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## Fertigation Control Systems

Pages 17.6-17.9

	Time/volume Irrig control programs	Irrigated sectors	Fertilization control by EC	Fertilization control by volume	pH correction	EC probes	pH probes	Agitators control	Filter control, differential presostat	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
HI 8001/ HI 8002	10	32	4		acid or alk.	3	2	•	2 and 2	•				1 irrig.	4 fertilizer, 1 acid/alk., 1 mixing, 5 external		•		1 irrigation
HI 8011	10	16	no	4	acid or alk., by volume	No	No	•	2 and 2	•	2		1	1 irrig, 4 fert., 1 acid	1 mixing, 5 external	•	•		1 irrigation
HI 8021/ HI 8022	10	16	EC monitor	4	acid or alk.	3	2	•	2 and 2	•				1 irrig, 4 fert., 1 acid	1 mixing, 5 external		•		1 irrigation
HI 8051/ HI 8052	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	Bromine	Iodine	pH	ORP	Temperature	Logging	Alarm	PC connection	Analog output	Password protection
PCA 310	•						•	•	•	•	•
PCA 320	•			•		•	•	•	•	•	•
PCA 330	•			•	•	•	•	•	•	•	•
PCA 311		•					•	•	•	•	•
PCA 321		•		•		•	•	•	•	•	•
PCA 331		•		•	•	•	•	•	•	•	•
PCA 312			•				•	•	•	•	•
PCA 322			•	•		•	•	•	•	•	•
PCA 332			•	•	•	•	•	•	•	•	•

\*applies to "L" models with LCD

## Digital Panel Mount Controllers

Pages 17.14-17.28

	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
HI 504	•	•			•	•	•	S or D	•		•			S or D	•	•	•
HI 720			•		•	•	•	S or D	•		•		RS485	S or D	•	•	•
pH 502	•				•		•	S or D	•		•	•	RS485	S	•		
pH 500	•				•		•	S or D	•	•			RS232	S	•		
mV 602		•			•		•	S or D	•		•		RS485	S	•		
mV 600		•			•		•	S	•	•			RS232	S	•		
HI 700			•		•		•	D	•		•		RS485	S	•		
HI 710			•	•	•		•	D	•		•		RS485	S	•		

## Analog Process Controllers

Pages 17.31-17.38

	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
HI 8510	•				•	•		1		•		
HI 8710	•				•	•	S	1	•	•	•	•
HI 8711	•				•	•	D	2	•	•	•	•
HI 8512		•			•	•		1	•	•		
HI 8720		•			•	•	S	1	•	•	•	•
HI 8931			•		•	•	S	1	•	•	•	•
HI 943500			•		•	•	S	1	•	•		
HI 8410				•	•	•	S	1	•	•	•	•

## Controller and Pump Systems

Pages 17.40-17.41

	pH	ORP	Proportional dosing	Dosing contacts	Alarm contact	Recorder output
BL 7916	•		•	1	1	•
BL 7917		•	•	1	1	•

## Wall Mount Controllers

Pages 17.44-17.57

	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
HI 21	•				•	•	•	S or D	•	•		RS485	•		
HI 22		•			•	•	•	S	•	•		RS485	•		
HI 23			•		•	•	•	D	•		•	RS485	•		
HI 24			•	•	•	•	•	D	•		•	RS485	•		
HI 9912	•	•					•	D		•			•		
HI 9913	•		•				•	S		•			•		•
HI 9923	•		•				•	S					•	•	
HI 9935	•			•			•	S		•			•		•
HI 9914	•		•				•	S					•		•
HI 9910	•						•	S		•			•		
HI 9911	•						•	D		•			•		
HI 9920		•					•	S		•			•		
HI 9931			•				•	S		•			•		•
HI 9934				•			•	S		•			•		•

## Digital and Analog Transmitters

Pages 17.59-17.62

	pH	ORP	Conductivity	Output	Recorder output	ATC	LCD	Casing	Designed for HI 8000 series
HI 98143-01	•		•	0-1 V		•		IP54	
HI 98143-04	•		•	0-4 V		•		IP54	
HI 98143-20	•		•	4-20 mA		•		IP54	
HI 98143-22	•		•	4-20 mA		•		IP54	•
HI 8614N	•			4-20 mA	•	•		IP65	
HI 8614LN	•			4-20 mA	•	•	•	IP65	
HI 8615N		•		4-20 mA	•			IP65	
HI 8615LN		•		4-20 mA	•		•	IP65	
HI 8936 "N" series			•	4-20 mA	•	•		IP65	
HI 8936 "LN" series			•	4-20 mA	•	•	•	IP65	





HI 8000 Series

**Fertigation Control Systems**

17.6

A wide variety of models are available to cover the requirements of specific fertigation applications.

HI 8000 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.

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.



PCA 300 Series

**Chlorine, Bromine, Iodine, pH, ORP and Temperature Analyzers**

17.10

The HANNA PCA 300 series models are chlorine, bromine or iodine and pH, ORP and temperature process analyzers which continuously monitor a sample stream and control the dosing to adjust the chlorine, bromine or iodine content and pH.

From drinking and wastewater treatment to the pool and spa sanitation, the monitoring of chlorine, bromine or iodine levels has an important bearing on public health as well as ROI and efficiency for heating system and industrial applications.



HI 504

**pH/ORP Digital Controller with Sensor Check™**

17.18

Digital controllers are designed for complex process systems and offer a full package of features for the control of the process 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.

# Fertigation Control Systems

- Fertigation (fertilizer and irrigation) controllers
- Time or volume control with up to 10 irrigation programs for up to 32 sectors
- 4 fertilizer dosing control based on EC, volume or ratiometric
- Agitators controlled
- Filter cleaning detection and control
- Up to 2 pH and up to 3 EC probes connected through analog transmitters
- pH and EC reading temperature compensated on transmitter level
- Solar radiation, wind, temperature sensors
- Power engine back-up management (HI 801X only)
- Mixing input water control (HI 804X, HI 805X)
- Alarms for controlled parameters, water presence, pH or EC out of range and self system diagnostics
- Logging organized on three levels, user selectable
- RS232 connection to PC



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.

HI 8000 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.

## 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.



Panel Mount

## 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 (dedicated PC software HI 800104).

## 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).







### HI 8001 and HI 8002 models

The HI 8001 and HI 8002 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.

### HI 8011 model

The HI 8011 fertigation controller provides up to 10 irrigation programs to irrigate up to 16 sectors using volume control. The start condition of the program, the irrigation sectors and the 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 volumetric control (quantity of fertilizer is dosed in ratio with volume of irrigated water). Another important feature is related to the ability to manage an external back-up power supply. The start of irrigation programs based on the temperature variations (like antifreeze reaction) is also a unique feature offered by this model. Agitator control and filter cleaning control are performed automatically. This instrument provides an alarm system and logging organized on three levels that are user selectable.

### HI 8021 and HI 8022 models

The HI 8021 and HI 8022 fertigation controllers provide up to 10 irrigation programs to irrigate up to 16 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 volumetric control. Additionally, an EC level monitoring/alarm is implemented to stop irrigation should the conductivity exceed the maximum set level in order to avoid damages to irrigated crops. Agitator control and filter cleaning control is performed automatically. The instruments read up to two EC probes redundant in-line 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 three user selectable levels.

### HI 8051 model

The HI 8051 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.



HI 98143 pH/EC Transmitter

FAMILY	800X	8011	802X	8051
Irrigation control	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			
Fertilization control	By EC	By volume	By volume, the EC monitored	By EC, By volume, Ratiometric
Fertilizers	Up to 4 valves			Up to 4 motorized valves
pH control/correction	Acid or alkaline	Acid or alkaline, by vol.	Acid or alkaline	Acid or alkaline, motorized pump
Agitators control	Yes	yes	Yes	Yes
Filter control/cleaning	2 differential presostate/2 filter cleaning relays			
Fertilizer tank levels/counters control	Level	No	Counters	Level and counters
Irrigation counter	Yes			
Acid/Alkaline tank level/counter control	Level	No	Counter	Level and counter
EC inputs	Up to 3, 0.0 to 10 mS/cm	No	Up to 2, 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	No	Up to 2, 0.0 to 14.0 pH	1, 0.0 to 14.0 pH
Temperature Compensation	EC, pH		EC, pH	EC, pH
Solar radiation input	1; 0 to 2000 W/m <sup>2</sup>	1; 0 to 2000 W/m <sup>2</sup>	1; 0 to 2000 W/m <sup>2</sup>	No
Temperature	No	2	No	1
Wind speed	No	Yes	No	No
Engine power back-up	No	Yes	No	No
Irrigated sectors	Up to 32	Up to 16	Up to 16	Up to 24
Mixing source of water	No	No	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 HI 8000 Series model is supplied instructions.

Choose your configuration:

**HI 8001-0100U** Fertigation controller with priority for pH and EC, panel mount, 8 sectors, English, 115V.

**HI 8001-0100D** Fertigation controller with priority for pH and EC, panel mount, 8 sectors, English, 230V.

**HI 8001-0200U** Fertigation controller with priority for pH and EC, panel mount, 16 sectors, English, 115V.

**HI 8001-0200D** Fertigation controller with priority for pH and EC, panel mount, 16 sectors, English, 230V.

**HI 8001-0300U** Fertigation controller with priority for pH and EC, panel mount, 16 sectors, English, 115V.

**HI 8001-0300D** Fertigation controller with priority for pH and EC, panel mount, 16 sectors, English, 230V.

**HI 8001-0400U** Fertigation controller with priority for pH and EC, panel mount, 32 sectors, English, 115V.

**HI 8001-0400D** Fertigation controller with priority for pH and EC, panel mount, 32 sectors, English, 230V.

**HI 8002-0100U** Fertigation controller with priority for pH and EC, wall mount, 8 sectors, English, 115V.

**HI 8002-0100D** Fertigation controller with priority for pH and EC, wall mount, 8 sectors, English, 230V.

**HI 8002-0200U** Fertigation controller with priority for pH and EC, wall mount, 16 sectors, English, 115V.

**HI 8002-0200D** Fertigation controller with priority for pH and EC, wall mount, 16 sectors, English, 230V.

**HI 8002-0400U** Fertigation controller with priority for pH and EC, wall mount, 32 sectors, English, 115V.

**HI 8002-0400D** Fertigation controller with priority for pH and EC, wall mount, 32 sectors, English, 230V.

**HI 8011-0200U** Fertigation controller with flow control (irrigation counter), panel mount, 16 sectors, English, 115V.

**HI 8011-0200D** Fertigation controller with flow control (irrigation counter), panel mount, 16 sectors, English, 230V.

**HI 8021-0200U** Fertigation controller with flow control (irrigation counter), pH dosage and EC monitor, panel mount, 16 sectors, English, 115V.

**HI 8021-0200D** Fertigation controller with flow control (irrigation counter), pH dosage and EC monitor, panel mount, 16 sectors, English, 230V.

**HI 8022-0200U** Fertigation controller with flow control (irrigation counter), pH dosage and EC monitor, wall mount, 16 sectors, English, 115V.

**HI 8022-0200D** Fertigation controller with flow control (irrigation counter), pH dosage and EC monitor, wall mount, 16 sectors, English, 230V.

**HI 8051-0300U** 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.

**HI 8051-0300D** 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

**HI 98143-22** 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)*

## ACCESSORIES

**HI 1001** "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)*

**HI 3001** "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)*

**HI 60542** Electrode Holder for Direct Pipe  
*Order according with the total amount of ordered probes*

**HI 800104** Windows compatible PC application

**HI 7004L** pH 4.01 buffer solution, 500 mL

**HI 7007L** pH 7.01 buffer solution, 500 mL

**HI 7039L** 5.00 mS/cm calibration solution, 500 mL

**HI 70300L** Electrode storage solution, 500 mL

**HI 7061L** Electrode cleaning solution, 500 mL

**HI 710005** 115 VAC to 12VDC power adapter

**HI 710006** 230 VAC to 12VDC power adapter

For a complete list of Solutions, see the end of pH Section 3 and Conductivity Section 6.

# Chlorine, Bromine, Iodine, pH, ORP and Temperature Analyzers

- Implements the DPD colorimetric method to determine free or total chlorine, bromine or iodine concentration
- One point calibration of photometric cell
- Up to two point pH calibration and in-line pH electrode calibration support
- ORP monitoring
- Control time cycles adjustable between 3 to 90 minutes
- Proportional control of Chlorine, bromine or iodine concentration
- Proportional control of pH and ORP monitoring
- Out of range measurement and self-diagnostic system alarms
- Parameter control through analog output or dedicated relays
- Logging space of up to of 3500 measurements and alarm status
- Multi-language support
- RS485 connectivity

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 ( $\text{Cl}_2$ ), a liquid like sodium hypochlorite or bleach ( $\text{NaOCl}$ ) or in a solid state like calcium hypochlorite, chloro-hydantoin or chloro-cyanuric acid compounds. These compounds, once dissolved in water do establish equilibrium between the hypochlorous acid ( $\text{HOCl}$ ) and the hypochlorite ions ( $\text{OCl}^-$ ). 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 depends upon the pH value of the solution. Changes in pH value will affect the  $\text{HOCl}$  equilibrium in relation to the hydrogen and hypochlorite ion;  $\text{HOCl}$  decreases and  $\text{OCl}^-$  increases as pH increases. At a low pH, almost all the free chlorine is in the molecular form  $\text{HOCl}$  and at a pH of around 7.5, the ratio between  $\text{HOCl}$  and  $\text{OCl}^-$  is 50:50. Since the ionic form  $\text{OCl}^-$  is a slow acting sanitizer while the molecular  $\text{HOCl}$  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.

## Bromine

In many countries, bromine sanitizing has been introduced as an alternative for chlorine, although it is a less effective sanitizer. The advantage of bromine is its stability at higher temperatures (advantageous for hot well pools), and its ability to maintain disinfection power at higher pH. Furthermore, it hardly reacts with 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.

## Iodine

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 and 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.

## Models

The HANNA PCA 300 series models are chlorine, bromine or iodine and pH, ORP and temperature process analyzers which continuously monitor a sample stream and control the dosing to adjust the chlorine, bromine or iodine content and pH.

From drinking and wastewater treatment to the pool and spa sanitation, the monitoring of chlorine, bromine or iodine levels has an important bearing on public health as well as ROI and efficiency for heating system and industrial applications.

The PCA 3X0 series monitors the free chlorine or total chlorine in the 0 to 5.0 mg/L range;

The PCA 3X1 series monitors the bromine in the 0 to 10.0 mg/L range;

The PCA 3X2 series monitors the iodine in the 0 to 12.5 mg/L range;

In the DPD Colorimetric method, N, N-Diethyl-p-phenylene-Diamine indicator and a buffer are mixed with the sample. Free available chlorine oxidizes the DPD indicator reagent at a pH between 6.3 and 6.6 to form a magenta colored compound. The intensity of the resulting color is proportional to the concentration of chlorine in the sample. The purpose of the buffer solution is to maintain the proper pH.

In total chlorine measurement (free available chlorine plus combined chloramines), potassium iodide is added. The chloramines in the sample cause the iodide ions to become iodine which reacts with free chlorine to oxidize the DPD indicator. A pH of 5.1 is required for this reaction. Thus total chlorine measurements require a different buffer solution containing potassium iodide. Once the chemical reaction is completed, the optical signal at 555 nm is compared to the signal measured through the sample before the reagents were added. From these measurements chlorine concentration is calculated and shown on the display.

Indicator and buffer reagent bottles are placed directly into the instrument case. With a sampling period of 5 minutes, reagents need only to be replenished about once a month.

Since chlorine, bromine and iodine effectiveness is closely tied with pH levels, HANNA has designed our new analyzers PCA 32X and PCA 33X with pH control and temperature and pH control, ORP monitoring and temperature respectively.

PCA 32X and PCA 33X use the HI 1005 pH probe to continuously measure the pH of the sample stream in the range of 0 to 14 pH. The sample temperature is measured in the 5 to 75°C range. pH and temperature are displayed on the front panel, and the pH value is temperature compensated.

PCA 33X uses the HI 2008 platinum ORP electrode to continuously measure the sample ORP value. The pH/temperature combined sensor and the ORP sensor are placed inside the case, directly in the sample stream.

## 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/Bromine/Iodine Control

Four chlorine/bromine/iodine 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 ( $1/\Delta$ ) is user selectable with a delta between 0.1 and 2 pH. Chlorine/bromine/iodine 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 ( $1/\Delta$ ) 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/alkali 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		PCA 310	PCA 320	PCA 330	PCA 311	PCA 321	PCA 331	PCA 312	PCA 322	PCA 332
Range	Free & Total Chlorine	0.00 to 5.00 mg/L (ppm)			–	–	–	–	–	–
	Bromine	–	–	–	0.0 to 10.0 mg/L			–	–	–
	Iodine	–	–	–	–	–	–	0.0 to 12.5 mg/L		
	pH	–	0.00 to 14.00 pH		–	0.00 to 14.00 pH		–	0.00 to 14.00 pH	
	ORP	–	–	0 to 2000 mV	–	–	0 to 2000 mV	–	–	0 to 2000 mV
	Temperature	–	5.0 to 75.0 °C (41 to 167 °F)		–	5.0 to 75.0 °C (41 to 167 °F)		–	5.0 to 75.0 °C (41 to 167 °F)	
Resolution	Free & Total Chlorine	0.01 mg/L (ppm)			–	–	–	–	–	–
	Bromine	–	–	–	0.1 mg/L (ppm)			–	–	–
	Iodine	–	–	–	–	–	–	0.1 mg/L (ppm)		
	pH	–	0.01 pH		–	0.01 pH		–	0.01 pH	
	ORP	–	–	1 mV	–	–	1 mV	–	1 mV	
	Temperature	–	0.1 °C		–	0.1 °C		–	0.1 °C	
Accuracy	Free & Total Chlorine	± 8% or ±0.05 mg/L whichever is greater			–	–	–	–	–	–
	Bromine	–	–	–	±8% or ±0.1 mg/L whichever is greater			–	–	–
	Iodine	–	–	–	–	–	–	± 8% or ±0.1 mg/L whichever is greater		
	pH	–	±0.05 pH		–	±0.05 pH		–	±0.05 pH	
	ORP	–	–	±1 mV	–	–	±1 mV	–	–	±1 mV
	Temperature	–	±0.5°C		–	±0.5°C		–	±0.5°C	
Min. Detectable Level	F & T Chlorine, Bromine, Iodine	0.05 mg/L (ppm)			0.1 mg/L (ppm)			0.1 mg/L (ppm)		
Input Impedance		10 <sup>12</sup> Ohm								
Calibration	F & T Chlorine, Bromine, Iodine	one point								
	pH	one or two point or in line calibration								
Sampling Rate	F & T Chlorine, Bromine, Iodine	adjustable from 3 to 90 minutes								
	pH	adjustable from 3 to 120 seconds								
Dosage	F & T Chlorine, Bromine, Iodine	proportional								
	pH	ON/OFF or proportional, relay or 4-20mA output								
Delta	F & T Chlorine, Bromine, Iodine	selectable from 0.1 to 5 mg/L (ppm)								
	pH	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 **PCA 300 series** model is supplied with reagent bottles (2), reagent caps (2), 1 DPD compound powder, tubing and instructions.

