is tripped when there is a power failure if, for example, the power cable is accidentally cut. This function is very important in industrial plants where alarms are usually not activated if there is a power supply interruption, which can cause serious damage due to a loss of control of the process plant. At the software level, the Fail Safe Alarm System function activates an alarm in case of abnormal circumstances, for example if the dosing contacts remain closed for an excessive period. The alarm condition is also indicated by a red LED, located directly on the front panel of the controller.

Specifications	HI504
Range	-2.00 to 16.00 pH; -2000 to 2000 mV; -30 to 130.0°C
Resolution	0.01 pH; 1 mV; 0.1°C (above -10 °C); 1°C (below -10°C)
Accuracy (@25°C/77°F)	±0.02 pH; ±2 mV; ±0.5°C (-9.9 to 130.0°C); ±1°C (-30 to -10°C)
Input Impedance	10^{12} Ohm
Digital Input for the pH/ ORP/°C Transmitter	RS485
Other Digital Insulated Inputs	two digital insulated inputs: one for hold and one for the advanced cleaning; ON state: 5 to 24 VDC
Digital Insulated Output	a digital insulated contact closed upon hold mode
Temperature Compensation	automatic or manual, -30 to 130°C
Temperature Probe	with three-wire or two-wire Pt100/Pt1000 sensor (with automatic recognition and damage test)
Power Supply (depending on model)	24 VDC/AC, 115 VAC ±10%, 230 VAC ±10% or 100 VAC ±10%; 50/60 Hz
Power Consumption	10 VA
Over Current Protection	400 mA 250V quick blow fuse
Max. Oscillation Frequency	8 MHz
Relays 1, 2, 3, 4	electromechanical relay SPDT contact outputs, 5A-250 VAC, 5A - 30 VDC (resistive load); fuse protected: 5A, 250V quick blow fuse
Alarm Relay	electromechanical relay SPDT contact output, 5A - 250 VAC, 5A - 30 VDC (resistive load) fuse protected: 5A, 250V quick blow fuse
Analog Output	two independent outputs, 0 - 22 mA (configuring as 0-20 mA or 4-20 mA)
Analog Output Resolution	0.1% f.s.
Analog Output Accuracy	± 2% f.s.
Data logging	6000 pH/°C or ORP samples
Environment	0 to 50°C (32 to 122°F); RH max 85% non-condensing
Casing	IP20 (housing); IP54 (front panel)
Weight	1.6 kg (3.5 lb.)
Ordering Information	Each HI504 model is supplied complete with mounting brackets and instructions. **Choose your configuration** **HI504222-1** dual setpoint, on/off and PID control, single analog output, 115V **HI504222-2** dual setpoint, on/off and PID control, single analog output, 230V **HI504224-0** dual setpoint, on/off and PID control, dual analog output, 24VDC/AC **HI504224-1** dual setpoint, on/off and PID control, dual analog output, 115V **HI504224-2** dual setpoint, on/off and PID control, dual analog output, 230V **HI504924-1** dual setpoint, advanced cleaning, on/off and PID control, dual analog output, 115V **HI504924-2** dual setpoint, advanced cleaning, on/off and PID control, dual analog output, 230V
Probes	**HI7610** Stainless steel Pt100 probe with front and back 1/2" NPT thread and 5 m (16.4') cable
	HI7611 Glass Pt100 probe with front and back 1/2" NPT thread and 5 m (16.4') cable

HI720

Conductivity Process Digital Controller

with Inductive Probe

- Sensor Check™
  - Tells the user if there is something wrong with the electrode
- CAL Check™
  - Alerts users of calibration status
- ATC
  - Automatic temperature compensation
- Logging
  - Logging of up to 100 system events

HI720 Overview

HI720 is a PID, PI, proportional or on/off EC/TDS controller with one or two set points and includes an inductive conductivity probe.

The measurement configuration settings and EC and TDS control are saved separately and permits users to switch between EC and TDS without losing settings. TDS or a specific user defined curve can be used for concentration.

Temperature is continuously monitored using a temperature sensor (Pt100 or Pt1000 type) with ATC of conductivity. Conductivity temperature compensation parameters are fully customizable: linear or non-linear temperature compensation, reference temperature and temperature coefficient. Users can define the specific curve of temperature compensation.

The working conductivity range is user selectable and the conductivity calibration in one point is performed in a value that corresponds to the measurement range.

One or two analog controller outputs (0-20 or 4-20 mA) can be configured for recording or controlling (only for models with PID), and up to 4 relays can be used to control the process or be connected with alarm status. Controller status is visable with LED's on the front panel and on LCD.

The controller logging feature can save the last 100 error, configuration, calibration and cleaning events. This information can be accessible from a PC through RS485 and HI92500 software. The controller also has a full auto diagnostic procedure. A cleaning procedure of the EC inductive probe is also available.

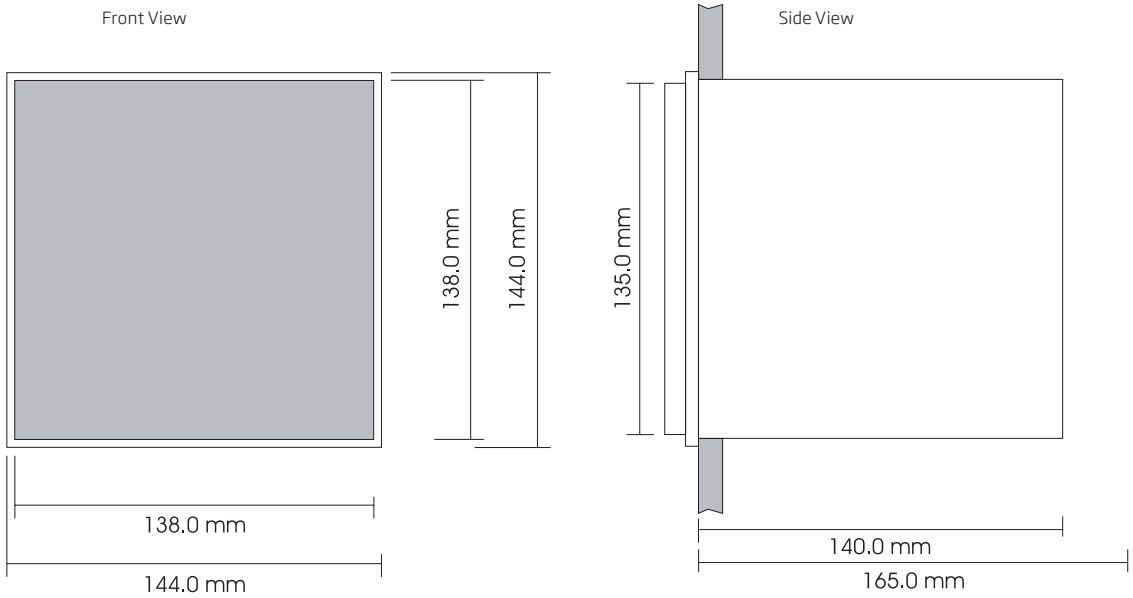
In-Line Cleaning

The cleaning feature allows an automatic cleaning action of the probe. To perform cleaning, the controller activates an external device (pump). Cleaning actions never take place if no relay is configured for cleaning. Cleaning can be of two types:

1. **Simple cleaning:** with water only, it can be triggered only by a timer (periodical cleaning) or by an error for which a cleaning action can be configured.
2. **Advanced cleaning (optional):** with water and detergent, it can be triggered by the following events:

Timer: Digital input or RS485 command (external trigger); Timer and digital input or RS485 command (external trigger); Timer masked by the digital input (i.e. disabled when the digital input is on); Error for which a cleaning action can be configured

Mechanical Dimensions



Specifications	HI720
Range	0 to 2000 mS/cm (autoranging); -30 to 130°C / -22 to 266°F
Resolution	1 µS/cm (0 to 1999 µS/cm); 0.01 mS/cm (2.00 to 19.99 mS/cm); 0.1 mS/cm (20.0 to 199.9 mS/cm); 1 mS/cm (200 to 2000 mS/cm); 0.1°C / 0.2°F
Accuracy (@25°C/77°F)	±2% f.s. (conductivity) / ±0.5°C / ±1°F
Temperature Compensation	automatic or manual, -30 to 130°C
Temperature Probe	three-wire or two-wire Pt100 or Pt1000 sensor with automatic recognition and damage test
Digital Input	digital transmitter, hold and advanced cleaning inputs
Digital Output	one digital insulated contact closed upon hold mode
Analog Output	one or two independent outputs; 0-22 mA (configuring as 0-20 mA or 4-20 mA)
Digital Serial Output	RS485
Dosing Relay	1, 2, 3 or 4 electromechanical relays SPDT; 5A-250 VAC, 5A-30 VDC (resistive load); fuse protected: 5A, 250 V fuse
Alarm Relay	1 electromechanical relay SPDT; 5A-250 VAC, 5A-30 VDC (resistive load); fuse protected: 5A, 250 V fuse
Installation Category	II
Power supply (depending on model)	24 VDC/ac, or 115 VAC or 230 VAC or 100 VAC ±10%, 50/60 Hz; fuse protected: 400 mA, 250 V fast fuse
Power Consumption	10 VA
Max Oscillation Frequency	8 MHz
Environment	0 to 50°C (32 to 122°F); RH max 85% non-condensing
Enclosure	single case 1/2 DIN
Weight	approximately 1.6 kg (3.5 lb.)
Ordering Information	Each HI720 model is supplied complete with mounting brackets and instructions. **Choose your configuration:** **HI720122-1** single setpoint, on/off and PID control, single analog output, 115V **HI720122-2** single setpoint, on/off and PID control, single analog output, 230V **HI720224-1** dual setpoint, on/off and PID control, dual analog output, 115V **HI720224-2** dual setpoint, on/off and PID control, dual analog output, 230V
Probes	**HI7610** Stainless steel Pt100 probe with front and back 1/2" NPT thread and 5 m (16.4') cable
	HI7611 Glass Pt100 probe with front and back 1/2" NPT thread and 5 m (16.4') cable
	HI7620 Stainless steel Pt1000 probe with PG 13.5 thread and 5 m (16.4') cable
	HI7621 Glass Pt1000 probe with PG 13.5

For complete list of EC solutions, see section 6

HI7650

Inductive Conductivity Probe

for HI720

EC Inductive Probe Theory of Operation

This instrument allows conductivity measurements without any electrical contact between electrodes and process fluid. The measurement is based on inductive coupling of two toroidal transformers by the liquid.

The instrument supplies a high frequency, reference voltage to the "Drive Coil", and a strong magnetic field is generated in the toroid.

The liquid passes through the hole in the toroid and can be considered as one turn secondary winding. The magnetic field induces a voltage in this liquid winding, the current induced in the flow is proportional to this voltage, and the conductance of the liquid one-turn winding is in accordance to Ohm's law.

The conductance is proportional to the specific conductivity and a constant factor determined by the sensor geometry and installation.

The liquid also passes through the second toroid and therefore the liquid turn can be considered as a primary winding of the second toroidal transformer. The current in the liquid will create a magnetic field in the second toroid, and the induced current can be measured as an output.

The output current of this "receive coil" is therefore proportional to the specific conductivity of process liquid.

For an inductive cell, the cell constant is defined as the measured conductivity, obtained by making a loop through the sensor with a resistor R, multiplied by that R value.

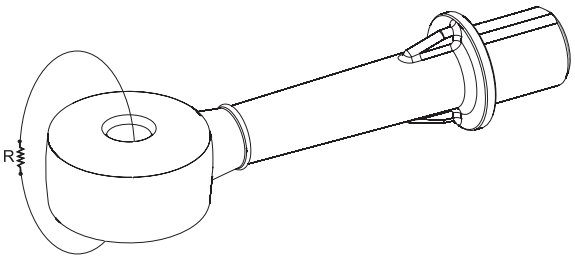
The cell constant depends only on the sensor geometry. However, when the probe is immersed in a liquid, the induced current in the solution is affected by the piping or any other container where the probe is inserted. This effect is negligible when there is an area of at least 3 cm of liquid around the cell.

Otherwise, it is necessary to multiply measurements by the installation factor:
Conductivity = (cell constant)(installation factor)/(measured resistance).

The installation factor is < 1 for conductive piping/containers, and > 1 for nonconductive piping/containers.

Since this type of sensor has no electrodes, common problems such as polarization and contamination are eliminated and will not affect the performance of the electrodeless sensor.

Specifications	HI7650 Inductive Conductivity Probe	
Measuring Range	0 to 2000 mS/cm	
Accuracy	±2% f.s.	
Cell Constant	approx. 2.4 cm-1	
Protection Class	IP67	
Temperature Sensor	Pt100 to Pt1000 (depending on model)	
Temperature Response	90% of the final value, approximately 10 minutes	
Required Pipe Diameter	>80 mm (consider installation factor for pipe with diameter < 125 mm)	
Dimensions (probe only)	40 x 190 x 55 mm (1.57 x 7.48 x 2.16") ; head: 32 x OD 55 mm (1.25" x OD 2.16"n)	
Weight (probe only)	approximately 330 g (11.64 oz.)	
Ordering Information	**Choose your configuration**	
	HI7650-1105	PVC body, Pt100, 5 m cable
	HI7650-1110	PVC body, Pt100, 10 m cable
	HI7650-1115	PVC body, Pt100, 15 m cable



pH 502

pH Digital Controllers

with Matching Pin and PID Control

- CAL Check™
  - Alerts users of calibration status
- ATC
  - Automatic temperature compensation
- 3 Point Calibration
  - Up to three point calibration

The pH 502 series of controllers offer many features to increase the level of control available in your plant. These instruments can be configured to utilize P, PI, PID controlling. With this feature, the pH 502 takes the place of three instruments that only allow one configuration each. The pH 502 line includes models that incorporate control through analog output to drive any compatible device, such as an electrovalve or pump. The solid state relay is available to ensure maximum life of the switching device. Each model has a differential input for a grounding bar to extend electrode life.

Fail Safe Alarm System protects against power interruption or line failure. 1, 2 or 3 point automatic calibration and manual or Automatic Temperature Compensation complete the features of this controller.

Specifications	pH 502
Range	0.00 to 14.00 pH; -9.9 to 120°C
Resolution	0.01 pH; 0.1°C
Accuracy (@25°C/77°F)	±0.02 pH; ±0.5°C
Input Impedance	10^{12} Ohm
pH Calibration	automatic, one, two or three point, at pH 4.01, 7.01, 10.01
Temperature Compensation	automatic (with Pt100 probe) or manual from -9.9 to 120°C
Outputs	digital: RS485 bi-directional opto-isolated; or analog, galvanically isolated: 0-1 mA, 0-20 mA and 4-20 mA, 0-5 VDC, 1-5 VDC and 0-10 VDC
Set Point Relay	1 or 2 contact outputs SPDT 5A-250 VAC, 5A-30 VDC (resistive load) or 1 or 2 Solid State Relay (SSR), 1A, 250 VAC (resistive and inductive load), fuse protected (2A, 250V fast fuse)
Alarm Relay	one contact output SPDT, 5A-250 VAC, 5A-30 VDC (resistive load), fuse protected (5A, 250V fuse)
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz
Power Consumption	15 VA
Over Current Protection	400 mA 250V fast fuse
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Dimensions	panel cutout:140 x 140 mm, instrument: 144 x 144 x 170 mm
Weight	1.6 kg (3.5 lb.)
Ordering Information	Each pH 502 model is supplied complete with mounting brackets and instructions. **Choose your configuration** **pH 502421-1** Dual setpoint with SSR relay, on/off and PID controls, analog output, 115V **pH 502421-2** Dual setpoint with SSR relay, on/off and PID controls, analog output, 230V

For complete list of pH calibration and electrode solutions, see section 3

pH 500

pH Digital Controllers

with Matching Pin

- CAL Check™
  - Alerts users of calibration status
- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation
- 3 Point Calibration
  - Up to three point calibration

pH 500 series of controllers are simple to operate, microprocessor-based process meters packed with features. For more flexibility and better resolution for chart recorders, any two points between 0 and 14 pH can be chosen to correspond to the analog output spans. Several pH 500 models are equipped with a bi-directional RS232 port. Push button password programming prevents tampering.

The Fail Safe Alarm System protects the pH 500 against the pitfalls of process control, like power interruption or line failure. With pH 500 quick one, two or three point calibration at pH 4.01, 7.01 and 10.01 comes standard. The temperature can be manually or automatically compensated for. Models with RS232 output allow computer compatibility, a necessity for process control instrumentation. You can also choose from ON/OFF or proportional dosage to save on chemicals.

Specifications	pH 500
Range	0.00 to 14.00 pH; -9.9 to 120°C
Resolution	0.01 pH; 0.1°C
Accuracy (@25°C/77°F)	±0.02 pH; ±0.5°C
Input Impedance	10^{12} Ohm
pH Calibration	automatic, one, two or three point, at pH 4.01, 7.01, 10.01
Temp. Compensation	automatic (with Pt100 probe) or manual from -9.9 to 120°C
Outputs	digital: RS232 bi-directional optoisolated; or analog, galvanically isolated: 0-1 mA, 0-20 mA and 4-20 mA,0-5 VDC, 1-5 VDC and 0-10 VDC
Set Point Relay	1 or 2 contact outputs SPDT 5A-250 VAC, 5A-30 VDC (resistive load), fuse protected (2A, 250V fast fuse)
Alarm Relay	1 contact output SPDT, 5A-250 VAC, 5A-30 VDC (resistive load), fuse protected (2A, 250V fast fuse)
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz
Power Consumption	15 VA
Over Current Protection	400 mA 250V fast fuse
Max. Oscillation Frequency	4 MHz
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Dimensions	panel cutout: 140 x 140 mm, instrument: 144 x 144 x 170 mm
Weight	1.6 kg (3.5 lb.)
Ordering Information	Each pH 500 model is supplied complete with mounting brackets and instructions. **Choose your configuration** **pH 500111-1** single setpoint, on/off control, analog output, 115V **pH 500111-2** single setpoint, on/off control, analog output, 230V **pH 500121-1** single setpoint, proportional control, analog output, 115V **pH 500121-2** single setpoint, proportional control, analog output, 230V **pH 500211-1** dual setpoint, on/off control, analog output, 115V **pH 500211-2** dual setpoint, on/off control, analog output, 230V **pH 500221-1** dual setpoint, proportional control, analog output, 115V **pH 500221-2** dual setpoint, proportional control, analog output, 230V **pH 500222-1** dual setpoint, proportional control, RS232 output, 115V **pH 500222-2** dual setpoint, proportional control, RS232 output, 230V

For complete list of pH calibration and electrode solutions, see section 3

mV 600

ORP Digital Controller

with Matching Pin

- CAL Check™
  - Alerts users of calibration status
- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation
- 2 Point Calibration
  - Up to two point calibration
- Connectivity
  - PC compatible

The mV 600 controllers have been engineered with the same outstanding features as the pH 500 meters. The Fail Safe Alarm System protects these meters against the pitfalls of process control. User selectable timing capability safeguards against overdosing.

These instruments have a differential input, extending electrode life by eliminating ground loop current through the reference. Users can choose between ON/OFF and proportional control as well as selectable current and voltage output. For more flexibility and better resolution for chart recorders, choose any two points between 0 and 2000 mV to correspond to the analog output spans.

RS232 capability makes two mV 600 models PC compatible. Wiring the controllers is simple with extractable terminal modules. A host of self-testing features and user friendly functions make mV 600 a great value.

Specifications	mV 600
Range	±2000 mV; -9.9 to 120°C
Resolution	1 mV; 0.1°C
Accuracy (@25°C/77°F)	±2 mV; ±0.5°C
Input Impedance	10^{12} Ohm
ORP Calibration	automatic, two point, at 0 and 350 or 1900 mV
Outputs	digital: RS232 bi-directional optoisolated; or analog, galvanically isolated: 0-1 mA, 0-20 mA and 4-20 mA, 0-5 VDC, 1-5 VDC and 0-10 VDC
Set Point Relay	1 or 2 contact outputs SPDT 5A-250 VAC, 5A-30 VDC (resistive load), fuse protected (2A, 250V fast fuse)
Alarm Relay	1 contact output SPDT, 5A-250 VAC, 5A-30 VDC (resistive load), fuse protected (2A, 250V fast fuse)
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz
Power Consumption	15 VA
Over Current Protection	400 mA 250V fast fuse
Max. Oscillation Frequency	4 MHz
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Dimensions	panel cutout: 140 x 140 mm, instrument: 144 x 144 x 170 mm
Weight	1.6 kg (3.5 lb.)
Ordering Information	Each mV 600 model is supplied complete with mounting brackets and instructions. **Choose your configuration** **mV 600111-1** single setpoint, on/off control, analog output, 115V **mV 600111-2** single setpoint, on/off control, analog output, 230V **mV 600121-1** single setpoint, proportional control, analog output, 115V **mV 600121-2** single setpoint, proportional control, analog output, 230V

For complete list of ORP standard and electrode solutions, see section 3

HI700 • HI710

Conductivity and TDS Digital Controllers

with Four-ring Potentiometric Probe

- CAL Check™
  - Alerts users of calibration status
- ATC
  - Automatic temperature compensation
- 2 Point Calibration
  - Up to two point calibration
- Backlight
  - Backlit, LCD display

The HI700 series of controllers offer state of the art specifications for your process control. They can be configured for ON/OFF, proportional, PI or PID control. Thanks to our exclusive technology, they can be customized to best fit your application. Bright LED's show the current status even from a distance. A menu-driven display aids the user throughout the operations with running messages and clear prompts. All relevant parameters can be simply adjusted and will remain memorized until overwritten.

With self-diagnostic features and extractable terminals, installation and maintenance are fast and simple. Password protection guarantees that the calibration and predetermined parameters cannot be altered unnecessarily. The controllers can operate with four-ring probe or 4-20 mA signal. They accept probes with or without a built-in Pt100 temperature sensor. HI710 includes all of the features of the HI700 and adds TDS measurement.

Specifications		HI700	HI710
Range	EC	0.0 to 199.9 µS/cm; 0 to 1999 µS/cm; 0.00 to 19.99 mS/cm; 0.0 to 199.9 mS/cm	0.0 to 199.9 µS/cm; 0 to 1999 µS/cm; 0.00 to 19.99 mS/cm; 0.0 to 199.9 mS/cm
	TDS	–	0.0 to 100.0 mg/L (ppm); 0 to 1000 mg/L (ppm); 0.00 to 10.00 g/L (ppt); 0.0 to 100.0 g/L (ppt)
	Temperature	-10.0 to 100.0°C	-10.0 to 100.0°C
Additional Specifications	Resolution	**EC:** 0.1 µS; 1 µS; 0.01 mS; 0.1 mS; 0.1 °C –	**EC:** 0.1 µS; 1 µS; 0.01 mS; 0.1 mS; 0.1 °C **TDS:** 0.1 ppm; 1 ppm; 0.01 g/L (ppt); 0.1 g/L (ppt)
	TDS Conversion Factor	–	adjustable from 0.00 to 1.00
	Accuracy (@25°C/77°F)	±0.5% f.s. (EC / TDS); ±0.5°C (0 to 70°C); ±1°C (outside)	
	EC Calibration	automatic or manual at 1 point	
	Temperature Compensation	automatic or manual, -10 to 100°C with adjustable temperature coefficient from 0.00 to 10.00%/°C	
	Outputs	analog: isolated 0-1 mA, 0-20 mA and 4-20 mA; 0-5 VDC, 1-5 VDC and 0-10 VDC or digital: RS485 bi-directional opto-isolated	
	Analog Input	4-20 mA	
	Set Point Relay	two contact outputs SPDT 5A-250 VAC, 5A-30 VDC (resistive load), fuse protected (2A, 250V fast fuse)	
	Alarm Relay	contact output SPDT 5A-250 VAC, 5A-30 VDC (resistive load), fuse protected (2A, 250V fast fuse	
	Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz	
	Power Consumption	15 VA	
	Over Current Protection	400 mA 250V fast fuse	
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
	Dimensions	panel cutout: 140 x 140 mm, instrument: 144 x 144 x 170 mm	
	Weight	1.6 kg (3.5 lb.)	

Ordering Information

Each HI700 and HI710 model is supplied with mounting brackets and instructions.

Choose your configuration

HI700221-1	dual setpoint, on/off and PID controls, analog output, 115V
HI700221-2	dual setpoint, on/off and PID controls, analog output, 230V
HI710221-1	dual setpoint, on/off and PID controls, analog output, 115V
HI710221-2	dual setpoint, on/off and PID controls, analog output, 230V
HI710222-1	dual setpoint, on/off and PID controls, RS485 output, 115V
HI710222-2	dual setpoint, on/off and PID controls, RS485 output, 230V

For complete list of EC and TDS solutions, see section 6

Analog Process Controllers

Panel Mounted Controllers

Hanna panel mounted pH, ORP and conductivity controllers are designed to meet your most demanding process control requirements. Our controllers come equipped with a relay operating at a maximum of 2 A (240V). Where a direct electrode input is not suitable, the controller is available with a 4-20 mA input from a transmitter. This feature greatly improves the safety of your instrumentation and plant. Accurate measurements are displayed on a large LCD, enabling the operator to check the controller readings easily. These units have sophisticated, built-in, self-diagnostic functions that allow the operator to check whether a malfunction has originated in the instrument itself, or in the outside connection (electrode, transmitter or cables). This saves valuable time and money, particularly in the monitoring of critical processes. In the event of a malfunction, the operator can determine the origin and rectify the situation before any costly errors occur. This Self-Diagnostic Error Prevention System makes these process instruments superior to conventional controllers.

Alarm Feature

Hanna controllers incorporate an alarm warning system. When the measured value of the meter is out of the user-specified range, the alarm is activated. When activated, the alarm contacts close, triggering the mechanism of your choice, whether a buzzer, light or any other electrical connection. The alarm feature is a necessity when the installation is in a remote location and corrective action must be taken immediately in the event of an out of range condition.

Recorder Output

The ability to record data from the process you are monitoring greatly enhances process troubleshooting. By simply connecting a recorder to the controller's output terminals (choose between 0 to 20 mA or 4 to 20 mA according to your needs), users are able to acquire a hard copy for demonstrative or analytical purposes.

Low or High Impedance Input and Analog Inputs

Hanna pH and ORP controllers come in two different models to meet user requirements. These models, have a high impedance 10^{12} Ohm direct input from an electrode, ideal for connections with a distance of up to 10 m (33'). However, if the distance is greater than 10 m (33') then a 4 to 20 mA transmitter should be used. The greater the distance between the controller and the sample, the greater the chance you have of line noise causing erroneous readings. Using a transmitter greatly enhances the input signal, thus allowing high accuracy at distances of up to 300 m (1000').

Consent Feature

The consent contact allows you to be sure that the ORP dosing occurs only when the pH value is correct. This assures that the pH is within a specified range before any dosing of oxidizing or reducing agents occurs. This will prevent any overdosing of chemicals, a very important cost-effective feature in many applications, especially in pools, spas and hot tubs.

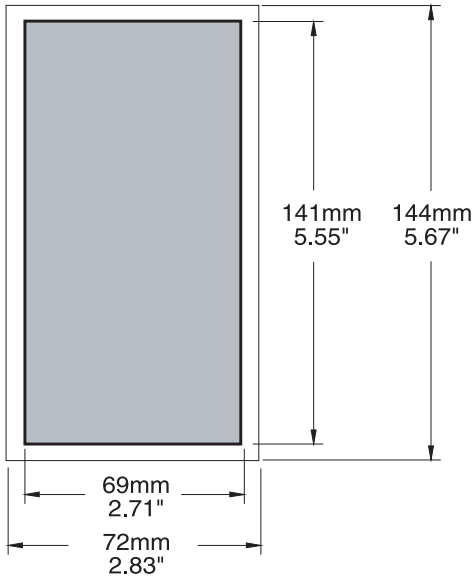
Quality Construction

The controllers are housed in sturdy aluminum casings with ABS plastic front panels. The mounting brackets that are supplied with the meter, can be installed securely and quickly. When in operation, and with the transparent protective cover installed, the units comply with IP42 standards (see chart in section 20 for IP codes). The use of this design protects the unit from the conditions associated with industrial environments, ensuring a long and trouble-free operation.

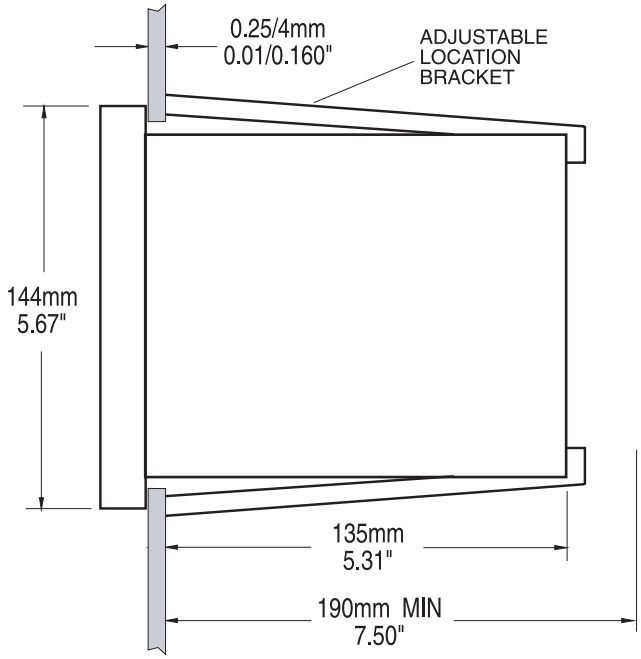
LED Indicators

The LEDs on the front panel light up to indicate the current operational mode. The LEDs also blink at different rates to indicate multiple modes occurring simultaneously. This feature allows the user to evaluate the controller from a distance and clearly read which mode it is in.

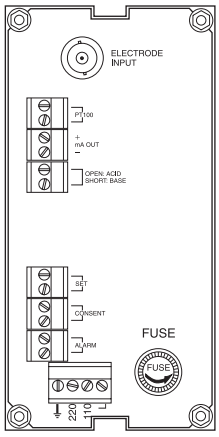
Analog Indicators and Controllers
HI8510 / HI8710 / HI8711 / HI8720 /
HI8931A / HI8931B / HI8931C / HI8931D / HI943500



Front View
Dimensions show the cutout size for installation and also the outside dimensions of the instrument panel.



Side View
Adjustable location brackets allow the instrument to slide into the cutout and will hold the unit securely in place. 190 mm (7.50") is the minimum amount of room required to install the indicator with the cables connected.



Rear View
Rear view of the HI8710 shows the typical electrical connections.

HI8510

pH Analog Indicator

with Self Diagnostic Test

- ATC
  - Automatic temperature compensation Backlight
- Backlit, LCD display

HI8510 is ideal for monitoring pH in process control. It can provide highly accurate pH measurements and display values on the easy to read LCD. BNC input, amplified probe input and input from transmitter are supported.

Designed for easy and fast installation, the HI 8510 is provided with membrane keypads on the front panel, large display, and auto-diagnostic functions to check pH electrode and instrument status. These instruments also provide ±5V power output and input terminals for amplified electrodes.

A removable, transparent splash-proof cover protects the front panel.

Specifications	HI8510	
Range	0.00 to 14.00 pH	
Resolution	0.01 pH	
Accuracy (@25°C/77°F)	±0.02 pH (0 to 100 °C); ±0.05 pH (-20 to 0 °C); ±0.5% (input transmitter)	
Input	high impedance 10^{12} Ohm; reference and matching pin inputs are available; 4-20 mA	
Power Output	±5 Vcc; 150 mA max load for amplified electrodes	
Calibration	offset: ±2 pH with OFFSET trimmer; slope: 80 to 110% with SLOPE trimmer	
Temperature Compensation	fixed or automatic with Pt100, from -20 to 100°C (-4 to 212°F)	
Recorder Output	0-20 mA or 4-20 mA (isolated)	
Backlight	continuous on	
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz	
Enclosure	flame retardant ABS body and front panel; transparent splash-proof front cover	
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing	
Panel Cutout	141 x 69 mm (5.6 x 2.7")	
Weight	1 kg (2.2 lb.)	
Ordering Information	The **HI8510** is supplied complete with mounting brackets and instructions.	
Accessories	**HI8427**	pH / ORP electrode simulator
	HI931001	pH / ORP electrode simulator with display
	HI8614N	pH transmitter
	HI8614LN	pH transmitter with display

For complete list of pH calibration and electrode solutions, see section 3

HI8710

pH Analog Controller

with Self-Diagnostic Test

- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation
- Backlight
  - Backlit, LCD display

HI8710 is a panel mounted pH controller with self-diagnostic test capabilities. Users can set: the setpoint for acid or alkaline dosage, the tolerance of the setpoint before an alarm is activated, the dosage mode: automatic, continuous on or OFF and the over dosage control by setting the overtime dosage knob.

When used in conjunction with the HI8720 ORP controller, the ODCD* function will ensure that the ORP dosage will start only when the pH level is correct.

"Overtime dosage" function with selection knob and jumper for disable on the rear panel. If the dosing relay remains continuously activated for more than selected dosing time the alarm relay is activated, the alarm LED is blinking and the dosing relay is deactivated.

A removable, transparent splash-proof cover protects the front panel.

* ORP dosing consent device

Specifications	HI8710	
Range	0.00 to 14.00 pH	
Resolution	0.01 pH	
Accuracy (@25°C/77°F)	±0.02 pH (0 to 100 °C); ±0.05 pH (-20 to 0 °C); ±0.5% (input from transmitter)	
Input	high impedance 10^{12} Ohm; reference and matching pin inputs are available 4-20 mA	
Power Output	±5 Vcc; 150 mA max load for amplified electrodes	
Calibration	offset: ±2 pH with OFFSET trimmer; slope: 80 to 110% with SLOPE trimmer	
Temperature Compensation	fixed or automatic with Pt100, from -20 to 100°C (-4 to 212°F)	
Recorder Output	0-20 mA or 4-20 mA (isolated)	
Set Point Relay	1, isolated, 2 A, max 240 V, resistive load, 1000000 strokes (not fuse protected)	
Set Point Range	0.00 to 14.00 pH	
Alarm Relay	1, isolated, 2 A, max 240 V, resistive load, 1000000 strokes (not fuse protected)	
Alarm Range	0.2 to 3.00 pH	
Consent Relay	1, isolated, 2 A, max 240 V, resistive load, 1000000 strokes (not fuse protected)	
Dosing Control	OFF/AUTO/ON with selection switch	
Over Dosing Control	adjustable, from 5 min to 60 min with knob or disable by wire strap - on rear panel	
Backlight	continuous on	
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz	
Enclosure	flame retardant ABS body and front panel; transparent splash-proof front cover	
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing	
Panel Cutout	141 x 69 mm (5.6 x 2.7")	
Weight	1 kg (2.2 lb.)	
Ordering Information	The **HI8710** is supplied complete with mounting brackets and instructions.	
Accessories	**HI8427**	pH / ORP electrode simulator
	HI931001	pH / ORP electrode simulator with display
	HI8614N	pH transmitter
	HI8614LN	pH transmitter with display

For complete list of pH calibration and electrode solutions, see section 3

HI8711

pH Analog Controller

with Dual Output and Self-Diagnostic Test

- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation
- Backlight
  - Backlit, LCD display

HI8711 allows the selection of two set points with two independent outputs for acid and alkaline dosages.

Each model accepts either a direct input from a pH or ORP electrode or from a transmitter through 4-20 mA input. The instrument also provides ±5V power output and input terminals for amplified electrodes. In addition, you can choose the output configuration for connecting a recorder or a PLC, between 0-20 or 4-20 mA.

The HI8711 incorporates adjustable overtime dosing protection from 5 to 60 minutes. If dosing exceeds selected time, the alarm will be triggered and the dosing contact will deactivate. This feature can be activated or deactivated.

A removable, transparent splash-proof cover protects the front panel.

Specifications	**HI8711**	
Range	0.00 to 14.00 pH	
Resolution	0.01 pH	
Accuracy (@25°C/77°F)	±0.02 pH (0 to 100 °C); ±0.05 pH (-20 to 0 °C); ±0.5% (input from transmitter)	
Input	high impedance 10^{12} Ohm; reference and matching pin inputs are available; 4-20 mA	
Power Output	±5 Vcc; 150 mA max load for amplified electrodes	
Calibration	offset: ±2 pH with OFFSET trimmer; slope: 80 to 110% with SLOPE trimmer	
Temperature Compensation	fixed or automatic with Pt100, from -20 to 100°C (-4 to 212°F)	
Recorder Output	0-20 mA or 4-20 mA (isolated)	
Set Point Relay	2, isolated, 2 A, max 240 V, resistive load, 1000000 strokes (not fuse protected)	
Set Point Range	alk. set: from 0.00 to 14.00 pH; acid set: from 0.00 to 14.00 pH	
Alarm Relay	1, isolated, 2 A, max 240 V, resistive load, 1000000 strokes (not fuse protected)	
Alarm Range	0.2 to 3.00 pH	
Dosing Control	OFF/AUTO/ON with selection switch	
Over Dosing Control	adjustable, from 5 min to 60 min with knob or disable by wire strap - on rear panel	
Backlight	continuous on	
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz	
Enclosure	flame retardant ABS body and front panel; transparent splash-proof front cover	
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing	
Panel Cutout	141 x 69 mm (5.6 x 2.7")	
Weight	1 kg (2.2 lb.)	
Ordering Information	The **HI8711** is supplied complete with mounting brackets and instructions.	
Accessories	**HI8427**	pH / ORP electrode simulator
	HI931001	pH / ORP electrode simulator with display
	HI8614N	pH transmitter
	HI8614LN	pH transmitter with display

For complete list of pH calibration and electrode solutions, see section 3

HI8720

ORP Analog Controller

with Self-Diagnostic Test

- Backlight
  - Backlit, LCD display

This instrument allows the selection of a set point for oxidizing or reducing dosage.

When used in conjunction with the HI8710 pH controller, the ODCD (ORP dosing consent device) function (featured by the HI8710) will ensure that the ORP dosage will start only when the pH level is correct.

These instruments have been designed for easy and fast installation and are provided with membrane keypads on the front panel, large display, and autodiagnostic functions.

Each model accepts either a direct input from an ORP electrode or from a transmitter through 4-20 mA input. The instrument also provides ±5V power output and input terminals for amplified electrodes.

Moreover, you can choose the output configuration for connecting a recorder or a PLC, between 0-20 or 4-20 mA.

A removable, transparent splash-proof cover protects the front panel.