**PCA 310-1** Free & total chlorine analyzer/control (115V)

**PCA 310-2** Free & total chlorine analyzer/control (230V)

**PCA 320-1** Free & total chlorine analyzer/control, pH control, temperature (115V)

**PCA 320-2** Free & total chlorine analyzer/control, pH control, temperature (230V)

**PCA 330-1** Free & total chlorine analyzer/control, pH control, ORP monitoring, temperature (115V)

**PCA 330-2** Free & total chlorine analyzer/control, pH control, ORP monitoring, temperature (230V)

**PCA 311-1** Bromine analyzer/control (115V)

**PCA 311-2** Bromine analyzer/control (230V)

**PCA 321-1** Bromine analyzer/control, pH control, temperature (115V)

**PCA 321-2** Bromine analyzer/control, pH control, temperature (230V)

**PCA 331-1** Bromine analyzer/control, pH control, ORP monitoring, temperature (115V)

**PCA 331-2** Bromine analyzer/control, pH control, ORP monitoring, temperature (230V)

**PCA 312-1** Iodine analyzer/control (115V)

**PCA 312-2** Iodine analyzer/control (230V)

**PCA 322-1** Iodine analyzer/control, pH control, temperature (115V)

**PCA 322-2** Iodine analyzer/control, pH control, temperature (230V)

**PCA 332-1** Iodine analyzer/control, pH control, ORP monitoring, temperature (115V)

**PCA 332-2** Iodine analyzer/control, pH control, ORP monitoring, temperature (230V)





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

HI 2008 Amplified ORP electrode with Matching Pin (15) (PCA 330 only)

## REAGENTS

- HI 70431 Total Chlorine reagent set for PCA (buffer citrate), 500 mL (2)
- HI 70481 Total chlorine reagent set for PCA, 500 mL (2) + 6 g powder
- HI 70491 Total chlorine reagent set for PCA, 500 mL (2) + 5 sachets (DPD)
- HI 70430 Free chlorine reagents set for PCA (the most stable), recommended for long term measurements, 500 mL (2) + 6 g powder
- HI 70480 Free chlorine reagents set for PCA, recommended for short term measurements, 500 mL (2) + 5 sachets (DPD)
- HI 70490 Free chlorine reagents set for PCA, 500 mL (2) + 5 sachets (DPD)
- HI 70452 DPD reagent, 5 sachets
- HI 70498 Bromine replacement reagent set for process bromine analyzer, 500 mL (2) + 5 sachets (DPD)
- HI 70499 Iodine replacement reagent set for



process iodine analyzer, 500 mL (2) + 5 sachets (DPD)

## PARTS

- HI 70473 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)
- HI 70474 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)
- HI 70475 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)
- HI 70476 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)
- HI 70477 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)
- HI 70478 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)
- HI 70479 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)
- HI 70482 PCA filters. The kit includes 0.5 µm and 50 µm filters (13)

- HI 70496 Replacement filter, 0.5 µm (15)
- HI 70497 Replacement filter, 50 µm (16)
- HI 70483 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 (2.0 x 0.03") (2 pcs), non-transparent C-flex tubes (8) 50L x 0.8ID (2.0 x 0.03") and Y strainer (7)
- HI 70484 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)
- HI 70485 PCA stirrer motor
- HI 70486 PCA stirring bar (2)
- HI 70487/N Measuring cell (9)
- HI 70487/A Adapter set for measuring cell
- HI 70488 Electrovalve, 24VAC/60Hz (12)
- HI 70489 Electrovalve, 24VAC/50Hz (12)
- HI 70494 PCA calibration port cap (10)
- HI 70492 Electrode holder (PCA 330)
- HI 70493 Closing cap for electrode holder

## ELECTRODES

- HI 1005 Amplified pH electrode with Matching Pin and Pt100 (14) (PCA 320/330 only)

## SOLUTIONS

- HI 70460 Total chlorine indicator solution for PCA, 500 mL
- HI 70461 Total chlorine buffer solution for PCA, 500 mL
- HI 70450 Free chlorine indicator solution for PCA, 500 mL
- HI 70451 Free chlorine buffer solution for PCA, 500 mL
- HI 7004L pH 4.01 buffer solution, 500 mL
- HI 7006L pH 6.86 buffer solution, 500 mL
- HI 7007L pH 7.01 buffer solution, 500 mL
- HI 7009L pH 9.18 buffer solution, 500 mL
- HI 7010L pH 10.01 buffer solution, 500 mL
- HI 7020L 200-275 mV buffer solution, 500 mL
- HI 7091L Pretreatment reducing solution, 500 mL
- HI 7092L Pretreatment oxidizing sol., 500 mL
- HI 70300L Storage solution, 500 mL
- HI 7082 3.5M KCL electrolyte, 50 mL (4)
- HI 7061L Electrode cleaning solution, 500 mL

## SOFTWARE

- HI 92500 Windows® compatible software

For a complete list of pH and ORP Solutions, see the end of pH Section 3.



The HANNA line of process instrumentation offers different solutions to control processes in which parameters like pH, ORP, Conductivity, TDS are important. The versatile solutions provided by HANNA can cover any application. Digital controllers are offered for complex process systems and offer a full package of features for the control of the process 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.

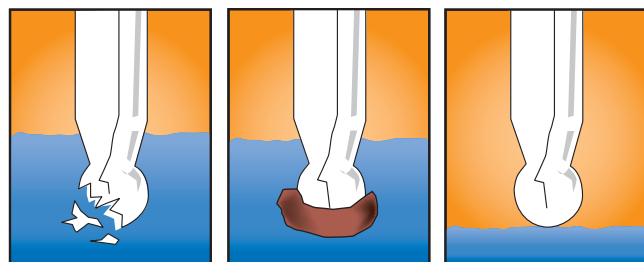
## Input of the controllers

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.  $\text{pH } (7.0 - 3.0) \times \text{approx. } 59.16 \text{ mV} = 236.64 \text{ mV}$  (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  $\text{M}\Omega$  at high temperatures, and up to  $1,000 \text{ M}\Omega$  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  $10 \text{ M}\Omega$ ). 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



## Process Instrumentation

connection between the internal silver reference and test solution, completing the circuit.

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.** Usres 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 HI 504 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.

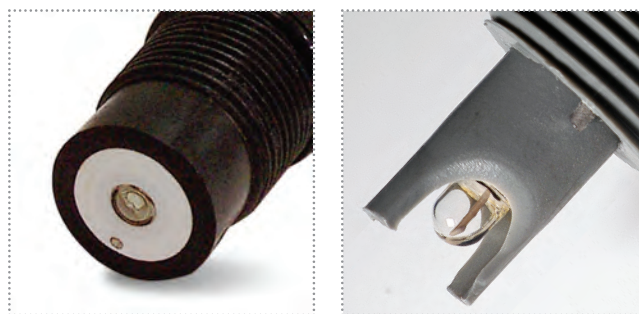
Unlike with a portable battery powered pH meter and electrode, the process system is not isolated from potential difference and the resulting current flow. It is possible, given that unwanted potentials exist in the process, that the silver/silver chloride wire of the reference is exposed to current 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 Solution to the Ground Loop Effect

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 is 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.

Quite often users need to design a simple and remote solution close to the measurement point. To solve this problem, HANNA has designed a series of wall mounted instruments which do not require enclosures and housing for a multitude of connections and wiring.

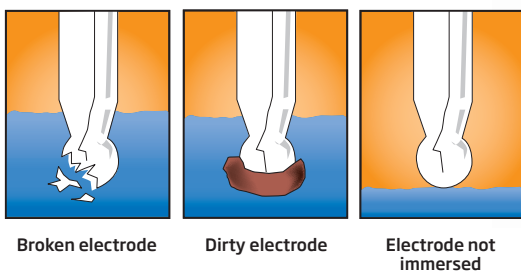
Almost the entire range of HANNA panel mount instrumentation is available in stand alone wall mountable versions for quick and easy "plug and play" installation.

HI 504

**pH/ORP Digital Controller with Sensor Check™**

- PID, PI, proportional or ON/OFF control of pH or ORP for one or two set points
- Sensor Check™ for a real-time pH/ORP electrode status monitoring
- Digital transmitter or direct connection of the probe
- Matching PIN to eliminate the ground loop effect
- Automatic temperature compensation for pH
- Logging of up to 100 system events and up to 6000 readings (pH, ORP, T)
- Control performed with up to 4 relays or analog output in 0-20 or 4-20 mA
- Automatic probe cleaning from alarm or user request

Problems Detected by the Sensor Check™ System



HI 504 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 visible with LED's on the front panel and on LCD.

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 can be accessible from a PC through RS485 and HI 92500 software. The powerful HI 92500 software has graphing capabilities and can print graphs directly or can be saved as a bitmap. Data can be exported in common spreadsheet formats.

**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.

**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 cataloging of process data (pH/mV and temperature), or can be used for controlling dosing systems (pumps or electrovalves) using PID control.

**Logging of the Last 100 Events**

With the HI 504 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 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 HI 504 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.

## 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 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	HI 504
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 (@20°C/68°F)	±0.02 pH; ±2 mV; ±0.5°C (-9.9 to 130.0°C); ±1°C (-30 to -10°C)
Input Impedance	10 <sup>12</sup> 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.)



## HI 504 • pH/ORP Digital Controller with Sensor Check™

## ORDERING INFORMATION

Each HI 504 model is supplied complete with mounting brackets and instructions.

Choose your configuration:

- HI 504112-0** single setpoint, on/off control, single analog output, 24VDC/AC
- HI 504112-1** single setpoint, on/off control, single analog output, 115V
- HI 504112-2** single setpoint, on/off control, single analog output, 230V
- HI 504122-0** single setpoint, on/off and PID control, single analog output, 24VDC/AC
- HI 504122-1** single setpoint, on/off and PID control, single analog output, 115V
- HI 504122-2** single setpoint, on/off and PID control, single analog output, 230V
- HI 504124-0** single setpoint, on/off and PID control, dual analog output, 24VDC/AC
- HI 504124-1** single setpoint, on/off and PID control, dual analog output, 115V
- HI 504124-2** single setpoint, on/off and PID control, dual analog output, 230V
- HI 504212-0** dual setpoint, on/off control, single analog output, 24VDC/AC

- HI 504212-1** dual setpoint, on/off control, single analog output, 115V
- HI 504212-2** dual setpoint, on/off control, single analog output, 230V
- HI 504214-0** dual setpoint, on/off control, dual analog output, 24VDC/AC
- HI 504214-1** dual setpoint, on/off control, dual analog output, 115V
- HI 504214-2** dual setpoint, on/off control, dual analog output, 230V
- HI 504222-0** dual setpoint, on/off and PID control, single analog output, 24VDC/AC
- HI 504222-1** dual setpoint, on/off and PID control, single analog output, 115V
- HI 504222-2** dual setpoint, on/off and PID control, single analog output, 230V
- HI 504224-0** dual setpoint, on/off and PID control, dual analog output, 24VDC/AC
- HI 504224-1** dual setpoint, on/off and PID control, dual analog output, 115V
- HI 504224-2** dual setpoint, on/off and PID control, dual analog output, 230V
- HI 504922-0** dual setpoint, advanced cleaning, on/off and PID control, single analog output, 24VDC/AC
- HI 504922-1** dual setpoint, advanced cleaning, on/off and PID control, single analog output, 115V

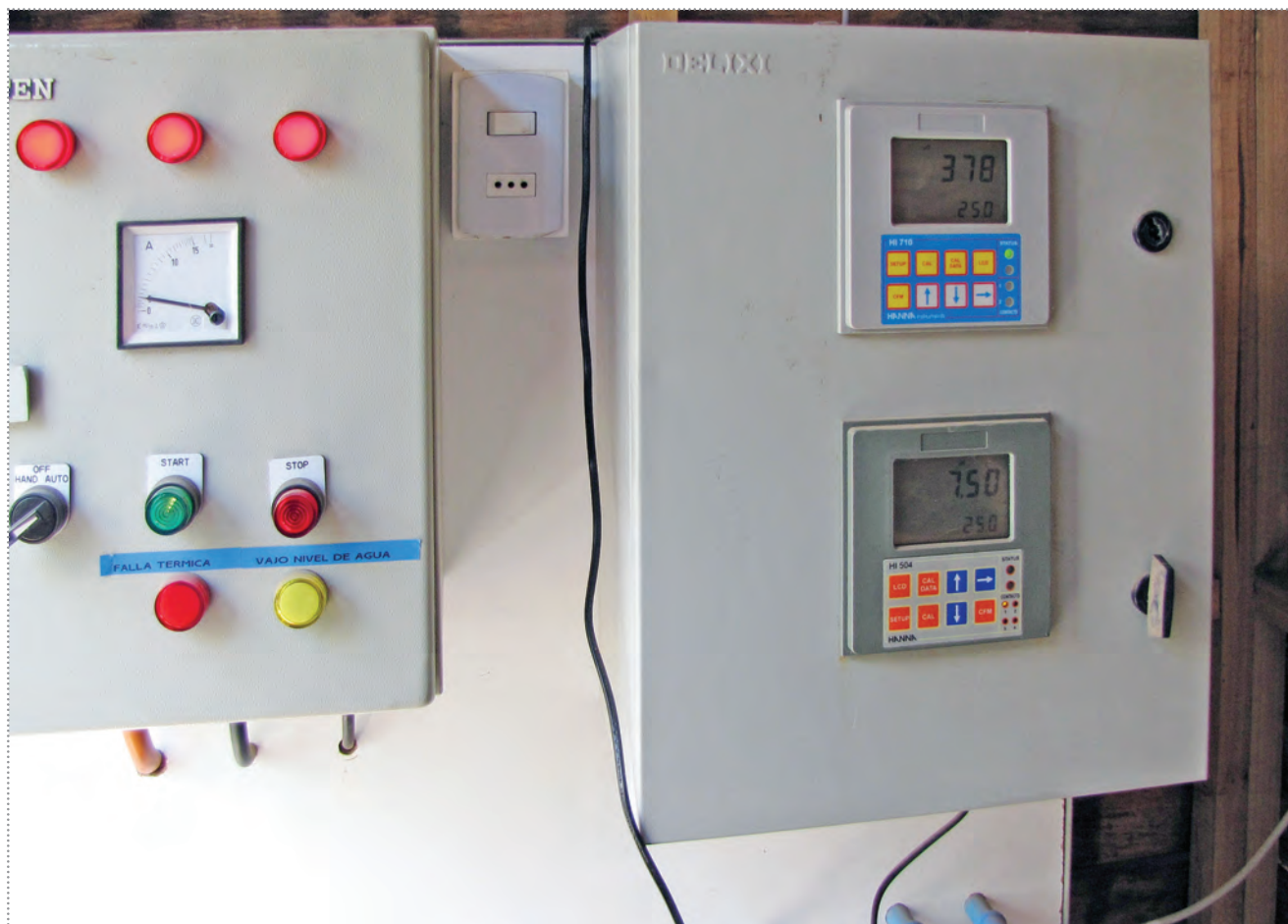
- HI 504922-2** dual setpoint, advanced cleaning, on/off and PID control, single analog output, 230V
- HI 504924-0** dual setpoint, advanced cleaning, on/off and PID control, dual analog output, 24VDC/AC
- HI 504924-1** dual setpoint, advanced cleaning, on/off and PID control, dual analog output, 115V
- HI 504924-2** dual setpoint, advanced cleaning, on/off and PID control, dual analog output, 230V

## PROBES

- HI 62920D** pH electrode with titanium body
- HI 7610** Stainless steel Pt100 probe with front and back 1/2" NPT thread and 5 m (16.4') cable
- HI 7611** Glass Pt100 probe with front and back 1/2" NPT thread and 5 m (16.4') cable

## ACCESSORIES

- HI 92500** Windows® compatible software



For a complete list of Solutions, see the end of pH Section 3.



# Conductivity Process Digital Controller with Inductive Probe



The HI 720 is equipped with a graphic display that is understandable and straightforward. Simple messages guide the user through all operations and parameter settings.

HI 720 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 of pH/ORP 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 visible with LEDs on the front panel and on LCD.

- Autoranging EC or TDS and temperature for EC/TDS
- Automatic temperature compensation for EC/TDS
- Fully customizable:  
automatic/manual/no temperature compensation  
Selectable reference temperature between 02 and 25 C;  
Selectable temperature coefficient between 0.00 to 20.00%/C,  
Selectable temperature compensation curve between linear, salinity or user definable, Selectable TDS factor between 0.01 to 1.00
- Temperature compensation curve selectable between linear, salinity or user defined
- TDS factor selectable between 0.01 to 1.00
- Supports inductive EC probe with built-in or external Pt100/1000 sensor temperature
- PID, PI, Proportional or On/off control for one or two set points
- Sensor Check™ for real time detection of soiled EC/TDS probes
- Damage test for temperature probe
- Mount probes directly or use a digital transmitter for large distances
- Logging of up to 100 system events
- Control with up to 4 relays or analog output in 0-20 mA or 4-20 mA
- Probe cleaning program performed automatically, by alarm or upon user request
- Large variety of models to fit the user system requirements

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 HI 92500 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*

## 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:  $\text{Conductivity} = (\text{cell constant})(\text{installation factor})/(\text{measured resistance})$ . 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	HI 7650 Inductive Conductivity Probe
Measuring Range	0 to 2000 mS/cm
Accuracy	$\pm 2\%$ f.s.
Cell Constant	approx. $2.4 \text{ cm}^{-1}$
Protection Class	IP67
Temperature Sensor	Pt100 to Pt1000 (depending on model)
Temperature Response	90% of the final value, approximately 10 minutes
Required Pipe Diameter	$> 80 \text{ mm}$ (consider installation factor for pipe with diameter $< 125 \text{ mm}$ )
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")
Weight (probe only)	approximately 330 g (11.64 oz.)