Specifications	HI8720	
Range	±1999 mV	
Resolution	1 mV	
Accuracy (@25°C/77°F)	±5 mV; ±0.5% (input from transmitter)	
Input	high impedance 10^{12} Ohm; reference and matching pin inputs are available; 4-20 mA	
Power Output	±5 Vcc; 150 mA max load for amplified electrodes	
Calibration	offset: ±200 mV with CAL trimmer;	
Recorder Output	0-20 mA or 4-20 mA (isolated)	
Set Point Relay	1, isolated, 2 A, max 240 V, resistive load, 1000000 strokes (not fuse protected)	
Set Point Range	±1999 mV	
Alarm Relay	1, isolated, 2 A, max 240 V, resistive load, 1000000 strokes (not fuse protected)	
Alarm Range	10 to 300 mV	
Dosing Control	OFF/AUTO/ON with selection switch	
Over Dosing Control	adjustable, from 5 min to 60 min with knob or disable by wire strap - on rear panel	
Backlight	continuous on	
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz	
Enclosure	flame retardant ABS body and front panel; transparent splash-proof front cover	
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing	
Panel Cutout	141 x 69 mm (5.6 x 2.7")	
Weight	1 kg (2.2 lb.)	
Ordering Information	The **HI8720** is supplied complete with mounting brackets and instructions.	
Accessories	**HI8427**	pH / ORP electrode simulator
	HI8615N	ORP transmitter
	HI8615LN	ORP transmitter with display

For complete list of ORP Standards , see section 3

HI8931AN • HI8931BN
HI8931CN • HI8931DN

EC Analog Controller

with Input from Probe or Transmitter

- ATC
  - Automatic temperature compensation
- Backlight
  - Backlit, LCD display

HI8931 is a panel mounted conductivity controller designed for simplicity of use. For in-line applications, use the HI7635 probe, while for tanks the HI7638 with external threads is recommended. These probes are provided with a built-in NTC sensor for temperature compensated conductivity measurements.

HI8931 also features a direct connection up to 20 m (67'), without needing to amplify the signal to the conductivity probe.

Using the HI8931 in conjunction with a 4-20 mA output transmitter (HI8936 or HI8936L series) will assure a strong, interference free signal at distances up to 300 meters (1000').

A removable, transparent splash-proof cover protects the front panel.

Specifications	HI8931AN	HI8931BN	HI8931CN	HI8931DN
Range	0.0 to 199.9 mS/cm	0.00 to 19.99 mS/cm	0 to 1999 µS/cm	0.0 to 199.9 µS/cm
Resolution	0.1 mS/cm	0.01 mS/cm	1 µS/cm	0.1 µS/cm
Accuracy (@25°C/77°F)	±2% F.S. (excluding probe error)	±2% F.S. (excluding probe error)	±2% F.S. (excluding probe error)	±2% F.S. (excluding probe error)
Input from Transmitter	HI8936A / AL	HI8936B / BL	HI8936C / CL	HI8936D / DL
Set Point Range	0.0 to 199.9 mS/cm	0.00 to 19.99 mS/cm	0 to 1999 µS/cm	0.0 to 199.9 µS/cm
Alarm Range	0.0 mS and 100.0 mS	0.00 mS and 10.00 mS	0 µS and 1000 µS	0.0 µS and 100.0 µS
Temp. Compensation	automatic, 0 to 60°C with β=2%/°C; see also transmitter HI8936			
Inputs	DIN (probe) or 4-20 mA (transmitter)			
Conductivity Probe	HI7635 for in-line applications or HI3001D for flow-thru (not included)			
Calibration	manual, two point, through offset and slope trimmers			
Recorder Output	0 to 20 mA or 4 to 20 mA (isolated)			
Set Point and Alarm Relay	1, Isolated, 2A, max. 240V, resistive load, 1,000,000 strokes			
Dosing Control	OFF/AUTO/ON with selection switch			
Over Dosing Control	adjustable, from 5 min to 60 min with knob or disable by wire strap - on rear panel			
Backlight	continuous on			
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz			
Enclosure	flame retardant ABS body and front panel; transparent splash-proof front cover			
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing			
Panel Cutout	141 x 69 mm (5.6 x 2.7")			
Weight	1 kg (2.2 lbs.)			
Ordering Information	The **HI8931** series is supplied with mounting brackets and instructions.			

For complete list of EC solutions, see section 6

HI943500A, HI943500B
HI943500C, HI943500D

EC Analog Controller

with Direct Input from Potentiometric Probe

- ATC
  - Automatic temperature compensation
- Backlight
  - Backlit, LCD display

These controllers allow direct connection of a potentiometric conductivity probe (HI7638) with a cable up to 20 m long, without needing a transmitter to amplify the signal.

The output configuration for connecting a recorder or a PLC can be chosen between 0-20 or 4-20 mA.

The LED on the front panel indicates the operating status of the controller.

The Automatic Temperature Compensation (ATC) is performed directly by the HI7638 probe with built-in temperature sensor.

A removable, transparent splash-proof cover protects the front panel.

Specifications	HI943500A	HI943500B	HI943500C	HI943500D
Range	0.0 to 199.9 mS/cm	0.00 to 19.99 mS/cm	0 to 1999 µS/cm	0.0 to 199.9 µS/cm
Resolution	0.1 mS/cm	0.01 mS/cm	1 µS/cm	0.1 µS/cm
Accuracy (@25°C/77°F)	±2% F.S.			
Calibration	manual, two point, through offset and slope trimmers			
Temperature Compensation	automatic, 0 to 60°C (32 to 140°F), with β=2%/°C			
Recorder Output	4-20 mA (isolated)			
Set Point Relay	1, isolated, 2A, max. 240 V, resistive load, 1,000,000 strokes			
Alarm Relay	1, isolated, 2A, max. 240 V, resistive load, 1,000,000 strokes			
Power Supply	115 or 230 VAC ±10% (user selectable); 50/60 Hz			
Enclosure	black anodized aluminum body; front panel with flame retardant ABS; transparent splash-proof front cover			
Environment	-10 to 50°C (14 to 122°F); RH max 95%			
Panel Cutout	141 x 69 mm (5.6 x 2.7")			
Weight	1 kg (2.2 lb.)			
Ordering Information	The **HI943500** series is supplied complete with mounting brackets and instructions.			
Probes	**HI7638**	PEI/glass body, 75 mm conductivity probe with internal temperature sensor and 3/8" NPT thread (immersion)		
	HI3001	PEI/PVDF body, 20 mm conductivity probe with internal temperature sensor, 1/2" NPT front thread (flow-thru) and 3/4" NPT back thread (submersion/pipe) mounting and 3 m (9.9') cable		
	HI3002	PEI/PVDF body, 60 mm conductivity probe with internal temperature sensor, 1/2" NPT front thread (flow-thru) and 3/4" NPT back thread (submersion/pipe) mounting and 3 m (9.9') cable		

For complete list of EC solutions, see section 6

HI8410

Dissolved Oxygen Controller

with Extended Range and Analog Output

- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation

The HI8410 is a panel mounted dissolved oxygen controller that is used to maintain and monitor the concentration of DO in a wide range of industrial process applications. The HI8410 uses a Galvanic probe that typically requires less maintenance than a Polarographic style making it ideal for long term monitoring.

The set point for controlling the activation of a relay is adjusted manually by the user. An alarm relay is also manually adjustable and is based upon a tolerance from the programmed setpoint. This controller features single set point calibration in zero oxygen solution.

The dosage mode: automatic, continuous ON or OFF and over dosage control by setting the overtime dosage trimmer. If the dosing relay remains continuously activated for more than the selected dosing time, the alarm relay is activated, the alarm LED will start blinking and the dosing relay will be deactivated. A jumper located on the controller's rear panel can disable the "over time dosage" function.

"Automatic/Off/manual" dosing selection switch and LED on the front panel. In Automatic mode all the relays are controlled based on the measurement set point and alarm values. In OFF mode the dosing and alarm relays are always deactivated. The dosing LED is OFF (as relay status) and the ALARM LED is in accordance with the instrument set point, input reading, and ALARM. In ON (Manual) mode the dosing relay is always on. The alarm relay is still enabled. If an alarm occurs the dosing relay remains activated. If the over dose time exceeds the setting during manual mode, the alarm relay remains activated.

The D.O. probe is provided with a membrane covering the galvanic sensor and a built-in thermistor for temperature measurement and compensation.

Specifications	HI8410	
Range	0.0 to 50.0 mg/L (ppm) O_2; 0 to 600 % O_2; -5.0 to 50.0°C	
Resolution	0.1 mg/L (ppm) or 1% (O_2) / 0.1°C	
Accuracy (@25°C/77°F)	±1% of reading (O_2) / ±0.2°C	
Calibration	manual, one point, in saturated air	
Temp. Compensation	automatic, from -5 to 50°C (23 to 122 °F)	
Salinity Compensation	0 to 51 g/L (resolution 1 g/L)	
Probe (not included)	HI76410/4 with 4 m (13.1') cable or HI76410/10 with 10 m (32.8') cable	
Recorder Output	0 to 20 mA or 4 to 20 mA (isolated)	
Set point and Alarm Relay	1, isolated, 2A, max. 240V, resistive load, 1,000,000 strokes	
Set point Range	1 to 600 % O2; 0.1to 50.0 mg/L (mg/L (ppm) O_2	
Alarm Range	1.0 to 5.0 mg/L (ppm) O_2	
Hysteresis Range	0.5 to 2.4 mg/L (ppm) O_2	
Dosing Control	OFF/AUTO/ON with selection switch	
Over Dosing Control	adjustable, from 5 min to 60 min with knob or disable by wire strap - on rear panel	
Backlight	continuous on	
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz	
Enclosure	flame retardant ABS body and front panel; transparent splash-proof front cover	
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-conndensing	
Panel Cutout	141 x 69 mm (5.6 x 2.7")	
Weight	1 kg (2.2 lb.)	
Ordering Information	The **HI8410** is supplied complete with mounting brackets and instructions.	
Probes	**HI76410/4**	Galvanic DO probe (fixed) with internal temperature sensor, DIN connector and 4 m (13.1') cable
	HI76410/10	Galvanic DO probe (fixed) with internal temperature sensor, DINconnector and 10 m (32.8') cable

For complete list of DO solutions, see section 7

MEADOS pH and ORP Measuring and Dosing System

Black Stone by Hanna

Two Advanced Instruments in One

MEADOS pumps combine the powerful Blackstone dosing pumps with Hanna pH/ORP controllers. This latest innovation eliminates the need for multiple units by combining a pH controller and chemical feed pump into one. No more complicated installations, wiring and compatibility problems. This compact unit features accurate regulation, proportional dosing, alarm and recorder signals and much more, all in one meter.

Easy Installation

Designed with mounting holes built into a rugged base, Blackstone pump/controllers are simple to install. They use a standard pH probe with a BNC connector to eliminate the need for any additional hardware. All of the controls and pump assemblies are conveniently located on the front of the unit. There is no need to uninstall the unit to access the pump head or control panel.

Rugged Construction

Blackstone pump/controllers are housed in rugged, fiber-reinforced polypropylene IP55 rated casings to prevent the ingress of liquids. The material used for the housing resists corrosion caused by most chemicals, protecting the unit from hazardous spills and splashes.

Superior Materials

Blackstone pumps use PVDF, FPM/FKM and PTFE materials for all components in contact with the chemicals being dosed. These materials have properties which enable them to resist even the most corrosive chemicals in the industry. The chemical resistance chart on page 17.54 shows how well PVDF, FPM/FKM and PTFE resist the harmful effects of different products.

Simple Pump Action

A positive displacement solenoid with few moving parts makes Blackstone pumps more reliable than motor driven pumps since there is no rotating parts, gears or cams; drastically reducing any chance of mechanical failure.

Proportional Dosing

The Blackstone controller/pump strokes at full capacity when the measured value deviates by more than 1.5 pH or 150 mV from the set value. A proportional control slows down the stroke rate as the measured value approaches the user selectable set points, avoiding overdosage of chemicals. This feature makes the pump's dosing more accurate, saves chemicals and eliminates unnecessary and costly corrections to your process, especially with slow reacting chemicals.

Isolated Recorder Output

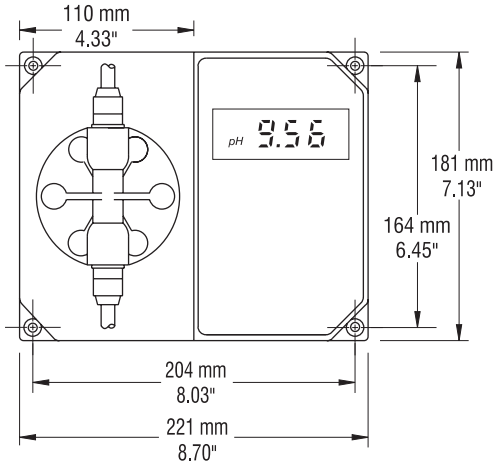
To enhance troubleshooting and the ability to record data while monitoring, Blackstone controller/pumps provide a recorder output. By simply attaching a recording device to the instrument's 4 to 20 mA output contacts, conveniently located on the front panel, you can obtain a hard copy of the results on demand.

Alarm Output

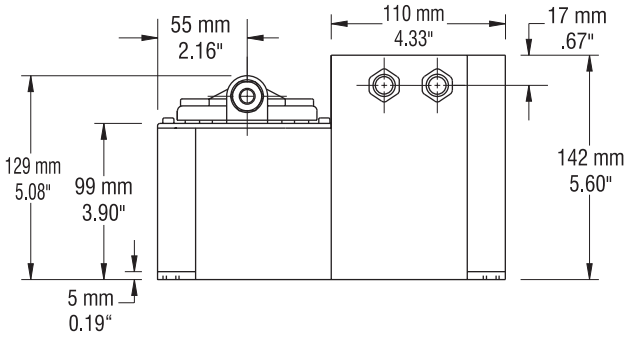
When monitoring and controlling pH and ORP levels in a process, it is very important that any potential problem does not go unattended. The Hanna MEADOS units incorporate an alarm system that will alert the user if the reaction is not within certain guidelines. The alarm of the BL7916 will be activated if the measured pH value is 2 pH units lower than the set point (if dosing acid, this indicates overdosage, a common symptom of siphoning). The alarm will also activate if the value is 2 pH higher than the set point (if dosing acid, this is an indication of insufficient dosage, a common symptom of the lack of chemicals). The BL7917's alarm will activate if the mV value is 200 mV lower than the set point (if dosing reducing chemicals, this indicates overdosage). The alarm will also activate if the value is 200 mV higher than the set point (if dosing reducing chemicals, this is an indication of lack of chemicals).

Auxiliary Dosing Contacts

The auxiliary dosing contacts of the MEADOS units are closed whenever the pump is dosing. This solution offers considerable advantages, especially for small plants, where these pumps need to be the only equipment left running. This will spare other equipment such as mixers, priming pumps etc. With this feature activated, a mixer can be automatically started, when the pump is dosing.



Front View
This series of instruments will mount easily in your plant using a minimum of wall space. The controls and pump head are located in the front to allow easy access.



Bottom View
The controller/pump series of instruments are enclosed in a modular housing for maximum protection. These illustrations show the layout of the controller/pumps and how they utilize the one-piece polypropylene, injection-molded housing for rigidity.

Black Stone

BL7916

pH Controller and Pump

- pH controller and dosing pump
- ±0.01 pH accuracy
- Isolated 4 to 20 mA recorder output.
- Proportional dosing
  - Slows the pump down when the measured pH level approaches the set value, which ensures precise dosage and avoids costly waste of chemicals due to overdosage.
- Alarm contact
  - Activated whenever the pH value varies more than 2 pH units from the set point.
- Auxiliary contacts
  - Allow the user to attach a mixer or priming pump that is activated only when the pump is dosing.
- PVDF, FPM/FKM and PTFE materials
  - Used for all parts that come into contact with liquid.

Specifications	BL7916
Range	0.00 to 14.00 pH
Resolution	0.01 pH
Accuracy (@25°C/77°F)	±0.01 pH
Flow Rate	see table
Input Impedance	10^{12} Ohm
Dosage	proportional, acid or base, user selectable
Dosing Contact	1 isolated, 2A, max. 240V, resistive load, 1,000,000 strokes
Alarm Contact	1 isolated, 2A, max. 240V, resistive load, 1,000,000 strokes
Calibration	offset: ±1 pH with trimmer; slope: 85 to 115% with trimmer
Recorder Output	4-20 mA (isolated)
Power Supply	BL 7916-1: 115V ±15%; 50/60Hz (40W); BL 7916-2: 230V ±15%; 50/60Hz (40W)
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Dimensions	221 x 142 x 181 mm (8.7 x 5.6 x 7.1")
Weight	5 kg (11 lb.)
Ordering Information	**BL7916-1** is supplied with discharge and suction valves, polyethylene tubing, 115V power cable and instructions **BL7916-2** is supplied with discharge and suction valves, polyethylene tubing, 230V power cable and instructions

BL7916 PRESSURE/FLOW

BAR (PSI)	LPH (GPH)
0.5 (7.4)	13.3 (3.46)
1.0 (14.7)	11.7 (3.04)
2.0 (29.4)	10.1 (2.63)
3.0 (44.1)	9.0 (2.33)
4.0 (58.8)	7.8 (2.03)

For complete list of pH calibration and electrode solutions, see section 3

BL7917

ORP Controller and Pump

Black Stone by Hanna

- ORP controller and dosing pumps
- ±5 mV accuracy
- Isolated 4 to 20 mA recorder output.
- Proportional dosing
  - Slows the pump down when the measured ORP level approaches the set value, to avoid over dosage of oxidizing or reducing agents.
- Alarm contact
  - Is activated whenever the ORP reading varies more than 200 mV from the setpoint.
- Auxiliary contacts
  - Allow users to attach a mixer or priming pump that is activated only when the pump is dosing
- PVDF, FPM/FKM and PTFE materials
  - are used for all parts that come into contact with liquid.

Specifications	BL7917
Range	-999 mV to +999 mV
Resolution	1 mV
Accuracy (@20°C/68°F)	±5 mV
Flow Rate	see table
Input Impedance	10^{12} Ohm
Dosage	proportional, oxidizing or reducing, user selectable
Dosing Contact	1 isolated, 2A, max. 240V, resistive load, 1,000,000 strokes
Alarm Contact	1 isolated, 2A, max. 240V, resistive load, 1,000,000 strokes
Recorder Output	4-20 mA (isolated)
Power Supply	BL 7917-1: 115V ±15%; 50/60Hz (40W) BL 7917-2: 230V ±15%; 50/60Hz (40W)
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Dimensions	221 x 142 x 181 mm (8.7 x 5.6 x 7.1")
Weight	5 kg (11 lb.)
Ordering Information	**BL7917-1** is supplied with discharge and suction valves, polyethylene tubing, 115V power cable and instructions. **BL7917-2** is supplied with discharge and suction valves, polyethylene tubing, 230V power cable and instructions.

BL7917 PRESSURE/FLOW

BAR (PSI)	LPH (GPH)
0.5 (7.4)	13.3 (3.46)
1.0 (14.7)	11.7 (3.04)
2.0 (29.4)	10.1 (2.63)
3.0 (44.1)	9.0 (2.33)
4.0 (58.8)	7.8 (2.03)

For complete list of ORP standards, see section 3

Wall-Mounted Process Controllers

Reliable, High Performance Wall Mounted Controllers

Hanna wall mounted pH, ORP, and conductivity controllers are specifically designed to meet your process control requirements. The controllers come equipped with power relays operating at a maximum of 2A (240V). Electrodes can be installed quickly and easily. Simply plug the universal BNC or DIN connector over the socket and twist it into a secured position. This feature greatly improves the reliability of your instrumentation by assuring a positive connection. Accurate measurements are displayed on a large LCD, enabling the operator to check the controller readings easily.

Alarm Feature

The Hanna wall mounted series of controllers incorporate a triple contact alarm system that allows the user to select whether the alarm contacts will be in a normally open or normally closed position. When the measured value of the meter is out of range, the alarm is activated. The alarm will also be activated if the unit loses power. When activated, the alarm contacts will open or close, triggering the mechanism of your choice, whether a buzzer, light or any other electrical device. The alarm is a necessity when the installation is in a remote location and corrective action must be taken immediately in the event of an out of range condition.

Isolated Recorder Output

The ability to record the data from the process you are monitoring greatly enhances process troubleshooting. By simply connecting a recorder to the controller's output terminals you are able to acquire a hard copy of the readings for demonstrative or analytical purposes. The recorder output terminals are isolated from the controller circuitry to avoid any interference and are user switchable between 0 to 20 mA or 4 to 20 mA.

High Impedance Input

The pH and ORP controllers come with high impedance 10^{12} Ω direct input from the electrode, ideal for applications with distances of up to 10 m (33'). The greater the distance between the controller and the sample, the greater the chance that line noise will occur, causing faulty readings. Use an AmpHel® pH electrode (available also with external battery) to greatly enhance the input signal allowing high accuracy at distances of up to 50 m (165').

Quality Construction

These controllers are housed in a rugged, modular, fiber-reinforced polypropylene housing. Polypropylene has properties that will resist the harmful effects of most chemicals. When in operation, and with the transparent protective cover installed, the units comply with the IP54 standards. The modular design isolates the controller circuitry from all contacts, assuring that there is no noise interference. The use of this rugged design protects the unit from the tough conditions associated with industrial environments, ensuring long periods of trouble-free operation.

HI2X Advanced Controllers

This line of industrial microprocessor controllers offers a wide range of features and functions such as single and dual set points, ON/OFF, proportional and PID control, relay outputs, bi-directional isolated RS485, isolated recorder outputs in mAmps and volts, differential input, control through analog output and Fail Safe features.

The large, dual-level LCD shows both primary measurement and temperature and guides operators through calibration and programming with step-by-step prompts. The choice of ON/OFF, proportional and PID control provides extra versatility and makes it possible to pick the process controller that best fits your application. Keeping track of multiple controllers in different plants is made easy. These advanced controllers can be identified with both a factory and process ID.

Save Money with Custom Programs

HI2X help to prevent overdosing or costly system failures. You can set your high and low set point hysteresis bands independently to fine tune dosing processes with the ON/OFF controllers. Similarly, the proportional band and time period are user-programmable to save on slow reacting chemicals which are commonly overdosed.

All models offer an adjustable overdosing timer from 10 minutes to 7 days as the maximum time that the relay contacts may remain closed. An important feature in case of sudden chemical depletion, truncated intake or discharge tubing and other calamities.

Fail Safe Protection

The Fail Safe Alarms protect processes against critical errors arising from power interruptions, surges and human errors. The sophisticated yet easy to use system resolves these problems on two fronts: hardware and software. To eliminate blackout and line failure problems, the alarm function operates in a "normally closed" state and goes off if the wires are accidentally tripped, or when the power is down. This is an important feature since with most meters the alarm terminals close in abnormal situations, but no alarm is sounded with a line interruption, causing extensive damage. With our controllers, software is employed to set off the alarm in abnormal circumstances, for example, if the dosing terminals are closed too long a red LED will provide a visual warning signal.

Differential Input (Matching Pin)

All Hanna controllers in this family come with a differential input to prevent problems due to ground loop current. With this new feature, the life of the electrodes will be greatly extended.

Password Protection

The Hanna password protection feature keeps these controllers safe from tampering. Only users with the proper password can change the settings of these controllers.

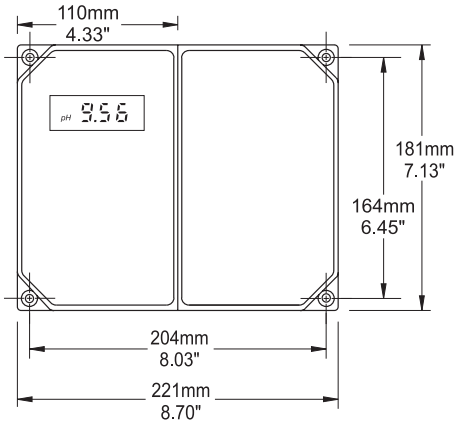
Simple Installation

These wall mounted controllers have mounting holes molded into the housing to assure simple, quick and secure installation without the need for additional hardware. Once all electrical connections are made, the protective cover can be installed over the front panel, making it possible to perform all adjustments without disassembling any part of the unit. Temperature probes can also be installed. Pumps to be used in conjunction with the controller simply plug into the controller's input and will be powered up through the unit's internal power supply.

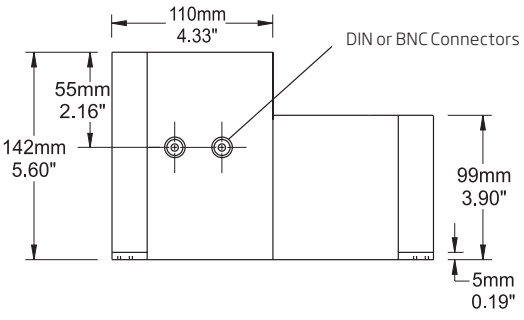
Mechanical Dimensions

The modular design isolates electrical connections in a closed compartment, while the control settings are accessible and can be made through the adjacent compartment.

Front View



Bottom View



HI21

Industrial Grade pH Digital Controllers

Wall Mounted with Matching Pin

- CAL Check™
  - Alerts users of calibration status
- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation
- 3 Point Calibration
  - Up to three point calibration at

The HI21 controllers are simple to operate, microprocessor-based pH process controllers packed with features. With HI21 quick one, two or three point calibration at pH 4.01, 7.01 and 10.01 comes standard and you can choose from ON/OFF, proportional and PID control to save on chemicals. These instruments have a differential input, extending electrode life by eliminating ground loop current through the reference.

Password protection prevents unauthorized modifications in settings or calibration. The Fail Safe Alarm System protects the HI21 against the pitfalls of process control, like power interruption or line failure.

Extractable terminal modules make wiring simple. A host of self-testing features and user-friendly functions make the HI21 a great value.

For more flexibility and better resolution for chart recorders, any two points between 0 and 14 pH can be chosen to correspond to the analog output spans. HI21 models are equipped with a bi-directional RS485 port, which allows remote control of the instrument from a PC.

Specifications	HI21
Range	0.00 to 14.00 pH; -9.9 to 120°C
Resolution	0.01 pH; 0.1°C
Accuracy	±0.02 pH; ±0.5°C
Input Impedance	10^{12} Ohm
pH Calibration	automatic, one, two or three point, at pH 4.01, 7.01, 10.01
Temperature Compensation	automatic (with Pt100 probe) or manual from -9.9 to 120°C
Analog Output	0 to 1 mA, 0 to 20 mA, 4 to 20 mA; 0 to 5 VDC, 1 to 5 VDC, 0 to 10 VDC
Digital Output	RS485
Relays 1 and 2	electromechanical relay SPDT contact outputs, 5A-250 VAC, 5A - 30 VDC (resistive load) (HI211YZ and HI212YZ), fuse protected: 5A, 250V fast fuse
Alarm Relay	electromechanical relay SPDT contact output, 5A - 250 VAC, 5A - 30 VDC (resistive load) fuse protected: 5A, 250V, 250V fast fuse
Power Supply Input	±5V (for amplified electrodes)
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz
Power Consumption	15 VA
Over Current Protection	400 mA, 250V, fast fuse
Environment	0 to 50°C (32 to 122°F); RH max. 85% non-condensing
Protection	IP 54
Dimensions	221 x 181 x 86 mm (8.7 x 7.1 x 3.4")
Weight	1.4 kg (3.1 lb.)
Ordering Information	Each HI21 model is supplied with instructions. **Choose your configuration** **HI21211-1** dual setpoint, on/off control, analog output, 115V **HI21211-2** dual setpoint, on/off control, analog output, 230V

For complete list of pH calibration and electrode solutions, see section 3

HI22

Industrial Grade ORP Digital Controllers

Wall Mounted with Matching Pin

- CAL Check™
  - Alerts users of calibration status
- Alarm
  - Fail Safe Alarm System
- Connectivity
  - PC compatible

The HI22 has been engineered with the same outstanding quality and features as the HI21 meters.

The Fail Safe Alarm System protects these meters against the pitfall of process control, like power interruption or line failure. User selectable timing capability safeguards against overdosing and saves money while protecting the environment. RS485 capability makes this model PC compatible. The microprocessor memory is fully programmable and has a 3-month backup power supply.

These instruments have a differential input, extending electrode life by eliminating ground loop current through the reference. Users can choose between ON/OFF and proportional control as well as selectable current and voltage outputs. For more flexibility and better resolution for chart recorders, choose any two points between 0 and ±2000 mV to correspond to the analog output spans.

Wiring the controllers is simple with extractable terminal modules. A host of self-testing features and user-friendly functions make HI22 a great value.

Specifications	HI22
Range	±2000 mV; -9.9 to 120°C
Resolution	1 mV; 0.1°C
Accuracy (@25°C/77°F)	±2 mV; ±0.5°C
Input Impedance	10^{12} Ohm
ORP Calibration	automatic, at 0 and 350 or 1900 mV
AnalogOutput	0 to 1 mA, 0 to 20 mA, 4 to 20 mA; 0 to 5 VDC, 1 to 5 VDC, 0 to 10 VDC
Digital Output	RS485
Relays 1 and 2	electromechanical relay SPDT contact outputs, 5A-250 VAC, 5A - 30 VDC (resistive load) (HI221YZ), fuse protected: 5A, 250V fast fuse
Alarm Relay	electromechanical relay SPDT contact output, 5A - 250 VAC, 5A - 30 VDC (resistive load) Fuse protected: 5A, 250V, 250V fast fuse
Power Supply Input	±5V (for amplified electrodes)
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz
Power Consumption	15 VA
Over Current Protection	400 mA, 250V, fast fuse
Environment	0 to 50°C (32 to 122°F); RH max. 85% non-condensing
Protection	IP 54
Dimensions	221 x 181 x 86 mm (8.7 x 7.1 x 3.4")
Weight	1.4 kg (3.1 lb.)
Ordering Information	Each **HI22** model is supplied complete with instructions. **Choose your configuration** **HI22111-1** single setpoint, on/off controls, analog output, 115V **HI22111-2** single setpoint, on/off controls, analog output, 230V

For complete list of ORP standards, see section 3

HI23

Industrial Grade EC Digital Controllers

Wall Mounted with Four-ring Potentiometric Probe

- CAL Check™
  - Alerts users of calibration status
- ATC
  - Automatic temperature compensation

HI23 is a wall mounted, microprocessor conductivity controller that provides very accurate measurements due to the four-ring EC probe and Automatic Temperature Compensation (ATC) feature.

Users can choose among models featuring ON/OFF or PID control, analog input and output, double set point. The relay contacts can drive external devices such as pumps or electrovalves.

The input signal can come from a probe or a 4-20 mA transmitter. Models with the RS485 output option are also available. This option allows the user to insert the controller into a 2-wire RS485 network.

Specifications		HI23
EC	Range	0.0 to 199.9 µS/cm; 0 to 1999 µS/cm; 0.00 to 19.99 mS/cm; 0.0 to 199.9 mS/cm
	Resolution	0.1 µS/cm, 1 µS/cm; 0.01 mS/cm, 0.1 mS/cm
Temperature	Range	-10.0 to 100.0°C
	Resolution	0.1 °C
Additional Specifications	Accuracy	0.5% f.s. (EC); ±0.5 °C (0 to 70°C); ±1 °C (outside)
	Calibration	automatic, 1 point
	Temperature Compensation	automatic or manual from -10 to 100°C with Pt100 probe; β adjustable from 0.00 to 10.00%/°C
	Probe	four-ring conductivity probe with built-in 3-wire Pt100 temperature sensor or conductivity probe + external Pt100 (not included)
	Analog Input	4-20mA
	Analog Output	0-10 VDC, 0-5 VDC or 1-5 VDC; 0-1mA, 0-20 mA or 4-20mA
	RS485 baud rate	1200, 2400, 4800 and 9600
	Relays 1 and 2	electromechanical relay SPDT contact outputs, 5A-250 VAC, 5A - 30 VDC (resistive load) (HI211YZ and HI212YZ), fuse protected: 5A, 250V fast fuse
	Alarm Relay	electromechanical relay SPDT contact output, 5A - 250 VAC, 5A - 30 VDC (resistive load) fuse protected: 5A, 250V, 250V fast fuse
	Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz
	Power Consumption	15 VA
	Over Current Protection	400 mA, 250V, fast fuse
	Environment	0 to 50°C (32 to 122°F); RH max. 85% non-condensing
	Case Material	fiber-reinforced, self-extinguishing ABS
	Protection	IP54
	Dimensions	221 x 181 x 86 mm (8.7 x 7.1 x 3.4")
	Weight	1.6 kg (3.5 lb.)

Ordering Information

Each **HI23** model is provided with dual set point and is supplied complete with instructions.

Choose your configuration

HI23211-1 dual setpoint, on/off control, analog output, 115V

HI23211-2 dual setpoint, on/off control, analog output, 230V

For complete list of EC solutions, see section 6

HI9913

Industrial Grade pH & Conductivity Controller

with Proportional Control of Fertilization

- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation

HI9913 is a 2-in-1 pH and conductivity controller engineered for dosage of fertilizer solutions in hydroponics and agriculture.

HI9913 measures pH from 0 to 14 and EC from 0 to 10 mS/cm. Two separate set points can be user adjusted from 4 to 7 pH and 0 to 6 mS/cm. The relays are activated when pH exceeds the set point or conductivity falls below the desired value. Two pumps or electrovalves can be wired directly to the controller and be powered through the terminal. The operator can adjust two independent proportional settings for pH and conductivity. The time cycle is adjustable from 0 to 90 seconds, while the proportional band is 0 to 2 for both pH and EC. A matching pin/ground probe can be connected to the appropriate terminals to eliminate interference and prolong the pH electrode's life.

HI9913 provides for an alarm relay which is activated in several circumstances. These include when the pH is below the set point by the operator-adjustable threshold of 0.5 to 2.5 pH, or EC exceeds the set point by a value in the 0.5 to 2.5 mS/cm range. The alarm goes off if the pH and/or conductivity are not corrected within the operator-determined time frame of 1 to 10 minutes. The alarm can be turned off during maintenance.

Fertilization status can be ascertained from a distance through dosage and alarm LED's.

HI9913 accepts pH electrodes with BNC and conductivity probes with DIN connectors.

Specifications	HI9913
Range	0.00 to 14.00 pH; 0.00 to 10.00 mS/cm
Resolution	0.01 pH; 0.01 mS/cm
Accuracy (@25°C/77°F)	±0.02 pH; ±2% f.s. EC
Input Impedance	10^{12} Ohm
Calibration	through "OFFSET" and "SLOPE" trimmers for pH, and "ZERO CAL" and "SLOPE CAL" for EC
Set point	from 4.0 to 7.0 pH and 1.0 to 4.0 mS/cm (EC)
EC Temperature Compensation	automatic, 0 to 50°C (32 to 122°F) with β=2%/°C
Proportional Control	two independent controls: pH from 0.0 to 2.0 and conductivity (EC) from 0.0 to 2.0 mS/cm with two separate time cycles from 0 to 90 seconds
Alarm Contact	terminals can be configured as normally open or normally closed (isolated output max. 2A, max. 240V, resistive load, 1,000,000 strokes). The alarm is activated if pH falls below the set point by the user selectable interval (0.0 to 2.0 pH), or conductivity exceeds the set point by more than the user selectable interval (0 to 2.0 mS/cm) or due to overdosage
Dosing Terminals	two sets of independent terminals (115 to 240V, Max.2A, 1,000,000 strokes) are activated whenever pH exceeds the pH set point and/or conductivity falls below the EC set point
Probe	any combination pH electrode with a universal BNC connector and Hanna conductivity four-ring potentiometric probe with built-in temperature sensor and DIN connector (not included)
Power Supply	±10% 115 VAC or 230 VAC ; 50/60 Hz
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing
Case Material	fiber-reinforced, self-extinguishing ABS
Dimensions	221 x 181 x 86 mm (8.7 x 7.1 x 3.4")
Weight	1.6 kg (3.5 lb.)
Ordering Information	**HI9913** is supplied complete with instructions.

For complete list of pH calibration and electrode solutions , see section 3;
for EC solutions, see section 6

HI9935

Industrial Grade pH & TDS Controller

with Proportional Control of Fertilization

- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation

HI9935 is a pH and TDS controller for fertilizer solution dosage in hydroponics.

HI9935 measures pH from 0 to 14 and TDS from 0 to 1999 mg/L (ppm). Two separate set points can be adjusted from 4 to 7 pH and 900 to 1800 ppm (mg/L). The relays are activated when the pH exceeds the set point or TDS falls below the desired value. Two pumps or electrovalves can be wired directly to the controller and be powered through the terminals. Independent proportional settings for pH and TDS can be adjusted from 0 to 90 seconds, 0 to 2.0 for pH and 0 to 400 mg/L (ppm) for TDS. A matching pin/ground probe can be connected to the appropriate terminals to extend electrode life and eliminate interference.

HI9935 provides for an alarm relay which is activated in several circumstances. These include when the pH is below the set points in the operator adjustable threshold of 0.5 to 2.5 pH, or similarly, TDS exceeding the set point by a value in the 50 to 450 mg/L (ppm) range. The alarm also goes off if the pH and/or TDS are not corrected within the operator determined time frame of 1 to 10 minutes. Moreover, the alarm configuration is switchable from a normally-closed to a normally-open state or turned off during maintenance. The fertilization status can be ascertained from a distance through dosage and alarm LED's.

HI9935 accepts pH electrodes with a BNC connector and TDS probes with a DIN connector.

Specifications	HI9935
Range	0.00 to 14.00 pH; 0 to 1999 ppm (mg/L)
Resolution	0.01 pH; 1 ppm (mg/L)
Accuracy (@25°C/77°F)	±0.02 pH; ±2% f.s. TDS
Input Impedance	10^{12} Ohm
Calibration	through "OFFSET" and "SLOPE" trimmers for pH, and "ZERO CAL" and "SLOPE CAL" for TDS
Set point	from 4.0 to 7.0 pH and 900 to 1800 ppm (mg/L)
TDS Conversion Factor	0.65 mg/L (ppm) = 1 µS/cm
TDS Temperature Compensation	automatic, 0 to 50°C (32 to 122°F) with β = 2%/°C
Proportional Control	two independent controls: pH from 0.0 to 2.0 and TDS from 0.0 to 400 ppm (mg/L) with two separate time cycles from 0 to 90 seconds
Alarm Contact	terminals can be configured as normally open or normally closed (isolated output max. 2A, max. 240V, resistive load, 1,000,000 strokes). The alarm is activated if pH falls below the set point by the user selectable interval (0 to 2 pH),or TDS exceeds the set point by more than the user selectable interval (0 to 400 ppm) or due to overdosage
Dosing Terminals	two sets of independent terminals (115 to 240V, max. 2A, 1,000,000 strokes) are activated whenever pH exceeds the pH set point and for the TDS falls below the TDS set point
Probe	any combination pH electrode with a universal BNC connector and Hanna TDS four-ring potentiometric probe with built-in temperature sensor and DIN connector (not included)
Power Supply	±10% 115 VAC or 230 VAC; 50/60 Hz
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing
Case Material	fiber-reinforced, self-extinguishing ABS
Dimensions	221 x 181 x 86 mm (8.7 x 7.1 x 3.4")
Weight	1.6 kg (3.5 lb.)
Ordering Information	**HI9935** is supplied complete with instructions. **Choose your configuration:** **HI9935-1** 115V **HI9935-2** 230V

For complete list of pH calibration and electrode solutions, see section 3;
for TDS solutions, see section 6

HI9910

Industrial Grade pH Controller

with Single Set point and Proportional Dosage

- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation

HI9910 is a pH controller with a single set point for proportional dosage of acid or alkaline solutions. Any pH electrode ending in a BNC connector can be directly attached to the controller. The proportional control can be fine tuned through two dials on the front panel. The time cycle is adjustable from 0 to 90 seconds and the proportional band from 0.0 to 2.0 pH. Coarse and fine as well as offset and slope trimmers make accurate setting and calibration easy and convenient. A pump or electrovalve can be wired directly to the controller and be powered through the terminals.