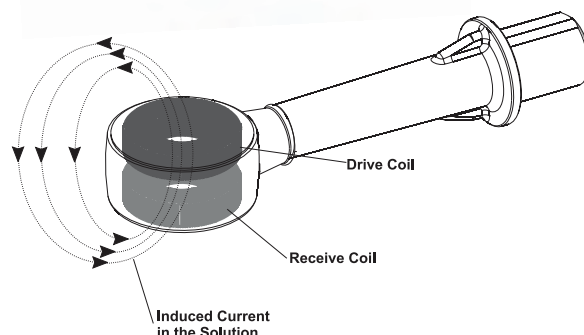
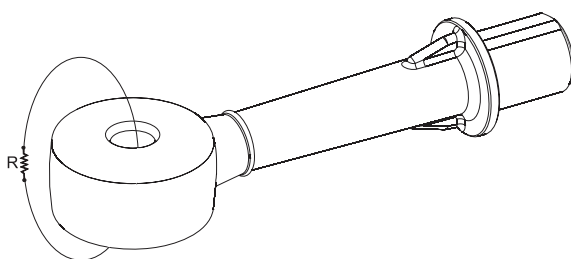
### ORDERING INFORMATION for HI 7650

Choose your configuration:

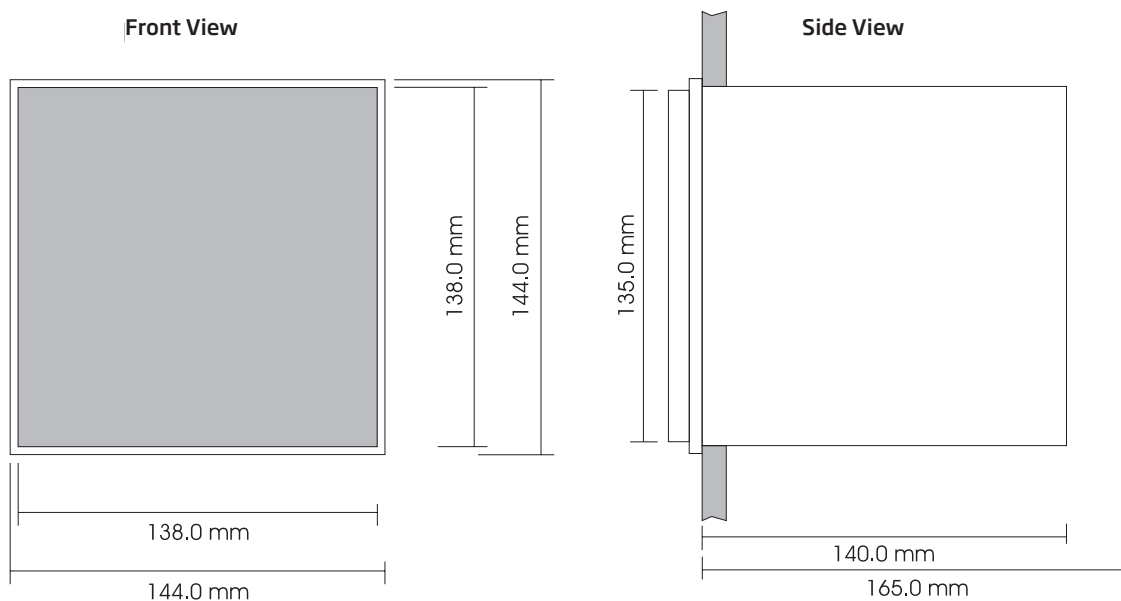
HI 7650-1105 PVC body, Pt100, 5 m cable

HI 7650-1110 PVC body, Pt100, 10 m cable

HI 7650-1115 PVC body, Pt100, 15 m cable



## Mechanical Dimensions



SPECIFICATIONS	HI 720
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 (@20°C/68°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 for HI 720

Each **HI 720** model is supplied complete with mounting brackets and instructions.

Choose your configuration:

- HI 720122-1** single setpoint, on/off and PID control, single analog output, 115V
- HI 720122-2** single setpoint, on/off and PID control, single analog output, 230V
- HI 720224-1** dual setpoint, on/off and PID control, dual analog output, 115V
- HI 720224-2** dual setpoint, on/off and PID control, dual analog output, 230V

## PROBES

- HI 7610** Stainless steel Pt100 probe with front and back 1/2" NPT thread and 5 m (16.4') cable
- HI 7611** Glass Pt100 probe with front and back 1/2" NPT thread and 5 m (16.4') cable
- HI 7620** Stainless steel Pt1000 probe with PG 13.5 thread and 5 m (16.4') cable
- HI 7621** Glass Pt1000 probe with PG 13.5

## ACCESSORIES

- BL Pumps** Dosing pumps with flow rate from 1.5 to 18.3 LPH
- HI 92500** Windows® compatible software
- HI 98501** ChecktempC temperature tester (-50 to 150°C range)
- HI 98502** ChecktempF temperature tester (-58 to 302°F range)

For a complete list of Solutions, see the end of Conductivity Section 6.

# pH Digital Controllers with Matching Pin and PID Control

- Single or dual set point
- SSR relay available
- Control through analog output
- PID control
- Fully programmable
- mA and VDC recorder output or RS485
- Differential input for ground loop protection
- Automatic three point calibration
- Last calibration data
- Automatic Temperature Compensation
- Simple wiring with removable terminal modules



## ORDERING INFORMATION

Each pH 502 model is supplied complete with mounting brackets and instructions.

Choose your configuration:

- pH 502113-1** single setpoint, on/off control, analog and RS485 output, 115V
- pH 502113-2** single setpoint, on/off control, analog and RS485 output, 230V
- pH 502123-1** single setpoint, on/off and PID controls, analog and RS485 output, 115V
- pH 502123-2** single setpoint, on/off and PID controls, analog and RS485 output, 230V
- pH 502213-1** dual setpoint, on/off control, analog and RS485 output, 115V
- pH 502213-2** dual setpoint, on/off control, analog and RS485 output, 230V
- pH 502223-1** dual setpoint, on/off and PID controls, analog and RS485 output, 115V
- pH 502223-2** dual setpoint, on/off and PID controls, analog and RS485 output, 230V
- pH 502321-1** single setpoint with SSR relay, on/off and PID controls, analog output, 115V
- pH 502321-2** single setpoint with SSR relay, on/off and PID controls, analog output, 230V
- 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
- pH 502423-1** dual setpoint with SSR relay, on/off and PID controls, RS485 output, 115V
- pH 502423-2** dual setpoint with SSR relay, on/off and PID controls, RS485 output, 230V
- pH 502523-1** control through analog output, on/off and PID controls, analog and RS485 output, 115V
- pH 502523-2** control through analog output, on/off and PID controls, analog and RS485 output, 230V

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. Models equipped with a solid state relay are also available to ensure maximum life of the switching device. Each model has a differential input for a grounding bar to extend electrode life. Several models come with an RS485 port, as well as analog recorder output.

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 (@20°C/68°F)	±0.02 pH; ±0.5°C
Input Impedance	10 <sup>12</sup> 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.)

For a complete list of Solutions, see the end of pH Section 3.



- Single or dual set point
- Fully programmable
- mA and VDC recorder output or RS232
- Differential input for ground loop protection
- Automatic three point calibration
- Last calibration data
- Automatic Temperature Compensation
- Simple wiring with removable terminal modules

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 (@20°C/68°F)	±0.02 pH; ±0.5°C
Input Impedance	10 <sup>12</sup> 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: 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 500112-1 single setpoint, on/off control, RS232 output, 115V
- pH 500112-2 single setpoint, on/off control, RS232 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 500212-1 dual setpoint, on/off control, RS232 output, 115V
- pH 500212-2 dual setpoint, on/off control, RS232 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

#### ACCESSORIES

- HI 8427 pH/ORP electrode simulator
- HI 931001 pH/ORP electrode simulator with display

For a complete list of Solutions, see the end of pH Section 3.



mV 602

# ORP Digital Controller with Matching Pin and PID Control

- Control through analog output (single set point)
- Fully programmable microprocessor memory
- RS485 interface
- Differential input for ground loop protection
- Automatic two point calibration
- Last calibration data
- Automatic Temperature Compensation
- Simple wiring with removable terminal modules



The mV 602 line of microprocessor controllers have been engineered to incorporate ease of use with a powerful set of features. These robust instruments can be configured to utilize P, PI or PID controlling. This means you don't need to choose from three separate instruments that only allow one configuration.

The mV 602 line includes models that incorporate control through analog output to drive compatible devices such as electrovalves or pumps. Several models feature bi-directional RS485 to allow remote operation with a PC as well as analog recorder output.

The Fail Safe Alarm System protects against power interruption or line failure. Use of solid state relay has been included to meet the needs of extreme industrial applications.

All models incorporate a differential input so a grounding bar may be attached, extending the life of the electrodes by eliminating ground loop current problems.

## ORDERING INFORMATION

Each **mV 602** model is supplied with mounting brackets and instructions.

Choose your configuration:

- mV 602113-1** single setpoint, on/off control, analog and RS485 outputs, 115 V
- mV 602113-2** single setpoint, on/off control, analog and RS485 output, 230 V
- mV 602123-1** single setpoint, on/off and PID controls, analog and RS485 output, 115 V
- mV 602123-2** single setpoint, on/off and PID controls, analog and RS485 output, 230 V
- mV 602321-1** dual setpoint, on/off and PID controls, analog output, 115 V
- mV 602321-2** dual setpoint, on/off and PID controls, analog output, 230 V
- mV 602323-1** dual setpoint, on/off and PID controls, analog and RS485 outputs, 115 V
- mV 602323-2** dual setpoint, on/off and PID controls, analog and RS485 outputs, 230 V

## ACCESSORIES

- HI 8427** pH/ORP electrode simulator
- HI 931001** pH/ORP electrode simulator with display

## SPECIFICATIONS

### mV 602

<b>Range</b>	-2000 to 2000 mV; -9.9 to 120°C
<b>Resolution</b>	1 mV; 0.1°C
<b>Accuracy (@20°C/68°F)</b>	±2 mV; ±0.5°C
<b>Input Impedance</b>	10 <sup>12</sup> Ohm
<b>ORP Calibration</b>	automatic, two point, at 0 and 350 or 1900 mV
<b>Outputs</b>	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
<b>Set Point Relay</b>	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)
<b>Alarm Relay</b>	1 contact output SPDT, 5A-250 VAC, 5A-30 VDC (resistive load), fuse protected (5A, 250V fuse)
<b>Power Supply</b>	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz
<b>Power Consumption</b>	15 VA
<b>Over Current Protection</b>	400 mA 250V fast fuse
<b>Environment</b>	0 to 50°C (32 to 122°F); RH max 95% non-condensing
<b>Dimensions</b>	panel cutout: 140 x 140 mm, instrument: 144 x 144 x 170 mm
<b>Weight</b>	1.6 kg (3.5 lb.)

For a complete list of Solutions, see the end of pH Section 3.

# ORP Digital Controller with Matching Pin



- Fully programmable
- mA and VDC recorder output or RS232
- Differential input for ground loop protection
- Automatic two point calibration
- Last calibration data
- Automatic Temperature Compensation
- Simple wiring with removable terminal modules



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 (@20°C/68°F)	±2 mV; ±0.5°C
Input Impedance	10 <sup>12</sup> 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 600112-1** single setpoint, on/off control, RS232 output, 115V
- mV 600112-2** single setpoint, on/off control, RS232 output, 230V
- mV 600121-1** single setpoint, proportional control, analog output, 115V
- mV 600121-2** single setpoint, proportional control, analog output, 230V
- mV 600122-1** single setpoint, proportional control, RS232 output, 115V
- mV 600122-2** single setpoint, proportional control, RS232 output, 230V

## ACCESSORIES

- HI 8427** pH/ORP electrode simulator
- HI 931001** pH/ORP electrode simulator with display

For a complete list of Solutions, see the end of pH Section 3.

HI 700 • HI 710

# Conductivity and TDS Digital Controllers with Four-ring Potentiometric Probe

- Fully programmable microprocessor memory
- Dual set points
- mA & VDC recorder output
- Differential input for ground loop protection
- Automatic one or two point calibration
- Last calibration data
- Manual or Automatic Temperature Compensation
- Extensive range for both conductivity and TDS



## ORDERING INFORMATION

Each HI 700 and HI 710 model is provided with dual set point, ON/OFF and PID controls and is supplied with mounting brackets and instructions.

Choose your configuration:

- HI 700221-1** dual setpoint, on/off and PID controls, analog output, 115V
- HI 700221-2** dual setpoint, on/off and PID controls, analog output, 230V
- HI 700222-1** dual setpoint, on/off and PID controls, RS485 output, 115V
- HI 700222-2** dual setpoint, on/off and PID controls, RS485 output, 230V
- HI 710221-1** dual setpoint, on/off and PID controls, analog output, 115V
- HI 710221-2** dual setpoint, on/off and PID controls, analog output, 230V
- HI 710222-1** dual setpoint, on/off and PID controls, RS485 output, 115V
- HI 710222-2** dual setpoint, on/off and PID controls, RS485 output, 230V

## SOLUTIONS

- HI 7030L** 12880  $\mu\text{S}/\text{cm}$  calibration solution, 500 mL
- HI 7031L** 1413  $\mu\text{S}/\text{cm}$  calibration solution, 500 mL
- HI 7033L** 84  $\mu\text{S}/\text{cm}$  calibration solution, 500 mL
- HI 7034L** 80000  $\mu\text{S}/\text{cm}$  calibration solution, 500 mL



The HI 700 series of regulators 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. HI 710 includes all of the features of the HI 700 and adds TDS measurement.

SPECIFICATIONS	HI 700	HI 710
EC	0.0 to 199.9 $\mu\text{S}/\text{cm}$ ; 0 to 1999 $\mu\text{S}/\text{cm}$ 0.00 to 19.99 $\text{mS}/\text{cm}$ ; 0.0 to 199.9 $\text{mS}/\text{cm}$	
Range	TDS	0.0 to 100.0 $\text{mg}/\text{L}$ (ppm); 0 to 1000 $\text{mg}/\text{L}$ (ppm) 0.00 to 10.00 $\text{g}/\text{L}$ (ppt); 0.0 to 100.0 $\text{g}/\text{L}$ (ppt)
Temperature	-10.0 to 100.0 $^{\circ}\text{C}$	
Resolution	0.1 $\mu\text{S}$ ; 1 $\mu\text{S}$ ; 0.01 $\text{mS}$ ; 0.1 $\text{mS}$ ; 0.1 $^{\circ}\text{C}$	
Accuracy (@20 $^{\circ}\text{C}/68^{\circ}\text{F}$ )	±0.5% f.s. (EC / TDS); ±0.5 $^{\circ}\text{C}$ (0 to 70 $^{\circ}\text{C}$ ); ±1 $^{\circ}\text{C}$ (outside)	
EC Calibration	automatic or manual at 1 point	
Temperature Compensation	automatic or manual, -10 to 100 $^{\circ}\text{C}$ with adjustable temperature coefficient from 0.00 to 10.00%/ $^{\circ}\text{C}$	
TDS Conversion Factor	—	adjustable from 0.00 to 1.00
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 $^{\circ}\text{C}$ (32 to 122 $^{\circ}\text{F}$ ); 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.)	

For a complete list of Solutions, see the end of Conductivity 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.

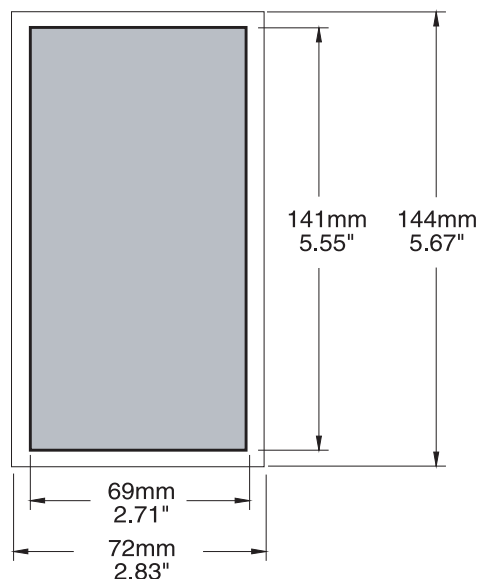


# Mechanical Dimensions for Panel Mounting



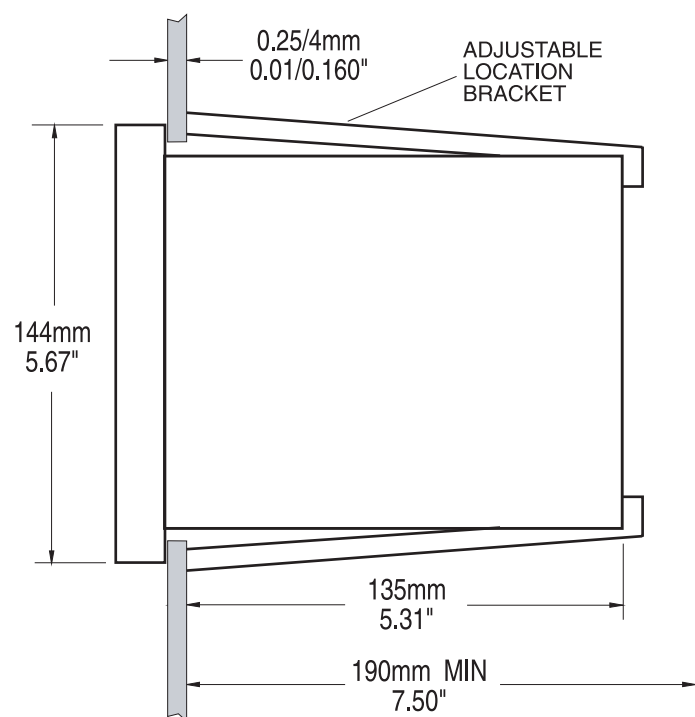
## Analog Indicators and Controllers

HI 8510 / HI 8512 / HI 8710 / HI 8711 / HI 8720 /  
HI 8931A / HI 8931B / HI 8931C / HI 8931D / HI 943500



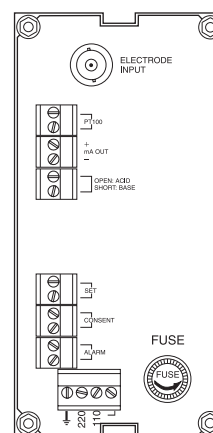
## Front View

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 HI 8710 shows the typical electrical connections.