The HI9910 also provides for an alarm relay. The alarm is activated when the measurements stray away from the set point by a predetermined value in the 0.5 to 2.5 pH range. A maximum dosing time from 1 to 10 minutes can also be set, after which the alarm is activated to warn of an abnormality. The alarm can be configured in either normally-closed or normally-opened state. HI9910 also provides an isolated output signal which is user selectable between 0-20 or 4-20 mA. A dial on the front panel renders manual temperature compensation fast and easy.

For automatic temperature compensation, hook up a three wire Pt100 to the controller. To speed up wiring, the HI9910 comes with extractable terminal modules. Once wired up, the compartment containing the connections is protected behind a fire-retardant ABS panel. Several LED's show whether the set point or alarm relays are activated from a distance.

Specifications	HI9910
Range	0.00 to 14.00 pH
Resolution	0.01 pH
Accuracy (@25°C/77°F)	±0.02 pH
Calibration	through "OFFSET" and "SLOPE" trimmers (max. ±1.5 pH for offset and 80% to 110% for slope)
Temperature Compensation	automatic from 0 to 50°C with Pt100 probe or manual from -10 to 80°C
Set point	from 0.00 to 14.00 pH with "COARSE" and "FINE" trimmers with "ACID" or "ALK" (alkaline) selection
mA Output	user selectable 0 to 20 mA or 4 to 20 mA over the 0-14 pH range with isolated output
Proportional Control	pH is user adjustable from 0.0 to 2.0 and time cycle from 0 to 90 seconds
Alarm Contact	terminals can be configured as normally open or normally closed (isolated output max. 2A, max. 240V, resistive load, 1,000,000 strokes). The alarm is activated if pH varies by more than user selectable interval (0 to 2 pH) from set point or due to overdosage
Dosing Terminals	relay terminals (115 to 240V, max.2A,1,000,000 strokes) are activated when pH exceeds the set point with "ACID" dosage or falls below the set point with "ALK" selection (alkaline dosage)
Power Supply	±10% 115 VAC or 230 VAC; 50/60 Hz
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing
Case Material	fiber-reinforced, self-extinguishing ABS
Dimensions	221 x 181 x 86 mm (8.7 x 7.1 x 3.4")
Weight	1.6 kg (3.5 lb.)
Ordering Information	**HI9910** is supplied complete with instructions. **Choose your configuration** **HI9910-1** 115V **HI9910-2** 230V

For complete list of pH calibration and electrode solutions, see section 3

HI9931

Industrial Grade EC Controller

with Proportional Fertilizer Dosing for Hydroponics Applications

- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation

HI9931 is a wall mounted meter that measures and controls conductivity in the 0 to 10 mS/cm range. A single set point allows for proportional dosage of fertilizer solutions. The proportional settings can be fine tuned through two conveniently positioned dials on the front panel. The time cycle is adjustable from 0 to 90 seconds and the proportional band from 0 to 1.6 mS/cm. Calibration and set points have a coarse and fine tuning trimmers. A pump or electrovalve can be wired directly to the controller and be powered through the terminals.

HI9931 also provides for an alarm relay which is activated when the measurements exceed the set point by a user selectable margin from 0.5 to 2.5 mS/cm. The alarm also triggers if, due to a malfunction, the continuous dosing time exceeds the operator adjustable period of 1 to 10 minutes. The alarm can be configured in either normally closed or open position and turned off during maintenance. HI9931 also provides an isolated output signal which is user selectable between 0-20 or 4-20 mA.

Hanna four-ring conductivity probes ending in a DIN connector can be quickly attached to the HI9931. Readings are automatically compensated for the effects of temperature in the 0 to 50°C (32 to 122°F) range. For quick and easy wiring, HI9931 comes with extractable terminal modules. Several LED's show whether the set point or alarm relays have been activated.

Specifications	HI9931
Range	0.00 to 10.00 mS/cm
Resolution	0.01 mS/cm
Accuracy	±2% f.s.
Calibration	through "ZERO CAL" and "SLOPE CAL" trimmers
Set point	from 0 to 10.00 mS/cm
Temperature Compensation	automatic, 0 to 50°C (32 to 122°F) with β= 2%/°C
Recorder Output	selectable at 0-20 mA or 4-20 mA (isolated)
Proportional Control	conductivity from 0.0 to 1.6 mS/cm and time cycle from 0 to 90 seconds
Alarm Contact	terminal can be configured as normally open or normally closed (isolated output max. 2A, max. 240V, resistive load, 1,000,000 strokes). The alarm is activated if conductivity exceeds by more than the user selectable interval (0 to 2.0 mS/cm) from the set point or due to overdosage
Dosing Terminals	relay (115 to 240V, max.2A, 1,000,000 strokes) is activated whenever conductivity falls below the setpoint
Probe	four-ring potentiometric with built-in temperature sensor and DIN connector (not included)
Power Supply	±10% 115 VAC or 230 VAC; 50/60 Hz
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing
Case Materials	fiber-reinforced, self-extinguishing ABS
Dimensions	221 x 181 x 86 mm (8.7 x 7.1 x 3.4")
Weight	1.6 kg (3.5 lb.)
Ordering Information	**HI9931** is supplied complete with instructions. **Choose your configuration** **HI9931-1** 115V **HI9931-2** 230V

For complete list of EC solutions, see section 6

HI9934

Industrial Grade TDS Controller

with Proportional Fertilizer Dosing for Hydroponics Applications

- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation

HI9934 is a wall mounted meter that controls TDS in the 0 to 1999 ppm (mg/L) range through a single set point for dosage of fertilizers. The proportional control can be fine tuned through the time cycle between 0 to 90 seconds and the proportional band from 0 to 400 ppm. Coarse and fine as well as a slope trimmer make for an accurate setting and calibration. A pump or electrovalve can be powered through the terminal. In addition to the set point relay, HI9934 also provides for an alarm relay. The alarm is activated when the measurements exceed the set point by a user selectable margin in the 50 to 450 mg/L (ppm) range. The alarm also triggers if, due to a malfunction, the continuous dosing time exceeds the operator adjustable period of 1 to 10 minutes. The alarm can be configured in either normally-closed or normally-open position and turned off during maintenance.

HI9934 also provides an isolated output signal which is user selectable between 0-20 or 4-20 mA.

Hanna instruments four-ring TDS probes with incorporated temperature sensor and DIN connector can be quickly attached to the controller. Readings are automatically compensated for temperature variations in the 0 to 50°C (32 to 122°F) range.

The extractable terminal wiring is through the side of the meter with washers and grommets. The compartment containing the connections is enclosed behind a fire-retardant ABS panel.

Specifications	HI9934
Range	0 to 1999 ppm (mg/L)
Resolution	1 ppm (mg/L)
Accuracy	±2% f.s.
Calibration	through "ZERO CAL" and "SLOPE CAL" trimmers
Set point	from 0 to 1999 ppm (mg/L)
TDS Conversion factor	0.65 mg/L (ppm) = 1 µS/cm
Temperature Compensation	automatic, 0 to 50°C (32 to 122°F) with β = 2%/°C
Recorder Output	selectable at 0-20 mA or 4-20 mA (isolated)
Proportional Control	TDS from 0 to 400 ppm and time cycle from 0 to 90 seconds
Alarm Contact	terminals can be configured as normally open or normally closed (isolated output max. 2A, max. 240V, resistive load, 1,000,000 strokes). The alarm is activated if TDS exceeds by more than the user- selectable interval (0 to 400 ppm) from the set point or due to overdosage
Dosing Terminals	relay (115 to 240V, max.2A, 1,000,000 strokes) are activated whenever TDS falls below the set point
Probe	four-ring potentiometric with built-in temperature sensor (not included)
Power Supply	±10% 115 VAC or 230 VAC; 50/60 Hz
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing
Case Material	fiber-reinforced, self-extinguishing ABS
Dimensions	221 x 181 x 86 mm (8.7 x 7.1 x 3.4")
Weight	1.6 kg (3.5 lb.)
Ordering Information	**HI9934** is supplied complete with instructions. **Choose your configuration** **HI9934-1** 115V **HI9934-2** 230V

For complete list of TDS solutions, see section 6

Digital and Analog Transmitters for pH, ORP and Conductivity

Two-Wire pH & ORP Transmitters

Two-wire transmitters are widely used for process control in industry. These instruments are particularly useful in industrial conditions where electrical interference is an important factor. By galvanically isolating the signals, any interference created is prevented from reaching the transmitter. Industrial environments are often associated with corrosive conditions, therefore any instrumentation used must be resistant to liquids and corrosion. Hanna transmitters meet all of these criteria and they only use two wires which reduces costs and eliminates the need for an expensive coaxial cable. Two-wire transmitters are ideal when used in remote applications that do not have AC power available.

As technology advances it is becoming more important to monitor certain processes closely, particularly from remote locations. Computers are commonly used to receive signals from transducers that have travelled a great distance (up to 300 meters, 1000'). When transmitting signals over such a distance, it is likely that a substantial portion of the signal will be absorbed by the resistance of the lines. Considerable differences in ground potentials and between the signal source and load, are inherent to long lines.

Powering the system with an AC supply is beneficial in eliminating this problem. One of the two wires is power ground return, while the other is the power supply. The power supply line acts in a dual manner, as a power supply, and as a signal carrier. This allows the transmitter to operate with 2 wires.

The signal current from the process controller is normally 4 to 20 mA. When the load is connected with the power supply return line, the signal current will be proportional in the range of 4 to 20 mA.

The ability to use a thinner gauge of wire greatly reduces the costs associated with the wiring of remote transmitters. Typically, a heavy gauge of shielded cable is required in order to minimize the ambient electrical noise from AC power sources, interference from electrical equipment, or various other sources of noise.

Thin wire will also provide better operation when the transmitter current output is a 4 to 20 mA signal. All of these features and many more, give Hanna transmitters the versatility to be used over long distances in almost any process control application.

Conductivity, Four-Ring Technology

Hanna conductivity transmitters use four-ring Potentiometric probes. As opposed to the more widely used 2-electrode Amperometric method, the four-ring Potentiometric method provides the highest accuracy and repeatability attainable. When measuring liquids that have a high conductivity, the 2-electrode system is susceptible to polarization. This condition makes it exceptionally difficult to obtain measurements with any accuracy. The polarization is directly related to the electrode's current load, and will cause a considerable, nonlinear drop in the voltage. As a result, the solution around the electrode simulates a low conductivity condition.

Four-ring electrodes eliminate the polarization effect by splitting the four rings into 2 current and 2 voltage electrodes. When placed in a conductive liquid, the 2 current electrodes take the alternating voltage and create a current. This alternating current produces a buffer field from which polarization is absent. The voltage is then measured in this field assuring no altered readings.

HI98143

pH and EC Transmitter

with Galvanic Isolated Output

- ATC
  - Automatic temperature compensation Connectivity
- PC compatible

The HI98143 series is designed to accept signals directly from a pH electrode and a conductivity probe at the same time.

Direct connection of the probes to the transmitter assure a positive electrical connection with no signal loss. This transmitter is ideal for remote process control applications.

Four models are available, transmitting a 0-1 V, 0-4 V or 4-20 mA signal. The output signals are proportional to the input signals but independent of changes in load or cable capacitance. Compensation for the effects of temperature for EC measurements are performed by the transmitters' Automatic Temperature Compenstion circuitry.

The transmitter can be connected to any pH or conductivity controller, recorder, PC or any data monitoring device that accepts 0 to 1 V, 0 to 4 V or 4 to 20 mA input. HI 98143 is an ideal tool for applications that require the monitoring of both pH and conductivity at the same time.

Specifications	HI98143-01 • HI98143-04 • HI98143-20 • HI98143-22
Range	0 to 14 pH; 0 to 10 mS/cm
Accuracy (@25°C/77°F)	±0.5% f.s. pH; ±2% f.s. EC
Calibration	manual, 2 point, through trimmers: pH: offset and slope trimmers; EC: 0 and 5 mS/cm trimmers
EC Temp. Compensation	automatic, 0 to 60°C (32 to 132°F) with β=2%/°C
pH Electrode	HI1001 pH electrode (suggested, not included), HI1283 matching pin (not included)
EC Probe	HI3001 (not included) with cell constant 2.1
Casing	IP54
Power Supply	12-24 VDC
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Dimensions	160 x 105 x 31 mm (6.3 x 4.1 x 1.2")
Weight	280 g (9.9 oz.)
Ordering Information	All **HI98143** models are supplied with instructions. **Choose your configuration** **HI98143-01** pH/EC transmitter with 0-1 V isolated output **HI98143-04** pH/EC transmitter with 0-4 V isolated output **HI98143-20** pH/EC transmitter with 4-20 mA isolated output **HI98143-22** pH/EC transmitter with 4-20 mA isolated output (specific for HI8000 controllers)

For complete list of pH calibration and electrode solutions, see section 3;
for EC solutions, see section 6

HI8614LN with LCD

HI8614N • HI8614LN

pH Transmitters

with 4-20 mA Galvanically Isolated Output

- ATC
  - Automatic temperature compensation
- Waterpoof
  - Water resistant
- Backlight
  - Backlit, LCD display

The HI8614N is a water-resistant pH transmitter is designed to be used with a standard high impedance pH probe with BNC connector. The signal is then processed by a special high-impedance amplifier, which transmits an output current directly proportional to the input signal but independent of changes in load or cable capacitance.

Calibration is performed by the adjustment of two independent trimmers – slope and offset.

Temperature compensation is performed by the transmitter's ATC (Automatic Temperature Compensation) circuitry when measurements are taken with a temperature probe attached; if ATC is not required, it is also possible to substitute a fixed resistor for the temperature probe. The transmitter can be connected to Hanna controller HI8510, HI8710 or HI8711, recorders, computers or any data monitoring device that accepts 4 to 20 mA input.

HI8614"L" versions allow easy verification and monitoring of measured values and is easier to calibrate and maintain.

Specifications	HI8614N • HI8614LN
Range	0.00 to 14.00 pH; 4-20 mA
Resolution (for "L" models)	0.01 pH; 0.01 mA
Accuracy (@20°C/68°F)	±0.02 pH; ±0.02 mA
Calibration	offset: ±2 pH; ±2.2 mA; slope: 86 to 116%; ±0.5 mA
Temperature Compensation	fixed or automatic from 0 to 100°C (32 to 212°F) with HI76608 probe
Input Impedance	10^{12} Ohm
Recorder Output	4-20 mA (isolated)
Protection	IP65
Power Supply	HI8614N: 18-30 VDC; HI8614LN: 20-36 VDC
LCD display	only for HI8614LN
Load	max 500 Ohm
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Dimensions	165 x 110 x 71 mm (6.5 x 4.3 x 2.8")
Weight	1 kg (2.2 lb.)
Ordering Information	**HI8614N** and **HI8614LN** (with display) is supplied with instructions.

HI8614N without LCD

For complete list of pH calibration and electrode solutions, see section 3

HI8936 Series

Conductivity Transmitters

to use with Four-ring Probe

- ATC
  - Automatic temperature compensation
- Backlight
  - Backlit, LCD display

HI8936 is a conductivity transmitter that utilizes a four-ring potentiometric probe. This probe is virtually immune to contamination by unclean solutions. This allows the transmitter to operate at peak performance at all times.

Temperature effects are compensated for by utilizing both the built-in temperature sensor on the probe and the transmitter's ATC circuitry with a d of 2%/°C.

Direct connection of the probe to the transmitter assures a positive electrical connection with no signal loss over long distances.

HI8936"L" versions allow easy verification and monitoring of measured values and is easier to calibrate and maintain.

The HI8936 series requires external power to the 4-20 mA current loop.

The HI8936 series should be used in conjunction with the HI7635 in-line probe or HI7638 platinum probe (see Process Electrodes and Probes).

ALN, BLN, CLN, and DLN with LCD

AN, BN, CN, and DN without LCD

Specifications	HI8936AN HI8936ALN	HI8936BN HI8936BLN	HI8936CN HI8936CLN	HI8936DN HI8936DLN
Range	0.0 to 199.9 mS/cm	0.00 to 19.99 mS/cm	0 to 1999 µS/cm	0.0 to 199.9 µS/cm
Resolution	0.1 mS/cm	0.01 mS/cm	1 µS/cm	0.1 µS/cm
Accuracy	±2% f.s. (excluding probe error)			
Calibration	manual, two point, with offset and slope trimmers			
Temperature Compensation	fixed or automatic from 0 to 50°C (32 to 122°F) with β=2%/°C			
Conductivity Probe	HI7635 for in-line applications (not included)			
Recorder Output	4-20 mA, not isolated, max 500 Ohm			
Protection	IP65			
Power Supply	without LCD: 12-30 VDC; with LCD: 17-36 VDC			
LCD Display	HI8936AN: no HI8936ALN: yes	HI8936BN: no HI8936BLN: yes	HI8936CN: no HI8936CLN: yes	HI8936DN: no HI8936DLN: yes
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing			
Dimensions	165 x 110 x 71 mm (6.5 x 4.3 x 2.8")			
Weight	1 kg (2.2 lb.)			
Ordering Information	All **HI8936** models are supplied complete with instructions.			

For complete list of EC solutions, see section 6

HI931002

4-20 mA Amperometer

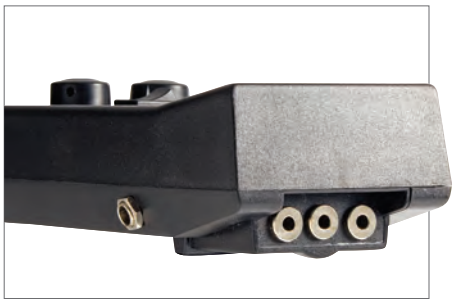
Simulator and Calibrator

HI931002 is a portable instrument designed by the Plant Repair and Maintenance Operator for the MRO! This portable simulator can monitor and regulate 4-20 mA from practically any process meter with or without a voltage generator. The communication bus from process instrumentation can be simulated in any of the following modes:

- Passive drive/Calibrator mode:
  - HI931002 can set the 4-20 mA current values and the user can then adjust the process meter accordingly.
- Active drive/Simulator mode:
  - HI931002 simulates the correct current values as above in addition to providing power to the bus communication. Power is provided through an external adapter (included) which is connected to the simulator. This mode is ideal to calibrate chart recorders, pressure transducer or current indicators.
- Passive measurement/Tester mode:
  - HI931002 practically becomes an Amperometer. It measures and displays the mA (or pH) values transmitted by the process meter.
- Active measurement/Tester mode:
  - Same as above in addition to providing voltage to the 4-20 mA bus.

HI931002 can measure incoming current, provide power, and simulate 4-20 mA output to calibrate your process meter. A large LCD shows values on the display. You can select between drive and measurement modes through a switch on the front panel and two dials allow for quick adjustment of the current.

Specifications		HI931002
Ranges	Active Drive	2.00 to 19.99 mA; -1.50 to 14.00 pH
	Passive Drive	2.00 to 19.99 mA; -1.50 to 14.00 pH
	Active Measure	0.00 to 19.99 mA; -3.50 to 14.00 pH
	Passive Measure	0.00 to 19.99 mA; -3.50 to 14.00 pH
Additional Specifications	Resolution	0.01 mA; 0.01 pH
	Accuracy (@20°C/68°F)	±0.01 mA; ±0.01 pH
	Input Resistance	20Ω
	Fuse	5 x 20 mm, 200 mA, 250V
	Power Supply	9V; approximately 1600 hours of continuous use; or 12 VDC adapter (included)
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Dimensions	180 x 83 x 40 mm (7.1 x 3.3 x 1.6")
	Weight	320 g (11.3 oz.)
Ordering Information	**HI931002** is supplied with 1 m (3.3') connection cable, battery, 12 VDC adapter and instructions.	



BlackStone Chemical Dosing Pumps

Versatility

BlackStone pumps have been designed to meet the ever changing needs of industry. With their broad, flat base and mounting holes for tank, shelf or floor mounting (horizontal), the pumps can be easily mounted anywhere in your plant. The rear of the pump housing also provides mounting holes to facilitate vertical mounting: wall, tank or machine. Since the pump valve assembly and controls for the unit are located on the front of the pump, there is never a problem with installation or flow adjustments.

Simple Operation

BlackStone pumps are equipped with a single control for pump output. The external flow rate control (potentiometer) on the face of the pump allows you to adjust the percentage of flow from 0 to 100% of the pump's rated capacity. This feature eliminates the need to worry about stroke lengths and power settings. An LED indicator lights up each time a stroke begins, allowing the user to assess the stroke rate from a distance.

High Quality Materials

BlackStone pumps have been manufactured with the highest level of mechanical precision from materials chosen for their inherent ability to resist the effects of aggressive chemicals. When you select a Blackstone pump, you are eliminating the time consuming effort involved in picking the right material for your application. Blackstone pumps are supplied with the highest quality material as standard equipment–not optional. The diaphragm utilizes one-piece construction of PTFE, which unlike conventional laminated diaphragms, will stand up to the test of time and wear. Ball valves are constructed in glass.

The pumphead and O-rings are made of PVDF, PTFE and FPM/FKM which offer unsurpassed resistance. The chemical resistance chart (right) shows how well PVDF and PTFE stand up to some of the most aggressive chemicals.

Chemical Resistance Guide*

Chemical	PVC	PP	Hypalon	FPM/ FKM	PVDF	PTFE
Acetic Acid, 80%	D	B	A	E	A	A
Bleach	A	B	A	A	A	B
Citric Acid	A	A	A	A	A	A
Copper Cyanide	A	A	X	B	A	A
Copper Sulfate	A	A	B	B	A	A
Ferric Chloride	A	A	B	B	A	A
Ferric Sulfate	A	A	B	B	A	A
Hydrazine	X	X	B	B	A	A
Hydrochloric Acid (concentrated)	A	A	B	B	A	A
Hydrochloric Acid (diluted)	A	A	B	B	A	A
Hydrofluoric Acid (diluted)	D	B	D	A	A	A
Hydrogen Sulfide	C	A	B	B	A	A
Magnesium Nitrate	A	A	A	A	A	A
Magnesium Sulfate	A	A	A	A	A	A
Nitric Acid, 50%	A	C	E	A	A	A
Phosphoric Acid	B	B	A	B	A	A
Plating Baths	A	A	C	A	A	A
Potassium Cyanide	A	A	B	B	A	A
Potassium Nitrate	A	A	B	B	A	A
Propyl Alcohol	C	X	B	B	A	A
Soaps	A	A	B	B	A	A
Sodium Bicarbonate	A	A	A	A	A	A
Sodium Bisulfite	A	A	A	A	A	A
Sodium Hydroxide, 50%	A	A	B	E	A	A
Sodium Hypochlorite, 18%	A	A	A	D	A	A
Sulfuric Acid (concentrated)	A	A	B	A	A	A
Tanning Reagents	A	A	A	X	A	A
Trichloretane	E	C	E	A	A	A

* PARTIAL LISTING

Symbol Key

A - Excellent	B - Good	C - Fair	D - Acceptable (limited use)	E - Not recommended	X - Unknown

BL Series Dosing Pumps

BlackStone's positive displacement solenoid driven pumps use a minimum number of moving parts, therefore reducing the chance of mechanical failure. Part wear and oiling associated with motor driven pumps (ball-bearings, gear drives and cams) are not a concern with these pumps. Blackstone pumps are more accurate than standard pumps due to the positive displacement design ensuring each stroke is identical to the strokes before and after it, thus keeping the flow rate consistent.

A wide range of BlackStone pumps with different dosing capacities are available for your specific dosing needs. Each pump is supplied with discharge and suction valves.

Part Number	Max Output	Rated Pressure	Dosing Frequency strokes/min
With Large Diaphragm			
BL20	18.3 lph (4.8 gph)	0.5 bar (7.4 psi)	120
BL15	15.2 lph (4.0 gph)	1 bar (14.5 psi)	120
BL10	10.8 lph (2.9 gph)	3 bar (43.5 psi)	120
BL7	7.6 lph (2.0 gph)	3 bar (43.5 psi)	120
With Small Diaphragm			
BL5	5.0 lph (1.3 gph)	7 bar (101.5 psi)	120
BL3	2.9 lph (0.8 gph)	8 bar (116 psi)	120
BL1.5	1.5 lph (0.4 gph)	13 bar (188.5 psi)	120

Specifications	BL Series
Max Output	see table above
Pump Casing	fiber-reinforced polypropylene
Materials	pumphead in PVDF, diaphragm in PTFE, glass ball valves and O-rings in FPM/FKM, polyethylene 5 x 8 mm tubing
Self-priming	max height: 1.5 m (5 feet)
Power Supply	110/115 VAC or 220/240 VAC, 50/60Hz
Max Power Consumption	approximately 200 W
Protection	IP65
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Dimensions	194 x 165 x 121 mm (7.6 x 6.5 x 4.8")
Weight	approx. 3 kg (6.6 lb.)

Ordering Information

BL1.5-1	1.5 LPH flow rate
BL1.5-2	1.5 LPH flow rate
BL3-1	2.9 LPH flow rate
BL3-2	2.9 LPH flow rate
BL5-1	5.0 LPH flow rate
BL5-2	5.0 LPH flow rate
BL7-1	7.6 LPH flow rate

-1 = 110/115 VAC power supply
-2 = 220/2400 VAC power supply

BL7-2	7.6 LPH flow rate
BL10-1	10.8 LPH flow rate
BL10-2	10.8 LPH flow rate
BL15-1	15.2 LPH flow rate
BL15-2	15.2 LPH flow rate
BL20-1	18.3 LPH flow rate
BL20-2	18.3 LPH flow rate

Accessories

HI721004**	Injection valve assembly
HI721005**	Foot valve assembly
HI721101	Pumphead, O-ring, screws and washer
HI721102	Discharge valve assembly
HI721103	Suction valve assembly
HI721008	Ceramic weight (4)
HI720011D	Magnet and coil for BL pumps (230VAC)
HI720011U	Magnet and coil for BL pumps (115VAC)
HI720025	Pump body
HI720034	Magnet pump head assembly for BL pumps

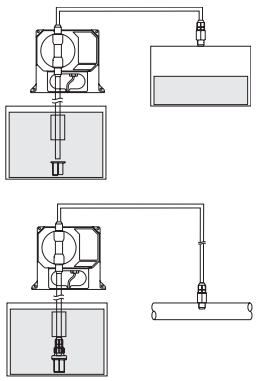
HI721001	Complete pumphead with valves
HI72001	Tube nut. 5 x 8 mm dia. (100 pcs)
HI721009	Diaphragm
HI721010	PTFE coated O-ring for pump head
HI721011	Aluminum piston, insulation disk, washer and springs replacement kit for BL pump
HI721013	Piston set for BL pump
HI721014	Bottom housing and housing seal
HI721104	Small diaphragm for BL pumps
HI721105	BlackStone spare pump head
HI721106	BlackStone pump head assembly

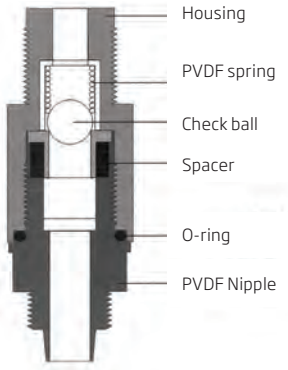
** Required for operation

Rugged Design

Blackstone pumps are completely sealed during assembly and offer IP65 protection against splashes and spills providing excellent protection even in hostile environments. The fiber-reinforced polypropylene housing stands up to aggressive chemicals while offering superior strength under tough industrial conditions.

Typical Installations

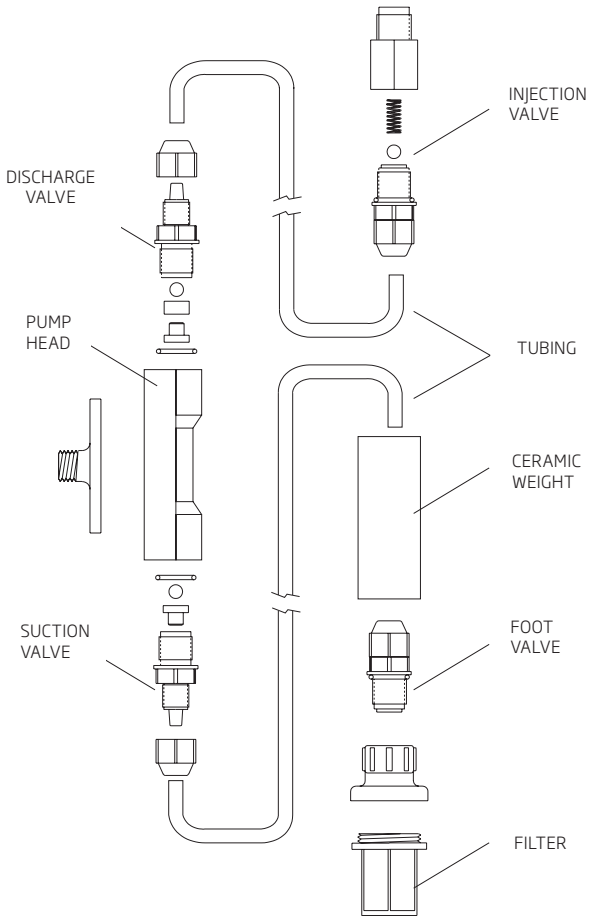


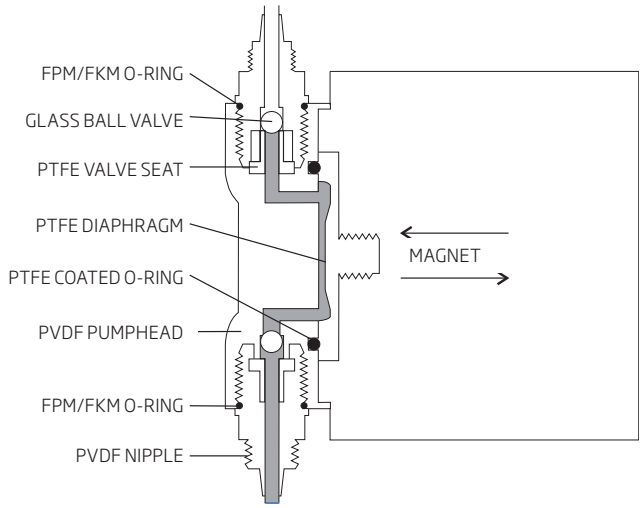


Replacement Parts

for BlackStone Chemical Dosing Pumps

Assembly Diagram

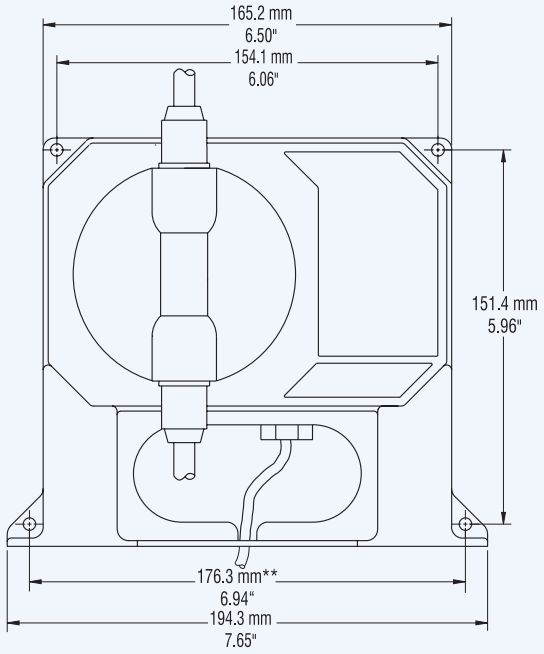




Mechanical Dimensions

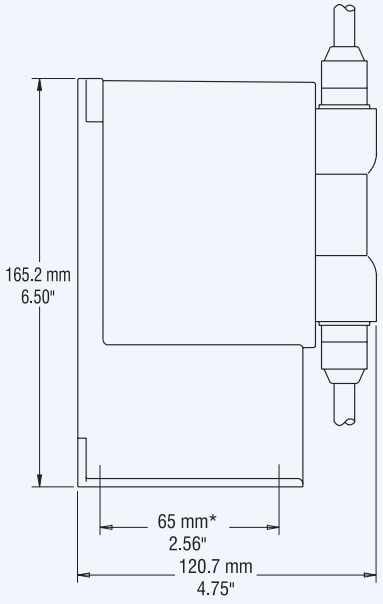
for BlackStone Chemical Dosing Pumps

Front View



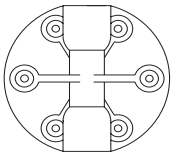
** Dimensions for floor and wall mounting

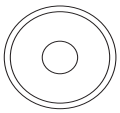
Side View

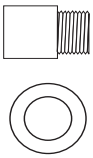


* Dimensions for floor mounting

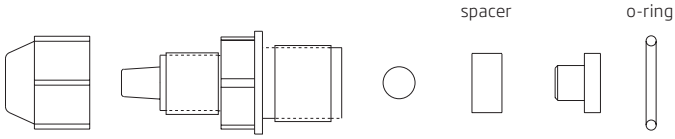
HI721101


pumphead

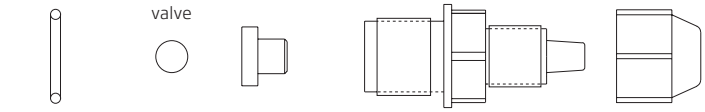

PTFE coated o-ring


6 screws and washers

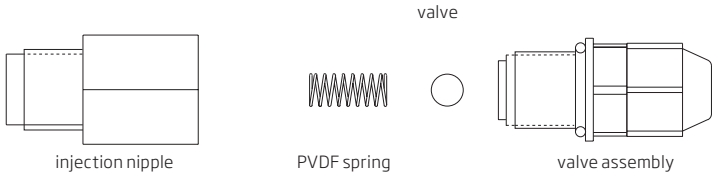
HI721102



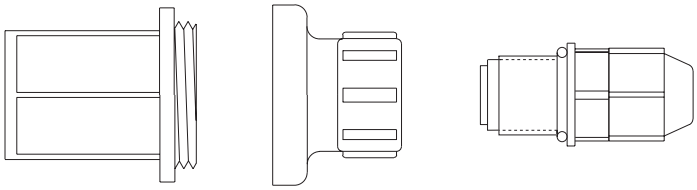
HI721103



HI721004



HI721005

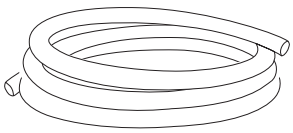


HI721003

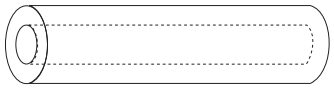
HI721006


PVDF spring

HI720032


LDPE hose

HI721008


ceramic weight

Ordering Information

HI721101

This kit contains the PVDF pumphead, PTFE coated O-ring, 6 screws and washers.

HI721102

This kit contains all the necessary replacement parts for your discharge valve assembly. Complete with a FPM/FKM O-ring, glass valve ball, the valve spacer and seat, head nipple and the tube nut to secure the assembled parts.

HI721103

Suction valve assembly, complete with a FPM/FKM O-ring, glass valve ball, the valve spacer and seat, head nipple and the tube nut to secure the assembled parts.

HI721004

Complete with an injection nipple, PTFE coated spring, glass valve ball and a valve assembly.

HI721005

This kit contains a filter with a filter holder and a valve assembly.

HI721003

This kit contains 10 glass balls and 10 valve O-rings.

HI721006

This kit contains 4 PVDF springs.

HI720029

LDPE hose, 3 m (9.9').
Inside diameter 4.71 mm
Outside diameter 7.87 mm

HI720030

LDPE hose, 10 m (33').
Inside diameter 4.71 mm
Outside diameter 7.87 mm

HI720031

LDPE hose, 50 m (165').
Inside diameter 4.71 mm
Outside diameter 7.87 mm

HI720032

LPDE hose, 100 m (333').
Inside diameter 4.71 mm
Outside diameter 7.87 mm

HI721008

This kit contains 4 ceramic weights.

HI740156

This kit contains 3 valve seats.

Electrodes Designed and Manufactured by Hanna

Process Electrodes

A Worldwide Leader in Electrode Manufacturing

Since the beginning of the 1990's Hanna has been a leader in the research & development of pH and ORP electrodes. Today, Hanna is proud to present the latest family of industrial electrodes, the Flat Tip Series, which completes the wide range of Hanna probes for any process application. All Hanna industrial pH and ORP electrodes are combination type, i.e. the reference half cell and the measurement half cell are assembled in the same body.

Industrial Electrodes and Probes

HI1000/HI2000 Series

Standard

AmpHel®

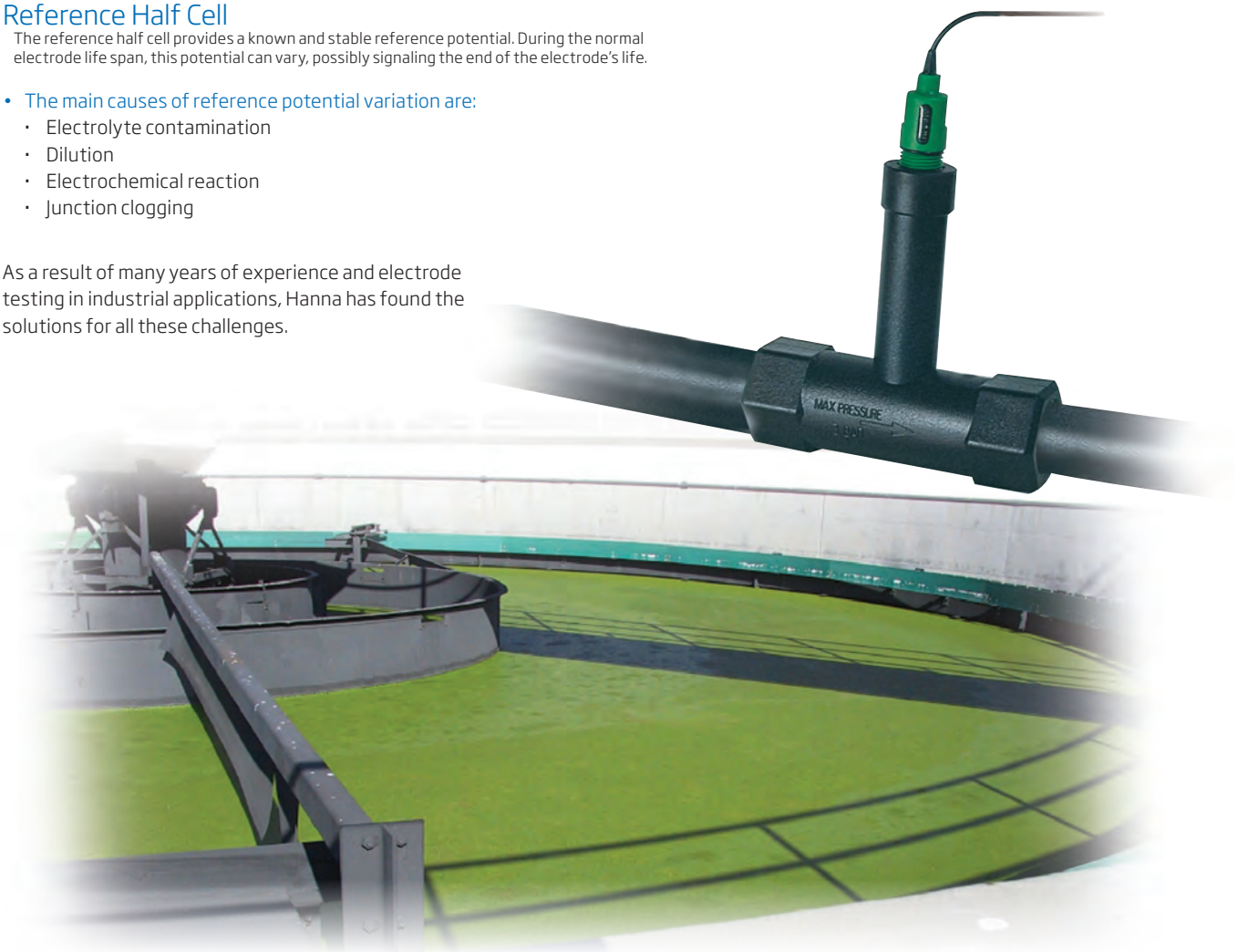
Flat Tip

Reference Half Cell

The reference half cell provides a known and stable reference potential. During the normal electrode life span, this potential can vary, possibly signaling the end of the electrode's life.

- The main causes of reference potential variation are:
  - Electrolyte contamination
  - Dilution
  - Electrochemical reaction
  - Junction clogging

As a result of many years of experience and electrode testing in industrial applications, Hanna has found the solutions for all these challenges.



Electrolyte Contamination

The contamination of the reference half cell is linked to the diffusion of external substances into the reference chamber (strong oxidants, reductants, complexing agents).

The combination of Hanna double junction technology with a polymer reference electrolyte, reduces the diffusion process rate and keeps the reference potential stable for long periods of time.

Dilution

When the reference cell containing concentrated 3.5M KCl electrolyte comes in contact with a less concentrated aqueous sample, diffusion of the electrolyte into the sample will occur. This process causes a progressive dilution of the reference electrolyte with a consequent variation of the reference potential.

Hanna double junction technology and the use of a large electrolyte volume (up to three times greater than traditional electrodes) makes this dilution effect negligible.

Electrochemical Reaction

In many industrial applications, it is possible to get a potential difference between the measuring point and the instrument. This inconvenience originates from electrical currents that destroy the Ag/AgCl element of the reference half-cell and also creates non-stable, interfering potentials.

Hanna's simple and effective solution to this challenge is the matching pin built-in to each industrial electrode. The matching pin is a stainless steel or titanium element that is connected to the instrument to prevent grounding problems, and to prolong electrode life.

Junction Clogging

Typical industrial applications require continuous monitoring of pH and ORP. Periodic cleaning and maintenance of the electrode junction ensure a stable and repeatable contact between sample and junction. The frequency of these cleaning procedures depends on the shape of the junction and material.

Hanna industrial electrodes are provided with different types of junctions. In particular, the porous PTFE junction used for the flat tip electrodes, which can provide optimum performance for months without requiring any maintenance.

Measurement Half Cell

All Hanna industrial pH electrodes include a measurement cell with a glass sensor. A glass sensor is the only answer for most industrial requirements. Below is a list of the main causes of shortened glass sensor life, for which Hanna has developed different types of specialized glass:

- High temperature
- Low temperature
- Acid samples containing fluoride

Electrodes Designed and Manufactured by Hanna

Process Electrodes

Built for Everyday, Demanding Use

Hanna provides glass sensors that are able to withstand the previously listed industrial environmental challenges.

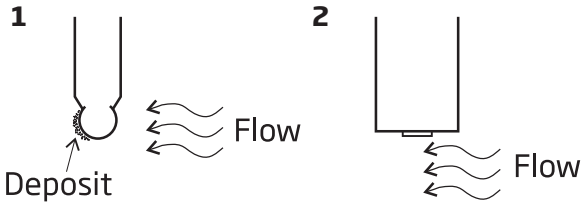
Glass Type	Application	pH Range	Temperature Range
LT	low temperature	0 to 12	-10 to 80°C
HT	high temperature	0 to 14	0 to 100°C
HF	acid samples with fluoride	0 to 10	-5 to 60°C

Mechanical Stress

In a continuous in-line installation, the glass sensor of the pH electrode can be physically damaged by solution streams containing suspended solids.

Our Flat Tip electrodes are the best answer to this problem. The flat tip virtually eliminates deposits that can foul the electrode, significantly reducing necessary maintenance.

Flat Tip Advantages



An exposed electrode surface will foul and require frequent cleaning

The flat shape of the electrode tip nearly eliminates deposits

Electrode Body Material: Glass, PVDF or PEI

Glass

The glass body electrode can withstand high pressure and high temperature applications. The glass body also offers high resistance to aggressive chemicals (only fluoridic acid and strong alkaline solutions can damage glass).

PVDF

The PVDF body used for the Flat Tip Series withstands high pressure and high temperature applications, and guarantees a high chemical and mechanical resistance. These characteristics makes the PVDF material the most recommended for many industrial applications. PVDF is also non-toxic and compatible with food applications.

PEI

PEI is a special plastic material used first to produce electrodes by Hanna. PEI electrodes proved to be ideally suited to field applications, as well as industrial environments. An electrode with a PEI body represents a very good combination of chemical, mechanical, and thermal resistance which can be used in non-critical applications (e.g. swimming pools), or with portable meters for routine field monitoring and control, such as wells, lakes and rivers, and discharges of tanks and reservoirs.

AmpHel®: Why and Where to Use It

pH electrode glass sensors have a high impedance of typically 100 Mohm, but can reach 800 Mohm depending on the temperature. This is a very weak signal available for accurate measurements. Impedance this high is difficult to handle especially between the electrode and the instrument. Normally this distance is covered by special cables with very high shielding and electrical insulation. Even with these cables, distances cannot be longer than 5 meters.

In industrial installations it is not easy to limit the distance between the electrode and the measuring instrument to 5 meters . Quite often, the recording instruments are located in separate areas from where the pH is measured. To avoid this limitation, a pH amplifier can be used.

Amplifiers are usually available with water-tight casings and can be used under extremely harsh conditions. The pH amplifier needs a power supply and usually must also provide for galvanic insulation between the power supply and the amplification circuit. At times it is difficult to have a power supply close to the measuring electrode. In such a case, 2-wire amplifiers and a 4-20 mA output can solve the problem (see HI8614 and HI8614L produced by Hanna).

Such amplifiers need instruments with 4-20 mA input in place of, or in parallel with, the BNC connector (some instruments are not provided with this option).

To overcome the instrument limitation, in 1988, Hanna produced the AmpHel® electrode (Amplified pH electrode). The AmpHel® electrodes feature an internal, high impedance pH amplifier with the required batteries.

An AmpHel® electrode has a life of approximately 3 years from the day it was produced. Taking into consideration that an average life for a pH electrode is one year, this should not be considered a limitation.

The output is still with 2 wires, as in the case of the typical coaxial cable, but it has a low impedance, and allows connections up to 75 meters long without delays in the measurements.

Cable Leakage

A high impedance coaxial cable, when installed more than 5 meters away from the electrode, could also be subject to current leakage. Quite often the installers place it in underground ducts as done with any other electric cable. During the installation of the cable, the insulation may become scratched by rubbing against the pipes or sharp corners. Underneath the insulation there is a screen connected to the reference electrode.

If the cable is in an underwater duct, it could happen that, sometime during the year, the reference electrode (the screen) could come into contact with the humid environment and, thus, with the grounding circuit of the electrical installations. Under these conditions, the pH electrode cannot take reliable measurements and can give erroneous readings. Without any reference to the measurement, the actual reading can be many pH units off. This is another solid reason for avoiding cables longer than 5 meters.

Electrode-Cable Connection

Some German manufacturers have produced pH electrodes with a coaxial connector mounted directly at one end of the electrode, i.e. without cable. The intention was to replace the electrode, without having to replace the connecting cable which remains attached. But as time passed, such an intention has proven to be harmful.

In fact, in many cases, the electrode is placed inside an electrode holder, which protects it from test liquid (tank measurement). Moisture forms inside the holder because of temperature changes from day to night. This moisture reduces the connector insulation, and the signal to the electrode drops.

When an electrode leaks, the generated emf drops and the reading drifts toward the pH 7 value. Therefore, for example, instead of pH 3, the measurement can be pH 3.5 or 4. This reading may result in a dosage that is harmful to the system.

Potential Matching Pin

In many industrial applications, especially in plating baths, grounding loop current is a very common problem.

When a traditional electrode/controller system is used with the electrode reference connected both to the electrode and to the instrument, a current flow occurs through the reference half cell, causing fluctuations in reading and serious damage to the Ag/AgCl

Electrodes Designed and Manufactured by Hanna

Process Electrodes

element. The potential matching pin shields the reference from external electrical fields. Shown above, the matching pin allows the measurement to stabilize and ensures effective process regulation. In order to function properly, the matching pin has to be continuously immersed in the measured solution and for this reason is placed near the electrode junction.

Temperature Effect

Sample temperature is an important parameter for solutions with a pH different from 7.0. In fact at pH 7.0, temperature compensation is not required.

Due to a built-in temperature sensor, there is only one electrode to install. Also due to its proximity to the pH sensor, the built-in temperature sensor ensures fast, accurately compensated readings even during sudden temperature fluctuations.

A Specific Electrode for Each Application

The table to the right lists the most common industrial applications with the corresponding, recommended Hanna electrodes.

For each application, several models are available, with different options for the following characteristics:

- Electrode dimensions
- Connection type
- Installation requirement
- Optional configurations (matching pin, Pt100 or Pt1000 sensor)

Hanna produces a wide range of industrial electrodes, for any specific application need.

Common Industrial Applications

Application	pH Electrode Series	Code
Domestic Wastewater Sewage, Septic Tank Treatment	easy	**HI1090B/5**
Industrial Wastewater	flat tip	**HI1006-2005**
	HI1000	**HI1003/5**
	easy	**HI1210B/5**
Food Industry (Beer, Jam, Diary Products)	flat tip	**HI1006-2005**
	easy	**HI1090B/5**
Chemical Neutralization	flat tip	**HI1006-2005**
	easy	**HI1210B/5**
Potable Water (>400µS/cm)	flat tip	**HI1006-2005**
	HI1000	**HI1001**
	easy	**HI1210B/5**
Cooling Towers	AmpHel®	**HI6291005**
	HI1000	**HI1002/5**
	easy	**HI1210B/5**
Water Softening	flat tip	**HI1006-2005**
	AmpHel®	**HI6291005**
	HI1000	**HI1001/5, HI1002/5**
	easy	**HI1210B/5**
Demineralization	flat tip	**HI1006-2005**
	easy	**HI1090B/5**
Low Conductivity Solutions	flat tip	**HI1006-2005**
Swimming Pools	flast tip	**HI1006-2005**
Sea Water	easy	**HI1090B/5**
Galvanic Baths	flat tip	**HI1006-3005**
	AmpHel®	**HI8299505**
	HI1000	**HI1003/5**
	easy	**HI1210B/5**
Sugar Industry, Paper Industry	flat tip	**HI1006-2005**
	easy	**HI1090B/5**
Textile Industry, Tanneries	flat tip	**HI1006-3005**
	AmpHel®	**HI8299505**
Acid Samples with Fluoride Ions	flat tip	**HI1006-4005**

Application	ORP Electrode Series	CODE
Oxidation of Cyanide and Nitrite	flat tip	**HI2004-2005**
Ozonization & Oxidant Products	AmpHel®	**HI6493005**
Reductant Products (Chromate Reduction)	AmpHel®	**HI6293005**
	HI2000	**HI2003/5**
	easy	**HI3210B/5**
Swimming Pools	HI2000	**HI2001, HI2003/5**
	easy	**HI3210B/5**

Flat Tip Industrial Electrodes

Select the flat tip electrode that best fits your process requirements by choosing from the following technical characteristics:

1. Junction

Three junction types are available:

- Annular non-clogging PTFE junction, for testing solutions with high content of suspended solids or for high pressure installation
- Open junction, ideal for wastewater analysis
- Ceramic junction

2a. pH Electrodes

Hanna has developed four types of specialized glass. First is a durable sensor glass for general purpose, industrial use. This glass can withstand the stress of daily use. The remaining types of electrode glass allow continuous monitoring in highly acidic solutions containing fluoride ions, as well as high or low temperature process and streams significantly increase the electrode life.

2b. ORP Electrodes

ORP electrodes are provided with a platinum sensor for most applications, while a gold sensor is required for measurement of cyanide or highly oxidative environments.

3. Temperature Sensor

The pH electrodes with built-in 3-wire Pt100 or Pt1000 temperature sensor allow for the temperature compensation of pH readings as well as temperature measurements.

4. Connection Type

Electrodes are wired for direct connection to a transmitter or process controller, or with the standard BNC connector.

5. Built-in Amplifier

Models with a built-in amplifier are necessary for long distance measurements, where it is not possible to install a transmitter.

The internal amplifier can be powered directly from select Hanna process controllers or a power source that supplies the appropriate voltage.

6. Cable Length

Non-amplified electrodes are provided with a 5, 10 or 15 m cable (16', 33' or 49'), while the amplified models are provided with a 15, 25, 50 or 75 m cable (49, 82, 164 or 246').

- Self-cleaning flat tip sensor
- Significantly reduced maintenance requirement
- Models especially designed for plating baths
- PVDF body
- Three junction types: ceramic, PTFE and open
- Built-in potential matching pin
- Three different glass type pH sensors
- ORP electrodes with platinum or gold sensor
- Models with built-in Pt100 or Pt1000 temp. sensor
- Internal amplifier models powered by the process controller
- 3/4" NPT external thread on both ends for easy installation

Hanna presents a series of combination pH and ORP electrodes, including more than 300 models, incorporating over 20 years of electrode manufacturing experience.

The most advanced feature of this series is the electrode shape with a flat tip, virtually eliminating deposits that can foul the electrode, significantly reducing necessary maintenance. This characteristic makes flat tip electrodes ideal for continuous in-line monitoring and for solutions containing aggressive chemicals.

The PVDF body offers a higher level of mechanical and temperature resistance. Moreover, the PVDF material is non-toxic and compatible with food applications.

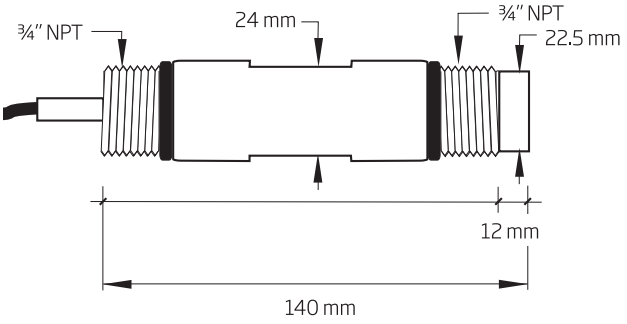
Each pH and ORP electrode is provided with an internal matching pin that can avoid typical problems caused by grounding loop current, such as:

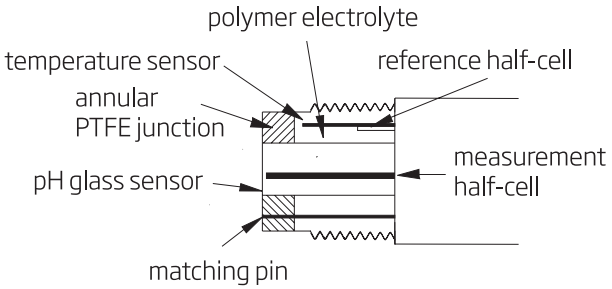
- progressive damage of the electrode
- fluctuating measurements
- poor process regulation

Glass Type	Application	pH Range	Temperature Range
LT	low temperature	0 to 12	-10 to 80°C
HT	high temperature	0 to 14	0 to 100°C
HF	acid samples with F- (*)	0 to 10	-5 to 60°C

(*) F- max 2 g/L, temperature max 60°C, pH >2

Flat Tip Industrial pH Electrodes





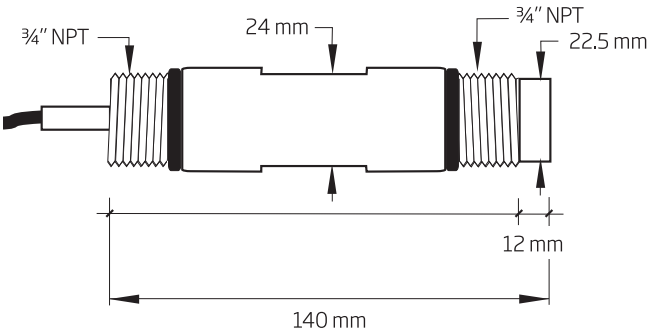
Flat Tip pH Electrodes: Ordering Information

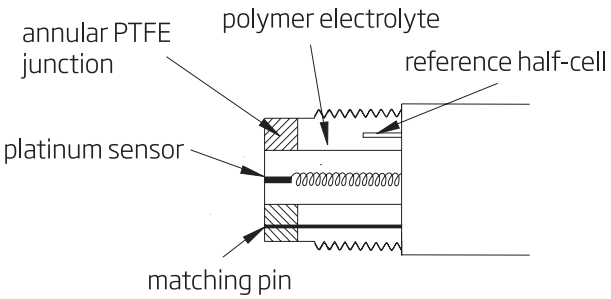
Choose your configuration:		
w =	**06**	PTFE junction
	16	ceramic junction
	26	open junction*
x =	**1**	LT (Low Temperature) glass sensor
	2	GP (General Purpose) glass sensor
	3	HT (High Temperature) glass sensor; titanium matching pin
	4	HF (Fluoride resistant) glass sensor
y =	**0**	BNC connector
	1	direct wire connection
	2	BNC connector + Pt100
	3	direct wire connection + Pt100
	4	BNC connector + Pt1000
	5	direct wire connection + Pt1000
	6	amplified electrode with BNC connector
	7	amplified electrode with BNC connector + Pt100
z =	**05, 10, 15** Cable length (meters); for non-amplified electrodes	
	15, 25, 50, 75 Cable length (meters); for amplified electrodes	

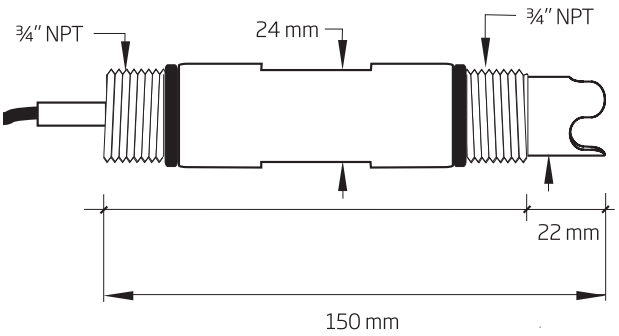
HI10 [w] – [x][y][z]

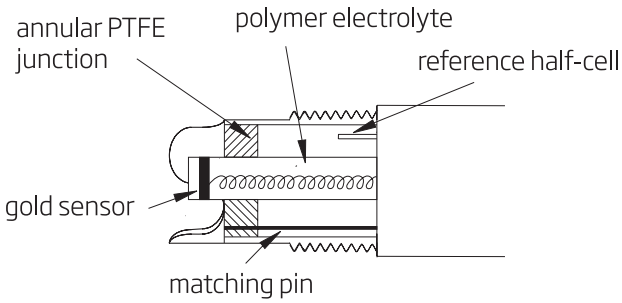
* Open junction is available only with GP glass sensor.
Note: The internal amplifier can be powered directly from select Hanna process controllers or a power source that supplies the appropriate voltage.

Flat Tip Industrial ORP Electrodes









Flat Tip ORP Electrodes: Ordering Information

Choose your configuration:		
w =	**04**	PTFE junction
	14	ceramic junction
	24	open junction
x =	**1**	platinum sensor
	2	gold sensor
y =	**0**	BNC connector
	1	direct wire connection
	6	amplified electrode with BNC connector
z =	**05, 10, 15**	Cable length (meters); for non-amplified electrodes
	15, 25, 50, 75	Cable length (meters); for amplified electrodes

HI20 [w] – [x] [y] [z]

Note: The internal amplifier can be powered directly from select Hanna process controllers or a power source that supplies the appropriate voltage.

AmpHel® Flat Tip Industrial Electrodes

- AmpHel® amplified
- Matching pin
- Flat tip
- PVDF body

AmpHel® Flat-tip pH Electrodes

General Purpose pH Electrodes

Code	Range	Body	Junction	Electrolyte	Glass Type	Temperature	ATC	Max Pressure	Connector	Cable
HI6100405	0-13	PVDF	double, PTFE	polymer	GP	-5 to 80 °C	–	6 bar (87 psi)	BNC	5 m
HI6101405	0-13	PVDF	double, PTFE	polymer	GP	-5 to 80 °C	Pt100	6 bar (87 psi)	BNC + lead	5 m
HI6101415	0-13	PVDF	double, PTFE	polymer	GP	-5 to 80 °C	Pt100	6 bar (87 psi)	BNC + lead	15 m

Low Temperature pH Electrodes

Code	Range	Body	Junction	Electrolyte	Glass Type	Temperature	ATC	Max Pressure	Connector	Cable
HI6100605	0-12	PVDF	double, PTFE	polymer	LT	-10 to 80 °C	–	6 bar (87 psi)	BNC	5 m
HI6101605	0-12	PVDF	double, PTFE	polymer	LT	-10 to 80 °C	Pt100	6 bar (87 psi)	BNC + lead	5 m

High Temperature pH Electrodes

Code	Range	Body	Junction	Electrolyte	Glass Type	Temperature	ATC	Max Pressure	Connector	Cable
HI6100805	0-14	PVDF	double, PTFE	polymer	HT	0 to 100 °C	–	6 bar (87 psi)	BNC	5 m
HI6101805	0-14	PVDF	double, PTFE	polymer	HT	0 to 100 °C	Pt100	6 bar (87 psi)	BNC + lead	5 m

pH Electrodes for Acid Samples with Fluoride Ions (F- max 2 g/L, Temperature Max 60 °C, pH >2)

Code	Range	Body	Junction	Electrolyte	Glass Type	Temperature	ATC	Max Pressure	Connector	Cable
HI6100205	0-10	PVDF	double, PTFE	polymer	HF	-5 to 60 °C	–	6 bar (87 psi)	BNC	5 m
HI6101205	0-10	PVDF	double, PTFE	polymer	HF	-5 to 60 °C	Pt100	6 bar (87 psi)	BNC + lead	5 m

AmpHel® Flat-tip ORP Electrodes

Platinum Type ORP Sensors

Code	Range	Body	Junction	Electrolyte	Temperature	ATC	Max Pressure	Connector	Cable
HI6200405	±2000 mV	PVDF	double, PTFE	polymer	-5 to 100 °C	–	6 bar (87 psi)	BNC	5 m

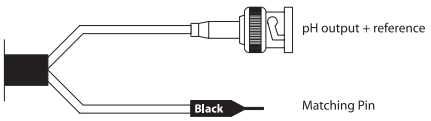
Gold Type ORP Sensors

Code	Range	Body	Junction	Electrolyte	Temperature	ATC	Max Pressure	Connector	Cable
HI6200505	±2000 mV	PVDF	double, PTFE	polymer	-5 to 100 °C	–	6 bar (87 psi)	BNC	5 m

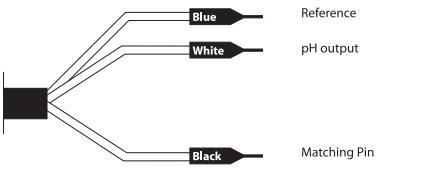
Flat Tip Industrial Electrodes Electrical Connections and Installation

Electrical Connections

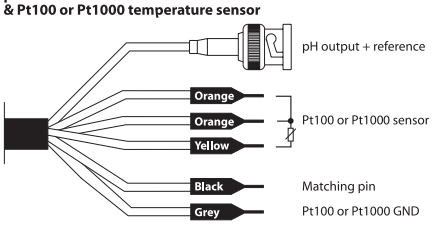
pH & ORP electrodes with BNC connector



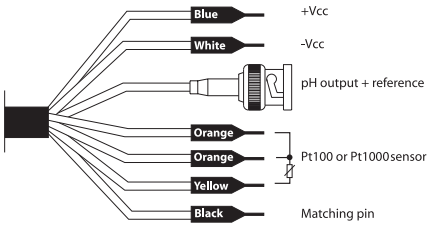
pH & ORP electrodes with direct wire connection



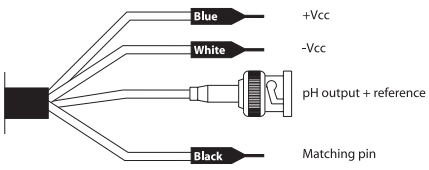
pH electrodes with BNC connector & Pt100 or Pt1000 temperature sensor



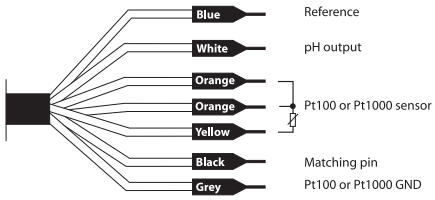
pH electrodes with BNC connector & Pt100 or Pt1000 temperature sensor, amplified



pH & ORP electrodes with BNC connector, amplified



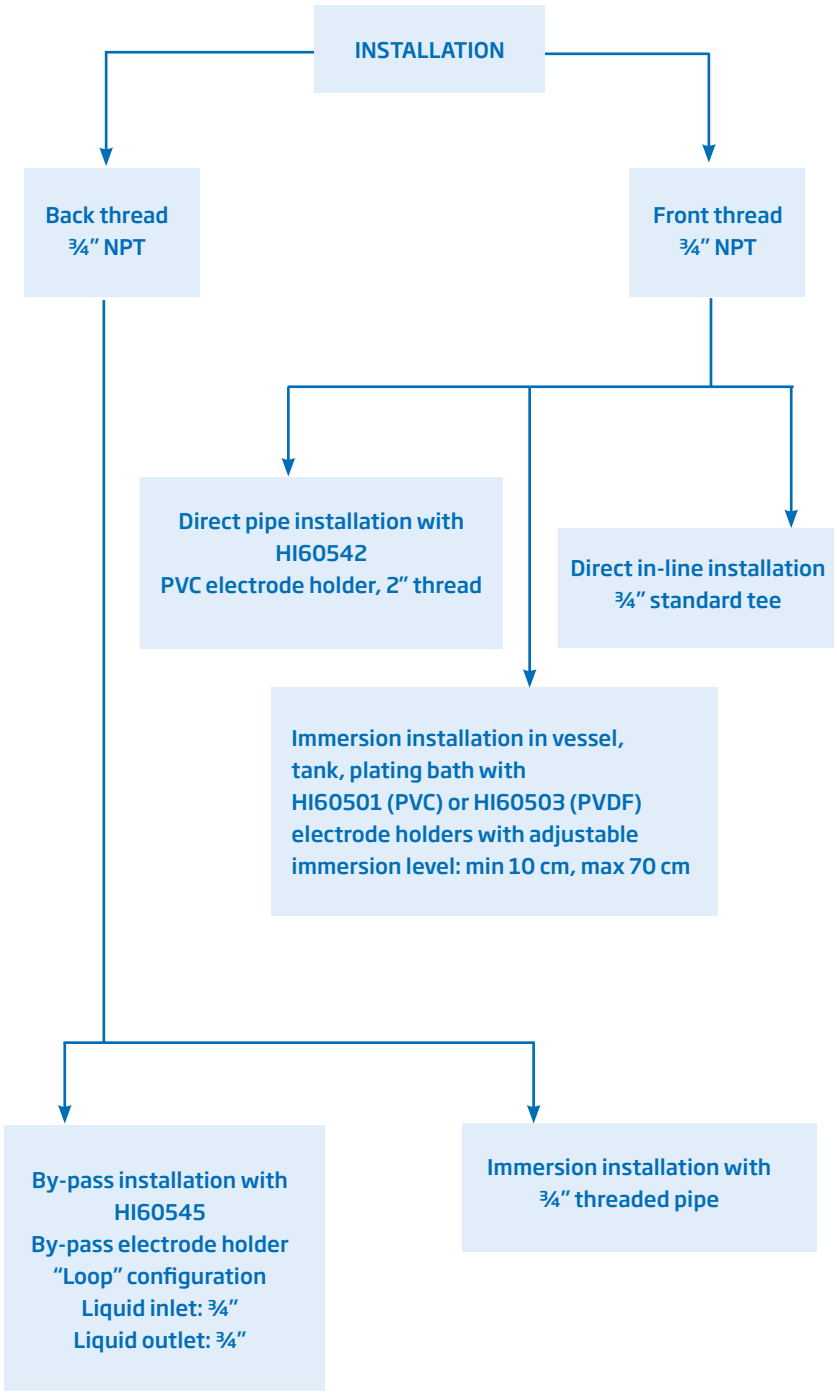
pH electrodes with direct wire connection & Pt100 or Pt1000 temperature sensor



Installation

These electrodes have been designed with ¾" external thread on both ends for easy installation.

Hanna also provides a series of probe holders for in-line, tank or by-pass installations for these electrodes, as shown below.



Amplified pH and ORP AmpHel® Electrodes

- Strong signal up to 75 meters (246')
- Low noise coaxial cables are no longer required
- Measurements in unclean samples and high humidity conditions
- Models with external replaceable battery, for longer electrode life
- Glass sensor for specific applications

Due to the high resistance of the glass membrane, conventional electrodes require a high impedance measurement system. Inadequate insulation of the connectors and cables results in erroneous readings due to leakage or noise. For conventional electrodes, the lead is therefore limited to typically less than 15-20 meters. Hanna AmpHel® electrodes incorporate a miniaturized amplifier which resolves most of the problems associated with high impedance signals. The amplifier circuitry is located right on top of the electrode and is completely sealed. As a result, a strong, low impedance signal is emitted and ordinary connectors with long unshielded cables can be used. This breakthrough technology provides a stable signal for industrial monitoring as well as a major saving in low noise coaxial cable costs. In some cases, the need for a transmitter is also eliminated, resulting in further cost reductions.

For those applications that have been proven particularly hostile to electrodes, Hanna has developed four types of specialized glass. First is an extremely durable sensor glass for general purpose and industrial use. This glass can withstand the stress of daily use. The remaining types of electrode glass allow continuous monitoring in highly acidic solutions containing fluoride ions, as well as high or low temperature process streams, without significantly reducing the life of the electrode.

The electrode body material is glass or PEI, while the junction is cloth or PTFE.

Hanna Glass Sensors for Process Electrodes

Glass Membrane	Application
GP	General Purpose
HT	High Temperature
LT	Low Temperature
HF	Samples with Fluoride

Easy Installation

Models with glass body and PTFE junctions are recommended for in-line installations.

Models with an PEI body and cloth junction are suitable for tank monitoring or for use with portable meters, where the electrode can be easily accessed for maintenance.

- Extend Electrode Life
  - With the AmpHel® replaceable battery model, it is no longer necessary to throw away an electrode when the battery is exhausted.

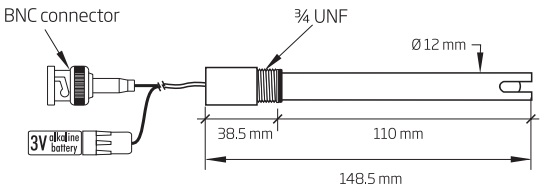
INSTALLATION

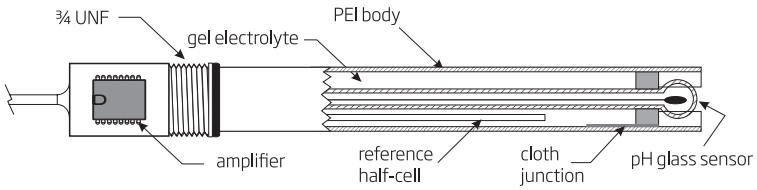
Front thread ¾" UNF

Direct in-line installation Electrode holder: HI6054B

Immersion installation Electrode holder: HI6050 (0.5 m) HI6051 (1.0 m) HI6052 (1.5 m)

Amplified pH and ORP AmpHel® Electrodes





AmpHel® pH Electrodes with Replaceable Battery - General Purpose pH Electrodes

Code	Body	Junction	Electrolyte	Glass Type	Temperature	Max Pressure	Connector	Cable
HI6291005	PEI	cloth	gel	GP	-5 to 70 °C	3 bar	BNC	5 m
HI6291010	PEI	cloth	gel	GP	-5 to 70 °C	3 bar	BNC	10 m

AmpHel® pH Electrodes with Replaceable Battery - High Temperature pH Electrodes

Code	Body	Junction	Electrolyte	Glass Type	Temperature	Max Pressure	Connector	Cable
HI8299505	glass	PTFE	polymer	HT	0 to 100 °C	3 bar	BNC	5 m


HI2911


HI2931

AmpHel® pH Electrodes with Internal Battery

Code	Body	Junction	Electrolyte	Glass Type	Temperature	Max Pressure	Connector	Cable
HI2910B	PEI	cloth	gel	GP	-5 to 70 °C	3 bar (43.5 psi)	BNC	1 m
HI2910B/5	PEI	cloth	gel	GP	-5 to 70 °C	3 bar (43.5 psi)	BNC	5 m
HI2911B/5	PEI	PTFE	polymer	GP	-5 to 80 °C	3 bar (43.5 psi)	BNC	5 m

AmpHel® ORP Electrodes with Replaceable Battery

Code	Body	Junction	Electrolyte	PIN Type	Temperature	Max Pressure	Connector	Cable
HI6293005	PEI	cloth	gel	platinum	-5 to 80 °C	3 bar (43.5 psi)	BNC	5 m
HI6493005	PEI	cloth	gel	gold	-5 to 80 °C	3 bar (43.5 psi)	BNC	5 m

AmpHel® ORP Electrodes with Internal Battery

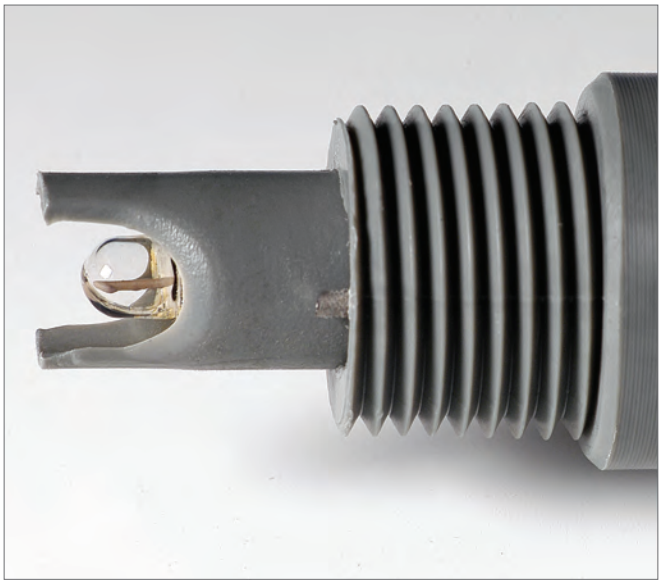
Code	Body	Junction	Electrolyte	PIN Type	Temperature	Max Pressure	Connector	Cable
HI2930B/5	PEI	cloth	gel	platinum	-5 to 80 °C	3 bar (43.5 psi)	BNC	5 m
HI2931B/5	PEI	PTFE	gel	platinum	-5 to 80 °C	3 bar (43.5 psi)	BNC	5 m

HI1000 and HI2000 Series

pH and ORP Electrodes for Continuous Flow-thru Monitoring

Specifically Built for Industrial Applications

- ½" NPT external thread for in-line installation
- pH electrode with exclusive PTFE non-clogging membrane
- Double-junction technology
- PVDF body
- Models with built-in matching pin and amplifier



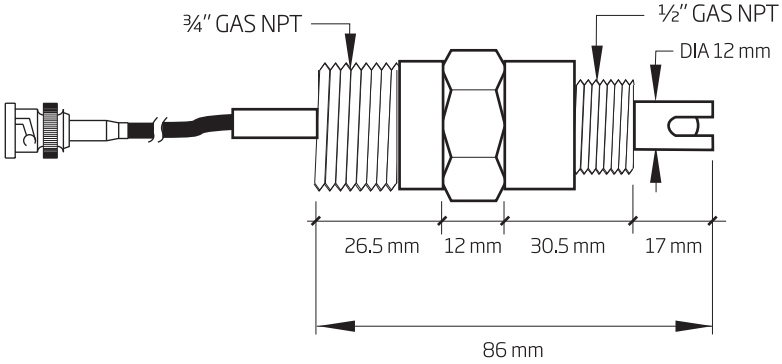
Matching pin with differential input for grounding

In order to reduce normal contamination coming from industrial use, these electrodes combine a polymer reference and double-junction technology. With this technology, no refilling is required and the electrode can be used in samples such as organic compounds, proteins and heavy metals. In addition, the pH electrodes use a unique annular PTFE junction that minimizes clogging.

These industrial probes have a glass body electrode for use in aggressive chemicals and are easy to clean. A PEI protective sleeve gives the electrodes resistance against mechanical stress. Operating limits are -5 to 80°C (23 to 176°F) and pressure up to 6 bar (87 psi).