# pH Analog Indicator with Self Diagnostic Test



- Inputs: BNC connector, Direct wire connection with amplified probe (supports HI 1006 series probes) and 4-20 mA from a transmitter
- Extended temperature compensation range: -20 to 100°C
- Supports potential matching pin connection
- Both 4-20 and 0-20 mA analog output
- $\pm 5V$  outputs for amplified electrodes
- Backlit LCD
- Auto-diagnostic tests for pH electrode and instrument status
- Operational mode LED indicators
- Designed for easy panel mount installation
- Transparent splash-proof cover included

HI 8510 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  $\pm 5V$  power output and input terminals for amplified electrodes.

The front panel is protected behind a transparent splash-proof cover.

SPECIFICATIONS	HI 8510
Range	0.00 to 14.00 pH
Resolution	0.01 pH
Accuracy (@20°C/68°F)	$\pm 0.02$ pH (0 to 100 °C) $\pm 0.05$ pH (-20 to 0 °C) $\pm 0.5\%$ (input transmitter)
Input	high impedance $10^{12}$ Ohm; reference and matching pin inputs are available; 4-20 mA
Power Output	$\pm 5$ Vcc; 150 mA max load for amplified electrodes
Calibration	offset: $\pm 2$ 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 $\pm 10\%$ or 230 VAC $\pm 10\%$ ; 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 HI 8510 is supplied complete with mounting brackets and instructions.

## SOLUTIONS

HI 7004/1L	pH 4.01 buffer solution, 1 L
HI 7007/1L	pH 7.01 buffer solution, 1 L
HI 7010/1L	pH 10.01 buffer solution, 1 L

## ACCESSORIES

HI 8427	pH / ORP electrode simulator
HI 931001	pH / ORP electrode simulator with display
HI 8614N	pH transmitter
HI 8614LN	pH transmitter with display

For a complete list of Solutions, see the end of pH Section 3.

HI 8710

# pH Analog Controller with Self-Diagnostic Test

- Inputs: BNC connector, Direct wire connection with amplified probe (supports HI 1006 series probes) and 4-20 mA from a transmitter
- Extended temperature compensation range: -20 to 100°C
- Supports potential matching pin connection
- Both 4-20 and 0-20 mA output
- $\pm 5V$  outputs for amplified electrodes
- Backlit LCD
- Auto-diagnostic tests for pH electrode and instrument status
- Operational mode LED indicators
- Fail Safe Function-the alarm relay is activated at power down
- Transparent splash-proof cover

HI 8710 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 HI 8720 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.

\* ORP dosing consent device

## ORDERING INFORMATION

The HI 8710 is supplied complete with mounting brackets and instructions.

## SOLUTIONS

HI 7004/1L	pH 4.01 buffer solution, 1 L
HI 7007/1L	pH 7.01 buffer solution, 1 L
HI 7010/1L	pH 10.01 buffer solution, 1 L

## ACCESSORIES

HI 8427	pH / ORP electrode simulator
HI 931001	pH / ORP electrode simulator with display
HI 8614N	pH transmitter
HI 8614LN	pH transmitter with display



SPECIFICATIONS	HI 8710
Range	0.00 to 14.00 pH
Resolution	0.01 pH
Accuracy (@20°C/68°F)	$\pm 0.02$ pH (0 to 100 °C) $\pm 0.05$ pH (-20 to 0 °C) $\pm 0.5\%$ (input from transmitter)
Input	high impedance $10^{12}$ Ohm; reference and matching pin inputs are available 4-20 mA
Power Output	$\pm 5$ Vcc; 150 mA max load for amplified electrodes
Calibration	offset: $\pm 2$ 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 $\pm 10\%$ or 230 VAC $\pm 10\%$ ; 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.)

For a complete list of Solutions, see the end of pH Section 3.



# pH Analog Controller with Dual Output and Self-Diagnostic Test



- Inputs: BNC connector, Direct wire connection with amplified probe (supports HI 1006 series probes) and 4-20 mA from a transmitter
- Auto-diagnostics to verify offset and slope calibration and electrode contamination/deterioration
- Selectable manual ON, OFF and automatic dosing control for alkaline, acid and REDOX dosing with indicator
- Dual set point with two independent dosing outputs
- Extended temperature compensation range: -20 to 100°C
- Supports potential matching pin connection
- Both 4-20 and 0-20 mA output
- $\pm 5V$  outputs for amplified electrodes
- Fail Safe Function-the alarm relay is activated at power down
- Operational mode LED indicators
- Backlit LCD
- Transparent splash-proof cover

HI 8711 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  $\pm 5V$  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 HI 8711 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.

## ORDERING INFORMATION

The HI 8711 is supplied complete with mounting brackets and instructions.

## SOLUTIONS

HI 7004/1L	pH 4.01 buffer solution, 1 L
HI 7007/1L	pH 7.01 buffer solution, 1 L
HI 7010/1L	pH 10.01 buffer solution, 1 L

## ACCESSORIES

HI 8427	pH / ORP electrode simulator
HI 931001	pH / ORP electrode simulator with display
HI 8614N	pH transmitter
HI 8614LN	pH transmitter with display

SPECIFICATIONS	HI 8711
Range	0.00 to 14.00 pH
Resolution	0.01 pH
Accuracy (@20°C/68°F)	$\pm 0.02$ pH (0 to 100 °C) $\pm 0.05$ pH (-20 to 0 °C) $\pm 0.5\%$ (input from transmitter)
Input	high impedance $10^{12}$ Ohm; reference and matching pin inputs are available; 4-20 mA
Power Output	$\pm 5$ Vcc; 150 mA max load for amplified electrodes
Calibration	offset: $\pm 2$ 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 $\pm 10\%$ or 230 VAC $\pm 10\%$ ; 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.)

For a complete list of Solutions, see the end of pH Section 3.

HI 8512

# ORP Analog Indicator with Self-Diagnostic Test

- Inputs: BNC connector, Direct wire connection with amplified probe (supports HI 1006 series probes) and 4-20 mA from a transmitter
- ORP range extension:  $\pm 1999$  mV
- BNC, amplified input and input from transmitter all in one instrument
- Supports potential matching pin connection
- Recorder output 0-20mA or 4-20mA user selectable
- $\pm 5$ V outputs for amplified electrodes
- Backlit LCD
- Auto-diagnostic tests for electrode and instrument status
- Operational mode LED indicators
- Designed for easy installation
- Transparent splash-proof cover included

HI 8512 ORP panel mounted controllers are ideal for process control monitoring in a wide range of industrial applications.

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  $\pm 5$ V 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.

## ORDERING INFORMATION

The HI 8512 is supplied complete with mounting brackets and instructions.

## SOLUTIONS

HI 7020L	ORP test solution @200/275 mV, 500 mL
HI 7091L	Pretreatment reducing solution, 500 mL
HI 7092L	Pretreatment oxidizing solution, 500 mL

## ACCESSORIES

HI 8427	pH / ORP electrode simulator
HI 931001	pH / ORP electrode simulator with display
HI 8615N	ORP transmitter
HI 8615LN	ORP transmitter with display



SPECIFICATIONS	HI 8512
Range	$\pm 1999$ mV
Resolution	1 mV
Accuracy (@20°C/68°F)	$\pm 5$ mV $\pm 0.5\%$ (input from transmitter)
Input	high impedance $10^{12}$ Ohm; reference and matching pin inputs are available; 4-20 mA
Power Output	$\pm 5$ Vcc; 150 mA max load for amplified electrodes
Calibration	offset: $\pm 200$ mV with CAL trimmer
Recorder Output	0-20 mA or 4-20 mA (isolated)
Backlight	continuous on
Power Supply	115 VAC $\pm 10\%$ or 230 VAC $\pm 10\%$ ; 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.)

For a complete list of Solutions, see the end of pH Section 3.

# ORP Analog Controller with Self-Diagnostic Test



- Inputs: BNC connector, Direct wire connection with amplified probe (supports HI 1006 series probes) and 4-20 mA from a transmitter
- Selectable manual ON, OFF and automatic dosing control for alkaline, acid and REDOX dosing with indicator
- Auto-diagnostic test for instrument status troubleshooting
- Operational mode LED indicators
- Supports potential matching pin connection
- Both 4-20 and 0-20 mA output
- $\pm 5V$  outputs for amplified electrodes
- Backlit LCD
- Transparent splash-proof cover

This instrument allows the selection of a set point for oxidizing or reducing dosage.

When used in conjunction with the HI 8710 pH controller, the ODCD (ORP dosing consent device) function (featured by the HI 8710) 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  $\pm 5V$  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.

## ORDERING INFORMATION

The HI 8720 is supplied complete with mounting brackets and instructions.

## SOLUTIONS

- |          |   |
|----------|---|
| HI 7020L | ORP test solution @200/275 mV, 500 mL   |
| HI 7091L | pretreatment reducing solution, 500 mL  |
| HI 7092L | pretreatment oxidizing solution, 500 mL |

## ACCESSORIES

- |           |                              |
|-----------|------------------------------|
| HI 8427   | pH / ORP electrode simulator |
| HI 8615N  | ORP transmitter              |
| HI 8615LN | ORP transmitter with display |

SPECIFICATIONS		HI 8720
Range		$\pm 1999$ mV
Resolution		1 mV
Accuracy (@20°C/68°F)		$\pm 5$ mV $\pm 0.5\%$ (input from transmitter)
Input	high impedance $10^{12}$ Ohm; reference and matching pin inputs are available; 4-20 mA	
Power Output	$\pm 5$ Vcc; 150 mA max load for amplified electrodes	
Calibration	offset: $\pm 200$ 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	$\pm 1999$ 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 $\pm 10\%$ or 230 VAC $\pm 10\%$ ; 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.)	

For a complete list of Solutions, see the end of pH Section 3.

HI 8931AN • HI 8931BN • HI 8931CN • HI 8931DN

## Conductivity Analog Controller with Input from Probe or Transmitter

- Both electrode and transmitter compatible inputs accepted
- Selectable manual ON, OFF and automatic dosing control with indicator
- Built-in auto-diagnostic function for offset and slope
- Both 4-20 and 0-20 mA output user selectable, all in one instrument
- Backlit LCD
- Transparent splash-proof cover included
- Operational mode LED indicators

HI 8931 is a panel mounted conductivity controller designed for simplicity of use. For in-line applications, use the HI 7635 probe, while for tanks the HI 7638 with external threads is recommended. These probes are provided with a built-in NTC sensor for temperature compensated conductivity measurements.

HI 8931 also features a direct connection up to 20 m (67'), without needing to amplify the signal to the conductivity probe.

Using the HI 8931 in conjunction with a 4-20 mA output transmitter (HI 8936 or HI 8936L series) will assure a strong, interference free signal at distances up to 300 meters (1000').

### ORDERING INFORMATION

The **HI 8931** series is supplied with mounting brackets and instructions.

### SOLUTIONS

HI 7033L	84 µS/cm calibration solution, 500 mL
HI 7031L	1413 µS/cm calibration solution, 500 mL
HI 7030L	12880 µS/cm calibration solution, 500 mL
HI 7034L	80000 µS/cm calibration solution, 500 mL
HI 7035L	111800 µS/cm calibration solution, 500 mL
HI 7039L	5000 µS/cm calibration solution, 500 mL

### PROBES

HI 3001D	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, DIN connector and 3 m (9.9') cable Other probes available upon request
----------	--

### ACCESSORIES

HI 779/15	6-wire cable (15 m/49.2' roll)
-----------	--------------------------------



SPECIFICATIONS	HI 8931AN	HI 8931BN	HI 8931CN	HI 8931DN
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 (@20°C/68°F)	±2% F.S. (excluding probe error)			
Input from Transmitter	HI 8936A / AL	HI 8936B / BL	HI 8936C / CL	HI 8936D / DL
Temperature Compensation	automatic, 0 to 60°C with $\beta=2\%/^{\circ}\text{C}$ ; see also transmitter HI 8936			
Inputs	DIN (probe) or 4-20 mA (transmitter)			
Conductivity Probe	HI 7635 for in-line applications or HI 3001D 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			
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
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 $\pm 10\%$ or 230 VAC $\pm 10\%$ ; 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.)			

For a complete list of Solutions, see the end of Conductivity Section 6.



# Conductivity Analog Controller with Direct Input from Potentiometric Probe



- Direct connection of up to 20 m (66') without needing to amplify the signal to the HI 7638 probe
- Automatic diagnostic controls
- Available in four models, each with a different measurement range
- Operational mode LED indicators
- Automatic Temperature Compensation with HI 7638 potentiometric conductivity probe with built-in temperature sensor
- Transparent splash-proof cover included

These controllers allow direct connection of a potentiometric conductivity probe (HI 7638) 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 HI 7638 probe with built-in temperature sensor.

The front panel is protected behind a transparent splash-proof cover.

## ORDERING INFORMATION

The **HI 943500** series is supplied complete with mounting brackets and instructions.

## PROBES

- HI 7638** PEI/glass body, 75 mm conductivity probe with internal temperature sensor and 3/8" NPT thread (immersion)
- HI 3001** 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
- HI 3002** 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

## SOLUTIONS

- HI 7033L** 84 μS/cm calibration solution, 500 mL
- HI 7031L** 1413 μS/cm calibration solution, 500 mL
- HI 7030L** 12880 μS/cm calibration solution, 500 mL
- HI 7034L** 80000 μS/cm solution, 500 mL

SPECIFICATIONS	HI 943500A	HI 943500B	HI 943500C	HI 943500D
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 (@20°C/68°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.)			

For a complete list of Solutions, see the end of Conductivity Section 6.

HI 8410

# Dissolved Oxygen Controller with Extended Range and Analog Output

- Extended range to 50 mg/L (ppm)
- Manual single point calibration
- Selectable 0-20 or 4-20 mA output
- Low maintenance Galvanic DO probe
- Backlit LCD
- Operational mode LED indicators
- Transparent splash-proof cover included

The HI 8410 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 HI 8410 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 set point. Calibration is single set point and can be done 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 found on the 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.

Other features include: recorder output in 0-20 mA or 4-20 mA configuration, LED indicators which identify whether the controller is in operation mode or setup selection mode, overtime control function and hysteresis setting.

## ORDERING INFORMATION

The HI 8410 is supplied complete with mounting brackets and instructions.

## PROBES

- HI 76410/4** Galvanic DO probe (fixed) with internal temperature sensor, DIN connector and 4 m (13.1') cable
- HI 76410/10** Galvanic DO probe (fixed) with internal temperature sensor, DIN connector and 10 m (32.8') cable

## SOLUTIONS

- HI 76410A** Spare membranes for HI 76410 DO probe



## SPECIFICATIONS

## HI 8410

<b>Range</b>	0.0 to 50.0 mg/L (ppm) O <sub>2</sub> 0 to 600 % O <sub>2</sub> -5.0 to 50.0 °C
<b>Resolution</b>	0.1 mg/L (ppm) or 1% (O <sub>2</sub> ) / 0.1 °C
<b>Accuracy (@20°C/68°F)</b>	±1% of reading (O <sub>2</sub> ) / ±0.2 °C
<b>Calibration</b>	manual, one point, in saturated air
<b>Temperature Compensation</b>	automatic, from -5 to 50°C (23 to 122 °F)
<b>Salinity Compensation</b>	0 to 51 g/L (resolution 1 g/L)
<b>Probe (not included)</b>	HI 76410/4 with 4 m (13.1') cable or HI 76410/10 with 10 m (32.8') cable
<b>Recorder Output</b>	0 to 20 mA or 4 to 20 mA (isolated)
<b>Set point and Alarm Relay</b>	1, isolated, 2A, max. 240V, resistive load, 1,000,000 strokes
<b>Set point Range</b>	1 to 600 % O <sub>2</sub> ; 0.1 to 50.0 mg/L (mg/L (ppm) O <sub>2</sub> )
<b>Alarm Range</b>	1.0 to 5.0 mg/L (ppm) O <sub>2</sub>
<b>Hysteresis Range</b>	0.5 to 2.4 mg/L (ppm) O <sub>2</sub>
<b>Dosing Control</b>	OFF/AUTO/ON with selection switch
<b>Over Dosing Control</b>	adjustable, from 5 min to 60 min with knob or disable by wire strap - on rear panel
<b>Backlight</b>	continuous on
<b>Power Supply</b>	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz
<b>Enclosure</b>	flame retardant ABS body and front panel; transparent splash-proof front cover
<b>Environment</b>	-10 to 50°C (14 to 122°F); RH max 95% non-condensing
<b>Panel Cutout</b>	141 x 69 mm (5.6 x 2.7")
<b>Weight</b>	1 kg (2.2 lb.)

For a complete list of Solutions, see the end of Dissolved Oxygen Section 7.

## Two Advanced Instruments in One

MEADOS pumps combine the powerful Blackstone dosing pumps with HANNA pH/ORP controllers. These unique products were developed by our Blackstone division for measuring and controlling pH or ORP. 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. If the operator must access the pump head or control panel for any reason, there is no need to uninstall the unit.

## Rugged Construction

Blackstone pump/controllers are housed in rugged, fiber-reinforced polypropylene casings that are IP55 rated 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. Blackstone's choice of material makes the pump more versatile, allowing it to handle a wider variety of reagents. The chemical resistance chart on page 18.76 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. With no rotating parts, gears or cams, part wear and oiling associated with motor driven pumps is eliminated; 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 provide the user with the ability to record data while monitoring, the 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 BL 7916 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 BL 7917'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.