Both pH and ORP models are available, many of which include a built-in matching pin. Some models also feature a built-in amplifier, which allows for measurements to be taken far from the location of the instrument without requiring a transmitter.

HI1000 and HI2000 series incorporate a BNC connector that enables connection to any pH/ORP meter quickly and easily. Models with 3 or 5 meters (9.8 or 16 feet) cable are available.



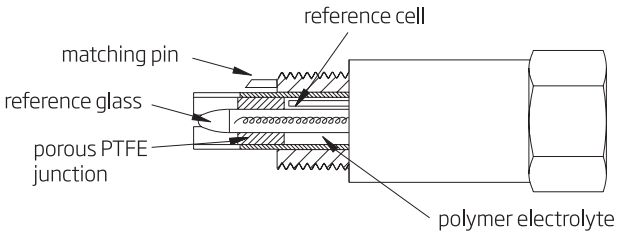
HI1000 and 2000 series

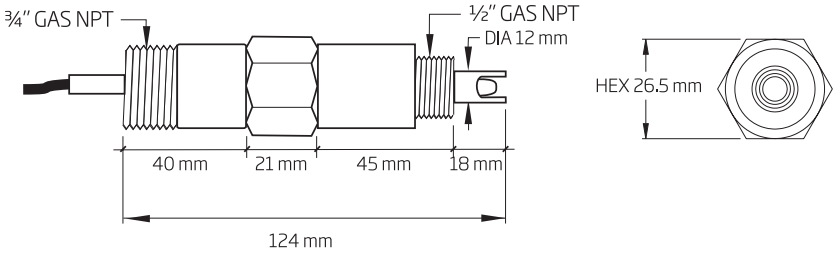
HI1001 and HI 1005 (pH Electrodes) and HI2001 (ORP Electrode with Pt sensor)

Code	Junction	Electrolyte	Temperature	Max Pressure	Connector	Cable
HI1001	double, PTFE	polymer	-5 to 80°C	6 bar (87 psi)	BNC	3 m
HI1005	double, PTFE	polymer	-5 to 80°C	6 bar (87 psi)	DIN	0.5 m
HI2001	double, PTFE	polymer	-5 to 80°C	6 bar (87 psi)	BNC	3 m

pH and ORP Electrodes for Continuous Flow-thru Monitoring

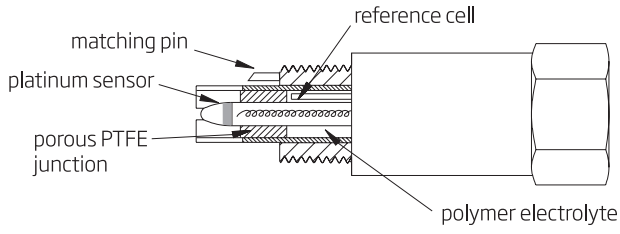
Specifically Built for Industrial Applications

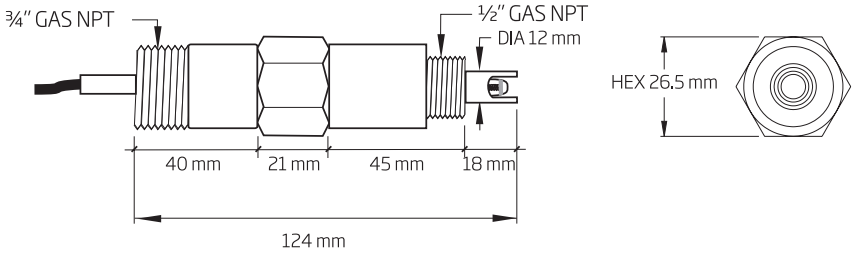




HI1000 Series: pH Electrodes

Code	Junction	Electrolyte	Matching Pin	Amplifier	Temperature	Max Pressure	Connector	Cable
HI1002/3	double, PTFE	polymer	–	–	-5 to 80°C	6 bar (87 psi)	BNC	3 m
HI1002/5	double, PTFE	polymer	–	–	-5 to 80°C	6 bar (87 psi)	BNC	5 m
HI1002/10	double, PTFE	polymer	–	–	-5 to 80°C	6 bar (87 psi)	BNC	10 m
HI1003/3	double, PTFE	polymer	yes	–	-5 to 80°C	6 bar (87 psi)	BNC	3 m
HI1003/5	double, PTFE	polymer	yes	–	-5 to 80°C	6 bar (87 psi)	BNC	5 m
HI1004/15	double, PTFE	polymer	yes	yes	-5 to 80°C	6 bar (87 psi)	spade lug	15 m





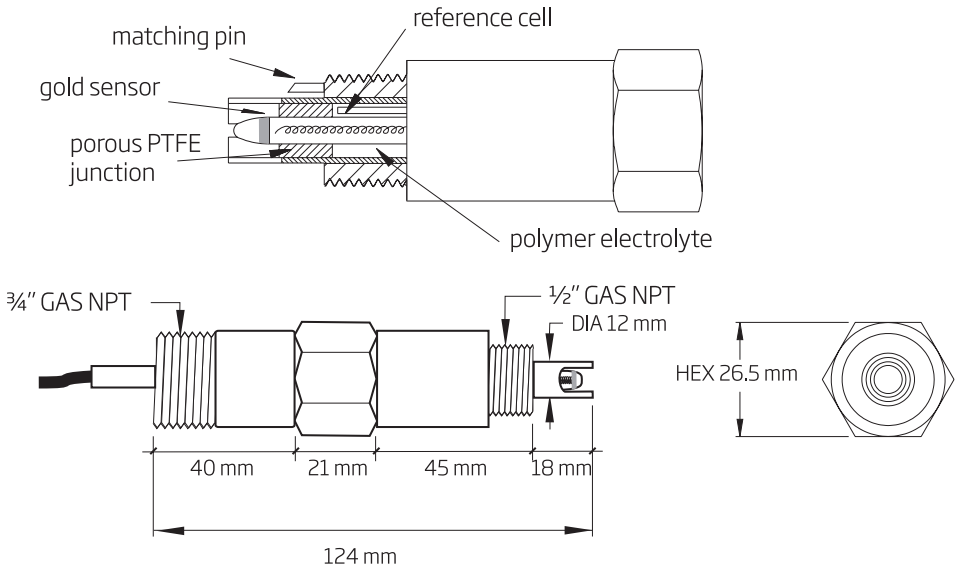
HI2000 Series: ORP Electrodes with Platinum Sensor

Code	Junction	Electrolyte	Matching Pin	Amplifier	Temperature	Max Pressure	Connector	Cable
HI2002/3	double, PTFE	polymer	–	–	-5 to 80°C	6 bar (87 psi)	BNC	3 m
HI2002/5	double, PTFE	polymer	–	–	-5 to 80°C	6 bar (87 psi)	BNC	5 m
HI2003/3	double, PTFE	polymer	yes	–	-5 to 80°C	6 bar (87 psi)	BNC	3 m
HI2003/5	double, PTFE	polymer	yes	–	-5 to 80°C	6 bar (87 psi)	BNC	5 m

HI1000 and HI2000 Series

pH and ORP Electrodes for Continuous Flow-thru Monitoring

Specifically Built for Industrial Applications

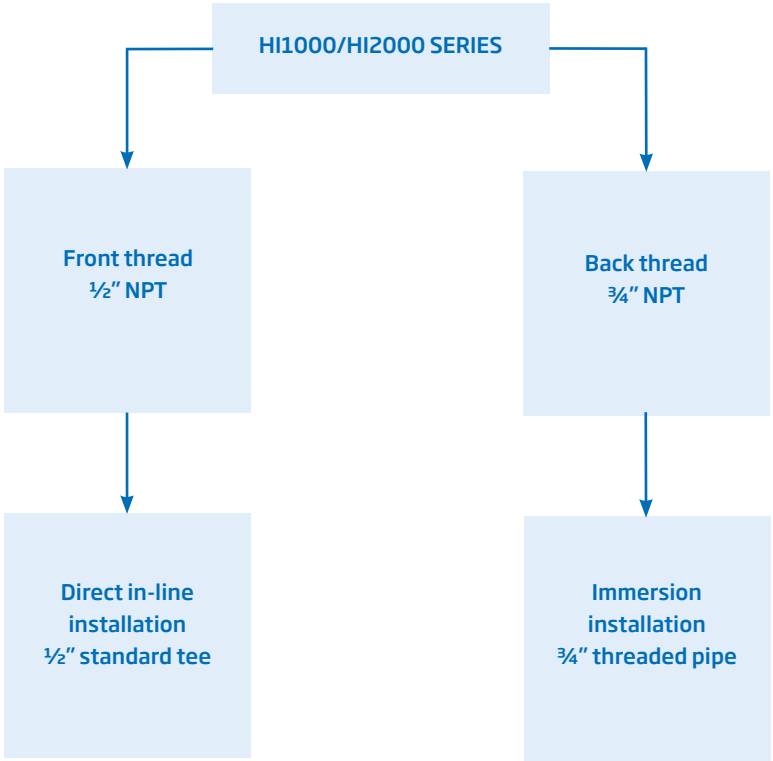


HI2000 Series: ORP Electrodes with Gold Sensor

Code	Junction	Electrolyte	Matching Pin	Amplifier	Temperature	Max Pressure	Connector	Cable
HI2008	double, PTFE	polymer	yes	yes	-5 to 80°C	6 bar (87 psi)	DIN	0.5 m

Installation

These sensors have a hex-shaped body for easy installation, requiring no special tools. Continuous in-line mounting is possible due to the ½" external thread. No special holders are required: HI1000 and HI2000 series can be used with any standard ½" pipe tee available on the market. On the opposite end, these probes are provided with a ¾" thread so that they can be attached to a pipe for dip applications.



Easy pH and ORP Electrodes

with Quick and Easy BNC Connection

- BNC connector
- Submersion and in-line installation capability
- PEI and glass body

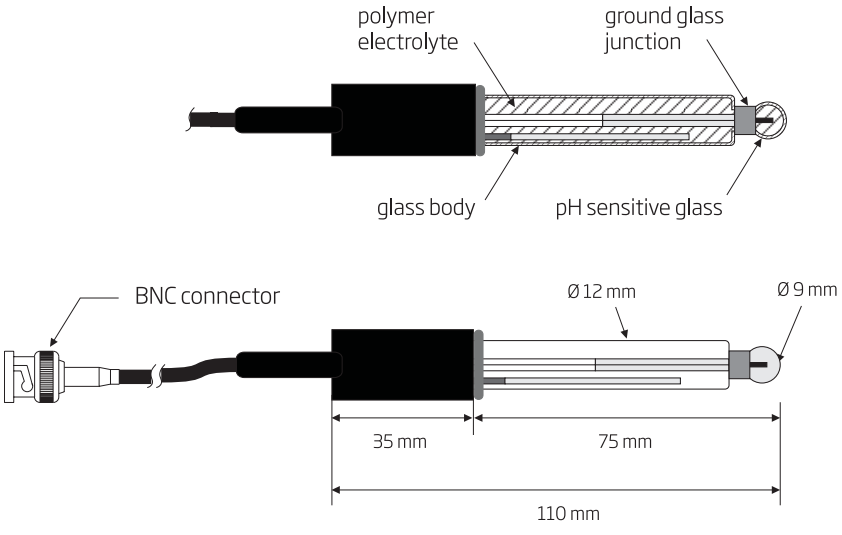
Hanna offers a wide range of combination pH and ORP electrodes specifically designed for the needs of industrial users.

In order to reduce contamination problems, all electrodes are gel or polymer filled and feature double-junction technology.

The BNC connector allows quick and easy connection to any pH/ORP meter or transmitter. In addition to this type of connection, select models offer a ¾" UNF thread for secure in-line installation.

PEI and glass body electrodes are available. PEI bodied electrodes are rugged and suitable for applications in which the capability to resist stress is needed. Glass body electrodes are easier to clean and recommended for use in aggressive chemicals.

All Hanna pH and ORP electrodes can be mounted with the Hanna in-line and submersion assemblies.

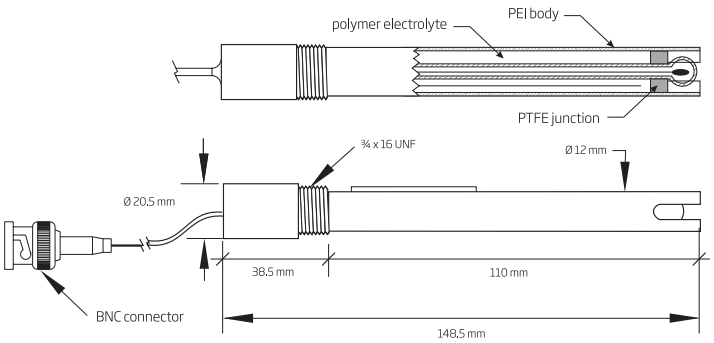


Combination Glass-body pH Electrode

Code	Junction	Electrolyte	Temperature	Max Pressure	Connector	Cable
HI1090B/5	double, ground glass	polymer	-5 to 95°C (23-203°F)	3 bar (43.5 psi)	BNC	5 m

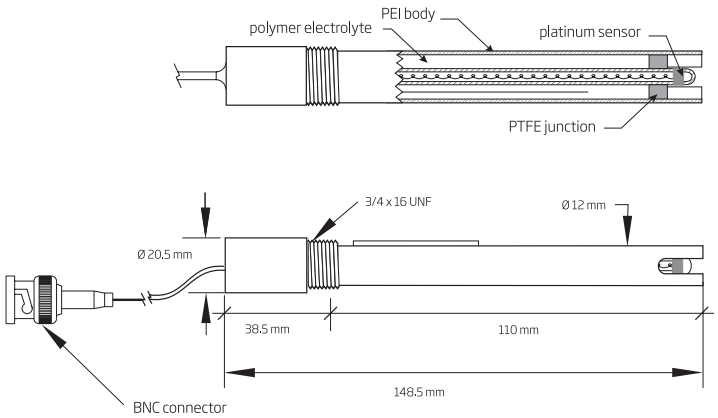
Easy pH and ORP Electrodes

with Quick and Easy BNC Connection



Combination PEI-body pH Electrode

Code	Junction	Electrolyte	Temperature	Max Pressure	Connector	Cable
HI1210B/5	double, PTFE	polymer	-5 to 80°C	3 bar (43.5 psi)	BNC	5 m



Combination PEI-body ORP Electrode with Platinum Sensor

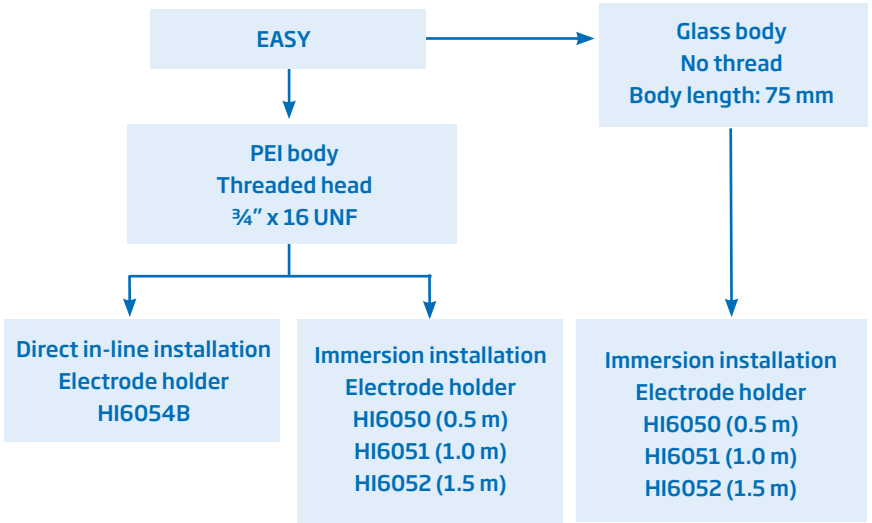
Code	Junction	Electrolyte	Temperature	Max Pressure	Connector	Cable
HI3210B/5	double, PTFE	polymer	-5 to 80°C	3 bar (43.5 psi)	BNC	5 m
HI3130B	single, ceramic	gel	0 to 80°C	3 bar (43.5 psi)	BNC	1 m

Installation

These electrodes feature flexible installation, with different mounting configurations available

Models with a glass body and no external thread can be installed on tanks using the HI6050 electrode holder with sealing O-ring.

Models with a PEI body and ¾" UNF thread or glass body and no thread can be easily installed directly in-line, using a T-shaped electrode holder, such as HI6054B.



pH and ORP Electrodes

with T-type Connection

- Screw cap connector and PG 13.5 thread
- Easy operation
- Double-junction technology
- Pressure up to 3 bar (43.5 PSI)

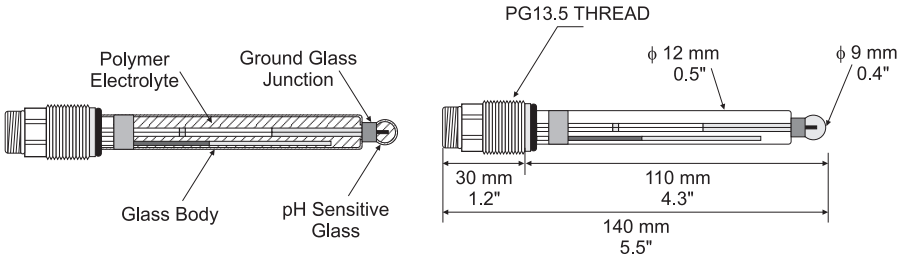
Electrodes featuring a T-connector have been designed by Hanna to take advantage of both PG 13.5 thread and screw cap. The PG 13.5 thread ensures proper in-line installation; furthermore, the user can quickly and easily perform all servicing and maintenance procedures. The screw cap allows for maximum versatility making it possible to connect a cable of different lengths. Easily detacheable cables make electrode replacement simple.

Many models are available to choose from, all of which feature a double junction of gel polymer filling to ensure long electrode life and reliability in harsh environments.
In addition, users can select from ground-glass or cloth junction technology to meet the needs of their specific application.

Electrodes featuring a PEI body are ideal for use in moderately aggressive liquids, such as in wastewater, while electrodes featuring glass bodies are recommended with more aggressive chemicals, such as in galvanic applications.

These sensors are suitable to be operated with moderate pressure up to 3 bar (43.5 psi) and operating temperature limits of -5 up to 95°C (23 to 203°F).

Hanna electrode holders and assemblies are featured at the end of this section for in-line and submersion applications. These optional accessories can be dismantled and reassembled easily without requiring any special tools.

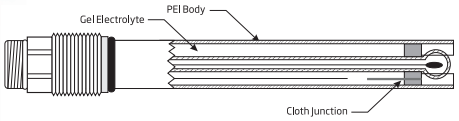


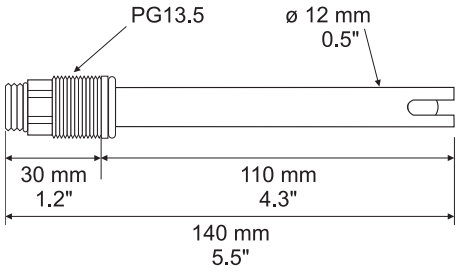
Combination Glass-body pH Electrode

Code	Junction	Electrolyte	Temperature	Max Pressure	Connector
HI1190T	double, PTFE	polymer	-15 to 80°C (5 to 176°F)	6 bar (87 psi)	T-type
HI1191T	double, PTFE	polymer	-15 to 80°C (5 to 176°F)	8 bar (116 psi)	T-type
HI1192T	double, PTFE	polymer	-15 to 80°C (5 to 176°F)	8 bar (116 psi)	T-type

pH and ORP Electrodes

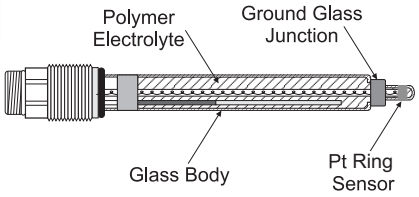
with T-type Connection

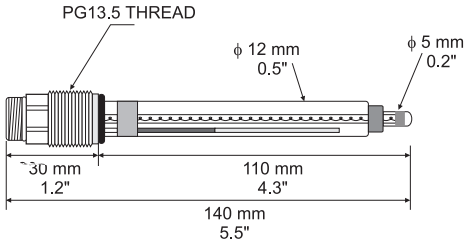




Combination PEI-body pH Electrode

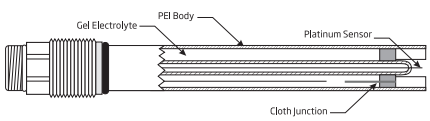
Code	Junction	Electrolyte	Temperature	Max Pressure	Connector
HI1210T	double, cloth	gel	-5 to 80°C (23 to 176°F)	3 bar (43.5 psi)	T-type
HI1211T	double, PTFE	polymer	-5 to 80°C (23 to 176°F)	3 bar (43.5 psi)	T-type

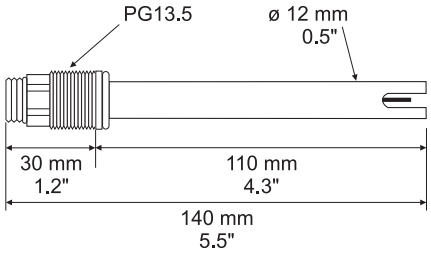




Combination Glass-body ORP Electrode with Platinum Sensor

Code	Junction	Electrolyte	Temperature	Max Pressure	Connector
HI3090T	double, ground glass	polymer	-5 to 95°C (23 to 203°F)	3 bar (43.5 psi)	T-type
HI3190T	double, PTFE	polymer	-15 to 100°C (5 to 212°F)	6 bar (87 psi)	T-type
HI3211T	double, cloth	gel	-5 to 80°C (23 to 176°F)	3 bar (43.5 psi)	T-type



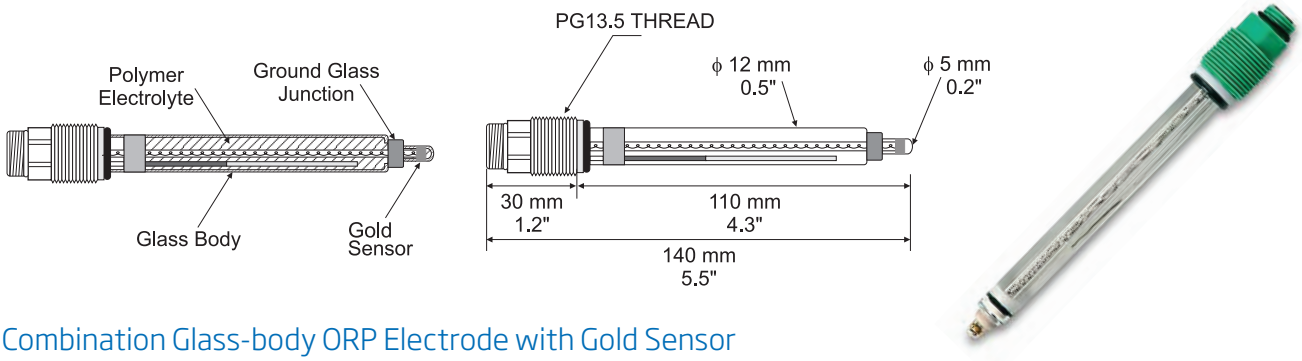


Combination PEI-body ORP Electrode with Platinum Sensor

Code	Junction	Electrolyte	Temperature	Max Pressure	Connector
HI3210T	double, cloth	gel	-5 to 80°C (23 to 176°F)	3 bar (43.5 psi)	T-type

pH and ORP Electrodes

with T-type Connection



Combination Glass-body ORP Electrode with Gold Sensor

Code	Junction	Electrolyte	Temperature	Max Pressure	Connector
HI4190T	double, PTFE	polymer	-5 to 80°C (23 to 176°F)	3 bar (43.5 psi)	T-type
HI4290T	single, ground glass	polymer	-5 to 80°C (23 to 176°F)	3 bar (43.5 psi)	T-type

pH and ORP Immersion and In-Line Electrodes

Code	HI101	HI102	HI201
Description	submersible pH electrode	in-line pH electrode	submersible ORP electrode
Reference	double, Ag/AgCl	double, Ag/AgCl	double, Ag/AgCl
Junction / Flow Rate	PTFE	PTFE	PTFE
Electrolyte	polymer	polymer	polymer
Max Pressure	6 bar (25°C)	6 bar (25°C)	6 bar (25°C)
Range	pH: 0 to 13	pH: 0 to 13	pH: 0 to 13
Recommended Operating Temp.	20 to 40°C (68 to 104°F)	20 to 40°C (68 to 104°F)	20 to 40°C (68 to 104°F)
Tip /Shape	flat	flat	flat, platinum
Temperature Sensor	no	no	no
Amplifier	no	no	no
Body Material	PVC	PVC	PVC
Connector	BNC female	BNC female	BNC female
Connection Cable	HI101/3 adapter with 3 m (9.9') cable	HI101/3 adapter with 3 m (9.9') cable	HI101/3 adapter with 3 m (9.9') cable
Recommended Use	Immersion	In-line	Immersion

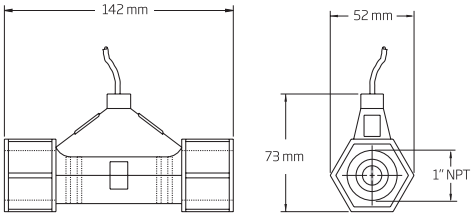
HI7635

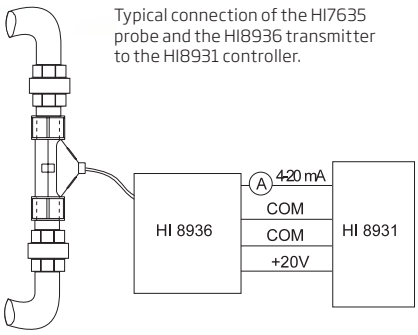
In-line Conductivity Probes

These conductivity probes combine the proven four-ring potentiometric method of measuring conductivity with platinum sensors. The universally acclaimed four-ring method provides an exceptionally stable measurement over a wider range. These probes do not suffer polarization, nor do they need frequent calibration or cell changes.

The built-in temperature sensor (select models) allows automatically temperature compensated measurements and features easy operation and maintenance.

The majority of probes are provided with a 4 m cable incorporating color coded wires for easy connection to HI8936 transmitters while others provide a DIN connection.





Typical connection of the HI7635 probe and the HI8936 transmitter to the HI8931 controller.

Code	Temperature Compansation	Body	Operating Temperature	Max Pressure (@25°C/77°F)	Cable/ Connection
HI7635	automatic, 0 to 50°C with NTC sensor	polypropylene	0 to 80°C (32 to 176°F)	5 bar	4 m (13.1')/Color coded wires

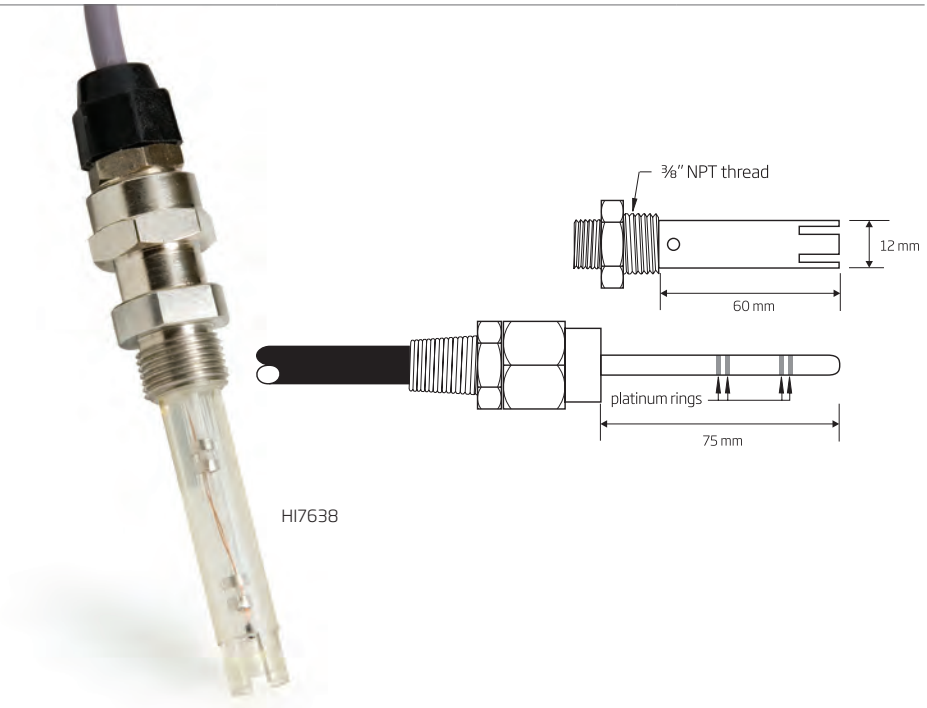
HI7638 • HI7639

In-line Conductivity Probes

with Platinum Ring

These conductivity probes combine the proven four-ring potentiometric method of measuring conductivity with platinum sensors. The universally acclaimed four-ring method provides an exceptionally stable measurement over a wider range. These probes do not suffer polarization, nor do they need frequent calibration or cell changes.

HI7638 and HI7639's built-in temperature sensor allows automatically temperature compensated measurements and features easy operation and maintenance.

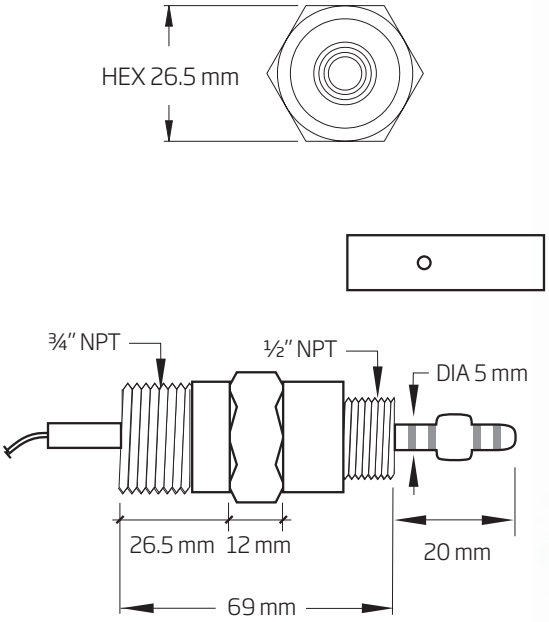


HI7638

Code	Temperature Compensation	Body	Operating Temperature	Max Pressure (@25°C/77°F)	Cable/Connection
HI7638	automatic, 0 to 50°C with NTC sensor	PEI and glass	0 to 120°C (32 to 248°F)	5 bar (72.5 psi)	3 m (9.9')/Color coded wires
HI7638/10	automatic, 0 to 50°C with NTC sensor	PEI and glass	0 to 120°C (32 to 248°F)	5 bar (72.5 psi)	10 m (32.8')/Color coded wires
HI7638/20	automatic, 0 to 50°C with NTC sensor	PEI and glass	0 to 120°C (32 to 248°F)	5 bar (72.5 psi)	20 m (65.6')/Color coded wires
HI7639	automatic, 0 to 50°C with Pt100 sensor	PEI and glass	0 to 120°C (32 to 248°F)	5 bar (72.5 psi)	3 m (9.9')/Color coded wires

HI3001 • HI3001D • HI3011

Flow-thru Conductivity Probes




HI3001

These four-ring probes measure conductivity with platinum sensors. They come with standard ½" external thread on the front for flow-thru mounting and ¾" threads on the back for submersion or pipe mounting.

These probes feature 3 m (9.9') of cable and the protective cover is made of PEI and can be removed for quick maintenance. These probes can withstand temperatures up to 80°C (176°F) and 6 bars (87 psi) of pressure.

In addition, HI3001 houses an NTC sensor for Automatic Temperature Compensation.

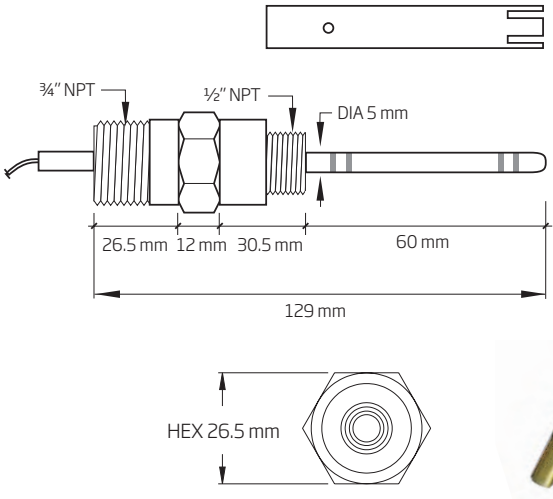
Model HI3001D with DIN connector is to be used with the HI99xx series of wall-mounted controllers.

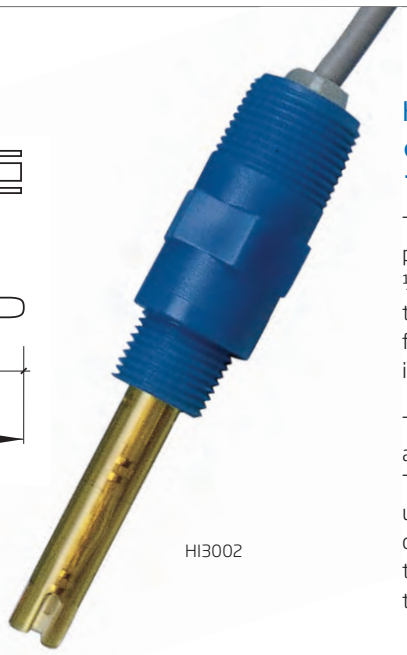
Code	Temperature Compensation	Body	Operating Temperature	Max Pressure (@25°C/77°F)	Connector	Cable
HI3001	automatic, 0 to 60°C with NTC sensor	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	–	3 m (9.9')
HI3001D	automatic, 0 to 60°C with NTC sensor	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	DIN	3 m (9.9')
HI3001D/5	automatic, 0 to 60°C with NTC sensor	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	DIN	5 m (16.4')
HI3001D/10	automatic, 0 to 60°C with NTC sensor	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	DIN	10 m (32.8')
HI3003/D*	automatic, 0 to 60°C with NTC sensor	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	DIN	3 m (9.9')
HI3011	–	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	–	3 m (9.9')

*for HI9914 only

HI3002

Submersion Probes




HI3002

The HI3002 four-ring probe measure EC with platinum sensors. It comes with standard ½" external thread on the front for flow-thru mounting and ¾" threads on the back for submersion or pipe mounting. Probes incorporate 3 m (9.9') of cable.

The protective probe cover is made of PEI and can be removed for quick maintenance. These probes can withstand temperatures up to 80°C (176°F) and 6 bars (87 psi) of pressure. HI3002 also houses an NTC temperature sensor for automatically temperature compensated measurements.

Code	Temperature Compensation	Body	Operating Temperature	Max Pressure (@25°C/77°F)	Connector	Cable
HI3002	automatic, 0 to 60°C with NTC sensor	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	–	3 m (9.9')

HI7610 • HI7611

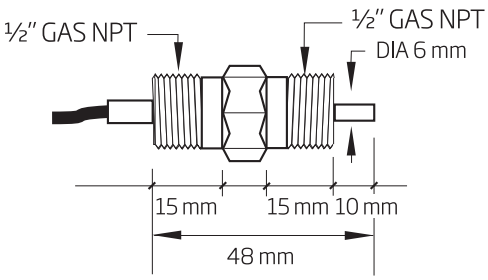
Stainless Steel Temperature Probes

- Flow-through and immersion mounting
- High accuracy
- Stainless steel model with ½" GAS NPT external thread
- Glass version with high chemical resistance and PG 13.5 external thread

HI7610 and HI7611 are temperature probes with 3-wire Pt100 or Pt1000 sensors. These probes provide accurate and effective temperature compensation. They can be used with a vast array of industrial pH, ORP and conductivity controllers on the market, as well as our pH 500, mV 600, HI700 and HI504 series.

HI7610 and HI7611 are constructed of stainless steel for additional ruggedness. They incorporate ½" external threads on both ends to facilitate inline and immersion installations.

HI7610, HI7611



HI7610 and HI7611 Industrial Temperature Probes

Code	Temperature Sensor	Body	Max Pressure	Cable Length
HI7610	Pt100	stainless steel	8 bar	5 m (16.4')
HI7611	Pt1000	stainless steel	8 bar	5 m (16.4')

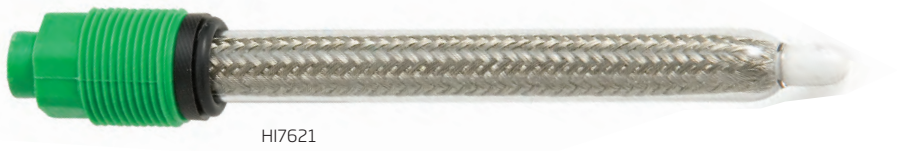
HI7620 • HI7621

Glass Body Probes

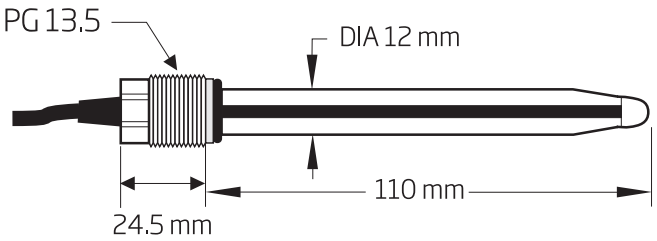
- Flow-thru and immersion mounting
- High accuracy
- Glass body with high chemical resistance and PG 13.5 external thread

HI7620 and HI7621 are temperature probes with 3-wire Pt100 or Pt1000 sensors. These probes provide accurate and effective temperature compensation. They can be used with a vast array of industrial pH, ORP and conductivity controllers on the market, as well as our pH 500, mV 600, HI700 and HI504 series.

HI7620 and HI7621 are made with a glass body in order to provide greater resistance against aggressive chemicals. They also come with a standard PG 13.5 external thread so that they may be used with our HI6054T holder as well as other common probe holders.