BL 7916

# pH Controller and Pump



- pH controller and dosing pump in one compact unit.
- $\pm 0.01$  pH accuracy with unbeatable performance.
- Isolated 4 to 20 mA recorder output.
- Proportional dosing slows the pump down when the measured pH level approaches the set valve, which ensures precise dosage and avoids costly waste of chemicals due to overdosage.
- Alarm contact is 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 are used for all parts that come into contact with liquid.

## BL 7916 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)

## ORDERING INFORMATION

BL 7916-1 is supplied with discharge and suction valves, polyethylene tubing, 115V power cable and instructions

BL 7916-2 is supplied with discharge and suction valves, polyethylene tubing, 230V power cable and instructions

## SOLUTIONS

HI 7004L	pH 4.01 buffer solution, 500 mL
HI 7007L	pH 7.01 buffer solution, 500 mL
HI 7010L	pH 10.01 buffer solution, 500 mL

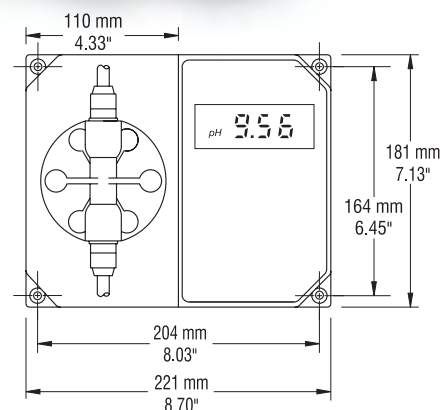
## ACCESSORIES

HI 721101	Pumphead, O-ring, screws and washer
HI 721102	Discharge valve assembly
HI 721103	Suction valve assembly
HI 721004	Injection valve assembly (required)
HI 721005	Foot valve assembly (required)
HI 721008	Ceramic weight (4)
HI 8427	pH/ORP electrode simulator
HI 931001	pH/ORP electrode simulator with display



## 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.



SPECIFICATIONS	BL 7916-1	BL 7916-2
Range	0.00 to 14.00 pH	
Resolution	0.01 pH	
Accuracy (@20°C/68°F)	$\pm 0.01$ 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: $\pm 1$ pH with trimmer; slope: 85 to 115% with trimmer	
Recorder Output	4-20 mA (isolated)	
Power Supply	115V $\pm 15\%$ ; 50/60Hz (40W)	230V $\pm 15\%$ ; 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.)	

For a complete list of Solutions, see the end of pH Section 3.

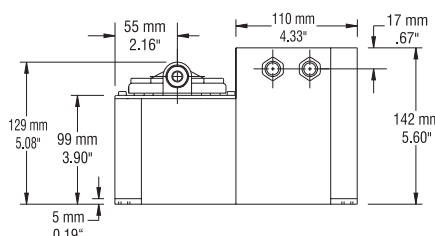




- ORP controller and dosing pumps in one compact unit.
- $\pm 5$  mV accuracy with unbeatable performance.
- Isolated 4 to 20 mA recorder output.
- Proportional dosing slows the pump down when the measured ORP level approaches the set value, to avoid over dosage of oxidizing or reducing agents.
- Alarm contact is activated whenever the ORP reading varies more than 200 mV from the set point.
- 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.

## 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. Since there are no joints or screws holding different sections of the housing together, the case is extremely rugged and sturdy.



### BL 7917 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)

### ORDERING INFORMATION

BL 7917-1 is supplied with discharge and suction valves, polyethylene tubing, 115V power cable and instructions.

BL 7917-2 is supplied with discharge and suction valves, polyethylene tubing, 230V power cable and instructions.

### SOLUTIONS

HI 7020L	ORP test solution @200/275 mV, 500 mL
HI 7091L	Pretreatment reducing solution, 500 mL
HI 7092L	Pretreatment oxidizing solution, 500 mL

### ACCESSORIES

HI 721101	Pumphead, O-ring, screws and washer
HI 721102	Discharge valve assembly
HI 721103	Suction valve assembly
HI 721004	Injection valve assembly (required)
HI 721005	Foot valve assembly (required)
HI 721008	Ceramic weight (4)
HI 8427	pH/ORP electrode simulator
HI 931001	pH/ORP electrode simulator with display

SPECIFICATIONS	BL 7917-1	BL 7917-2
Range	-999 mV to +999 mV	
Resolution	1 mV	
Accuracy (@20°C/68°F)	$\pm 5$ 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	115V $\pm 15\%$ ; 50/60Hz (40W)	230V $\pm 15\%$ ; 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.)	

For a complete list of Solutions, see the end of pH 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  $10^{12} \Omega$  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'). For distances greater than 50 m, an analog transmitter must be used to amplify the signal in a 4-20 mA current. When using the HI 504 or HI 25, HANNA's digital HI 504910 transmitter can be used at distances up to 1.2 km (.74 miles) and can store up to 6000 samples along with last calibration data. HI 504910 is also compatible with HANNA's Sensor Check™ feature for continuous pH and ORP probe inspection.

### 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 IP55 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.

### HI 2X 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.



## Simple to Use

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

HI 2X 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.

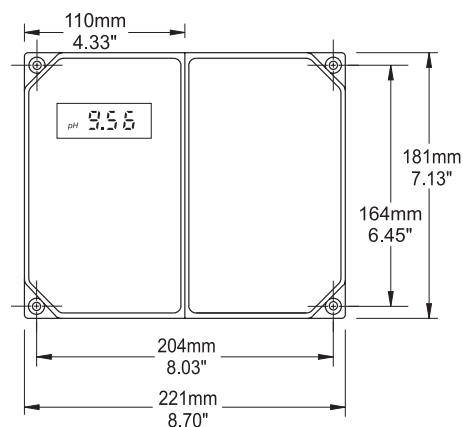
## Simple Installation

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.

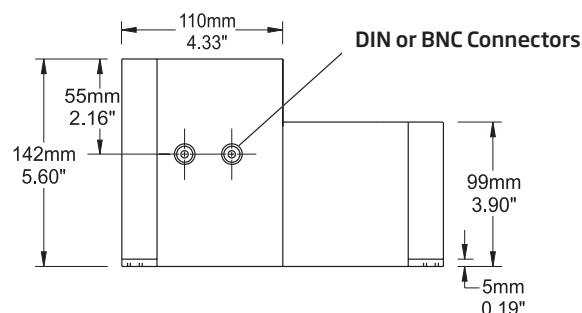
## Mechanical Dimensions

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





HI 21

# Industrial Grade pH Digital Controllers Wall Mounted with Matching Pin

- Control through analog output (single set point) or relay
- Fully customizable
- RS485 interface
- Differential input for ground loop protection
- Automatic three point pH calibration
- Last calibration data
- Automatic Temperature Compensation
- Password protection
- Fail Safe Alarm System
- Overdosing safeguard



The HI 21 controllers are simple to operate, microprocessor-based pH process controllers packed with features. With HI 21 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 HI 21 against the pitfalls of process control, like power interruption or line failure.

Wiring the controllers is simple with extractable terminal modules. A host of self-testing features and user-friendly functions make HI 21 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. Some HI 21 models are equipped with a bi-directional RS485 port, which allows remote control of the instrument from a PC.

## ORDERING INFORMATION

Each HI 21 model is supplied with instructions.

Choose your configuration:

HI 21111-1	single setpoint, on/off control, analog output, 115V
HI 21111-2	single setpoint, on/off control, analog output, 230V
HI 21211-1	dual setpoint, on/off control, analog output, 115V
HI 21211-2	dual setpoint, on/off control, analog output, 230V
HI 21221-1	dual setpoint, on/off and proportional control, analog output, 115V
HI 21221-2	dual setpoint, on/off and proportional control, analog output, 230V
HI 21222-1	dual setpoint, on/off and proportional control, RS485 output, 115V
HI 21222-2	dual setpoint, on/off and proportional control, RS485 output, 230V
HI 21523-1	control through analog output, on/off and proportional control, analog output and RS485, 115V
HI 21523-2	control through analog output, on/off and proportional control, analog output and RS485, 230V

## SOLUTIONS

HI 7004L	pH 4.01 buffer solution, 500 mL
HI 7007L	pH 7.01 buffer solution, 500 mL
HI 7010L	pH 10.01 buffer solution, 500 mL

## ACCESSORIES

HI 8427	pH / ORP electrode simulator
HI 931001	pH / ORP electrode simulator with display

SPECIFICATIONS	HI 21
Range	0.00 to 14.00 pH; -9.9 to 120°C
Resolution	0.01 pH; 0.1°C
Accuracy (@20°C/68°F)	±0.02 pH; ±0.5°C
Input Impedance	10 <sup>12</sup> 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) (HI 211YZ and HI 212YZ), 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.)

For a complete list of Solutions, see the end of pH Section 3.



# Industrial Grade ORP Digital Controllers Wall Mounted with Matching Pin



- Fully customizable
- RS485 interface
- Differential input for ground loop protection
- Automatic two point ORP calibration
- Last calibration data
- Password protection
- Fail Safe Alarm System
- Overdosing safeguard

The HI 22 controllers have been engineered with the same outstanding quality and features as the HI 21 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  $\pm 2000$  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 HI 22 a great value.

SPECIFICATIONS	HI 22
Range	$\pm 2000$ mV; -9.9 to 120°C
Resolution	1 mV; 0.1°C
Accuracy (@20°C/68°F)	$\pm 2$ mV; $\pm 0.5$ °C
Input Impedance	$10^{12}$ Ohm
ORP Calibration	automatic, at 0 and 350 or 1900 mV
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) (HI 221YZ), 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	$\pm 5$ V (for amplified electrodes)
Power Supply	115 VAC $\pm 10\%$ or 230 VAC $\pm 10\%$ ; 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 HI 22 model is supplied complete with instructions.

Choose your configuration:

HI 22111-1	single setpoint, on/off controls, analog output, 115V
HI 22111-2	single setpoint, on/off controls, analog output, 230V
HI 22122-1	single setpoint, on/off and proportional controls, RS485 output, 115V
HI 22122-2	single setpoint, on/off and proportional controls, RS485 output, 230V

## SOLUTIONS

HI 7020L	ORP test solution @200-275 mV, 500 mL
HI 7091L	ORP reducing pretreatment solution, 500 mL
HI 7092L	ORP oxidizing pretreatment solution, 500 mL

## ACCESSORIES

HI 8427	pH/ORP electrode simulator
HI 931001	pH/ORP electrode simulator with display

For a complete list of Solutions, see the end of pH Section 3.

HI 23

# Industrial Grade EC Digital Controllers Wall Mounted with Four-ring Potentiometric Probe

- Works with four-ring potentiometric probe
- Automatic EC calibration
- Automatic Temperature Compensation

HI 23 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.



## ORDERING INFORMATION

Each HI 23 model is provided with dual set point and is supplied complete with instructions.

Choose your configuration:

HI 23211-1	dual setpoint, on/off control, analog output, 115V
HI 23211-2	dual setpoint, on/off control, analog output, 230V
HI 23222-1	dual setpoint, on/off and PID controls, RS485 port, 115V
HI 23222-2	dual setpoint, on/off and PID controls, RS485 port, 230V

## PROBES

HI 7639D	Conductivity probe with DIN connector and 4 m (13.1') cable for high temp in-line applications
HI 7639D/5	Conductivity probe with DIN connector and 5 m (16.4') cable for high temp in-line applications

## SOLUTIONS

HI 7030L	12880 $\mu\text{S}/\text{cm}$ calibration solution, 500 mL
HI 7031L	1413 $\mu\text{S}/\text{cm}$ calibration solution, 500 mL
HI 7033L	84 $\mu\text{S}/\text{cm}$ calibration solution, 500 mL
HI 7034L	80000 $\mu\text{S}/\text{cm}$ calibration solution, 500 mL

SPECIFICATIONS	HI 23
Range	EC: 0.0 to 199.9 $\mu\text{S}/\text{cm}$ ; 0 to 1999 $\mu\text{S}/\text{cm}$ ; 0.00 to 19.99 mS/cm; 0.0 to 199.9 mS/cm Temperature: -10.0 to 100.0°C
Resolution	EC: 0.1 $\mu\text{S}/\text{cm}$ , 1 $\mu\text{S}/\text{cm}$ ; 0.01 mS/cm, 0.1 mS/cm Temperature: 0.1 °C
Accuracy (@20°C/68°F)	0.5% f.s. (EC); $\pm 0.5$ °C (0 to 70°C); $\pm 1$ °C (outside)
Calibration	automatic, 1 point
Temperature Compensation	automatic or manual from -10 to 100°C with Pt100 probe; $\beta$ 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) (HI 211YZ and HI 212YZ), 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 $\pm 10\%$ or 230 VAC $\pm 10\%$ ; 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.)

For a complete list of Solutions, see the end of Conductivity Section 6.

# Industrial Grade EC/TDS Digital Controllers Wall Mounted with Four-ring Potentiometric Probe



- Works with four-ring potentiometric probe
- Automatic EC calibration
- Automatic Temperature Compensation

HI 24 is a wall mounted, microprocessor-based EC and TDS controller which utilizes a four-ring probe (optional) and Automatic Temperature Compensation to provide very accurate EC and TDS measurements.

Users can choose among models featuring ON/OFF or PID control, analog input and output and 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 RS485 output are also available. This option allows the user to insert the controller into a 2-wire RS485 network.

SPECIFICATIONS		HI 24
Range	EC	0.0 to 199.9 $\mu\text{S}/\text{cm}$ , 0 to 1999 $\mu\text{S}/\text{cm}$ ; 0.0 to 19.99 $\text{mS}/\text{cm}$ , 0.0 to 199.9 $\text{mS}/\text{cm}$
	TDS	0.0 to 100.0 $\text{mg}/\text{L}$ (ppm), 0 to 1000 $\text{mg}/\text{L}$ (ppm); 0.00 to 10.00 $\text{g}/\text{L}$ (ppt), 0.0 to 100.0 $\text{g}/\text{L}$ (ppt)
	Temperature	-10.0 to 100.0°C
Resolution	EC	0.1 $\mu\text{S}/\text{cm}$ , 1 $\mu\text{S}/\text{cm}$ ; 0.01 $\text{mS}/\text{cm}$ , 0.1 $\text{mS}/\text{cm}$
	TDS	0.1 $\text{mg}/\text{L}$ (ppm), 1 $\text{mg}/\text{L}$ (ppm); 0.01 $\text{g}/\text{L}$ (ppt), 0.1 $\text{g}/\text{L}$ (ppt)
	Temperature	0.1 °C
Accuracy (@20°C/68°F)		0.5% F.S. (EC / TDS); $\pm 0.5^\circ\text{C}$ (0 to 70°C), $\pm 1^\circ\text{C}$ (outside)
EC Calibration		automatic, 1 point
Temperature Compensation		automatic or manual from -10 to 100°C with Pt100 probe; $\beta$ 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) (HI 211YZ and HI 212YZ), 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 $\pm 10\%$ or 230 VAC $\pm 10\%$ ; 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
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 HI 24 model is provided with dual set point and is supplied complete with instructions.

Choose your configuration:

- HI 24211-1 dual setpoint, on/off control, analog output, 115V
- HI 24211-2 dual setpoint, on/off control, analog output, 230V
- HI 24222-1 dual setpoint, on/off and PID controls, RS485 port, 115V
- HI 24222-2 dual setpoint, on/off and PID controls, RS485 port, 230V

## PROBES

- HI 7639 Conductivity probe for high temperature in-line applications

## SOLUTIONS

- HI 7030L 12880  $\mu\text{S}/\text{cm}$  calibration solution, 500 mL
- HI 7031L 1413  $\mu\text{S}/\text{cm}$  calibration solution, 500 mL
- HI 7033L 84  $\mu\text{S}/\text{cm}$  calibration solution, 500 mL
- HI 7034L 80000  $\mu\text{S}/\text{cm}$  calibration solution, 500 mL

For a complete list of Solutions, see the end of Conductivity Section 6.

HI 9912

# Industrial Grade pH & ORP Controller

HI 9912 is a pH and ORP controller specially designed for pool sanitization.

Two separate set points can be adjusted by the user from 6 to 8 pH and 500 to 900 mV. The relays are activated when the pH exceeds or the mV falls below the relevant set point. HI 9912 accepts any pH and ORP electrode ending in a universal BNC connector. Two independent terminals provide for pH and ORP matching pin/ground probes to extend electrode life and eliminate interference.

HANNA's proportional control allows considerable savings by minimizing the use of chemicals. The settings are made through independent time cycles adjustable from 0 to 90 seconds and two proportional bands from 0 to 200 mV and 0 to 2 pH. Two pumps or electrovalves can be wired directly to the controller and be powered through the terminal.

The HI 9912's alarm is activated when measurements exceed the operator-adjustable thresholds of 50 to 250 mV or 0.5 to 2.5 pH. Should the two max dosing periods of 1 to 10 minutes be exceeded an alarm is activated to signal the abnormality. The alarm is alterable in a normally-closed or a normally-open state and can be turned off during maintenance. A pools status can be ascertained from a distance through dosage and alarm LED's.

HI 9912 comes with extractable terminal modules for quicker and safer wiring. The wiring compartment is protected behind a fire-retardant ABS removable panel.

## ORDERING INFORMATION

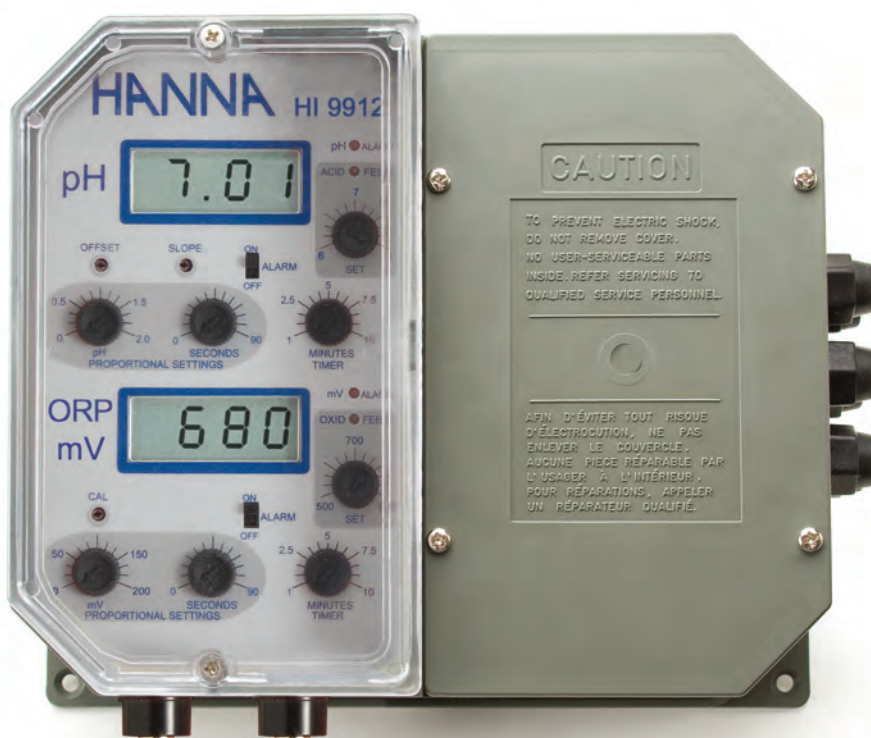
HI 9912 is supplied complete with instructions.