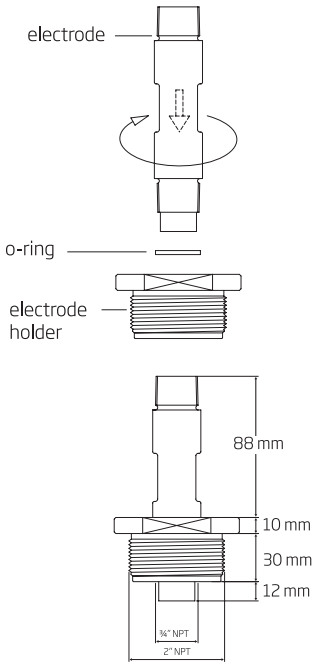


HI7621



HI7620 and HI7621 Industrial Temperature Probes

Code	Temperature Sensor	Body	Max Pressure	Cable Length
HI7620	Pt100	glass	3 bar	5 m (16.4')
HI7621	Pt1000	glass	3 bar	5 m (16.4')



HI60542

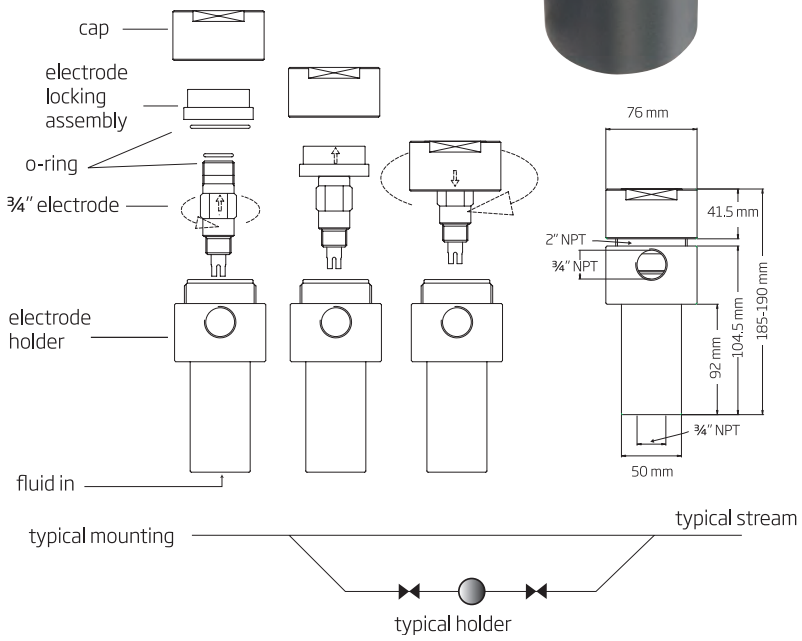
In-line Electrode Holder

for Direct Pipe Installation

HI60542 is a two inch NPT in-line PVC electrode holder ideal for direct pipe installation.

HI60542 has been designed specifically to be used with Hanna ¾" NPT process electrodes with built-in temperature sensor and matching pin.

Specifications	HI60542
Electrode Holder Material	PVC
O-ring Material	NBR (Buna N)
Minimum Temperature	-10 °C
Maximum Temperature	+60 °C
Maximum Pressure	8 bar @25°C or 3 bar @50°C



HI60545

By-pass Loop Electrode Holder

No Downtime

HI60545 is an electrode holder designed for use in a bypass loop configuration.

HI60545 allows easy maintenance and calibration without shutting down the process. The design of HI60545 assures that the glass sensor remains wet even when system is not under pressure.

HI60545 is only for use with Hanna 1006 series probes that have a ¾" NPT fitting.

Specifications	HI60545
Electrode Holder Material	PVC
O-ring Material	NBR (Buna N)
Minimum Temperature	-10 °C
Maximum Temperature	+60 °C
Maximum Pressure	8 bar @25°C or 3 bar @50°C

HI6050

Submersible Electrode Holder

These electrode mounting systems are constructed in rugged PVC and will resist most of the chemicals associated with wastewater treatment.

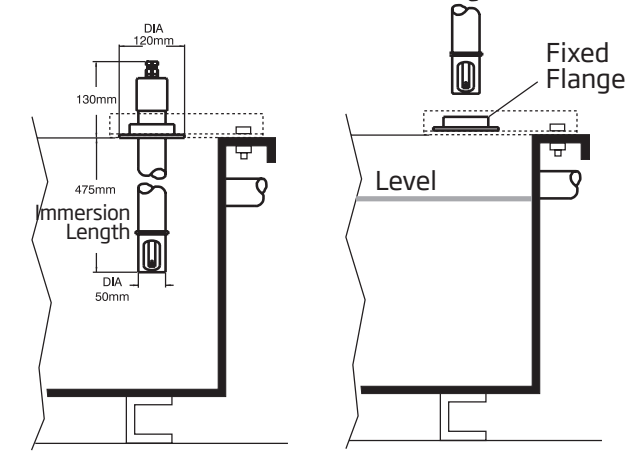
They are easy to install and require no tools for maintenance, making weekly electrode inspection and meter calibration a quick and easy task.

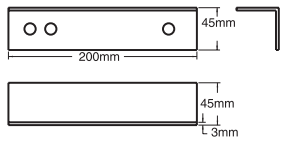
The mounting flange is a rugged PVC piece that mounts directly to the stainless steel brackets on tanks.

The figure illustrates the suggested bracket dimensions used for mounting. Once mounted to the tank, the electrode holder is a sturdy, protective housing that will extend the life of the electrodes.

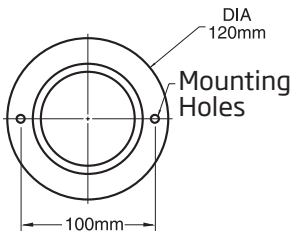
The electrode slides into the holder and is hand tightened into place. The cable from the electrode will lead up through the holder and out through the cap on top. The cable is also shielded inside the holder to prevent any damage to the insulation. The protective cap is removable to allow for quick and simple electrode maintenance and replacement.

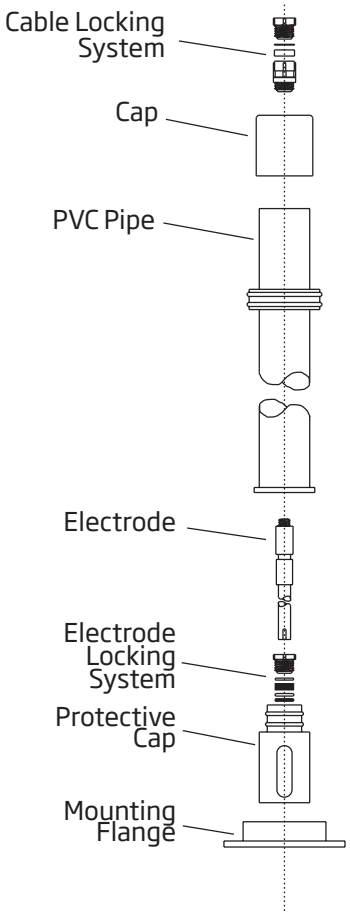
Removable electrode holder will slide in and out of mounting flange without the need for tools





Suggested dimensions of stainless steel mounting brackets to mount the flange onto the tank





Specifications	Total Length	Weight	Submersion Length
HI6050	605 mm (23.8")	0.8 kg (26 oz.)	475 mm (18.7")
HI6051	1105 mm (43.5")	1.2 kg (44 oz.)	975 mm (38.4")
HI6052	1605 mm (63.2")	2.0 kg (71 oz.)	1500 mm (59.1")

HI6054B • HI6054T

Electrode Holders

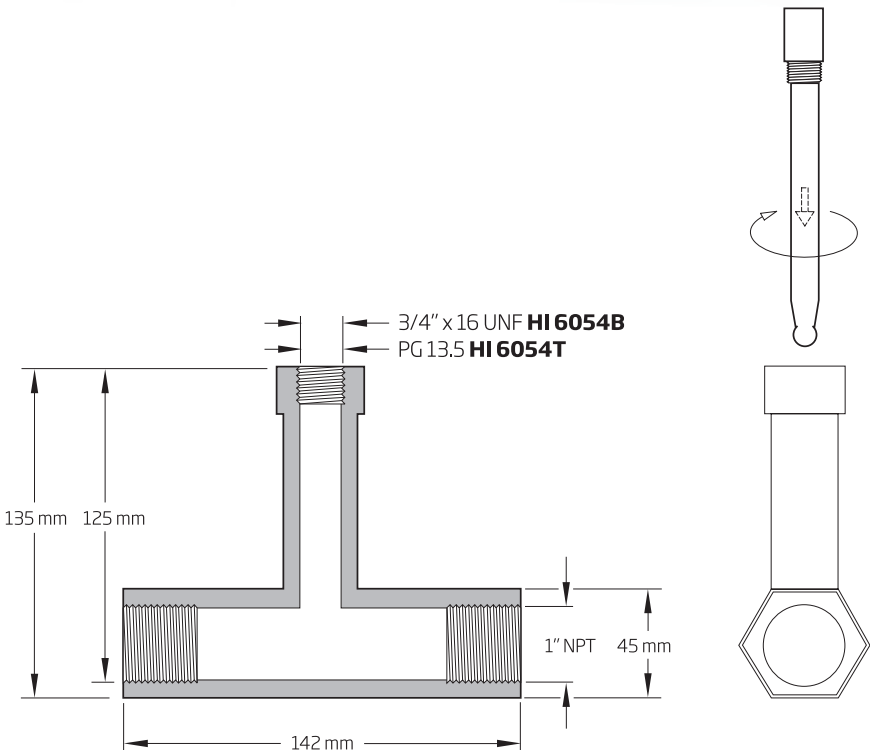
for In-line Applications

The HI6054 is a rugged, fiber-reinforced polypropylene in-line electrode holder.

Simply install the holder in the line so that liquid will always be present inside of it.

Once installed, the electrode will remain in contact with the fluid at all times, allowing the most accurate readings possible.

The HI6054B and HI6054T are designed specifically to work with Hanna electrodes with external thread of ¾" x 16 UNF and PG 13.5 respectively.



Actual Installation Examples

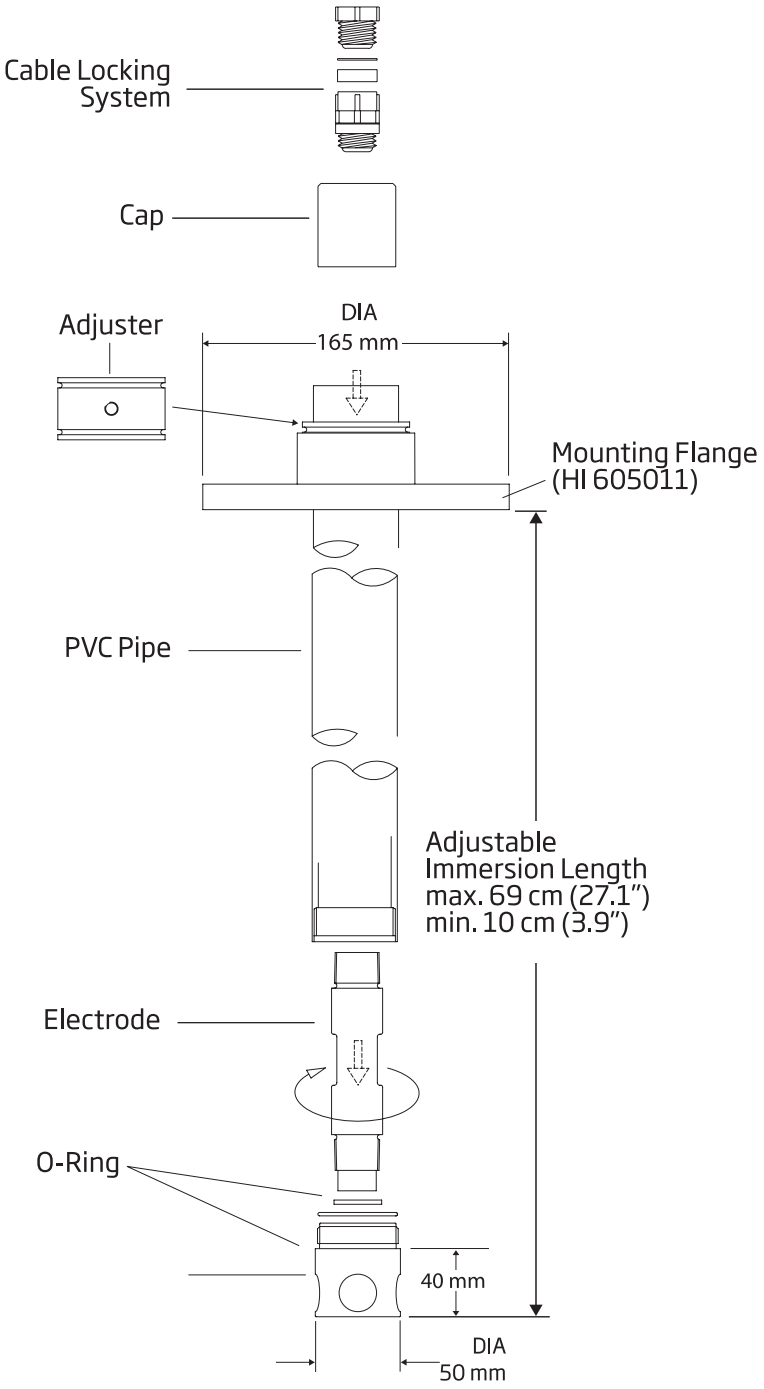
HI60501 • HI60503

Immersion Electrode Holders

for Tanks, Vessels, Baths and Open Channels

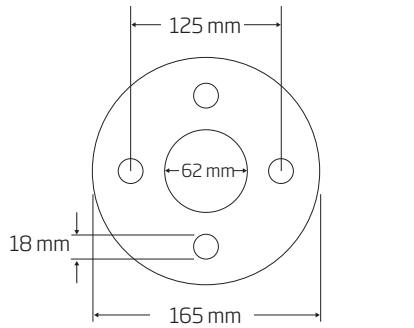
These electrode holders have an adjustable length and have been designed for immersion applications. Simply set the flange adjuster and the flange (HI605011) to the required length and install.

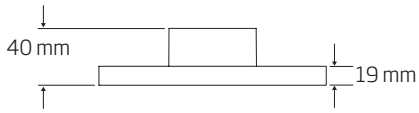
These holders have been designed specifically to be used with Hanna 1006 series probes that have a ¾" NPT fitting.



HI60503

HI 605011 mounting flange





Specifications	HI60501	HI60503
Electrode Holder Material	PVC	PVDF
O-ring Material	NBR (Buna N)	NBR (Buna N)
Minimum Immersion Level	10 cm (3.9")	10 cm (3.9")
Maximum Immersion Level	69 cm (27.1")	69 cm (27.1")
Minimum Temperature	-10°C (14°F)	-15°C (5°F)
Maximum Temperature	+60°C (140°F)	+100°C (212°F)

Table of Contents

IP67 Protection

IP67: The Waterproof Advantage

Hanna waterproof meters comply with the IP67 standards that classify them dust-tight and protected against the effect of temporary immersion in water.

This enables the units to operate in the harshest of environments, protected against spills, dust, high humidity and severe weather conditions. This makes them ideal for outdoor measurements and the most severe industrial applications such as mines, food processing, plating, foundries, etc. Hanna waterproof meters are built to last.

IP67 Protection

IP Codes

This standard describes a system for classifying the degree of protection provided by the enclosure of electrical/electronic equipment. Developed by the European Committee for Electro-Technical Standardization (CENELEC), these standards are designed to numerically rate an electrical product on the level of protection its enclosure provides. By assigning different number codes, the degree of protection of the product can be quickly and easily identified. In the IP 67 code, for example, IP signifies International Protection, the first digit 6 indicates the level of protection from solid objects, and the second digit 7 denotes the level of protection from liquids. See the tables below for the details.

DEGREE OF PROTECTION (First Number in the Code)

First #	Description
0	No special protection
1	Protected against solid foreign objects of 50 mm diameter and greater, e.g. human hands
2	Protected against solid foreign objects of 12.5 mm diameter and greater, e.g. human hands
3	Protected against solid foreign objects of 2.5 mm diameter and greater, e.g. tools, thick wire
4	Protected against solid foreign objects of 1.0 mm diameter and greater, e.g. wires, screws
5	Ingress of dust is not totally prevented, but dust shall not penetrate in a quantity to interfere with satisfactory operation of the apparatus or to impair safety.
6	No ingress of dust, complete protection

DEGREE OF PROTECTION FROM LIQUIDS (Second Number in the Code)

Second #	Description
0	Not protected
1	Protected against vertically falling water drops
2	Protected against vertically falling water drops tilted up to 15°
3	Protected against spraying water
4	Protected against splashing water
5	Protected against water jets
6	Protected against powerful water jets
7	Protected against the effects of temporary immersion in water, up to 1 m
8	Protected against the effects of continuous immersion in water, beyond 1 m

CE Mark Definition and Compliance

All industries make use of electronic instrumentation for their daily operations. The increased use of electronic equipment in many industries means that more instruments are used together and in conjunction with each other, often in a very restricted area.

Proximity of equipment has increased the likelihood of interferences between various instruments, as well as the instruments and the environment surrounding them. Improper operation of the equipment may result from these undesired Electromagnetic Interferences (EMI).

Electromagnetic Interferences (EMI)

Electromagnetic Interferences are generated by currents which flow into the electronic circuitry of instrumentation. Some electromagnetic interferences originate in nature through atomospheric phenomena, such as lightning and static electricity.

Electromagnetic Compatibility (EMC) Directives define two categories (illustrated below).

Susceptibility

Directives which sets standards for the amount of EMI a device can withstand and still operate normally and without incurring any damage.

Emission Directives

Restrict the amplitude of the signals emerging from a device.

Each category is further sub-divided into:

- Conducted EMI propagated by wires (such as power or connection cables)
- Radiated EMI spread through the air

The effects of these electromagnetic interferences are the main cause for:

- Incorrect equipment operation and therefore, inaccurate measurements
- Damage to the equipment, itself

International Governing bodies have defined the EMI tolerance limits for electronic instruments. The aim is to limit EMI effects and to reach an Electromagnetic Compatibility (EMC) that permits all electronic devices to operate normally, and in proximity with each other, without having an adverse effect on their operation.

Electromagnetic Compatibility

Electromagnetic Compatibility of an instrument means that electromagnetic interferences will not compromise its functionality, and at the same time, the meter itself will not generate interferences which may affect other equipment. In Europe, the CE mark on a product means compliance with the EMC Directives. The products must meet the directives before they can be legally sold. The CE Directive referring the the "Conducted and Radiated Emissions" is designated as EN 50081-1, while EN 50082-1 defines the prerequisites for "Susceptibility to the Conducted and Radiated EMI".

The "Mission Statement" of Hanna's Research and Development is "a complete dedication in designing electroanalytical instruments to monitor and safeguard the environment, in compliance with the CE Directives". The following provides a short list of the significance of CE Norms and how we comply with them.

- Radiated Susceptibility
  - Our instruments are not susceptible to radiation generated by other equipment that in turn can cause improper operation, such as, automatic switching off and/or inaccurate measurements.
- Radited Emissions
  - The Hanna meters do not emit radiation that might cause improper functioning of other equipment in their proximity (such as switching off and/or inaccurate measurements).
- Susceptibility to Conducted Interferences
  - This is caused mainly by power leads or signal/control cables connecting different devices, which could result in malfunctioning or permanent damage. Hanna products come with this protection
- Electrostatic Discharges
  - Hanna equipment is not susceptible to static electricity from users or objects, whether due to direct contact or proximity. This kind of discharge can cause severe damage to other equipment.
  - Compliance with the CE Directives, ensures reliability and accuracy for products manufactured by Hanna.

Hanna Meter Vs. Meter without CE

To show how susceptible instruments are to outside interference, we had a pH meter without the CE Mark tested against HI 98240 from Hanna (shown below). Both meters had a purported 0.01 pH margin of error.

Both meters were subjected to the effects of an external electro-magnetic field, in accordance with the procedures established by the CE Directives. The graphs show the measurements taken at different frequencies.

As you can see from the histograms, at 3 V/meter and 100 MHz frequency, the Hanna meters stayed within the stated tolerance, wheras the non-CE model displayed an erroneous reading of almost 5 pH! The rest of the graph also demonstrates that the readings from the Hanna meter remained practically unvaried throughout the test.


HANNA instruments

CE

DECLARATION OF CONFORMITY

HI 98127 and HI 98128

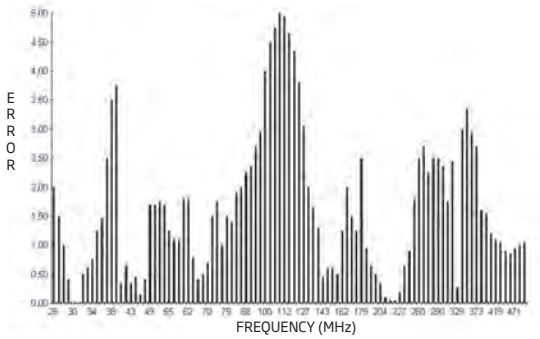
Our commitment to provide quality products for our customers has resulted in instruments manufactured by Hanna, complying with the European Directives

EN 61000-6-1,

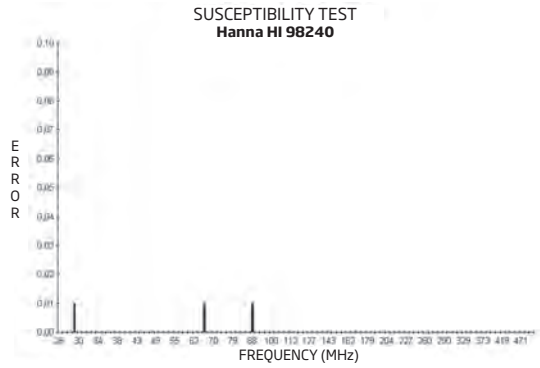
EN 61000-6-3 and

EN 61010-1.

SUSCEPTIBILITY TEST
pH Meter without CE Mark



SUSCEPTIBILITY TEST
Hanna HI 98240



ISO 9001:2008 Compliance


Certificate

ISO 9001:2008

HANNA INSTRUMENTS, INC. / HANNA INSTRUMENTS USA

ISO 9001:2008

Design, development, manufacture, sales and marketing, warehouse, distribution and servicing of electro-analytical instrumentation

ISO Standards

ISO 9000 standards were adopted in 1978 by the International Organization of Standards in Geneva, Switzerland, as a uniform standard of excellence for use in the European Economic Community. The standards were an immediate success and have since been adopted in more than 90 countries around the world, including the USA.

In order to obtain an ISO 9001:2008 Certification, each of the following departments need to comply with rigorous ISO standards:

1. Design/Development: Hanna products are designed, developed and engineered under ISO 9001:2008 standards.
2. Production: Every instrument undergoes stringent Quality Control tests at different stages of manufacturing.
3. Quality Assurance: All meters undergo 100% quality control checks prior to shipment.
4. Installation and Servicing: Hanna provides unsurpassed level of customer service, technical support and after sales assistance.

Hanna is an ISO 9001:2008 certified company. Our production system is certified to guarantee our customers a quality product every time.

With Hanna, you receive products manufactured to the most stringent quality standards.

ABS

Acrylonitrile butadiene styrene is a common thermoplastic.

ABS/LAS

Alkyl benzene sulfonate / Linear alkyl sulfonate (detergents)

Absorbance

Absorption of light is a typical phenomenon of interaction between electromagnetic radiation and matter. When a light beam crosses a substance, some of the radiation may be absorbed by atoms, molecules or crystal lattices.

Accuracy

The accuracy of an analytical procedure expresses the closeness of agreement between the value which is accepted either as a conventional true value or an accepted reference value and the value found.

AISI

The American Iron and Steel Institute.

Alkalinity

The quantitative capacity of a water sample to neutralize an acid to a set pH.

Analytical Procedure

The analytical procedure refers to the way of performing the analysis. This may include but is not limited to: the sample, the reference standard and the reagents preparations, use of the apparatus, generation of the calibration curve, use of the formula for the calculation, etc.

Amphel™

Hanna AmpHel® electrodes incorporate a miniaturized amplifier which resolves most of the problems associated with high impedance signals. The amplifier circuitry is located right on top of the electrode and is completely sealed. As a result, a strong, low impedance signal is emitted and ordinary connectors with long unshielded cables can be used. This breakthrough technology provides a stable signal for industrial monitoring as well as a major saving in low noise coaxial cable costs. In some cases, the need for a transmitter is also eliminated, resulting in further cost reductions.

AOAC

Association of Official Analytical Chemists

Aqua Dip™

Aqua Dip™ EC/TDS provides simple and fast EC/TDS/Temperature measurements in places with high relative humidity.

ASBC

American Society of Brewing Chemists.

ASTM

American Society for Testing and Materials.

ATC

Automatically Temperature Compensation.

Auto-feedback

With a Hanna magnetic stirrer incorporating auto-feedback, any change in viscosity or volume of the solution is automatically compensated for to keep the speed constant.

Backlight

A form of illumination used in LCD's; backlights illuminate the LCD from the side or back of the display panel.

Backpack Lab™

Backpack Lab™ from Hanna are portable student laboratories
that include a collection of well constructed lessons and activities, testing instruments, and kits for use by educators and students of environmental science.

°Baumé

The Baumé scale is used to measure density of various liquids. Notated variously as degrees Baume, degrees Baumé, B°, Be°, Bé, Baume.

BEPS

Battery Error Prevention System. Alerts the user in the event that low battery power could adversely affect readings

BNC Connector

Bayonet Neill-Concelman connector is a common type of radio-frequency connector used for the coaxial cable which connects various devices; usually is applied for frequencies below 3 GHz.

BOD

Biochemical Oxygen Demand (BOD) gives an indication of the biodegradable organic material present in a sample of water. The dissolved oxygen concentration is measured before and after an incubation period of 5 days and the BOD is calculated in mg/L from the difference.

% Brix

Degrees Brix is a unit representative of the sugar content of an aqueous solution. One degree Brix corresponds to 1 gram of sucrose in 100 grams of solution (% w/w).

°C

Celsius temperature degree;
°C = (°F-32) / 5/9

CAL Check™

With the Hanna exclusive CAL Check™ validation function, users are able to verify the performance of the instrument at any time. Taking just a few short steps, the validation procedure is extremely user friendly and ensures that the meter is properly calibrated.

Calibration

Calibration is the validation of specific measurement techniques and equipment.

The bias is the difference between the mean of the measurements and the reference value. The procedure that establishes and corrects the bias is the calibration.

At the simplest level, calibration is a comparison between measurements – one of known magnitude or correctness made or set with one device and another measurement made in as similar a way as possible with a second device.

Calibration is often regarded as including the process of adjusting the output or indication on a measurement instrument to agree with the value of the applied standard, within a specified accuracy.

CAL Check™ System

When used in tandem with a CAL Check™ meter, CAL Check™ equipped electrodes permit 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.

Calibration Curve

In analytical chemistry, a calibration curve is a general method for determining the concentration of a substance in an unknown sample by comparing the unknown to a set of standard samples of known concentration. A calibration curve is one approach to the problem of instrument calibration; other approaches may mix the standard into the unknown, giving an internal standard.

The calibration curve is a plot of how the instrumental response, the so called analytical signal, changes with the concentration of the analyte (the substance to be measured). The operator prepares a series of standards across a range of concentrations near the expected concentration of analyte in the unknown. The concentrations of the standards must lie within the working range of the technique (instrumentation) they are using. Analyzing each of these standards using the chosen technique will produce a series of measurements. For most analyses, a plot of instrument response vs. Analyte concentration will show a linear relationship. The operator can measure the response of the unknown, and using the calibration curve, they can interpolate to find the concentration of analyte.

Candela

The candela is the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540×10^{12} hertz and that has a radiant intensity in that direction of 1/683 watt per steradian.

CaT

Calcium tartrate

CE Mark

See page 18.4

Checker®

Hanna pocket-sized electronic meter.

Checkfridge™

Hanna temperature monitor with magnetic backing and remote thermistor sensor on a 1 meter cable.

Checktemp®

Hanna Electronic Digital Thermometer with sharp-tip probe

CIS

Commonwealth of Independent States

Cleaning Solution

The solution used for cleaning the glass bulb of the electrode/probe once a day or at least once a week to maintain accuracy and to prevent junction clogging.

Clip-Lock™

Interrupting an important cycle of analysis due to a malfunctioning burette is a thing of the past. With the Hanna Clip-Lock™ system you can simply substitute the burette and complete all your tests with the same titrant!

The Clip-Lock™ exchangeable burette system prevents cross contamination while reducing loss of time and reagents. Burettes simply slide out for quick exchanges, and detaching the aspiration and dispensing tubes from the titrant bottles is easy.

COD

Chemical Oxygen Demand is a measure of the oxygen equivalent of the organic matter in the sample that is susceptible to oxidation by a strong oxidizing agent.

Colorimeter

(see Photometer)

Colorimetry

Colorimetry is concerned with the determination of the concentration of a substance by measurement of the relative absorption of light with respect to a known concentration of the substance. In visual colorimetry, natural or artificial white light is generally used as a light source, and determinations are usually made with a simple instrument termed a photometer, or color comparator. When the eye is replaced by a photoelectric cell (thus largely eliminating the errors due to the personal characteristics of each observer) the instrument is termed a photoelectric colorimeter, or photometer.

Conditioning Solution

A specialized solution in which the electrode must be immersed in to activate the glass selective membrane.

CPS™

Clogging Prevention System. Conventional pH electrodes use ceramic junctions that may clog quickly when used in biological samples such as wine. When the junction is blocked, the entire electrode will not function properly. Electrodes that feature CPS™ technology utilize a ground glass/PTFE sleeve junction which controls a steady, predictable flow of fill solution thus keeping the junction open. The hydrophobic property of PTFE sleeve repels wetness and coatings.

CYAC

Cyanuric Acid

°Dornic

Determined by titrating a 100 mL sample with N/9 sodium hydroxide to a phenolphthalein end point.

Delrin

A plastic made from Acetal Homopolymer; a crystalline plastic that offers an excellent balance of properties that bridge the gap between metals and plastics.

Detection Limit

In analytical chemistry, the detection limit LOD of an individual analytical procedure is the lowest amount of analyte in a sample which can be detected but not necessarily quantitated as an exact value; or the lowest quantity of a substance that can be distinguished from the absence of that substance (a blank value) within a stated confidence limit (generally 1%).

The detection limit is estimated from the mean of the blank, the standard deviation of the blank and some confidence factor. Another consideration that affects the detection limit is the accuracy of the model used to predict concentration from the raw analytical signal. There are a number of different "detection limits" that are commonly used. These include: the instrument detection limit (IDL), the method detection limit (MDL) and the limit of quantitation (LOQ).

Even when the same terminology is used, there can be differences in the LOD, according to nuances of what definition is used and what type of noise contributes to the measurement and calibration.

Most analytical instruments produce a signal even when a blank (matrix without analyte) is analyzed. This signal is referred to as the noise level.

The IDL is the analyte concentration that is required to produce a signal greater than three times the standard deviation of the noise level.

Many times there is more to the analytical method than just doing a reaction or submitting it to direct analysis. For example it might be necessary to heat a sample that is to be analyzed for a particular metal with the addition of acid first (this is called digestion). The sample may also be diluted or concentrated prior to analysis on an instrument.

Additional steps in an analysis add additional opportunities for error.

Since detection limits are defined in terms of error, this will naturally increase the measured detection limit. This detection limit (with all steps of the analysis included) is called the MDL.

Dew Point

The dew point is defined as the temperature to which air must be cooled in order for condensation (saturation) to occur. The dew point is dependent on the concentration of water vapor present, and therefore, the relative humidity.

DIN Connector

A circular connector for consumer electronics, originally standardized by the Deutches Institut für Normung (DIN) for analog audio signals.

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 many concentrations. Hanna direct reading meters such as the HI 98184 and HI 98185 display concentration of the unknown sample by a direct reading after calibrating 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.

DiST®

Hanna Dissolved Solids Testers are widely used for monitoring EC/TDS in water conditioning, reverse osmosis, cooling towers, drinking water, wastewater, laboratories, agriculture, aquaculture and aquariums, hydroponics and the printing industry.

dKH

Degrees of carbonate hardness.
In case of alkalinity: 1 dKH = 0.36 meq/L = 17.86 mg/L $CaCO_3$

DO

Dissolved Oxygen. A relative measure of the amount of oxygen that is dissolved or carried in a given medium.

DPD

N,N-diethyl-p-phenylenediamine

EBC

European Brewery Convention.

EC

Electrical conductivity is a measure of how well a material accommodates the transport of electric charge. Its SI derived unit is the Siemens per meter, (A2s3m-3kg-1) (named after Werner von Siemens). It is the ratio of the current density to the electric field strength. This applies also to the electrolytic conductivity of a fluid.

EDTA

Edetic acid; etylenediaminetetraacetic acid

EES

Sodium exchangeable (in meq/100 g soil)

Electromagnetic Compatibility

See page 18.4

Electromagnetic Interferences (EMI)

See page 18.4

EPA (U.S. EPA)

United States Environmental Protection Agency

°F

Fahrenheit temperature degree; °F = °C x 9/5 + 32

FAO

Food and Agriculture Organization

Fast Tracker™–Tag Identification System

Hanna's Fact Tracker™–Tag Identification System simplifies test logging. iButton®s with a unique ID can be installed at various sampling sites. When the matching connector on the meter contacts the location button, measurements are logged and labeled with the alphanumeric user-entered location ID. Location, date, time and measurements are logged into the meter which can be transferred to a PC.

FDA

US Food & Drug Administration.

FDA bottle = bottles that meet FDA Standards.

Filling Solution

Solution containing the anion to which the reference electrode of the operational pH cell is reversible, eg. Chloride for Ag-AgCl electrodes.

FNU

Formazin Nephelometric Unit.

FTU

Formazin Turbidity Unit.

F.S. (or f.s.)

Full scale

Glass Membrane

Hanna utilizes four different types of pH sensitive glass to cover a vast number of applications. Our manufacturing processes are specific for each pH electrode design. For instance, some electrodes with low impedance glass are particularly suited at performing measurements in solutions with low conductivity or cold solutions. For industrial grade electrodes, Hanna produces a specific range of sensitive glass that guarantees a linear response over a wide pH range as well as being resistant to harsh environments.

To optimize a pH measurement for a particular application, the pH glass characteristics are considered, as well as materials of construction including reference junctions, wetted materials and internal seals. Hanna provides the best materials and performance for a particular application to ensure reliable measurements.

GP	General Purpose
HT	High Temperature
LT	Low Temperature
HF	Samples with Fluoride

GLP

Good Laboratory Practice. The phrase good laboratory practice especially refers to a Quality System concerned with the organizational process and the conditions under which non-clinical health and environmental safety studies are planned, performed, monitored, recorded, archived and reported.

GP Glass

Hanna's GP (general purpose) 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 sphere geometry with diameter of 9.5 mm (0.37"). This achieves a system with 100 MΩ, impedance. The GP glass is also used on smaller diameter spheres.

GPS

Global Positioning System

GR

Gypsum Requirement (metric ton/ha or ton/acre).

H_2T

Tartaric Acid.

HACCP

Hazard Analysis and Critical Control Points.

HC

Handheld Colorimeter.

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 2-10 pH.

High Input Impedance Meter

It is 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.

HOLD Function

Function that lets the user know when to take readings and freezes the readings on display for easy and accurate recording.

HPLC

High Performance Liquid Chromatography.

HR

High Range.

HT Glass

Designed for extended use at elevated temperature. The glass impedance 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. This glass makes it possible to obtain accurate, high temperature pH measurements for extended periods of time 90°C (194°F) and for a few weeks at 100°C (212°F). At room temperature, the response time may increase so additional time for equilibration in buffers should be allowed. This glass is clear.

HVAC

Heating, Ventilating, and Air Conditioning - refers to technology of indoor or automotive environmental comfort.

Hygrometer

The hygrometer is an instrument used to measure relative humidity (RH), that is, the quantity of water vapor present in the air. Hygrometers are often available in versions that also measure temperature–these are normally called thermohygrometers.

IARC

International Agency for Research on Cancer

iButton® Tags

Install the optional TAGs near your sampling points for quick and easy iButton® readings. Each TAG contains a computer chip with a unique identification code encased in stainless steel. Users can order and install a virtually unlimited amount of TAGs to meet any need of traceability requirements.

ICUMSA

International Commission for Uniform Methods of Sugar Analysis

Incremental Method

Incremental Methods are useful techniques used to determine ion concentration quickly 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 and analysis steps are reduced. Known addition, known subtraction, analyte addition, and analyte subtraction methods are four of these incremental techniques. All techniques involve adding a standard to the sample, or sample to the standard and the meter calculates the sample's ion concentration directly.

IR

Infrared. Electromagnetic radiation with a wavelength longer than VIS (according to CIE the IR band is 700 nm to 1 mm).

ISA

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 ISA's adjust pH and eliminate matrix effects.

ISE

Ion Selective Electrode, also known as a specific ion electrode. ISE's are sensors that convert the activity of a specific ion dissolved in a solution into an electrical potential, which can be measured by a pH meter or a voltmeter.

ISO Standards

See page 18.5

ISOPOTENTIAL pH

Is the pH at which the cell voltage does not change when the temperature changes.

ISSS

International Society of Soil Science.

ITS

International Temperature Scale.

Junction

The junction (the part in contact between the two liquids) is typically made with inert materials that will not increase a junction potential or be chemically attacked by the measured solutions.

JTU

Jackson Turbidity Unit.

KEY®

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

KHT

Potassium Bi-Tartrate.

°KMW

°Klosterneuburger Mostwaage is used in Austria to measure the sugar content of must. °KMW is also known as °Babo.

°KMW is related to °Oe by the following equation:
°Oe = °KMW x [(0.022 x °KMW) + 4.54]

1 °KMW is roughly equivalent to 1 %Brix or 5 °Oe.

% l.a.

Percent lactic acid 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 end point.

LCD

Liquid Crystal Display.

LDL Cholesterol

Low-density lipoprotein cholesterol.

LED

Light-emitting diode; a semiconductor light source.

LI

Langelier Index is a saturation index developed by Dr. Wilfred Langelier and is widely used to predict the balance of swimming pool waters. It is an estimation of the solutions ability to dissolve or precipitate calcium carbonate deposits.

Linearity

The linearity of an analytical procedure is its ability (within a given range) to obtain test results which are directly proportional to the concentration of analyte in the sample.

LOAEL

Lowest-observed-adverse-effect level.

LR

Low Range.

LSD

Low Significant Digit.

LT Glass

This glass is used on our flat and conical shaped membranes as well as sensors used at cold temperatures, because the glass has lower impedance. 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 and cause the mechanical destruction of the sensor. This glass has a more limited pH range and is dark green.

Lux (lx)

The SI unit of illuminance and luminous emittance measuring luminous power per area.

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.

MEADOS

Measuring and Dosing System.

MEBAK

Central European Brewing Commission.

meq/L

Milliequivalents per liter.

In case of alkalinity: 1 meq/L = 50 mg/L $CaCO_3$ = 2.8 dKH.

Mho/cm

see S/cm.

Millesimal pH Buffer

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

MR

Medium Range.

MTC

Manual Temperature Compensation.

The temperature value, shown on the LCD, can be manually set. The compensation is referenced at the selected temperature.

mV

1/1000 of a volt, a measure of electrical potential (voltage).

NIST

National Institute of Standards and Technology.

nm

Nanometer. Unit of measurement for length in the metric system, equal to one billionth of a meter.