Choose your configuration:

HI 9912-1 115V  
HI 9912-2 230V

## SOLUTIONS

HI 7004/1L pH 4.01 buffer solution, 1 L  
HI 7007/1L pH 7.01 buffer solution, 1 L  
HI 7010/1L pH 10.01 buffer solution, 1 L  
HI 7020L ORP test solution @200-275 mV, 500 mL  
HI 7021L ORP test solution @240 mV, 500 mL  
HI 7022L ORP test solution @470 mV, 500 mL

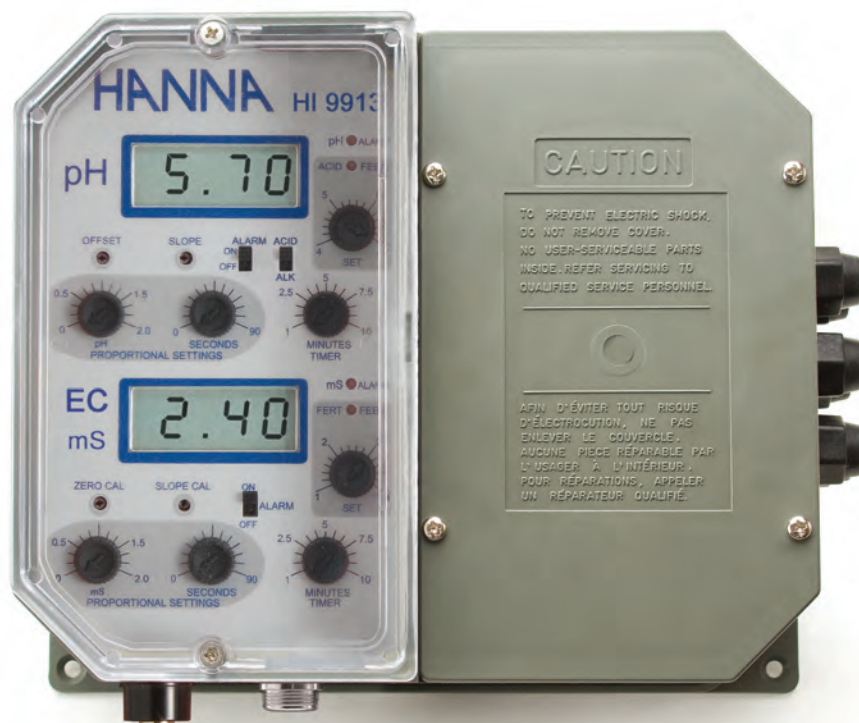


SPECIFICATIONS	HI 9912
Range	0.00 to 14.00 pH; 0 to 1000 mV
Resolution	0.01 pH; 1 mV
Accuracy (@20°C/68°F)	±0.02 pH; ±5 mV
Input Impedance	10 <sup>12</sup> Ohm
Calibration	manual, two points for pH and 1 point for ORP, through trimmers on the front panel
Set point	two, selectable from 6.00 to 8.00 pH and from 500 to 900 mV
Proportional Control	two independent controls: pH from 0.0 to 2.0 and ORP from 0 to 200 mV with two separate time cycle from 0 to 90 seconds
Alarm Contact	relay 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 the user selectable interval (0 to 2 pH), and/or ORP varies by more than the user selectable interval (0 to 200 mV) from the set points 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 or when ORP falls below the mV set point
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.)

For a complete list of Solutions, see the end of pH Section 3.



# Industrial Grade pH & Conductivity Controller with Proportional Control of Fertilization



HI 9913 is a 2-in-1 pH and conductivity controller engineered for dosage of fertilizer solutions in hydroponics and agriculture.

HI 9913 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.

HI 9913 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.

HI 9913 accepts pH electrodes with BNC and conductivity probes with DIN connectors.

## SPECIFICATIONS

### HI 9913

Range	0.00 to 14.00 pH; 0.00 to 10.00 mS/cm
Resolution	0.01 pH; 0.01 mS/cm
Accuracy (@20°C/68°F)	±0.02 pH; ±2% f.s. EC
Input Impedance	10 <sup>12</sup> Ohm
Calibration	through "OFFSET" and "SLOPE" trimmers for pH, and "ZERO CAL" and "SLOPE CAL" for Conductivity (EC)
Set point	from 4.0 to 7.0 pH and 1.0 to 4.0 mS/cm (EC)
Temperature Compensation (EC)	automatic, 0 to 50°C (32 to 122°F) with $\beta=2\%/^{\circ}\text{C}$
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

HI 9913 is supplied complete with instructions.

Choose your configuration:

HI 9913-1	115V
HI 9913-2	230V

## PROBES

HI 3001D	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, DIN connector and 3 m (9.9') cable
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## SOLUTIONS

HI 7004/1L	pH 4.01 buffer solution, 1 L
HI 7007/1L	pH 7.01 buffer solution, 1 L
HI 7010/1L	pH 10.01 buffer solution, 1 L
HI 7031L	1413 µS/cm calibration solution, 500 mL
HI 7039L	5000 µS/cm calibration solution, 500 mL

For a complete list of Solutions, see the end of pH Section 3 and Conductivity Section 6.

HI 9923

# Industrial Grade pH & Conductivity Controller for Boilers and Cooling Towers

HI 9923 is a 2-in-1 pH and conductivity controller engineered for the monitoring of industrial boilers and cooling towers. Two separate set points can be adjusted from 5 to 10 pH and 1 to 6 mS/cm to activate independent relays. Two pumps or electrovalves can be wired directly to the terminals. For optimum control, the operator can set the deadband (hysteresis) from 0 to 0.5 mS/cm. Trimmers for the pH and conductivity are positioned on the front panel make for easy calibration. A matching pin/ground probe can be connected to the appropriate terminals to prolong the pH electrode's life.

HI 9923 provides for an alarm relay which is activated when the pH falls below the set point by the operator adjustable threshold of 0.5 to 2.5 pH, or conductivity exceeds the set point by a value in the 0.5 to 2.5 mS/cm range. The alarm is also activated if the pH and/or conductivity are not corrected within the operator determined time frame of 1 to 90 minutes.

This 2-in-1 controller accepts pH electrodes with a BNC connector and a conductivity probe with a DIN connector incorporating a temperature sensor.



## ORDERING INFORMATION

HI 9923 is supplied complete with instructions.

Choose your configuration:

HI 9923-1	115V
HI 9923-2	230V

## PROBES

HI 3001D	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, DIN connector and 3 m (9.9') cable
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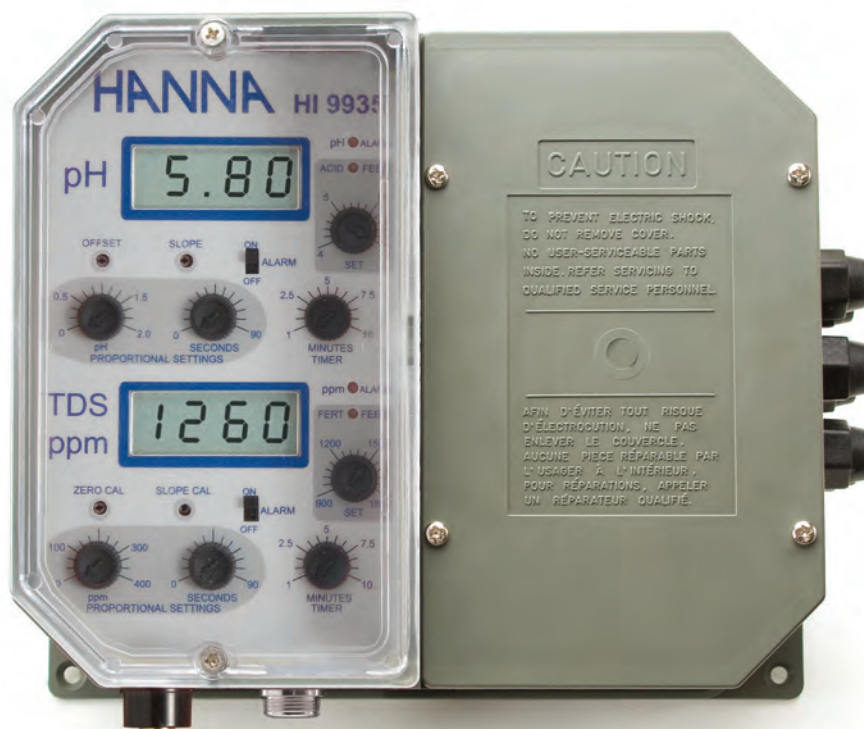
## SOLUTIONS

HI 7004/1L	pH 4.01 buffer solution, 1 L
HI 7007/1L	pH 7.01 buffer solution, 1 L
HI 7031L	1413 $\mu$ S/cm calibration solution, 500 mL
HI 7039L	5000 $\mu$ S/cm calibration solution, 500 mL

SPECIFICATIONS	HI 9923
Range	0.00 to 14.00 pH and 0.00 to 10.00 mS/cm (mmho/cm)
Resolution	0.01 pH and 0.01 mS/cm (mmho/cm)
Accuracy (@20°C/68°F)	$\pm 0.02$ pH; $\pm 2\%$ f.s. EC
Input Impedance	$10^{12}$ Ohm
Calibration	through "OFFSET" and "SLOPE" trimmers for pH, and "ZERO CAL" and "SLOPE CAL" for conductivity
Hysteresis (EC)	adjustable from 0.0 to 0.5 mS/cm (mmho/cm)
Set point	from 5.0 to 10.0 pH & 1.00 to 6.00 mS/cm (mmho/cm)
Temperature Compensation (EC)	automatic, 0 to 50°C (32 to 122°F) with $\beta = 2\%/^{\circ}\text{C}$
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 exceeds the set point by the user selectable interval (0 to 2 pH), or conductivity falls below 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 falls below the pH set point or the conductivity exceeds the "BLEED" 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 (optional)
Power Supply	$\pm 10\%$ 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.)

For a complete list of Solutions, see the end of pH Section 3 and Conductivity Section 6.

# Industrial Grade pH & TDS Controller with Proportional Control of Fertilization



HI 9935 is a pH and TDS controller for fertilizer solution dosage in hydroponics.

HI 9935 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.

HI 9935 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.

HI 9935 accepts pH electrodes with a BNC connector and TDS probes with a DIN connector.

SPECIFICATIONS	HI 9935
Range	0.00 to 14.00 pH; 0 to 1999 ppm (mg/L)
Resolution	0.01 pH; 1 ppm (mg/L)
Accuracy (@20°C/68°F)	±0.02 pH; ±2% f.s. TDS
Input Impedance	10 <sup>12</sup> 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
Temperature Compensation (TDS)	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

HI 9935 is supplied complete with instructions.

Choose your configuration:

HI 9935-1	115V
HI 9935-2	230V

## PROBES

HI 3001D	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, DIN connector and 3 m (9.9') cable
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## SOLUTIONS

HI 7004/1L	pH 4.01 buffer solution, 1 L
HI 7007/1L	pH 7.01 buffer solution, 1 L
HI 70442L	1500 mg/L (ppm) calibration solution, 500 mL

For a complete list of Solutions, see the end of pH Section 3 and Conductivity Section 6.



HI 9914

# Industrial Grade Fertigation Controller for Process Control Requirements

HI 9914 is a wall mounted fertigation controller, designed to meet specific process control requirements in agricultural, horticultural and hydroponics applications. The controller is provided with two measuring channels, one for pH and one for conductivity. The readings are displayed simultaneously on two backlit, independent LCDs.

The conductivity probe is designed with a built-in temperature sensor which allows the controller to automatically compensate for the temperature effect. The differential input and the use of a matching pin prevent grounding problems and thus ensure longer life to the pH electrode.

The controller includes two regulators for pH and conductivity, that can be adjusted from the front panel by setting two independent thresholds. The conductivity and pH controls are time separated and have a timed operation mode to avoid overdosing of fertilizer or acid. The controller status is indicated by LEDs on the front panel. Moreover, the equipment is provided with a three-level sensor, to control the water level in mixing tanks, the alarm condition and irrigation sequences.

The instrument also features an alarm system, which is activated when an unusual working condition occurs. A humidity detector can be used to stop the controller if any leakage is detected. Water nozzle, circulation pump, feeding pump and alarm are equipped with relays.

## ORDERING INFORMATION

HI 9914 is supplied complete with instructions.

Choose your configuration:

HI 9914-1 115V  
HI 9914-2 230V

## PROBES

HI 3001D 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, DIN connector and 3 m (9.9') cable

## SOLUTIONS

HI 7004L pH 4.01 buffer solution, 500 mL  
HI 7007L pH 7.01 buffer solution, 500 mL  
HI 7010L pH 10.01 buffer solution, 500 mL  
HI 7031L 1.41 mS/cm calibration solution, 500 mL  
HI 7039L 5.00 mS/cm calibration solution, 500 mL



SPECIFICATIONS	HI 9914
Range	0.00 to 10.00 mS/cm; 0.00 to 14.00 pH
Resolution	0.01 mS/cm; 0.01 pH
Accuracy (@20°C/68°F)	±5% f.s. EC; ±0.02 pH
Calibration	EC: manual, 1 point with slope trimmer (80 to 120%) on the front panel; pH: manual, 2 point, with offset (±2 pH) and slope (80 to 120%) trimmers
Set point	EC: adjustable, from 0.50 to 10.00 mS/cm; pH: adjustable, from 0.5 to 14.0 pH
Temperature Compensation	EC: automatic from 0 to 50°C
Analog Output	0-5V±5% (0.5V/mS); 0-7V±5% (0.5 V/pH)
Controller Output	EC: 2A, 220V relay; pH: 2A, 220V relay
Timer	adjustable, from 1 to 10 minutes within a 15-minutes-time frame
Feed OK Output	12V, 15 mA current source
Humidity Sensor	activated if resistivity is below 220Ω
Water Nozzle Output	2A, 220V relay
Circulation Pump Output	2A, 220V relay
Feeding Pump Output	2A, 220V relay
Alarm Output	2A, 220V relay
Water Level Inputs	contact type water level sensors
User Input	contact type switch
External FILL Button	contact type push-button
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 90 mm (8.7 x 7.1 x 3.5")
Weight	1.75 kg (3.9 lb.)

For a complete list of Solutions, see the end of pH Section 3 and Conductivity Section 6.



# Industrial Grade pH Controller with Single Set point and Proportional Dosage



HI 9910 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 HI 9910 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. HI 9910 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 HI 9910 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	HI 9910
Range	0.00 to 14.00 pH
Resolution	0.01 pH
Accuracy (@20°C/68°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

HI 9910 is supplied complete with instructions.

Choose your configuration:

HI 9910-1	115V
HI 9910-2	230V

## SOLUTIONS

HI 7004L	pH 4.01 buffer solution, 500 mL
HI 7007L	pH 7.01 buffer solution, 500 mL
HI 7010L	pH 10.01 buffer solution, 500 mL

## ACCESSORIES

HI 8427	pH / ORP electrode simulator
HI 931001	pH / ORP electrode simulator with display

For a complete list of Solutions, see the end of pH Section 3 and Conductivity Section 6.

HI 9911

## Industrial Grade pH Controller with Dual Set point and Proportional Dosage

HI 9911 is a pH controller with two set points for proportional dosage of acidic and alkaline solutions. Through two sets of coarse and fine trimmers, the set points can be accurately fine tuned to any value in the 0.00 to 14.00 range. Likewise, two trimmers on the front panel allow for easy calibration. HI 9911 accepts any pH electrode ending in a BNC connector. The proportional control can be adjusted to match your application through the time cycle from 0 to 90 seconds and the proportional band of 0 to 2 pH. Two pumps or valves can be wired directly to the controller and be powered through the terminals.

HI 9911 provides for two types of alarms. The alarm relay is activated when the measurements are away from the set points by more than a predetermined value in the 0.5 to 2.5 pH range or when one of the two independently adjustable maximum dosing times is exceeded. The alarm can be configured in either normally-open or normally-closed state and turned off during maintenance. HI 9911 also provides for a user selectable 0-20 or 4-20 mA isolated recorder output.

You can choose from manual or automatic temperature compensation with an optional three-wire Pt100 probe. HI 9911 comes with extractable terminal modules. Once wired, the compartment containing the connections is closed behind a fire-retardant ABS removable panel. As with HI 9910, a matching pin/ground probe can be hooked up to the controller to eliminate interference.

### ORDERING INFORMATION

HI 9911 is supplied complete with instructions.

Choose your configuration:

HI 9911-1 115V  
HI 9911-2 230V

### SOLUTIONS

HI 7004L pH 4.01 buffer solution, 500 mL  
HI 7007L pH 7.01 buffer solution, 500 mL  
HI 7010L pH 10.01 buffer solution, 500 mL

### ACCESSORIES

HI 8427 pH / ORP electrode simulator  
HI 931001 pH / ORP electrode simulator with display



SPECIFICATIONS	HI 9911
Range	0.00 to 14.00 pH
Resolution	0.01 pH
Accuracy (@20°C/68°F)	±0.02 pH
Calibration	through "OFFSET" and "SLOPE" trimmers (max. ±1.5 pH for offset and 80% to 110% for slope)
Temperature Compensation	manual from -10 to 80 °C (14 to 176 °F) or automatic with three-wire Pt100 probe from 0 to 50 °C (32 to 122 °F)
Set point	from 0.00 to 14.00 pH with 2 trimmers: "COARSE" for approx. regulation, "FINE" for fine tuning
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	two sets of independent relay terminals (115 to 240V, max. 2A, 1,000,000 strokes) are activated whenever pH exceeds the "ACID" set point or falls below the "ALK" set point (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 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.)

For a complete list of Solutions, see the end of pH Section 3.

# Industrial Grade ORP Controller with Proportional Dosage



HI 9920 is an ORP controller with a single set point for user selectable dosage of reducing or oxidizing solutions. Any ORP electrode ending in a BNC connector can be directly attached to the controller. With proportional control, you can fine tune your treatment plant and minimize the use of chemicals. The proportional setting can be adjusted through the time cycle from 0 to 90 seconds and the band from 0 to 200 mV. The set point can be accurately adjusted through coarse and fine trimmers. A pump or electrovalve can be wired directly to the controller and be powered through the terminal.

In addition to the set point relay, HI 9920 also provides for an alarm relay. The alarm is activated when the measurements exceed the operator adjustable threshold of 50 to 250 mV from set point. For extra security, a maximum dosing time from 1 to 10 minutes can also be set, after which the alarm is activated to signal an abnormality. The alarm configuration is alterable in a normally-closed or normally-open state to accommodate Fail Safe installations.

Any recorder accepting a 0-20 or 4-20 mA output can also be hooked up to the controller. Users can see the controller's status, even from a distance, by observing the dosage or alarm LED's. To speed up wiring, HI 9920 comes with extractable terminal modules. Once wired up, the compartment containing the connections is protected behind a fire-retardant ABS removable panel.

HI 9920 also provides for a matching pin/ground probe to eliminate interference and prolong the electrode's life.

SPECIFICATIONS	HI 9920
Range	-500 to 1500 mV
Resolution	1 mV
Accuracy (@20°C/68°F)	±5 mV
Calibration	through "CAL" trimmer
Set point	from -500 to 1500 mV with "COARSE" and "FINE" 2 trimmers with "OXID" or "RED" selection for oxidizing or reducing dosage
mA Output	user-selectable 0 to 20 mA or 4 to 20 mA over the -500 to 1500 mV range with isolated output
Proportional Control	ORP setting is adjustable from 0 to 200 mV and time cycle from 0 to 90 seconds
Alarm Contact	normally open or normally closed isolated outputs (max. 2A, max. 240V, resistive load, 1,000,000 strokes). Terminals are activated when the ORP value varies by more than the user selectable interval (0 to 200mV) from set point, or due to overdosage
Dosing Terminals	relay terminals (115 to 240V, max.2A,1,000,000 strokes) are activated when mV exceeds the set point with "RED" dosage or when mV falls below the set point with "OXID" selection
Power Supply	110/115 VAC or 220/240 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

HI 9920 is supplied complete with instructions.

Choose your configuration:

HI 9920-1	115V
HI 9920-2	230V

## SOLUTIONS

HI 7020L	ORP test solution @200-275 mV, 500 mL
HI 7021L	ORP test solution @240 mV, 500 mL
HI 7022L	ORP test solution @475 mV, 500 mL
HI 7091L	ORP reducing pretreatment solution, 500 mL
HI 7092L	ORP oxidizing pretreatment solution, 500 mL

## ACCESSORIES

HI 8427	pH/ORP electrode simulator
HI 931001	pH/ORP electrode simulator with display

For a complete list of Solutions, see the end of pH Section 3.



HI 9931

## Industrial Grade EC Controller with Proportional Fertilizer Dosing for Hydroponics Applications

HI 9931 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.

HI 9931 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. HI 9931 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 HI 9931. 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, HI 9931 comes with extractable terminal modules. Several LED's show whether the set point or alarm relays have been activated.

### ORDERING INFORMATION

HI 9931 is supplied complete with instructions.

Choose your configuration:

HI 9931-1	115V
HI 9931-2	230V

### PROBES

HI 3001D 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, DIN connector and 3 m (9.9') cable

### SOLUTIONS

HI 7031L	1413 µS/cm calibration solution, 500 mL
HI 7039L	5000 µS/cm calibration solution, 500 mL



SPECIFICATIONS	HI 9931
Range	0.00 to 10.00 mS/cm
Resolution	0.01 mS/cm
Accuracy (@20°C/68°F)	±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 $\beta = 2\%/^{\circ}\text{C}$
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 set point
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.)

For a complete list of Solutions, see the end of pH Section 3.



# Industrial Grade TDS Controller with Proportional Fertilizer Dosing for Hydroponics Applications



HI 9934 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, HI 9934 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.

HI 9934 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	HI 9934
Range	0 to 1999 ppm (mg/L)
Resolution	1 ppm (mg/L)
Accuracy (@20°C/68°F)	±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 $\beta = 2\%/^{\circ}\text{C}$
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

HI 9934 is supplied complete with instructions.

Choose your configuration:

HI 9934-1	115V
HI 9934-2	230V

## PROBES

HI 3001D PEI/PVDF body, 20 mm TDS probe with internal temperature sensor, 1/2" NPT front thread (flow-thru) and 3/4" NPT back thread (submersion/pipe) mounting, DIN connector and 3 m (9.9') cable

## SOLUTIONS

HI 70442L	1500 mg/L (ppm) calibration solution, 500 mL
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For a complete list of Solutions, see the end of Conductivity 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. One usually associates industrial environments 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.

# pH and EC Transmitter with Galvanic Isolated Output



specifically designed to be used with HI 8000 series fertigation controllers

SPECIFICATIONS	HI 98143-01	HI 98143-04	HI 98143-20	HI 98143-22
Range	0 to 14 pH; 0 to 10 mS/cm			
Accuracy (@20°C/68°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			
Temperature Compensation (EC)	automatic, 0 to 60°C (32 to 132°F) with $\beta=2\%/^{\circ}\text{C}$			
Output (isolated)	0-1 V	0-4 V	4-20 mA	4-20 mA
pH Electrode	HI 1001 pH electrode (suggested, not included), HI 1283 matching pin (not included)			
EC Probe	HI 3001 (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.)			

For a complete list of Solutions, see the end of pH Section 3 and Conductivity Section 6.

- Accepts pH electrode and EC probe signals simultaneously
- Direct probe connection  
Assures a positive electrical connection eliminating signal loss
- Automatic Temperature Compensation (EC only)

The HI 98143 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 Compensation 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.

## ORDERING INFORMATION

All HI 98143 models are supplied with instructions.

Choose your configuration:

- HI 98143-01 pH/EC transmitter with 0-1 V isolated output
- HI 98143-04 pH/EC transmitter with 0-4 V isolated output
- HI 98143-20 pH/EC transmitter with 4-20 mA isolated output
- HI 98143-22 pH/EC transmitter with 4-20 mA isolated output (specific for HI 8000 controllers)

## PROBES

- HI 3001 Conductivity probe for in-line or submersion applications

## ACCESSORIES

- HI 7004/1L pH 4.01 buffer solution, 1 L
- HI 7007/1L pH 7.01 buffer solution, 1 L bottle
- HI 7010/1L pH 10.01 buffer solution, 1 L bottle
- HI 7039L 5000 µS/cm calibration solution, 500 mL
- HI 7855/1 1 m (3.3') connection cable with BNC and screw connectors

HI 8614N • HI 8614LN

# pH Transmitters with 4-20 mA Galvanically Isolated Output

- Water resistant
- Loop powered
- Automatic Temperature Compensation
- Available with or without LCD

The HI 8614N 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 HI 8510, HI 8710 or HI 8711, recorders, computers or any data monitoring device that accepts 4 to 20 mA input.

HI 8614"L" versions allow easy verification and monitoring of measured values and is easier to calibrate and maintain.



HI 8614LN with LCD



HI 8614N without LCD

## ORDERING INFORMATION

HI 8614N and HI 8614LN (with display) is supplied with instructions.

## ELECTRODES

HI 76608 Temperature probe with 3 m (9.9') cable

## SOLUTIONS

HI 7004L pH 4.01 buffer solution, 500 mL  
 HI 7007L pH 7.01 buffer solution, 500 mL  
 HI 7010L pH 10.01 buffer solution, 500 mL

## ACCESSORIES

HI 6054B In-line electrode holder  
 HI 931002 4-20 mA simulator  
 HI 931001 pH / ORP electrode simulator with display

SPECIFICATIONS	HI 8614N	HI 8614LN
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 HI 76608 probe	
Input Impedance	10 <sup>12</sup> Ohm	
Recorder Output	4-20 mA (isolated)	
Protection	IP65	
Power Supply	18-30 VDC	20-36 VDC
LCD display	-	yes
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.)	

For a complete list of Solutions, see the end of pH Section 3.



# ORP Transmitters with 4-20 mA Galvanically Isolated Output



HI 8615LN with LCD



HI 8615N without LCD

- Universal BNC connector for quick connections
- Rugged ABS casing
- Loop powered
- Available with or without LCD

The HI 8615 has been designed for transmitting ORP measurements from remote locations.

This improved transmitter features two controls (one for 4 mA and one for 20 mA) to compensate for electronic drift and ambient temperature.

The HI 8615 uses a universal BNC socket for quick and secure connection of any ORP electrode with a BNC connector.

An IP65 rating and a rugged ABS casing provide optimum protection even in harsh environments making this instrument ideal for chromium hexavalent reductions and water sanitation. The transmitter can be connected to HANNA meters HI 8512, HI 8720 or any recorders, PC's or data monitors that accept 4 to 20 mA input.

HI 8615"L" versions allow easy verification and monitoring of measured values and is easier to calibrate and maintain.

SPECIFICATIONS	HI 8615N	HI 8615LN
Range	±1999 mV; 4-20 mA	
Resolution	1 mV; 0.01 mA	
Accuracy (@20°C/68°F)	±5 mV; ±0.02 mA	
Calibration	offset: ±100 mV; ±0.8 mA slope: 90 to 110%; ±0.8 mA	
Input Impedance	10 <sup>12</sup> Ohm	
Recorder Output	4-20 mA (isolated)	
Protection	IP65	
Power Supply	18-30 VDC	20-36 VDC
LCD display	-	yes
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

HI 8615N and HI 8615LN (with display) is supplied with instructions.

## SOLUTIONS

- HI 7020L ORP test solution @200-275 mV,  
 HI 7091L Reducing pretreatment ORP solution, 500 mL  
 HI 7092L Oxidizing pretreatment ORP solution, 500 mL

## ACCESSORIES

- HI 6054B In-line electrode holder  
 HI 8427 pH / ORP electrode simulator  
 HI 931001 pH / ORP electrode simulator with display

For a complete list of Solutions, see the end of pH Section 3.

# Conductivity Transmitters to use with Four-ring Probe

- Utilizes HANNA's potentiometric four-ring conductivity probe
- Automatic Temperature Compensation
- Direct probe connection eliminates signal loss
- Available with or without LCD
- Use in conjunction with HI 7638 or HI 3001 platinum conductivity probes

HI 8936 is our redesigned 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  $\beta$  of 2%/°C.

Direct connection of the probe to the transmitter assures a positive electrical connection with no signal loss over long distances.

HI 8936 "L" versions allow easy verification and monitoring of measured values and is easier to calibrate and maintain.

The HI 8936 series requires external power to the 4-20 mA current loop.



ALN, BLN, CLN, and DLN with LCD



AN, BN, CN, and DN without LCD

The HI 8936 series should be used in conjunction with the HI 7635 in-line probe or HI 7638 platinum probe (see Process Electrodes and Probes).

## ORDERING INFORMATION

All HI 8936 models are supplied complete with instructions.

## SOLUTIONS

HI 7030L	12880 $\mu$ S/cm calibration solution, 500 mL
HI 7031L	1413 $\mu$ S/cm calibration solution, 500 mL
HI 7033L	84 $\mu$ S/cm calibration solution, 500 mL
HI 7034L	80000 $\mu$ S/cm calibration solution, 500 mL
HI 7035L	111800 $\mu$ S/cm calibration solution, 500 mL
HI 7039L	5000 $\mu$ S/cm calibration solution, 500 mL

## ACCESSORIES

HI 731326	Calibration screwdrivers (20)
HI 779/15	6-wire cable (15 m/49.2' roll)
HI 8733	Portable conductivity meter with ATC

SPECIFICATIONS	HI 8936AN HI 8936ALN	HI 8936BN HI 8936BLN	HI 8936CN HI 8936CLN	HI 8936DN HI 8936DLN
Range	0.0 to 199.9 mS/cm	0.00 to 19.99 mS/cm	0 to 1999 $\mu$ S/cm	0.0 to 199.9 $\mu$ S/cm
Resolution	0.1 mS/cm	0.01 mS/cm	1 $\mu$ S/cm	0.1 $\mu$ S/cm
Accuracy (@20°C/68°F)	$\pm 2\%$ 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 $\beta = 2\%/^{\circ}\text{C}$			
Conductivity Probe	HI 7635 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	HI 8936AN: no HI 8936ALN: yes	HI 8936BN: no HI 8936BLN: yes	HI 8936CN: no HI 8936CLN: yes	HI 8936DN: no HI 8936DLN: 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.)			

For a complete list of Solutions, see the end of Conductivity Section 6.

# 4-20 mA Amperometer, Simulator and Calibrator



HI 931002 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:

HI 931002 can set the 4-20 mA current values and the user can then adjust the process meter accordingly.

## Active drive/Simulator mode:

HI 931002 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.

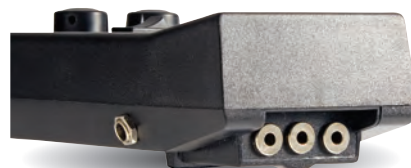
## Passive measurement/Tester mode:

HI 931002 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.

HI 931002 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.



## ORDERING INFORMATION

HI 931002 is supplied with 1 m (3.3') connection cable, battery, 12 VDC adapter and instructions.

## ACCESSORIES

HI 7862/1 1 m (3.3') connection cable

SPECIFICATIONS		HI 931002
Range	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
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.)



# 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 Resistance Guide*	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
Trichlorethane	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
<b>With Large Diaphragm</b>			
BL 20	18.3 lph (4.8 gph)	0.5 bar (7.4 psi)	120
BL 15	15.2 lph (4.0 gph)	1 bar (14.5 psi)	120
BL 10	10.8 lph (2.9 gph)	3 bar (43.5 psi)	120
BL 7	7.6 lph (2.0 gph)	3 bar (43.5 psi)	120
<b>With Small Diaphragm</b>			
BL 5	5.0 lph (1.3 gph)	7 bar (101.5 psi)	120
BL 3	2.9 lph (0.8 gph)	8 bar (116 psi)	120
BL 1.5	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\*

BL 1.5-1	1.5 LPH flow rate
BL 1.5-2	1.5 LPH flow rate
BL 3-1	2.9 LPH flow rate
BL 3-2	2.9 LPH flow rate
BL 5-1	5.0 LPH flow rate
BL 5-2	5.0 LPH flow rate
BL 7-1	7.6 LPH flow rate
BL 7-2	7.6 LPH flow rate
BL 10-1	10.8 LPH flow rate
BL 10-2	10.8 LPH flow rate
BL 15-1	15.2 LPH flow rate
BL 15-2	15.2 LPH flow rate
BL 20-1	18.3 LPH flow rate
BL 20-2	18.3 LPH flow rate

### ACCESSORIES

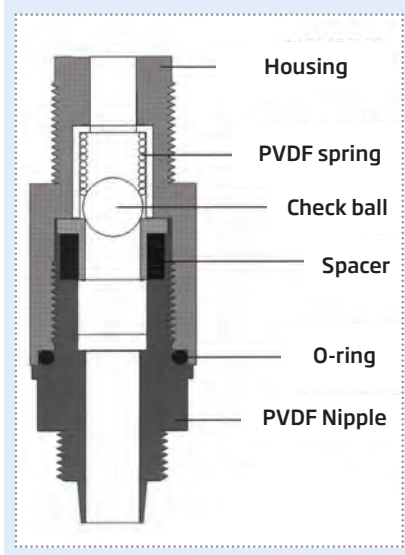
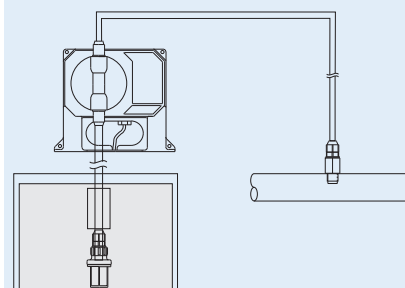
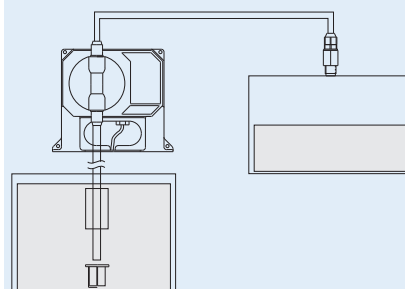
HI 721004**	Injection valve assembly
HI 721005**	Foot valve assembly
HI 721101	Pumphead, O-ring, screws and washer

HI 721102	Discharge valve assembly
HI 721103	Suction valve assembly
HI 721008	Ceramic weight (4)
HI 720011D	Magnet and coil for BL pumps (230VAC)
HI 720011U	Magnet and coil for BL pumps (115VAC)
HI 720025	Pump body
HI 720034	Magnet pump head assembly for BL pumps
HI 721001	Complete pumphead with valves
HI 72001	Tube nut, 5 x 8 mm dia. (100 pcs)
HI 721009	Diaphragm
HI 721010	PTFE coated O-ring for pump head
HI 721011	Aluminum piston, insulation disk, washer and springs replacement kit for BL pump
HI 721013	Piston set for BL pump
HI 721014	Bottom housing and housing seal
HI 721104	Small diaphragm for BL pumps
HI 721105	BlackStone spare pump head
HI 721106	BlackStone pump head assembly