NoTC

No Temperature Compensation. For actual conductivity or TDS measurement, the temperature value shown on the LCD is not taken into account.

NPK

Nitrogen, phosphorus, and potassium.

NPT

National Pipe Thread. A U.S. standard for tapered threads used on threaded pipes and fittings.

NTU

Nephelometric Turbidity Unit.

°Oechsle (°Oe)

°Oechsle is mainly used in the German, Swiss and Luxenburgish winemaking industry to measure the sugar content of must. The °Oe scale, one degree Oechsle corresponds to one ram of difference between the mass of one liter of must at 20°C and 1 kg (the mass of 1 liter of water at same temperature).

Open Junction

This type junction, found in reference half-cells, 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 it is virtually impossible to clog.

Opto-isolator

In electronics, an opto-isolator is an electronic device designed to transfer electrical signals by utilizing light waves to provide coupling with electrical isolation between its input and output.

ORP

Oxidation Reduction Potential. Solutions can be graded as oxidizing or reducing based on measurement of ORP values.

OSHA

The Occupational Safety and Health Administration.

OUR

Oxygen Uptake Rate. Used to determine the oxygen consumption or respiration rate; is measured in mg of oxygen consumed per liter per hour.

PAN

1-(2-pyridylazo)-2-naphtol (indicator)

PCU

Platinum Cobalt Unit.

PD Controller

Proportional Derivative controller.

PEI

Polyetherimide.

PELs

Standards for the length and intensity of exposure to certain elements.

Pfund Scale

The Pfund scale is a color grader used to provide readings of the range of honey colors. There are seven color classifications for processed honey; water white, extra white, white, extra light amber, light amber, amber and dark amber. Traditionally, the Pfund color grader works by visually comparing a wedge-shaped glass container of honey with an amber glass wedge.

pH [NIST]

The negative logarithm of the hydrogen ion activity has been given the symbol pH. The original definition was in terms of hydrogen ion concentration. The present definition of pH is associated with the "effective" concentration of hydrogen ion.

pH Glass Electrode [IUPAC]

Hydrogen ion responsive electrode usually consists of a bulb, or other suitable form of special glass attached to a stem of high-resistance glass complete with internal reference electrode and internal filling solution system. Other geometrical forms may be appropriate for special applications.

Photometer

An instrument used for measuring of photometric quantities by means of a photoreceptor.

PID Controller

Proportional-Integral-Derivative controller.

PLC

Programmable Logic Controller.

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 its 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 reagent EDTA. During the titration, there is a gradual decrease in the free Ca^{2+} ion concentrations as more EDTA is added. The endpoint corresponds to the point when all the Ca^{2+} is complexed. The progress of this titration can be monitored using a calcium ISE.

Pre-amplified Electrode

Hanna electrode containing an internal pre-amplifier. The pre-amplifier converts the high impedance signal from the pH glass to a low impedance signal thus allowing the user to use long runs of sensor cable with ordinary connectors without noisy or voltage drops resulting in erroneous measurements.

Precision

The precision of an analytical procedure expresses the closeness of agreement (degree of scatter) between a series of measurements obtained from multiple sampling of the same homogeneous sample under the prescribed conditions. Precision may be considered at three levels: repeatability, intermediate precision and reproducibility.

Precision should be investigated using homogeneous, authentic samples. However, if it is not possible to obtain a homogeneous sample it may be investigated using artificially prepared samples or a sample solution.

The precision of an analytical procedure is usually expressed as the variance, standard deviation or coefficient of variation of a series of measurements.

Intermediate precision expresses within-laboratories variations: different days, different analysts, different equipment, etc.

ppb

parts per billion; as concentration:
1 ppb = 1 µg substance /L solution.

ppm

parts per million; as concentration:
1 ppm = 1 mg substance /L solution; 1% = 10000 ppm.

ppt

parts per thousand; as concentration:
1 ppt = 1 g substance /L solution.

Pt100

Platinum sensors with means a resistance of 100Ω 0°C with a temperature coefficient of 0.00385Ω per degree Celsius. Similar for Pt1000.

PTFE

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

PVC

Polyvinyl chloride.

PVDF

Polyvinylidene Fluoride–a highly non-reactive and pure thermoplastic fluoropolymere.

PWT

Pure Water Test.

QC

Quality Control.

Range

The range of an analytical procedure is the interval between the upper and lower concentrations of analyte in the sample (including these concentrations) for which it has been demonstrated that the analytical procedure has a suitable level of precision, accuracy and linearity.

RDT

Resistance Temperature Detectors.

Reference Electrode

Half cell of the 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.

Refractive Index

Refractive Index is defined as the ratio of the speed of light in empty space to the speed of light in the substance.

Repeatability

Repeatability expresses the precision under the same operating conditions over a short interval of time. Repeatability is also termed intra-assay precision.

Reproducibility

Reproducibility expresses the precision between laboratories collaborative studies, (usually applied to standardization of methodology).

Resistivity

Electrical resistivity (also known as specific electrical resistance) is a measure indicating how strongly a material opposes the flow of electric current. A low resistivity indicates a material that readily allows the movement of electrons. The SI unit for electrical resistivity is the ohm meter.

RH

Relative humidity is expressed as the ratio of the quantity of water vapor present in the air to the quantity at which the air would reach saturation (100%) at a given temperature.

Robustness

The robustness of an analytical procedure is a measure of its capacity to remain unaffected by small, but deliberate variations in method parameters and provides an indication of its reliability during normal usage.

rpm

Revolutions per minute.

RS

Reducing Sugars.

RS232

In telecommunications, RS-232 (Recommended Standard 232) is traditional name for a series of standards for serial binary single-ended data and control signals.

RS485

In telecommunications, RS-485 (Recommended Standard 485) is a standard defining the electrical characteristics of drivers and receivers for use in balanced digital multipoint systems. RS-485 can be used effectively over long distances and in electrically noisy environments.

S/cm

The siemens (S) unit is named after Werner von Siemens, the 19th century German inventor and entrepreneur in the area of electrical engineering. Previously to the siemens per meter unit, mho/cm was used to measure conductivity, where the unit "mho" is a reciprocal ohm. The "mho" is "ohm" spelled backwards. Because of the history of conductivity, µmho/cm and mmho/cm is commonly translated to µS/cm and mS/cm because they correspond one-to-one.

The unit of measurement commonly used is one millionth of a Siemens per centimeter (micro-Siemens per centimeter or µS/cm).

When measuring more concentrated solutions, the units are expressed as milli-Siemens/cm or mS/cm (thousandths of a Siemens). For ease of expression, 1000 µS/cm are equal to 1 mS/cm.

Salinity

Salinity is a measurement without the unit corresponding to the weight of dissolved salts in seawater. Salinity is calculated from an empirical relationship between the conductivity and the salinity of a seawater sample. Oceanographic Tables and Standards endorsed by UNESCO/SCOR/ICES/IAPSO are used for the calculation.

Salinity measurements are performed with no direct temperature correction. The salinity range is calibrated using a standard sea water solution.

SAR

Sodium Absorbtion Ratio (meq/L).

Sensor Check™

Allows users to check electrode status at any time.

°SH

Soxlet Henkel degrees is determined by titrating a 50 mL sample with 0.1 M sodium hydroxide to a phenolphthalein end point.

SHE

Standard Hydrogen Electrode.

SMART electrode

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 intelligent electrodes help eliminate errors and will save time when working with more than one electrode.

SOP

Standard Operating Procedures means documented procedures which describe how to perform tests or activities normally not specified in detail in study plans or tests guidelines.

SOUR

Specific Oxygen Uptake Rate. This is used to determine the oxygen consumption or respiration rate; SOUR is measured in mg of oxygen consumed per gram of volatile suspended solids per hour.

SPDT relay

Single Pole Double Throw relay.

Specificity

Specificity is the ability to assess unequivocally the analyte in the presence of components which may be expected to be present. Typically these might include impurities, degradants, matrix, etc.

Speedsafe™

Each Hanna stirrer is equipped with a speed sensing device (opto-sensor) coupled with an FVC (frequency voltage converter), which monitors the speed. As the speed reaches a preset maximum level, the speed limiter shuts down the VCO to slow down the motor speed. This ensures that when the load is suddenly removed from the stirrer, the motor will not accelerate to such a high speed that will be hazardous to both the user and the stirrer; a feature not commonly found in conventional stirrers.

SPST Relay

Single Pole Single Throw relay.

SRM

Standard Reference Material (CRM of National Institute of Standards and Technology).

Storage Solution

Solution used to keep the electrode moist when not in use.

TDS

Total Dissolved Solids (often abbreviated TDS) is a measure of the combined content of all inorganic and organic substances contained in a liquid in: molecular, ionized or micro-granular (colloidal sol) suspended form.

TDS Factor

When a solution does not have a similar ionic content to natural water or salt water, then a TDS conversion factor is needed to automatically adjust the readings. TDS = CF x conductivity (CF is TDS Conversion factor).

TFPC

Thin Film Polymer Capacitance.

TEA

Total Exchangeable Acidity - A measure of the amount of acidic cations (hydrogen, aluminum, iron and manganese) present in soil. It is expressed in Milliequivalents per 100 grams (meq/100 g) of soil.

°Th

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 end point.

Timer Function

Counts down to appropriate time interval before a reading is displayed. This feature ensures consistency in measurements.

TPTZ

2,4,6-tri-(2-pyridyl)-1,3,5-triazine (iron indicator)

Traceability [IUPAC]

Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties. The concept is often expressed by the adjective traceable. The unbroken chain of comparisons is called a traceability chain.

Turbidity

Turbidity of water is an optical property that causes light to be scattered and absorbed, rather than transmitted. The scattering of the light that passes through a liquid is primarily caused by the suspended solids. The higher the turbidity, the greater the amount of scattered light. Because even the molecules in a very pure fluid scatter light to a certain degree, no solution will have zero turbidity.

UPW

Ultra Pure Water.

USB

Universal Serial Bus is a application to establish communication between various devices and a host controller (usually a PC).

USDA

United States Department of Agriculture.

USP

US Pharmacopoeia. USP <645> with Stage 1, 2 and 3 compliance is required for purified water and WFI (water for injection). Hanna offers instruments that are able to perform all three stages required by this standard. Some of these requirements are: Resolution of 0.1 µS/cm or better, accuracy at 1.3µS/cm of 0.1µS/cm, to be able to read with or without automatic temperature compensation, the cell constant be known with an uncertainty better than ±2%.

UV

Ultraviolet–electromagnetic radiation with a wavelength shorter than that of VIS, but longer than X-rays (10-400 nm).

VCO

Voltage Controlled Oscillator.

VIS

The visible spectrum - is the portion of the electromagnetic spectrum that is visible (can be detected by) to the human eye (390 - 750 nm for typical human eye).

WHO

World Health Organization.

Equilibrium Relative Humidity

Relative Humidity in air as a function of temperature of some saturated salt solutions

Temperature °C	Lithium Chloride	Potassium Acetate	Magnesium Chloride	Potassium Carbonate	Magnesium Nitrate
0	11.23 ± 0.54		33.66 ± 0.33	43.13 ± 0.66	60.35 ± 0.55
5	11.26 ± 0.47		33.60 ± 0.28	43.13 ± 0.50	58.86 ± 0.43
10	11.29 ± 0.41	23.28 ± 0.53	33.47 ± 0.24	43.14 ± 0.39	57.36 ± 0.33
15	11.30 ± 0.35	23.40 ± 0.32	33.30 ± 0.21	43.15 ± 0.33	55.87 ± 0.27
20	11.31 ± 0.31	23.11 ± 0.25	33.07 ± 0.18	43.16 ± 0.33	54.38 ± 0.23
25	11.30 ± 0.27	22.51 ± 0.32	32.78 ± 0.16	43.16 ± 0.39	52.89 ± 0.22
30	11.28 ± 0.24	21.61 ± 0.53	32.44 ± 0.14	43.17 ± 0.50	51.40 ± 0.24
35	11.25 ± 0.22		32.05 ± 0.13		49.91 ± 0.29
40	11.21 ± 0.21		31.60 ± 0.13		48.42 ± 0.37
45	11.16 ± 0.21		31.10 ± 0.13		46.93 ± 0.47
50	11.10 ± 0.22		30.54 ± 0.13		45.44 ± 0.60
55	11.03 ± 0.23		29.93 ± 0.16		
60	10.95 ± 0.26		29.26 ± 0.18		
65	10.86 ± 0.29		28.54 ± 0.21		
70	10.75 ± 0.33		27.77 ± 0.25		
75	10.64 ± 0.38		26.94 ± 0.29		
80	10.51 ± 0.44		26.05 ± 0.34		
85	10.38 ± 0.51		25.11 ± 0.39		
90	10.23 ± 0.59		24.12 ± 0.46		
95	10.07 ± 0.67		23.07 ± 0.52		
100	9.90 ± 0.77		21.97 ± 0.60		

Relative Humidity in air as a function of temperature of some saturated salt solutions

Temperature °C	Sodium Chloride	Potassium Chloride	Potassium Nitrate	Potassium Sulfate
0	75.51 ± 0.34	88.61 ± 0.53	96.33 ± 2.90	98.77 ± 1.10
5	76.65 ± 0.27	87.67 ± 0.45	96.27 ± 2.10	98.48 ± 0.91
10	75.67 ± 0.22	86.77 ± 0.39	95.96 ± 1.40	98.18 ± 0.76
15	75.61 ± 0.18	85.92 ± 0.33	95.41 ± 0.96	97.89 ± 0.63
20	75.47 ± 0.14	85.11 ± 0.29	94.62 ± 0.66	97.59 ± 0.53
25	75.29 ± 0.12	84.34 ± 0.26	93.58 ± 0.55	97.30 ± 0.45
30	75.09 ± 0.11	83.62 ± 0.25	93.21 ± 0.60	97.00 ± 0.40
35	74.87 ±0.12	82.95 ± 0.25	90.79 ± 0.83	96.71 ± 0.38
40	74.68 ± 0.13	82.32 ± 0.25	89.03 ± 1.20	96.41 ± 0.38
45	74.52 ± 0.16	81.74 ± 0.28	87.03 ± 1.80	96.12 ± 0.40
50	74.43 ± 0.19	81.20 ± 0.31	84.78 ± 2.50	95.82 ± 0.45
55	74.41 ± 0.24	80.70 ± 0.35		
60	74.50 ± 0.30	80.25 ± 0.41		
65	74.71 ± 0.37	79.85 ± 0.48		
70	75.06 ± 0.45	79.49 ± 0.57		
75	75.58 ± 0.55	79.17 ± 0.66		
80	76.29 ± 0.65	78.90 ± 0.77		
85		78.68 ± 0.89		
90		78.50 ± 1.00		
95				
100				

Thermoelectric Voltage in milliVolts

Thermocouple Reference Tables

Reference Tables
N.I.S.T Rev. ITS-90

K-type thermocouple - Temperature in degrees "C" with reference junction at 0°C

°C	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	°C
-270	-6.458											-270
-260	-6.441	-6.444	-6.446	-6.448	-6.450	-6.452	-6.453	-6.455	-6.456	-6.457	-6.458	-260
-250	-6.404	-6.408	-6.413	-6.417	-6.421	-6.425	-6.429	-6.432	-6.435	-6.438	-6.441	-250
-240	-6.344	-6.351	-6.358	-6.364	-6.370	-6.377	-6.382	-6.388	-6.393	-6.399	-6.404	-240
-230	-6.262	-6.271	-6.280	-6.289	-6.297	-6.306	-6.314	-6.322	-6.329	-6.337	-6.344	-230
-220	-6.158	-6.170	-6.181	-6.192	-6.202	-6.213	-6.223	-6.233	-6.243	-6.252	-6.262	-220
-210	-6.035	-6.048	-6.061	-6.074	-6.087	-6.099	-6.111	-6.123	-6.135	-6.147	-6.158	-210
-200	-5.891	-5.907	-5.922	-5.936	-5.951	-5.965	-5.980	-5.994	-6.007	-6.021	-6.035	-200
-190	-5.730	-5.747	-5.763	-5.780	-5.797	-5.813	-5.829	-5.845	-5.861	-5.876	-5.891	-190
-180	-5.550	-5.569	-5.588	-5.606	-5.624	-5.642	-5.660	-5.678	-5.695	-5.713	-5.730	-180
-170	-5.354	-5.374	-5.395	-5.415	-5.435	-5.454	-5.474	-5.493	-5.512	-5.531	-5.550	-170
-160	-5.141	-5.163	-5.185	-5.207	-5.228	-5.250	-5.271	-5.292	-5.313	-5.333	-5.354	-160
-150	-4.913	-4.936	-4.960	-4.983	-5.006	-5.029	-5.052	-5.074	-5.097	-5.119	-5.141	-150
-140	-4.669	-4.694	-4.719	-4.744	-4.768	-4.793	-4.817	-4.841	-4.865	-4.889	-4.913	-140
-130	-4.411	-4.437	-4.463	-4.490	-4.516	-4.542	-4.567	-4.593	-4.618	-4.644	-4.669	-130
-120	-4.138	-4.166	-4.194	-4.221	-4.249	-4.276	-4.303	-4.330	-4.357	-4.384	-4.411	-120
-110	-3.852	-3.882	-3.911	-3.939	-3.968	-3.997	-4.025	-4.054	-4.082	-4.110	-4.138	-110
-100	-3.554	-3.584	-3.614	-3.645	-3.675	-3.705	-3.734	-3.764	-3.794	-3.823	-3.852	-100
-90	-3.243	-3.274	-3.306	-3.337	-3.368	-3.400	-3.431	-3.462	-3.492	-3.523	-3.554	-90
-80	-2.920	-2.953	-2.986	-3.018	-3.050	-3.083	-3.115	-3.147	-3.179	-3.211	-3.243	-80
-70	-2.587	-2.620	-2.654	-2.688	-2.721	-2.755	-2.788	-2.821	-2.854	-2.887	-2.920	-70
-60	-2.243	-2.278	-2.312	-2.347	-2.382	-2.416	-2.450	-2.485	-2.519	-2.553	-2.587	-60
-50	-1.889	-1.925	-1.961	-1.996	-2.032	-2.067	-2.103	-2.138	-2.173	-2.208	-2.243	-50
-40	-1.527	-1.564	-1.600	-1.637	-1.673	-1.709	-1.745	-1.782	-1.818	-1.854	-1.889	-40
-30	-1.156	-1.194	-1.231	-1.268	-1.305	-1.343	-1.380	-1.417	-1.453	-1.490	-1.527	-30
-20	-0.778	-0.816	-0.854	-0.892	-0.930	-0.968	-1.006	-1.043	-1.081	-1.119	-1.156	-20
-10	-0.392	-0.431	-0.470	-0.508	-0.547	-0.586	-0.624	-0.663	-0.701	-0.739	-0.778	-10
0	0.000	-0.039	-0.079	-0.118	-0.157	-0.197	-0.236	-0.275	-0.314	-0.353	-0.392	0

°C	0	1	2	3	4	5	6	7	8	9	10	°C
0	0.000	0.039	0.079	0.119	0.158	0.198	0.238	0.277	0.317	0.357	0.397	0
10	0.397	0.437	0.477	0.517	0.557	0.597	0.637	0.677	0.718	0.758	0.798	10
20	0.798	0.838	0.879	0.919	0.960	1.000	1.041	1.081	1.122	1.163	1.203	20
30	1.203	1.244	1.285	1.326	1.366	1.407	1.448	1.489	1.530	1.571	1.612	30
40	1.612	1.653	1.694	1.735	1.776	1.817	1.858	1.899	1.941	1.982	2.023	40
50	2.023	2.064	2.106	2.147	2.188	2.230	2.271	2.312	2.354	2.395	2.436	50
60	2.436	2.478	2.519	2.561	2.602	2.644	2.685	2.727	2.768	2.810	2.851	60
70	2.851	2.893	2.934	2.976	3.017	3.059	3.100	3.142	3.184	3.225	3.267	70
80	3.267	3.308	3.350	3.391	3.433	3.474	3.516	3.557	3.599	3.640	3.682	80
90	3.682	3.723	3.765	3.806	3.848	3.889	3.931	3.972	4.013	4.055	4.096	90
100	4.096	4.138	4.179	4.220	4.262	4.303	4.344	4.385	4.427	4.468	4.509	100
110	4.509	4.550	4.591	4.633	4.674	4.715	4.756	4.797	4.838	4.879	4.920	110
120	4.920	4.961	5.002	5.043	5.084	5.124	5.165	5.206	5.247	5.288	5.328	120
130	5.328	5.369	5.410	5.450	5.491	5.532	5.572	5.613	5.653	5.694	5.735	130
140	5.735	5.775	5.815	5.856	5.896	5.937	5.977	6.017	6.058	6.098	6.138	140
150	6.138	6.179	6.219	6.259	6.299	6.339	6.380	6.420	6.460	6.500	6.540	150
160	6.540	6.580	6.620	6.660	6.701	6.741	6.781	6.821	6.861	6.901	6.941	160
170	6.941	6.981	7.021	7.060	7.100	7.140	7.180	7.220	7.260	7.300	7.340	170
180	7.340	7.380	7.420	7.460	7.500	7.540	7.579	7.619	7.659	7.699	7.739	180
190	7.739	7.779	7.819	7.859	7.899	7.939	7.979	8.019	8.059	8.099	8.138	190
200	8.138	8.178	8.218	8.258	8.298	8.338	8.378	8.418	8.458	8.499	8.539	200
210	8.539	8.579	8.619	8.659	8.699	8.739	8.779	8.819	8.860	8.900	8.940	210
220	8.940	8.980	9.020	9.061	9.101	9.141	9.181	9.222	9.262	9.302	9.343	220
230	9.343	9.383	9.423	9.464	9.504	9.545	9.585	9.626	9.666	9.707	9.747	230
240	9.747	9.788	9.828	9.869	9.909	9.950	9.991	10.031	10.072	10.113	10.153	240
250	10.153	10.194	10.235	10.276	10.316	10.357	10.398	10.439	10.480	10.520	0.561	250
260	10.561	10.602	10.643	10.684	10.725	10.766	10.807	10.848	10.889	10.930	10.971	260
270	10.971	11.012	11.053	11.094	11.135	11.176	11.217	11.259	11.300	11.341	11.382	270
280	11.382	11.423	11.465	11.506	11.547	11.588	11.630	11.671	11.712	11.753	11.795	280
290	11.795	11.836	11.877	11.919	11.960	12.001	12.043	12.084	12.126	12.167	12.209	290
300	12.209	12.250	12.291	12.333	12.374	12.416	12.457	12.499	12.540	12.582	12.624	300
310	12.624	12.665	12.707	12.748	12.790	12.831	12.873	12.915	12.956	12.998	13.040	310
320	13.040	13.081	13.123	13.165	13.206	13.248	13.290	13.331	13.373	13.415	13.457	320
330	13.457	13.498	13.540	13.582	13.624	13.665	13.707	13.749	13.791	13.833	13.874	330
340	13.874	13.916	13.958	14.000	14.042	14.084	14.126	14.167	14.209	14.251	14.293	340
350	14.293	14.335	14.377	14.419	14.461	14.503	14.545	14.587	14.629	14.671	14.713	350
360	14.713	14.755	14.797	14.839	14.881	14.923	14.965	15.007	15.049	15.091	15.133	360
370	15.133	15.175	15.217	15.259	15.301	15.343	15.385	15.427	15.469	15.511	15.554	370
380	15.554	15.596	15.638	15.680	15.722	15.764	15.806	15.849	15.891	15.933	15.975	380
390	15.975	16.017	16.059	16.102	16.144	16.186	16.228	16.270	16.313	16.355	16.397	390
400	16.397	16.439	16.482	16.524	16.566	16.608	16.651	16.693	16.735	16.778	16.820	400
410	16.820	16.862	16.904	16.947	16.989	17.031	17.074	17.116	17.158	17.201	17.243	410
420	17.243	17.285	17.328	17.370	17.413	17.455	17.497	17.540	17.582	17.624	17.667	420
430	17.667	17.709	17.752	17.794	17.837	17.879	17.921	17.964	18.006	18.049	18.091	430
440	18.091	18.134	18.176	18.218	18.261	18.303	18.346	18.388	18.431	18.473	18.516	440
450	18.516	18.558	18.601	18.643	18.686	18.728	18.771	18.813	18.856	18.898	18.941	450
460	18.941	18.983	19.026	19.068	19.111	19.154	19.196	19.239	19.281	19.324	19.366	460
470	19.366	19.409	19.451	19.494	19.537	19.579	19.622	19.664	19.707	19.750	19.792	470
480	19.792	19.835	19.877	19.920	19.962	20.005	20.048	20.090	20.133	20.175	20.218	480
490	20.218	20.261	20.303	20.346	20.389	20.431	20.474	20.516	20.559	20.602	20.644	490
500	20.644	20.687	20.730	20.772	20.815	20.857	20.900	20.943	20.985	21.028	21.071	500
510	21.071	21.113	21.156	21.199	21.241	21.284	21.326	21.369	21.412	21.454	21.497	510
520	21.497	21.540	21.582	21.625	21.668	21.710	21.753	21.796	21.838	21.881	21.924	520
530	21.924	21.966	22.009	22.052	22.094	22.137	22.179	22.222	22.265	22.307	22.350	530
540	22.350	22.393	22.435	22.478	22.521	22.563	22.606	22.649	22.691	22.734	22.776	540

Thermocouple Reference Tables

K-type thermocouple - Temperature in degrees "C" with reference junction at 0°C

°C	0	1	2	3	4	5	6	7	8	9	10	°C
550	22.776	22.819	22.862	22.904	22.947	22.990	23.032	23.075	23.117	23.160	23.203	550
560	23.203	23.245	23.288	23.331	23.373	23.416	23.458	23.501	23.544	23.586	23.629	560
570	23.629	23.671	23.714	23.757	23.799	23.842	23.884	23.927	23.970	24.012	24.055	570
580	24.055	24.097	24.140	24.182	24.225	24.267	24.310	24.353	24.395	24.438	24.480	580
590	24.480	24.523	24.565	24.608	24.650	24.693	24.735	24.778	24.820	24.863	24.905	590
600	24.905	24.948	24.990	25.033	25.075	25.118	25.160	25.203	25.245	25.288	25.330	600
610	25.330	25.373	25.415	25.458	25.500	25.543	25.585	25.627	25.670	25.712	25.755	610
620	25.755	25.797	25.840	25.882	25.924	25.967	26.009	26.052	26.094	26.136	26.179	620
630	26.179	26.221	26.263	26.306	26.348	26.390	26.433	26.475	26.517	26.560	26.602	630
640	26.602	26.644	26.687	26.729	26.771	26.814	26.856	26.898	26.940	26.983	27.025	640
650	27.025	27.067	27.109	27.152	27.194	27.236	27.278	27.320	27.363	27.405	27.447	650
660	27.447	27.489	27.531	27.574	27.616	27.658	27.700	27.742	27.784	27.826	27.869	660
670	27.869	27.911	27.953	27.995	28.037	28.079	28.121	28.163	28.205	28.247	28.289	670
680	28.289	28.332	28.374	28.416	28.458	28.500	28.542	28.584	28.626	28.668	28.710	680
690	28.710	28.752	28.794	28.835	28.877	28.919	28.961	29.003	29.045	29.087	29.129	690
700	29.129	29.171	29.213	29.255	29.297	29.338	29.380	29.422	29.464	29.506	29.548	700
710	29.548	29.589	29.631	29.673	29.715	29.757	29.798	29.840	29.882	29.924	29.965	710
720	29.965	30.007	30.049	30.090	30.132	30.174	30.216	30.257	30.299	30.341	30.382	720
730	30.382	30.424	30.466	30.507	30.549	30.590	30.632	30.674	30.715	30.757	30.798	730
740	30.798	30.840	30.881	30.923	30.964	31.006	31.047	31.089	31.130	31.172	31.213	740
750	31.213	31.255	31.296	31.338	31.379	31.421	31.462	31.504	31.545	31.586	31.628	750
760	31.628	31.669	31.710	31.752	31.793	31.834	31.876	31.917	31.958	32.000	32.041	760
770	32.041	32.082	32.124	32.165	32.206	32.247	32.289	32.330	32.371	32.412	32.453	770
780	32.453	32.495	32.536	32.577	32.618	32.659	32.700	32.742	32.783	32.824	32.865	780
790	32.865	32.906	32.947	32.988	33.029	33.070	33.111	33.152	33.193	33.234	33.275	790
800	33.275	33.316	33.357	33.398	33.439	33.480	33.521	33.562	33.603	33.644	33.685	800
810	33.685	33.726	33.767	33.808	33.848	33.889	33.930	33.971	34.012	34.053	34.093	810
820	34.093	34.134	34.175	34.216	34.257	34.297	34.338	34.379	34.420	34.460	34.501	820
830	34.501	34.542	34.582	34.623	34.664	34.704	34.745	34.786	34.826	34.867	34.908	830
840	34.908	34.948	34.989	35.029	35.070	35.110	35.151	35.192	35.232	35.273	35.313	840
850	35.313	35.354	35.394	35.435	35.475	35.516	35.556	35.596	35.637	35.677	35.718	850
860	35.718	35.758	35.798	35.839	35.879	35.920	35.960	36.000	36.041	36.081	36.121	860
870	36.121	36.162	36.202	36.242	36.282	36.323	36.363	36.403	36.443	36.484	36.524	870
880	36.524	36.564	36.604	36.644	36.685	36.725	36.765	36.805	36.845	36.885	36.925	880
890	36.925	36.965	37.006	37.046	37.086	37.126	37.166	37.206	37.246	37.286	37.326	890
900	37.326	37.366	37.406	37.446	37.486	37.526	37.566	37.606	37.646	37.686	37.725	900
910	37.725	37.765	37.805	37.845	37.885	37.925	37.965	38.005	38.044	38.084	38.124	910
920	38.124	38.164	38.204	38.243	38.283	38.323	38.363	38.402	38.442	38.482	38.522	920
930	38.522	38.561	38.601	38.641	38.680	38.720	38.760	38.799	38.839	38.878	38.918	930
940	38.918	38.958	38.997	39.037	39.076	39.116	39.155	39.195	39.235	39.274	39.314	940
950	39.314	39.353	39.393	39.432	39.471	39.511	39.550	39.590	39.629	39.669	39.708	950
960	39.708	39.747	39.787	39.826	39.866	39.905	39.944	39.984	40.023	40.062	40.101	960
970	40.101	40.141	40.180	40.219	40.259	40.298	40.337	40.376	40.415	40.455	40.494	970
980	40.494	40.533	40.572	40.611	40.651	40.690	40.729	40.768	40.807	40.846	40.885	980
990	40.885	40.924	40.963	41.002	41.042	41.081	41.120	41.159	41.198	41.237	41.276	990
1000	41.276	41.315	41.354	41.393	41.431	41.470	41.509	41.548	41.587	41.626	41.665	1000
1010	41.665	41.704	41.743	41.781	41.820	41.859	41.898	41.937	41.976	42.014	42.053	1010
1020	42.053	42.092	42.131	42.169	42.208	42.247	42.286	42.324	42.363	42.402	42.440	1020
1030	42.440	42.479	42.518	42.556	42.595	42.633	42.672	42.711	42.749	42.788	42.826	1030
1040	42.826	42.865	42.903	42.942	42.980	43.019	43.057	43.096	43.134	43.173	43.211	1040
1050	43.211	43.250	43.288	43.327	43.365	43.403	43.442	43.480	43.518	43.557	43.595	1050
1060	43.595	43.633	43.672	43.710	43.748	43.787	43.825	43.863	43.901	43.940	43.978	1060
1070	43.978	44.016	44.054	44.092	44.130	44.169	44.207	44.245	44.283	44.321	44.359	1070
1080	44.359	44.397	44.435	44.473	44.512	44.550	44.588	44.626	44.664	44.702	44.740	1080
1090	44.740	44.778	44.816	44.853	44.891	44.929	44.967	45.005	45.043	45.081	45.119	1090
1100	45.119	45.157	45.194	45.232	45.270	45.308	45.346	45.383	45.421	45.459	45.497	1100
1110	45.497	45.534	45.572	45.610	45.647	45.685	45.723	45.760	45.798	45.836	45.873	1110
1120	45.873	45.911	45.948	45.986	46.024	46.061	46.099	46.136	46.174	46.211	46.249	1120
1130	46.249	46.286	46.324	46.361	46.398	46.436	46.473	46.511	46.548	46.585	46.623	1130
1140	46.623	46.660	46.697	46.735	46.772	46.809	46.847	46.884	46.921	46.958	46.995	1140
1150	46.995	47.033	47.070	47.107	47.144	47.181	47.218	47.256	47.293	47.330	47.367	1150
1160	47.367	47.404	47.441	47.478	47.515	47.552	47.589	47.626	47.663	47.700	47.737	1160
1170	47.737	47.774	47.811	47.848	47.884	47.921	47.958	47.995	48.032	48.069	48.105	1170
1180	48.105	48.142	48.179	48.216	48.252	48.289	48.326	48.363	48.399	48.436	48.473	1180
1190	48.473	48.509	48.546	48.582	48.619	48.656	48.692	48.729	48.765	48.802	48.838	1190
1200	48.838	48.875	48.911	48.948	48.984	49.021	49.057	49.093	49.130	49.166	49.202	1200
1210	49.202	49.239	49.275	49.311	49.348	49.384	49.420	49.456	49.493	49.529	49.565	1210
1220	49.565	49.601	49.637	49.674	49.710	49.746	49.782	49.818	49.854	49.890	49.926	1220
1230	49.926	49.962	49.998	50.034	50.070	50.106	50.142	50.178	50.214	50.250	50.286	1230
1240	50.286	50.322	50.358	50.393	50.429	50.465	50.501	50.537	50.572	50.608	50.644	1240
1250	50.644	50.680	50.715	50.751	50.787	50.822	50.858	50.894	50.929	50.965	51.000	1250
1260	51.000	51.036	51.071	51.107	51.142	51.178	51.213	51.249	51.284	51.320	51.355	1260
1270	51.355	51.391	51.426	51.461	51.497	51.532	51.567	51.603	51.638	51.673	51.708	1270
1280	51.708	51.744	51.779	51.814	51.849	51.885	51.920	51.955	51.990	52.025	52.060	1280
1290	52.060	52.095	52.130	52.165	52.200	52.235	52.270	52.305	52.340	52.375	52.410	1290
1300	52.410	52.445	52.480	52.515	52.550	52.585	52.620	52.654	52.689	52.724	52.759	1300
1310	52.759	52.794	52.828	52.863	52.898	52.932	52.967	53.002	53.037	53.071	53.106	1310
1320	53.106	53.140	53.175	53.210	53.244	53.279	53.313	53.348	53.382	53.417	53.451	1320
1330	53.451	53.486	53.520	53.555	53.589	53.623	53.658	53.692	53.727	53.761	53.795	1330
1340	53.795	53.830	53.864	53.898	53.932	53.967	54.001	54.035	54.069	54.104	54.138	1340
1350	54.138	54.172	54.206	54.240	54.274	54.308	54.343	54.377	54.411	54.445	54.479	1350
1360	54.479	54.513	54.547	54.581	54.615	54.649	54.683	54.717	54.751	54.785	54.819	1360
1370	54.819	54.852	54.886									1370

Thermoelectric Voltage in milliVolts

Thermocouple Reference Tables

Reference Tables
N.I.S.T Rev. ITS-90

K-type thermocouple - Temperature in degrees "F" with reference junction at 32°F

°F	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	°F
-450							-6.458	-6.457	-6.457	-6.456	-6.456	-450
-440	-6.456	-6.455	-6.454	-6.454	-6.453	-6.452	-6.451	-6.450	-6.449	-6.448	-6.446	-440
-430	-6.446	-6.445	-6.444	-6.443	-6.441	-6.440	-6.438	-6.436	-6.435	-6.433	-6.431	-430
-420	-6.431	-6.429	-6.427	-6.425	-6.423	-6.421	-6.419	-6.416	-6.414	-6.411	-6.409	-420
-410	-6.409	-6.406	-6.404	-6.401	-6.398	-6.395	-6.392	-6.389	-6.386	-6.383	-6.380	-410
-400	-6.380	-6.377	-6.373	-6.370	-6.366	-6.363	-6.359	-6.355	-6.352	-6.348	-6.344	-400
-390	-6.344	-6.340	-6.336	-6.332	-6.328	-6.323	-6.319	-6.315	-6.310	-6.306	-6.301	-390
-380	-6.301	-6.296	-6.292	-6.287	-6.282	-6.277	-6.272	-6.267	-6.262	-6.257	-6.251	-380
-370	-6.251	-6.246	-6.241	-6.235	-6.230	-6.224	-6.218	-6.213	-6.207	-6.201	-6.195	-370
-360	-6.195	-6.189	-6.183	-6.177	-6.171	-6.165	-6.158	-6.152	-6.146	-6.139	-6.133	-360
-350	-6.133	-6.126	-6.119	-6.113	-6.106	-6.099	-6.092	-6.085	-6.078	-6.071	-6.064	-350
-340	-6.064	-6.057	-6.049	-6.042	-6.035	-6.027	-6.020	-6.012	-6.004	-5.997	-5.989	-340
-330	-5.989	-5.981	-5.973	-5.965	-5.957	-5.949	-5.941	-5.933	-5.925	-5.917	-5.908	-330
-320	-5.908	-5.900	-5.891	-5.883	-5.874	-5.866	-5.857	-5.848	-5.840	-5.831	-5.822	-320
-310	-5.822	-5.813	-5.804	-5.795	-5.786	-5.776	-5.767	-5.758	-5.749	-5.739	-5.730	-310
-300	-5.730	-5.720	-5.711	-5.701	-5.691	-5.682	-5.672	-5.662	-5.652	-5.642	-5.632	-300
-290	-5.632	-5.622	-5.612	-5.602	-5.592	-5.581	-5.571	-5.561	-5.550	-5.540	-5.529	-290
-280	-5.529	-5.519	-5.508	-5.497	-5.487	-5.476	-5.465	-5.454	-5.443	-5.432	-5.421	-280
-270	-5.421	-5.410	-5.399	-5.388	-5.377	-5.365	-5.354	-5.343	-5.331	-5.320	-5.308	-270
-260	-5.308	-5.296	-5.285	-5.273	-5.261	-5.250	-5.238	-5.226	-5.214	-5.202	-5.190	-260
-250	-5.190	-5.178	-5.166	-5.153	-5.141	-5.129	-5.117	-5.104	-5.092	-5.079	-5.067	-250
-240	-5.067	-5.054	-5.042	-5.029	-5.016	-5.003	-4.991	-4.978	-4.965	-4.952	-4.939	-240
-230	-4.939	-4.926	-4.913	-4.900	-4.886	-4.873	-4.860	-4.847	-4.833	-4.820	-4.806	-230
-220	-4.806	-4.793	-4.779	-4.766	-4.752	-4.738	-4.724	-4.711	-4.697	-4.683	-4.669	-220
-210	-4.669	-4.655	-4.641	-4.627	-4.613	-4.599	-4.584	-4.570	-4.556	-4.542	-4.527	-210
-200	-4.527	-4.513	-4.498	-4.484	-4.469	-4.455	-4.440	-4.425	-4.411	-4.396	-4.381	-200
-190	-4.381	-4.366	-4.351	-4.336	-4.321	-4.306	-4.291	-4.276	-4.261	-4.246	-4.231	-190
-180	-4.231	-4.215	-4.200	-4.185	-4.169	-4.154	-4.138	-4.123	-4.107	-4.091	-4.076	-180
-170	-4.076	-4.060	-4.044	-4.029	-4.013	-3.997	-3.981	-3.965	-3.949	-3.933	-3.917	-170
-160	-3.917	-3.901	-3.885	-3.869	-3.852	-3.836	-3.820	-3.803	-3.787	-3.771	-3.754	-160
-150	-3.754	-3.738	-3.721	-3.705	-3.688	-3.671	-3.655	-3.638	-3.621	-3.604	-3.587	-150
-140	-3.587	-3.571	-3.554	-3.537	-3.520	-3.503	-3.486	-3.468	-3.451	-3.434	-3.417	-140
-130	-3.417	-3.400	-3.382	-3.365	-3.348	-3.330	-3.313	-3.295	-3.278	-3.260	-3.243	-130
-120	-3.243	-3.225	-3.207	-3.190	-3.172	-3.154	-3.136	-3.119	-3.101	-3.083	-3.065	-120
-110	-3.065	-3.047	-3.029	-3.011	-2.993	-2.975	-2.957	-2.938	-2.920	-2.902	-2.884	-110
-100	-2.884	-2.865	-2.847	-2.829	-2.810	-2.792	-2.773	-2.755	-2.736	-2.718	-2.699	-100
-90	-2.699	-2.680	-2.662	-2.643	-2.624	-2.605	-2.587	-2.568	-2.549	-2.530	-2.511	-90
-80	-2.511	-2.492	-2.473	-2.454	-2.435	-2.416	-2.397	-2.378	-2.359	-2.339	-2.320	-80
-70	-2.320	-2.301	-2.282	-2.262	-2.243	-2.223	-2.204	-2.185	-2.165	-2.146	-2.126	-70
-60	-2.126	-2.106	-2.087	-2.067	-2.048	-2.028	-2.008	-1.988	-1.969	-1.949	-1.929	-60
-50	-1.929	-1.909	-1.889	-1.869	-1.850	-1.830	-1.810	-1.790	-1.770	-1.749	-1.729	-50
-40	-1.729	-1.709	-1.689	-1.669	-1.649	-1.628	-1.608	-1.588	-1.568	-1.547	-1.527	-40
-30	-1.527	-1.507	-1.486	-1.466	-1.445	-1.425	-1.404	-1.384	-1.363	-1.343	-1.322	-30
-20	-1.322	-1.301	-1.281	-1.260	-1.239	-1.218	-1.198	-1.177	-1.156	-1.135	-1.114	-20
-10	-1.114	-1.094	-1.073	-1.052	-1.031	-1.010	-0.989	-0.968	-0.947	-0.926	-0.905	-10
0	-0.905	-0.883	-0.862	-0.841	-0.820	-0.799	-0.778	-0.756	-0.735	-0.714	-0.692	0

°F	0	1	2	3	4	5	6	7	8	9	10	°F
0	-0.692	-0.671	-0.650	-0.628	-0.607	-0.586	-0.564	-0.543	-0.521	-0.500	-0.478	0
10	-0.478	-0.457	-0.435	-0.413	-0.392	-0.370	-0.349	-0.327	-0.305	-0.284	-0.262	10
20	-0.262	-0.240	-0.218	-0.197	-0.175	-0.153	-0.131	-0.109	-0.088	-0.066	-0.044	20
30	-0.044	-0.022	0.000	0.022	0.044	0.066	0.088	0.110	0.132	0.154	0.176	30
40	0.176	0.198	0.220	0.242	0.264	0.286	0.308	0.330	0.353	0.375	0.397	40
50	0.397	0.419	0.441	0.463	0.486	0.508	0.530	0.552	0.575	0.597	0.619	50
60	0.619	0.642	0.664	0.686	0.709	0.731	0.753	0.776	0.798	0.821	0.843	60
70	0.843	0.865	0.888	0.910	0.933	0.955	0.978	1.000	1.023	1.045	1.068	70
80	1.068	1.090	1.113	1.136	1.158	1.181	1.203	1.226	1.249	1.271	1.294	80
90	1.294	1.316	1.339	1.362	1.384	1.407	1.430	1.453	1.475	1.498	1.521	90
100	1.521	1.543	1.566	1.589	1.612	1.635	1.657	1.680	1.703	1.726	1.749	100
110	1.749	1.771	1.794	1.817	1.840	1.863	1.886	1.909	1.931	1.954	1.977	110
120	1.977	2.000	2.023	2.046	2.069	2.092	2.115	2.138	2.161	2.184	2.207	120
130	2.207	2.230	2.253	2.276	2.298	2.321	2.344	2.367	2.390	2.413	2.436	130
140	2.436	2.459	2.483	2.506	2.529	2.552	2.575	2.598	2.621	2.644	2.667	140
150	2.667	2.690	2.713	.736	2.759	2.782	2.805	2.828	2.851	2.874	2.897	150
160	2.897	2.920	2.944	2.967	2.990	3.013	3.036	3.059	3.082	3.105	3.128	160
170	3.128	3.151	3.174	3.197	3.220	3.244	3.267	3.290	3.313	3.336	3.359	170
180	3.359	3.382	3.405	3.428	3.451	3.474	3.497	3.520	3.544	3.567	3.590	180
190	3.590	3.613	3.636	3.659	3.682	3.705	3.728	3.751	3.774	3.797	3.820	190
200	3.820	3.843	3.866	3.889	3.912	3.935	3.958	3.981	4.004	4.027	4.050	200
210	4.050	4.073	4.096	4.119	4.142	4.165	4.188	4.211	4.234	4.257	4.280	210
220	4.280	4.303	4.326	4.349	4.372	4.395	4.417	4.440	4.463	4.486	4.509	220
230	4.509	4.532	4.555	4.578	4.601	4.623	4.646	4.669	4.692	4.715	4.738	230
240	4.738	4.760	4.783	4.806	4.829	4.852	4.874	4.897	4.920	4.943	4.965	240
250	4.965	4.988	5.011	5.034	5.056	5.079	5.102	5.124	5.147	5.170	5.192	250
260	5.192	5.215	5.238	5.260	5.283	5.306	5.328	5.351	5.374	5.396	5.419	260
270	5.419	5.441	5.464	5.487	5.509	5.532	5.554	5.577	5.599	5.622	5.644	270
280	5.644	5.667	5.690	5.712	5.735	5.757	5.779	5.802	5.824	5.847	5.869	280
290	5.869	5.892	5.914	5.937	5.959	5.982	6.004	6.026	6.049	6.071	6.094	290
300	6.094	6.116	6.138	6.161	6.183	6.205	6.228	6.250	6.272	6.295	6.317	300
310	6.317	6.339	6.362	6.384	6.406	6.429	6.451	6.473	6.496	6.518	6.540	310
320	6.540	6.562	6.585	6.607	6.629	6.652	6.674	6.696	6.718	6.741	6.763	320
330	6.763	6.785	6.807	6.829	6.852	6.874	6.896	6.918	6.941	6.963	6.985	330
340	6.985	7.007	7.029	7.052	7.074	7.096	7.118	7.140	7.163	7.185	7.207	340

K-type thermocouple - Temperature in degrees "F" with reference junction at 32°F

°F	0	1	2	3	4	5	6	7	8	9	10	°F
350	7.207	7.229	7.251	7.273	7.296	7.318	7.340	7.362	7.384	7.407	7.429	350
360	7.429	7.451	7.473	7.495	7.517	7.540	7.562	7.584	7.606	7.628	7.650	360
370	7.650	7.673	7.695	7.717	7.739	7.761	7.783	7.806	7.828	7.850	7.872	370
380	7.872	7.894	7.917	7.939	7.961	7.983	8.005	8.027	8.050	8.072	8.094	380
390	8.094	8.116	8.138	8.161	8.183	8.205	8.227	8.250	8.272	8.294	8.316	390
400	8.316	8.338	8.361	8.383	8.405	8.427	8.450	8.472	8.494	8.516	8.539	400
410	8.539	8.561	8.583	8.605	8.628	8.650	8.672	8.694	8.717	8.739	8.761	410
420	8.761	8.784	8.806	8.828	8.851	8.873	8.895	8.918	8.940	8.962	8.985	420
430	8.985	9.007	9.029	9.052	9.074	9.096	9.119	9.141	9.163	9.186	9.208	430
440	9.208	9.231	9.253	9.275	9.298	9.320	9.343	9.365	9.388	9.410	9.432	440
450	9.432	9.455	9.477	9.500	9.522	9.545	9.567	9.590	9.612	9.635	9.657	450
460	9.657	9.680	9.702	9.725	9.747	9.770	9.792	9.815	9.837	9.860	9.882	460
470	9.882	9.905	9.927	9.950	9.973	9.995	10.018	10.040	10.063	10.086	10.108	470
480	10.108	10.131	10.153	10.176	10.199	10.221	10.244	10.267	10.289	10.312	10.334	480
490	10.334	10.357	10.380	10.402	10.425	10.448	10.471	10.493	10.516	10.539	10.561	490
500	10.561	10.584	10.607	10.629	10.652	10.675	10.698	10.720	10.743	10.766	10.789	500
510	10.789	10.811	10.834	10.857	10.880	10.903	10.925	10.948	10.971	10.994	11.017	510
520	11.017	11.039	11.062	11.085	11.108	11.131	11.154	11.176	11.199	11.222	11.245	520
530	11.245	11.268	11.291	11.313	11.336	11.359	11.382	11.405	11.428	11.451	11.474	530
540	11.474	11.497	11.519	11.542	11.565	11.588	11.611	11.634	11.657	11.680	11.703	540
550	11.703	11.726	11.749	11.772	11.795	11.818	11.841	11.864	11.887	11.910	11.933	550
560	11.933	11.956	11.978	12.001	12.024	12.047	12.070	12.093	12.116	12.140	12.163	560
570	12.163	12.186	12.209	12.232	12.255	12.278	12.301	12.324	12.347	12.370	12.393	570
580	12.393	12.416	12.439	12.462	12.485	12.508	12.531	12.554	12.577	12.600	12.624	580
590	12.624	12.647	12.670	12.693	12.716	12.739	12.762	12.785	12.808	12.831	12.855	590
600	12.855	12.878	12.901	12.924	12.947	12.970	12.993	13.016	13.040	13.063	13.086	600
610	13.086	13.109	13.132	13.155	13.179	13.202	13.225	13.248	13.271	13.294	13.318	610
620	13.318	13.341	13.364	13.387	13.410	13.433	13.457	13.480	13.503	13.526	13.549	620
630	13.549	13.573	13.596	13.619	13.642	13.665	13.689	13.712	13.735	13.758	13.782	630
640	13.782	13.805	13.828	13.851	13.874	13.898	13.921	13.944	13.967	13.991	14.014	640
650	14.014	14.037	14.060	14.084	14.107	14.130	14.154	14.177	14.200	14.223	14.247	650
660	14.247	14.270	14.293	14.316	14.340	14.363	14.386	14.410	14.433	14.456	14.479	660
670	14.479	14.503	14.526	14.549	14.573	14.596	14.619	14.643	14.666	14.689	14.713	670
680	14.713	14.736	14.759	14.783	14.806	14.829	14.853	14.876	14.899	14.923	14.946	680
690	14.946	14.969	14.993	15.016	15.039	15.063	15.086	15.109	15.133	15.156	15.179	690
700	15.179	15.203	15.226	15.250	15.273	15.296	15.320	15.343	15.366	15.390	15.413	700
710	15.413	15.437	15.460	15.483	15.507	15.530	15.554	15.577	15.600	15.624	15.647	710
720	15.647	15.671	15.694	15.717	15.741	15.764	15.788	15.811	15.834	15.858	15.881	720
730	15.881	15.905	15.928	15.952	15.975	15.998	16.022	16.045	16.069	16.092	16.116	730
740	16.116	16.139	16.163	16.186	16.209	16.233	16.256	16.280	16.303	16.327	16.350	740
750	16.350	16.374	16.397	16.421	16.444	16.468	16.491	16.514	16.538	16.561	16.585	750
760	16.585	16.608	16.632	16.655	16.679	16.702	16.726	16.749	16.773	16.796	16.820	760
770	16.820	16.843	16.867	16.890	16.914	16.937	16.961	16.984	17.008	17.031	17.055	770
780	17.055	17.078	17.102	17.125	17.149	17.173	17.196	17.220	17.243	17.267	17.290	780
790	17.290	17.314	17.337	17.361	17.384	17.408	17.431	17.455	17.478	17.502	17.526	790
800	17.526	17.549	17.573	17.596	17.620	17.643	17.667	17.690	17.714	17.738	17.761	800
810	17.761	17.785	17.808	17.832	17.855	17.879	17.902	17.926	17.950	17.973	17.997	810
820	17.997	18.020	18.044	18.068	18.091	18.115	18.138	18.162	18.185	18.209	18.233	820
830	18.233	18.256	18.280	18.303	18.327	18.351	18.374	18.398	18.421	18.445	18.469	830
840	18.469	18.492	18.516	18.539	18.563	18.587	18.610	18.634	18.657	18.681	18.705	840
850	18.705	18.728	18.752	18.776	18.799	18.823	18.846	18.870	18.894	18.917	18.941	850
860	18.941	18.965	18.988	19.012	19.035	19.059	19.083	19.106	19.130	19.154	19.177	860
870	19.177	19.201	19.224	19.248	19.272	19.295	19.319	19.343	19.366	19.390	19.414	870
880	19.414	19.437	19.461	19.485	19.508	19.532	19.556	19.579	19.603	19.626	19.650	880
890	19.650	19.674	19.697	19.721	19.745	19.768	19.792	19.816	19.839	19.863	19.887	890
900	19.887	19.910	19.934	19.958	19.981	20.005	20.029	20.052	20.076	20.100	20.123	900
910	20.123	20.147	20.171	20.194	20.218	20.242	20.265	20.289	20.313	20.336	20.360	910
920	20.360	20.384	20.407	20.431	20.455	20.479	20.502	20.526	20.550	20.573	20.597	920
930	20.597	20.621	20.644	20.668	20.692	20.715	20.739	20.763	20.786	20.810	20.834	930
940	20.834	20.857	20.881	20.905	20.929	20.952	20.976	21.000	21.023	21.047	21.071	940
950	21.071	21.094	21.118	21.142	21.165	21.189	21.213	21.236	21.260	21.284	21.308	950
960	21.308	21.331	21.355	21.379	21.402	21.426	21.450	21.473	21.497	21.521	21.544	960
970	21.544	21.568	21.592	21.616	21.639	21.663	21.687	21.710	21.734	21.758	21.781	970
980	21.781	21.805	21.829	21.852	21.876	21.900	21.924	21.947	21.971	21.995	22.018	980
990	22.018	22.042	22.066	22.089	22.113	22.137	22.160	22.184	22.208	22.232	22.255	990
1000	22.255	22.279	22.303	22.326	22.350	22.374	22.397	22.421	22.445	22.468	22.492	1000
1010	22.492	22.516	22.540	22.563	22.587	22.611	22.634	22.658	22.682	22.705	22.729	1010
1020	22.729	22.753	22.776	22.800	22.824	22.847	22.871	22.895	22.919	22.942	22.966	1020
1030	22.966	22.990	23.013	23.037	23.061	23.084	23.108	23.132	23.155	23.179	23.203	1030
1040	23.203	23.226	23.250	23.274	23.297	23.321	23.345	23.368	23.392	23.416	23.439	1040
1050	23.439	23.463	23.487	23.510	23.534	23.558	23.581	23.605	23.629	23.652	23.676	1050
1060	23.676	23.700	23.723	23.747	23.771	23.794	23.818	23.842	23.865	23.889	23.913	1060
1070	23.913	23.936	23.960	23.984	24.007	24.031	24.055	24.078	24.102	24.126	24.149	1070
1080	24.149	24.173	24.197	24.220	24.244	24.267	24.291	24.315	24.338	24.362	24.386	1080
1090	24.386	24.409	24.433	24.457	24.480	24.504	24.527	24.551	24.575	24.598	24.622	1090
1100	24.622	24.646	24.669	24.693	24.717	24.740	24.764	24.787	24.811	24.835	24.858	1100
1110	24.858	24.882	24.905	24.929	24.953	24.976	25.000	25.024	25.047	25.071	25.094	1110
1120	25.094	25.118	25.142	25.165	25.189	25.212	25.236	25.260	25.283	25.307	25.330	1120
1130	25.330	25.354	25.377	25.401	25.425	25.448	25.472	25.495	25.519	25.543	25.566	1130
1140	25.566	25.590	25.613	25.637	25.660	25.684	25.708	25.731	25.755	25.778	25.802	1140
1150	25.802	25.825	25.849	25.873	25.896	25.920	25.943	25.967	25.990	26.014	26.037	1150
1160	26.037	26.061	26.084	26.108	26.132	26.155	26.179	26.202	26.226	26.249	26.273	1160
1170	26.273	26.296	26.320	26.343	26.367	26.390	26.414	26.437	26.461	26.484	26.508	1170
1180	26.508	26.532	26.555	26.579	26.602	26.626	26.649	26.673	26.696	26.720	26.743	1180
1190	26.743	26.767	26.790	26.814	26.837	26.861	26.884	26.907	26.931	26.954	26.978	1190

Thermoelectric Voltage in milliVolts

Thermocouple Reference Tables

Reference Tables
N.I.S.T Rev. ITS-90

K-type thermocouple - Temperature in degrees "F" with reference junction at 32°F

°F	0	1	2	3	4	5	6	7	8	9	10	°F
1200	26.978	27.001	27.025	27.048	27.072	27.095	27.119	27.142	27.166	27.189	27.213	1200
1210	27.213	27.236	27.259	27.283	27.306	27.330	27.353	27.377	27.400	27.424	27.447	1210
1220	27.447	27.471	27.494	27.517	27.541	27.564	27.588	27.611	27.635	27.658	27.681	1220
1230	27.681	27.705	27.728	27.752	27.775	27.798	27.822	27.845	27.869	27.892	27.915	1230
1240	27.915	27.939	27.962	27.986	28.009	28.032	28.056	28.079	28.103	28.126	28.149	1240
1250	28.149	28.173	28.196	28.219	28.243	28.266	28.289	28.313	28.336	28.360	28.383	1250
1260	28.383	28.406	28.430	28.453	28.476	28.500	28.523	28.546	28.570	28.593	28.616	1260
1270	28.616	28.640	28.663	28.686	28.710	28.733	28.756	28.780	28.803	28.826	28.849	1270
1280	28.849	28.873	28.896	28.919	28.943	28.966	28.989	29.013	29.036	29.059	29.082	1280
1290	29.082	29.106	29.129	29.152	29.176	29.199	29.222	29.245	29.269	29.292	29.315	1290
1300	29.315	29.338	29.362	29.385	29.408	29.431	29.455	29.478	29.501	29.524	29.548	1300
1310	29.548	29.571	29.594	29.617	29.640	29.664	29.687	29.710	29.733	29.757	29.780	1310
1320	29.780	29.803	29.826	29.849	29.873	29.896	29.919	29.942	29.965	29.989	30.012	1320
1330	30.012	30.035	30.058	30.081	30.104	30.128	30.151	30.174	30.197	30.220	30.243	1330
1340	30.243	30.267	30.290	30.313	30.336	30.359	30.382	30.405	30.429	30.452	30.475	1340
1350	30.475	30.498	30.521	30.544	30.567	30.590	30.613	30.637	30.660	30.683	30.706	1350
1360	30.706	30.729	30.752	30.775	30.798	30.821	30.844	30.868	30.891	30.914	30.937	1360
1370	30.937	30.960	30.983	31.006	31.029	31.052	31.075	31.098	31.121	31.144	31.167	1370
1380	31.167	31.190	31.213	31.236	31.260	31.283	31.306	31.329	31.352	31.375	31.398	1380
1390	31.398	31.421	31.444	31.467	31.490	31.513	31.536	31.559	31.582	31.605	31.628	1390
1400	31.628	31.651	31.674	31.697	31.720	31.743	31.766	31.789	31.812	31.834	31.857	1400
1410	31.857	31.880	31.903	31.926	31.949	31.972	31.995	32.018	32.041	32.064	32.087	1410
1420	32.087	32.110	32.133	32.156	32.179	32.202	32.224	32.247	32.270	32.293	32.316	1420
1430	32.316	32.339	32.362	32.385	32.408	32.431	32.453	32.476	32.499	32.522	32.545	1430
1440	32.545	32.568	32.591	32.614	32.636	32.659	32.682	32.705	32.728	32.751	32.774	1440
1450	32.774	32.796	32.819	32.842	32.865	32.888	32.911	32.933	32.956	32.979	33.002	1450
1460	33.002	33.025	33.047	33.070	33.093	33.116	33.139	33.161	33.184	33.207	33.230	1460
1470	33.230	33.253	33.275	33.298	33.321	33.344	33.366	33.389	33.412	33.435	33.458	1470
1480	33.458	33.480	33.503	33.526	33.548	33.571	33.594	33.617	33.639	33.662	33.685	1480
1490	33.685	33.708	33.730	33.753	33.776	33.798	33.821	33.844	33.867	33.889	33.912	1490
1500	33.912	33.935	33.957	33.980	34.003	34.025	34.048	34.071	34.093	34.116	34.139	1500
1510	34.139	34.161	34.184	34.207	34.229	34.252	34.275	34.297	34.320	34.343	34.365	1510
1520	34.365	34.388	34.410	34.433	34.456	34.478	34.501	34.524	34.546	34.569	34.591	1520
1530	34.591	34.614	34.637	34.659	34.682	34.704	34.727	34.750	34.772	34.795	34.817	1530
1540	34.817	34.840	34.862	34.885	34.908	34.930	34.953	34.975	34.998	35.020	35.043	1540
1550	35.043	35.065	35.088	35.110	35.133	35.156	35.178	35.201	35.223	35.246	35.268	1550
1560	35.268	35.291	35.313	35.336	35.358	35.381	35.403	35.426	35.448	35.471	35.493	1560
1570	35.493	35.516	35.538	35.560	35.583	35.605	35.628	35.650	35.673	35.695	35.718	1570
1580	35.718	35.740	35.763	35.785	35.807	35.830	35.852	35.875	35.897	35.920	35.942	1580
1590	35.942	35.964	35.987	36.009	36.032	36.054	36.076	36.099	36.121	36.144	36.166	1590
1600	36.166	36.188	36.211	36.233	36.256	36.278	36.300	36.323	36.345	36.367	36.390	1600
1610	36.390	36.412	36.434	36.457	36.479	36.501	36.524	36.546	36.568	36.591	36.613	1610
1620	36.613	36.635	36.658	36.680	36.702	36.725	36.747	36.769	36.792	36.814	36.836	1620
1630	36.836	36.859	36.881	36.903	36.925	36.948	36.970	36.992	37.014	37.037	37.059	1630
1640	37.059	37.081	37.104	37.126	37.148	37.170	37.193	37.215	37.237	37.259	37.281	1640
1650	37.281	37.304	37.326	37.348	37.370	37.393	37.415	37.437	37.459	37.481	37.504	1650
1660	37.504	37.526	37.548	37.570	37.592	37.615	37.637	37.659	37.681	37.703	37.725	1660
1670	37.725	37.748	37.770	37.792	37.814	37.836	37.858	37.881	37.903	37.925	37.947	1670
1680	37.947	37.969	37.991	38.013	38.036	38.058	38.080	38.102	38.124	38.146	38.168	1680
1690	38.168	38.190	38.212	38.235	38.257	38.279	38.301	38.323	38.345	38.367	38.389	1690
1700	38.389	38.411	38.433	38.455	38.477	38.499	38.522	38.544	38.566	38.588	38.610	1700
1710	38.610	38.632	38.654	38.676	38.698	38.720	38.742	38.764	38.786	38.808	38.830	1710
1720	38.830	38.852	38.874	38.896	38.918	38.940	38.962	38.984	39.006	39.028	39.050	1720
1730	39.050	39.072	39.094	39.116	39.138	39.160	39.182	39.204	39.226	39.248	39.270	1730
1740	39.270	39.292	39.314	39.335	39.357	39.379	39.401	39.423	39.445	39.467	39.489	1740
1750	39.489	39.511	39.533	39.555	39.577	39.599	39.620	39.642	39.664	39.686	39.708	1750
1760	39.708	39.730	39.752	39.774	39.796	39.817	39.839	39.861	39.883	39.905	39.927	1760
1770	39.927	39.949	39.970	39.992	40.014	40.036	40.058	40.080	40.101	40.123	40.145	1770
1780	40.145	40.167	40.189	40.211	40.232	40.254	40.276	40.298	40.320	40.341	40.363	1780
1790	40.363	40.385	40.407	40.429	40.450	40.472	40.494	40.516	40.537	40.559	40.581	1790
1800	40.581	40.603	40.624	40.646	40.668	40.690	40.711	40.733	40.755	40.777	40.798	1800
1810	40.798	40.820	40.842	40.864	40.885	40.907	40.929	40.950	40.972	40.994	41.015	1810
1820	41.015	41.037	41.059	41.081	41.102	41.124	41.146	41.167	41.189	41.211	41.232	1820
1830	41.232	41.254	41.276	41.297	41.319	41.341	41.362	41.384	41.405	41.427	41.449	1830
1840	41.449	41.470	41.492	41.514	41.535	41.557	41.578	41.600	41.622	41.643	41.665	1840
1850	41.665	41.686	41.708	41.730	41.751	41.773	41.794	41.816	41.838	41.859	41.881	1850
1860	41.881	41.902	41.924	41.945	41.967	41.988	42.010	42.032	42.053	42.075	42.096	1860
1870	42.096	42.118	42.139	42.161	42.182	42.204	42.225	42.247	42.268	42.290	42.311	1870
1880	42.311	42.333	42.354	42.376	42.397	42.419	42.440	42.462	42.483	42.505	42.526	1880
1890	42.526	42.548	42.569	42.591	42.612	42.633	42.655	42.676	42.698	42.719	42.741	1890
1900	42.741	42.762	42.783	42.805	42.826	42.848	42.869	42.891	42.912	42.933	42.955	1900
1910	42.955	42.976	42.998	43.019	43.040	43.062	43.083	43.104	43.126	43.147	43.169	1910
1920	43.169	43.190	43.211	43.233	43.254	43.275	43.297	43.318	43.339	43.361	43.382	1920
1930	43.382	43.403	43.425	43.446	43.467	43.489	43.510	43.531	43.552	43.574	43.595	1930
1940	43.595	43.616	43.638	43.659	43.680	43.701	43.723	43.744	43.765	43.787	43.808	1940
1950	43.808	43.829	43.850	43.872	43.893	43.914	43.935	43.957	43.978	43.999	44.020	1950
1960	44.020	44.041	44.063	44.084	44.105	44.126	44.147	44.169	44.190	44.211	44.232	1960
1970	44.232	44.253	44.275	44.296	44.317	44.338	44.359	44.380	44.402	44.423	44.444	1970
1980	44.444	44.465	44.486	44.507	44.528	44.550	44.571	44.592	44.613	44.634	44.655	1980
1990	44.655	44.676	44.697	44.719	44.740	44.761	44.782	44.803	44.824	44.845	44.866	1990
2000	44.866	44.887	44.908	44.929	44.950	44.971	44.992	45.014	45.035	45.056	45.077	2000
2010	45.077	45.098	45.119	45.140	45.161	45.182	45.203	45.224	45.245	45.266	45.287	2010
2020	45.287	45.308	45.329	45.350	45.371	45.392	45.413	45.434	45.455	45.476	45.497	2020
2030	45.497	45.518	45.539	45.560	45.580	45.601	45.622	45.643	45.664	45.685	45.706	2030
2040	45.706	45.727	45.748	45.769	45.790	45.811	45.832	45.852	45.873	45.894	45.915	2040

K-type thermocouple - Temperature in degrees "F" with reference junction at 32°F

°F	0	1	2	3	4	5	6	7	8	9	10	°F
2050	45.915	45.936	45.957	45.978	45.999	46.019	46.040	46.061	46.082	46.103	46.124	2050
2060	46.124	46.145	46.165	46.186	46.207	46.228	46.249	46.269	46.290	46.311	46.332	2060
2070	46.332	46.353	46.373	46.394	46.415	46.436	46.457	46.477	46.498	46.519	46.540	2070
2080	46.540	46.560	46.581	46.602	46.623	46.643	46.664	46.685	46.706	46.726	46.747	2080
2090	46.747	46.768	46.789	46.809	46.830	46.851	46.871	46.892	46.913	46.933	46.954	2090
2100	46.954	46.975	46.995	47.016	47.037	47.057	47.078	47.099	47.119	47.140	47.161	2100
2110	47.161	47.181	47.202	47.223	47.243	47.264	47.284	47.305	47.326	47.346	47.367	2110
2120	47.367	47.387	47.408	47.429	47.449	47.470	47.490	47.511	47.531	47.552	47.573	2120
2130	47.573	47.593	47.614	47.634	47.655	47.675	47.696	47.716	47.737	47.757	47.778	2130
2140	47.778	47.798	47.819	47.839	47.860	47.880	47.901	47.921	47.942	47.962	47.983	2140
2150	47.983	48.003	48.024	48.044	48.065	48.085	48.105	48.126	48.146	48.167	48.187	2150
2160	48.187	48.208	48.228	48.248	48.269	48.289	48.310	48.330	48.350	48.371	48.391	2160
2170	48.391	48.411	48.432	48.452	48.473	48.493	48.513	48.534	48.554	48.574	48.595	2170
2180	48.595	48.615	48.635	48.656	48.676	48.696	48.717	48.737	48.757	48.777	48.798	2180
2190	48.798	48.818	48.838	48.859	48.879	48.899	48.919	48.940	48.960	48.980	49.000	2190
2200	49.000	49.021	49.041	49.061	49.081	49.101	49.122	49.142	49.162	49.182	49.202	2200
2210	49.202	49.223	49.243	49.263	49.283	49.303	49.323	49.344	49.364	49.384	49.404	2210
2220	49.404	49.424	49.444	49.465	49.485	49.505	49.525	49.545	49.565	49.585	49.605	2220
2230	49.605	49.625	49.645	49.666	49.686	49.706	49.726	49.746	49.766	49.786	49.806	2230
2240	49.806	49.826	49.846	49.866	49.886	49.906	49.926	49.946	49.966	49.986	50.006	2240
2250	50.006	50.026	50.046	50.066	50.086	50.106	50.126	50.146	50.166	50.186	50.206	2250
2260	50.206	50.226	50.246	50.266	50.286	50.306	50.326	50.346	50.366	50.385	50.405	2260
2270	50.405	50.425	50.445	50.465	50.485	50.505	50.525	50.545	50.564	50.584	50.604	2270
2280	50.604	50.624	50.644	50.664	50.684	50.703	50.723	50.743	50.763	50.783	50.802	2280
2290	50.802	50.822	50.842	50.862	50.882	50.901	50.921	50.941	50.961	50.981	51.000	2290
2300	51.000	51.020	51.040	51.060	51.079	51.099	51.119	51.139	51.158	51.178	51.198	2300
2310	51.198	51.217	51.237	51.257	51.276	51.296	51.316	51.336	51.355	51.375	51.395	2310
2320	51.395	51.414	51.434	51.453	51.473	51.493	51.512	51.532	51.552	51.571	51.591	2320
2330	51.591	51.611	51.630	51.650	51.669	51.689	51.708	51.728	51.748	51.767	51.787	2330
2340	51.787	51.806	51.826	51.845	51.865	51.885	51.904	51.924	51.943	51.963	51.982	2340
2350	51.982	52.002	52.021	52.041	52.060	52.080	52.099	52.119	52.138	52.158	52.177	2350
2360	52.177	52.197	52.216	52.235	52.255	52.274	52.294	52.313	52.333	52.352	52.371	2360
2370	52.371	52.391	52.410	52.430	52.449	52.468	52.488	52.507	52.527	52.546	52.565	2370
2380	52.565	52.585	52.604	52.623	52.643	52.662	52.681	52.701	52.720	52.739	52.759	2380
2390	52.759	52.778	52.797	52.817	52.836	52.855	52.875	52.894	52.913	52.932	52.952	2390
2400	52.952	52.971	52.990	53.010	53.029	53.048	53.067	53.087	53.106	53.125	53.144	2400
2410	53.144	53.163	53.183	53.202	53.221	53.240	53.260	53.279	53.298	53.317	53.336	2410
2420	53.336	53.355	53.375	53.394	53.413	53.432	53.451	53.470	53.490	53.509	53.528	2420
2430	53.528	53.547	53.566	53.585	53.604	53.623	53.643	53.662	53.681	53.700	53.719	2430
2440	53.719	53.738	53.757	53.776	53.795	53.814	53.833	53.852	53.871	53.890	53.910	2440
2450	53.910	53.929	53.948	53.967	53.986	54.005	54.024	54.043	54.062	54.081	54.100	2450
2460	54.100	54.119	54.138	54.157	54.176	54.195	54.214	54.233	54.252	54.271	54.289	2460
2470	54.289	54.308	54.327	54.346	54.365	54.384	54.403	54.422	54.441	54.460	54.479	2470
2480	54.479	54.498	54.517	54.536	54.554	54.573	54.592	54.611	54.630	54.649	54.668	2480
2490	54.668	54.687	54.705	54.724	54.743	54.762	54.781	54.800	54.819	54.837	54.856	2490
2500	54.856	54.875	54.894									

Resistance Values of HANNA Thermistor Sensors

HI 765 Series

The following table shows various ambient temperatures and the corresponding resistance values of our HI 765 sensor series in the -50.0 to +170.0°C range

Ambient Temperature (°C)	Resistance (ohm)	Ambient Temperature (°C)	Resistance (ohm)
-50.0	537.2	60.0	1275.3
-40.0	588.2	70.0	1361.9
-30.0	641.9	80.0	1450.2
-20.0	699.5	90.0	1542.0
-10.0	760.9	100.0	1637.2
0.0	825.0	110.0	1734.9
10.0	891.9	120.0	1835.9
20.0	962.4	130.0	1939.4
25.0	999.1	140.0	2045.2
30.0	1036.7	150.0	2154.3
40.0	1112.6	160.0	2267.5
50.0	1193.1	170.0	2380.2

HI 762 Series

The following table shows various ambient temperatures and the corresponding resistance values of our HI 762 sensor series in the -50.0 to +140.0°C range

Ambient Temperature (°C)	Resistance (ohm)	Ambient Temperature (°C)	Resistance (ohm)
-50.0	670100	50.0	3603
-40.0	336500	60.0	2488
-30.0	177000	70.0	1752
-20.0	97070	80.0	1258
-10.0	55330	90.0	917.7
0.0	32650	100.0	680.0
10.0	19900	110.0	511.2
20.0	12490	120.0	389.3
25.0	10000	130.0	300.9
30.0	8057	140.0	234.8
40.0	5327		

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Limited Warranty, Return and Exchange

Limited Warranty

Hanna products are manufactured in our ISO 9001:2008 facilities, meeting the highest quality standards in the industry. Hanna's high standards also apply should a product be returned due to defects in material or workmanship. Our extensive warranty extends up to five years on some products.

Limitations: Warranted products may be returned for repair or replacement only at the discretion of Hanna. In some circumstances, remedy may constitute refund for the price paid for the product.

The warranty period commences from the original date of sale to the user or a maximum of 18 months from factory ship date. Warranty is valid only when the product is used under normal conditions and in accordance with operating limitations and prescribed maintenance procedures. The express warranty stated previously is the only express warranty given by Hanna to the end-user buyer. Hanna expressly disclaims any warranties implied by law, including but not limited to warranty of merchantability of fitness for a particular purpose. Hanna shall not be liable for any individual or consequential damages of any kind for breach of any warranty, negligence, on the basis of strict liability or otherwise. Hanna's warranty periods differ across our range of instrumentation, please visit us on the web at: www.hannainst.com or contact your local Hanna representative for specific warranty information.

Instrument Service:

Warranty and non-warranty service, replacement, recalibration and repairs are performed by factory trained service technicians at one of Hanna's Technical Service Centers worldwide. All items must have a Return Goods Authorization (RGA) number that can be obtained by contacting the Hanna Technical Service Department. The RGA number should be clearly marked on the outside of the box and the unit shipped prepaid and insured. Any product not bearing an RGA number will be refused. All products returned for warranty repair or replacement MUST be preceded or accompanied with proof of purchase, such as the original invoice or packing slip. Under special circumstances it may be deemed necessary by Hanna to issue a Return In Advance (RIA). In such cases, the defective materials must be returned to Hanna within 30 days. Materials not returned within 30 days become chargeable. Materials must be packed properly to avoid damage during transport, which would render the warranty null and void. The sender is responsible for expediting any damage claims placed against the carrier.

In most cases, a flat minimum service charge applies to non-warranty repairs or recalibration. Please contact your local Hanna Technical Service Department for current rates. Any materials returned for repair which are considered non-warranty may be serviced at hourly cost (excluding parts) following subsequent notification and approval of such.

Product Return and Exchange

Returning Merchandise:

Should an instance occur when a product may need to be returned for exchange or credit, or should a discrepancy occur in a packing slip, Hanna must be contacted to obtain a Return Goods Authorization Number (RGA). Please follow these steps:

1. Within 30 days of receipt of merchandise call Hanna's Technical Service Department to obtain a Return Goods Authorization Number.
2. Hanna will issue a Return Goods Authorization Number.
3. The number must be clearly marked on the outside of the package being returned. Shipments not bearing a Return Goods Authorization Number will be refused.
4. Credit returns may be subject to a 25% restocking fee.

Terms and Conditions

Return shipments must meet the following requirements to be accepted for credit:

1. Products must be returned in the original packaging with labeling not defaced. All items returned will be inspected for credit worthiness. Credit will only be issued for product returned in like-new condition. No credit will be issued for product, which is not received in like-new condition.
2. All freight charges are the responsibility of the customer.
3. All chemicals and reagents being returned must be packaged in accordance with the laws and regulations of the governing country. Only unopened chemicals and reagents may be returned.

Hanna instruments® reserves the right to change or modify the design of its products at any time without advance notice.

HANNA® instruments

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