## 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

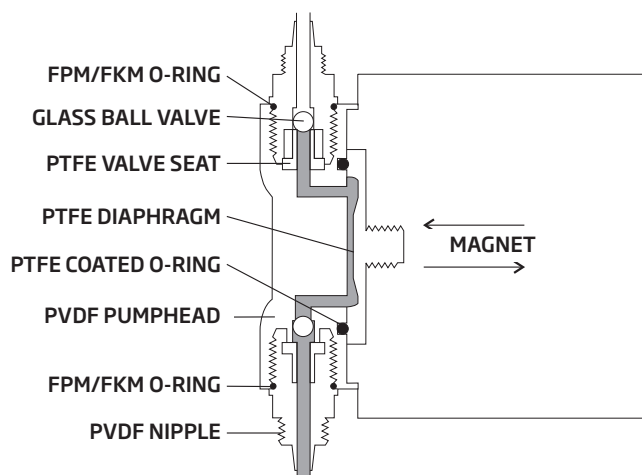
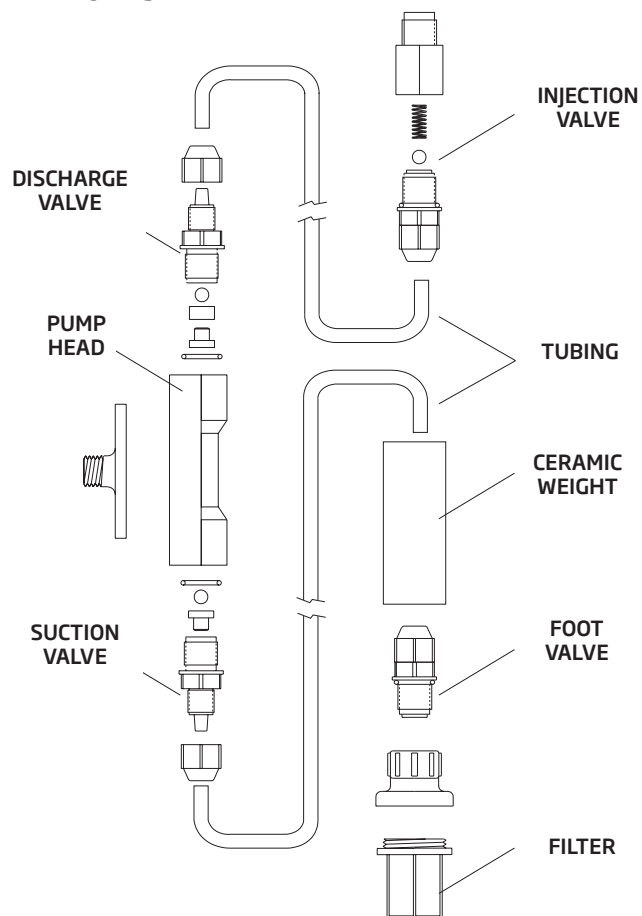


\* -1 = 110/115 VAC power supply  
-2 = 220/240 VAC power supply

\*\* Required for operation

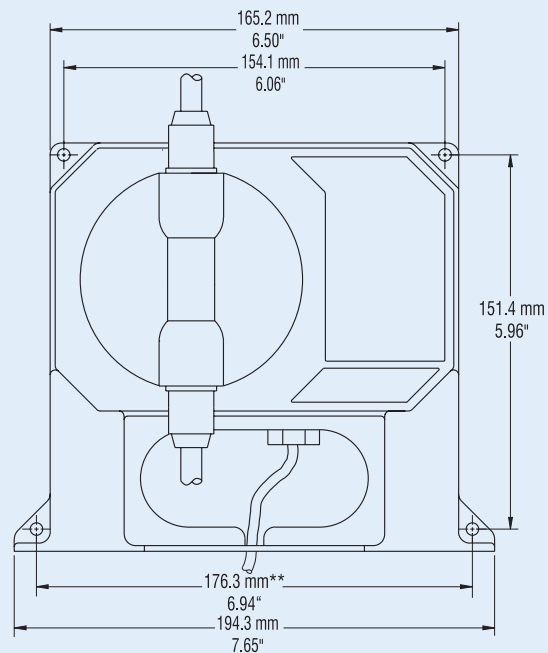
## Replacement Parts for BlackStone Chemical Dosing Pumps

Assembly Diagram



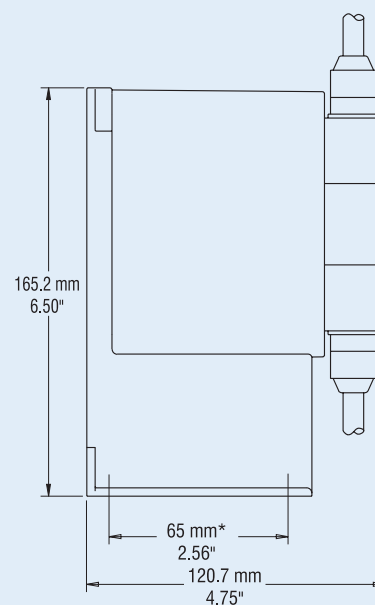
## Mechanical Dimensions for BlackStone Chemical Dosing Pumps

Front View



\*\* Dimensions for floor and wall mounting

Side View



\* Dimensions for floor mounting

## ORDERING INFORMATION

### HI 721101

This kit contains the PVDF pumphead, PTFE coated O-ring, 6 screws and washers.

### HI 721102

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.

### HI 721103

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.

### HI 721004

Complete with an injection nipple, PTFE coated spring, glass valve ball and a valve assembly.

### HI 721005

This kit contains a filter with a filter holder and a valve assembly.

### HI 721003

This kit contains 10 glass balls and 10 valve O-rings.

### HI 721006

This kit contains 4 PVDF springs.

### HI 720029

LDPE hose, 3 m (9.9').  
Inside diameter 4.71 mm  
Outside diameter 7.87 mm

### HI 720030

LDPE hose, 10 m (33').  
Inside diameter 4.71 mm  
Outside diameter 7.87 mm

### HI 720031

LDPE hose, 50 m (165').  
Inside diameter 4.71 mm  
Outside diameter 7.87 mm

### HI 720032

LDPE hose, 100 m (333').  
Inside diameter 4.71 mm  
Outside diameter 7.87 mm

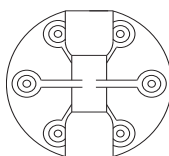
### HI 721008

This kit contains 4 ceramic weights.

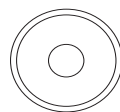
### HI 740156

This kit contains 3 valve seats.

## HI 721101



pumphead

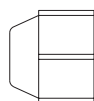


PTFE coated  
o-ring

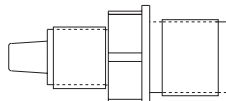


6 screws  
and  
washers

## HI 721102



tube nut



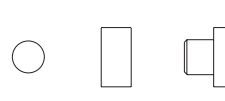
head nipple



valve

spacer

o-ring



valve seat

## HI 721103

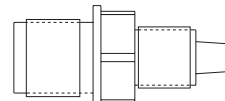


o-ring

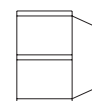
valve



valve seat

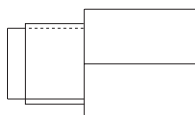


head nipple



tube nut

## HI 721004

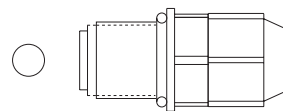


injection nipple



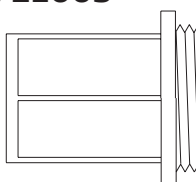
PVDF spring

valve

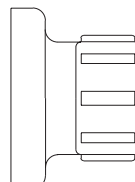


valve assembly

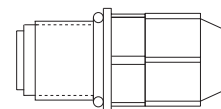
## HI 721005



filter



filter holder



valve assembly

## HI 721003



o-ring



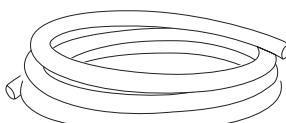
valve

## HI 721006



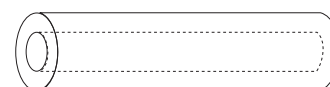
PVDF spring

## HI 720032



LDPE hose

## HI 721008



ceramic weight

## 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



HI 1000/HI 2000 Series



Standard



AmpHel®



Flat Tip

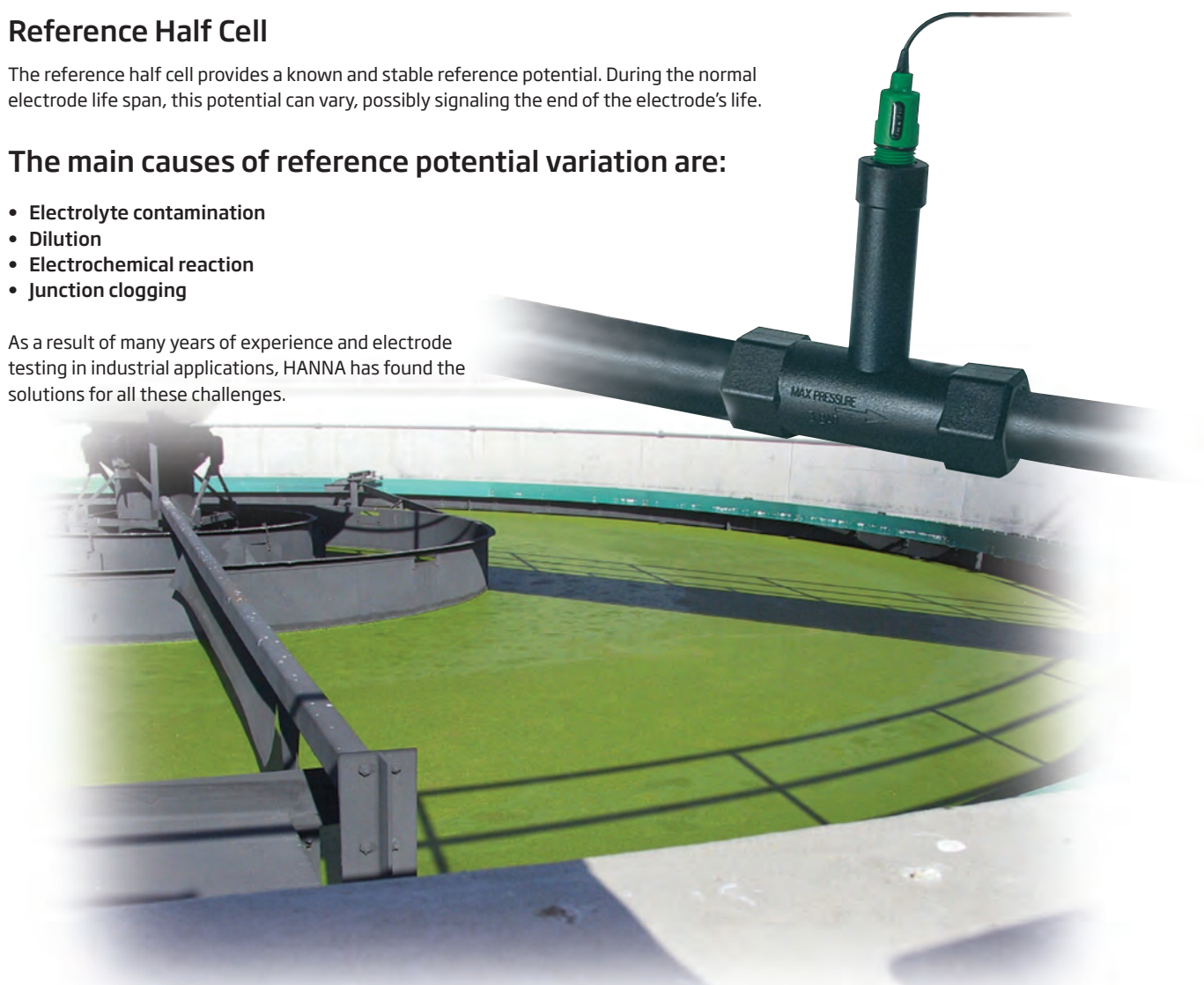
### Reference Half Cell

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 a reference cell, containing a very concentrated solution, comes in contact with a water solution sample much less concentrated, a diffusion phenomenon will take place on the electrolyte/sample junction, i.e. the diffusion of the electrolyte (KCl) into the sample solution. 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 the 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.

The simple and effective HANNA solution to this challenge is the matching pin built-in to each industrial electrode, a unique characteristic in the market. The matching pin is a stainless steel or titanium element that is connected to the instrument to prevent grounding problems, and thus 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 junction shape and material.

HANNA industrial electrodes are provided with different types of junctions. In particular, we want to highlight the porous PTFE junction used for our Flat Tip electrodes, which, thanks to its shape, can provide optimum performance for months without requiring any maintenance.



## Measurement Half Cell

All HANNA industrial pH electrodes include a measurement cell with glass sensor.

Even though it can be difficult to handle, the glass sensor is still 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

## Built for Everyday, Demanding Use

HANNA provides glass sensors that are able to withstand the previously listed industrial environmental challenges.

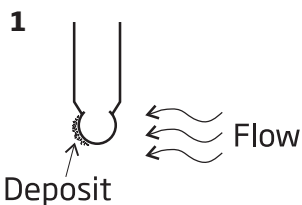
GLASS TYPE	APPLICATION	pH RANGE	TEMPERATURE RANGE
LT	low temperature	0 to 12	-10 to 80°C
HT	high temperature	0 to 14	0 to 100°C
HF	acid samples with fluoride	0 to 10	-5 to 60°C

## Mechanical Stress

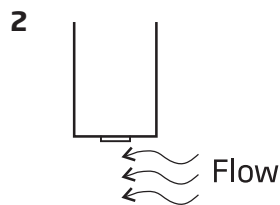
In a continuous in-line installation, the glass sensor of the pH electrode can be physically damaged by solution streams containing suspended solids.

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 an PEI body represents a very good combination of chemical, mechanical, and thermic resistance, and 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 HI 8614 and HI 8614L 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, three years from the date of production 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 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

The sample temperature is a very 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	flat tip	HI 1026-2005
	easy	HI 1090B/5
Industrial Wastewater	flat tip	HI 1006-2005
	AmpHel®	HI 5291005
	HI 1000	HI 1003/5
	easy	HI 1210B/5
Food Industry (Beer, Jam, Dairy Products)	flat tip	HI 1006-2005
	AmpHel®	HI 5291005
	easy	HI 1090B/5
Chemical Neutralization	flat tip	HI 1006-2005
	AmpHel®	HI 5291005
	easy	HI 1210B/5
Potable Water (>400µS/cm)	flat tip	HI 1006-2005
	AmpHel®	HI 5291005
	HI 1000	HI 1001
	easy	HI 1210B/5
Cooling Towers	flat tip	HI 1006-1005
	AmpHel®	HI 6291005
	HI 1000	HI 1002/5
	easy	HI 1210B/5
Water Softening	flat tip	HI 1006-2005
	AmpHel®	HI 6291005
	HI 1000	HI 1001/5, HI 1002/5
	easy	HI 1210B/5
Demineralization	flat tip	HI 1006-2005
	AmpHel®	HI 5291005
	easy	HI 1090B/5
Low Conductivity Solutions	flat tip	HI 1006-2005
	AmpHel®	HI 5291005
Swimming Pools	flat tip	HI 1006-2005
	AmpHel®	HI 5291005
Sea Water	flat tip	HI 1026-2005
	AmpHel®	HI 5291005
	easy	HI 1090B/5
Galvanic Baths	flat tip	HI 1006-3005
	AmpHel®	HI 8299505
	HI 1000	HI 1003/5
	easy	HI 1210B/5
Sugar Industry, Paper Industry	flat tip	HI 1006-2005
	AmpHel®	HI 5291005
	easy	HI 1090B/5
Textile Industry, Tanneries	flat tip	HI 1006-3005
	AmpHel®	HI 8299505
Acid Samples with Fluoride Ions	flat tip	HI 1006-4005
	AmpHel®	HI 7291005, HI 7299505

APPLICATION	ORP ELECTRODE SERIES	CODE
Oxidation of Cyanide and Nitrite	flat tip	HI 2004-2005
Ozonization & Oxidant Products	AmpHel®	HI 6493005
	HI 2000	HI 2013/5
Reductant Products (Chromate Reduction)	flat tip	HI 2004-1005
	AmpHel®	HI 6293005
	HI 2000	HI 2003/5
	easy	HI 3210B/5
Swimming Pools	HI 2000	HI 2001, HI 2003/5
	easy	HI 3210B/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 streams significantly increasing 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 provided with wire 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').

(\*) F- max 2 g/L, temperature max 60°C, pH >2



- 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.

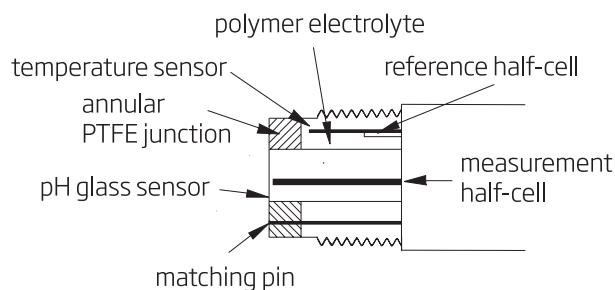
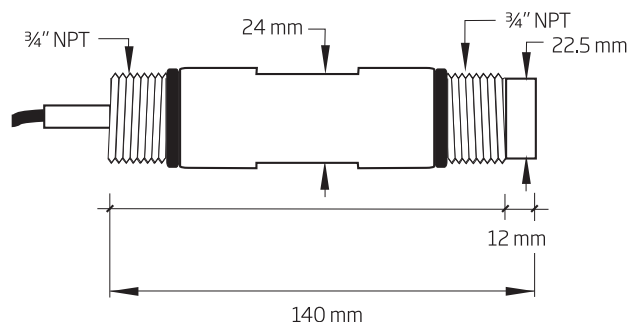
The most advanced feature of this series is the electrode shape with flat tip, virtually eliminating deposits that can foul the electrode, significantly reducing necessary maintenance. This characteristic makes flat tip electrodes ideal for continuous in-line monitoring and for solutions containing aggressive 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



### Flat Tip pH Electrodes: Ordering Information

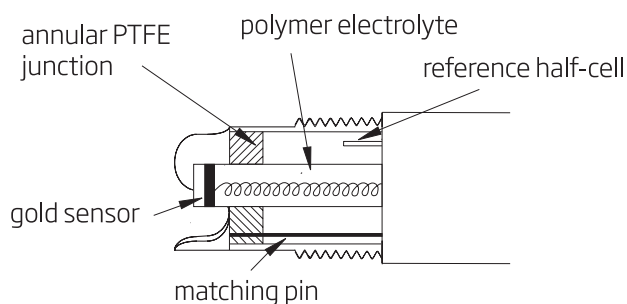
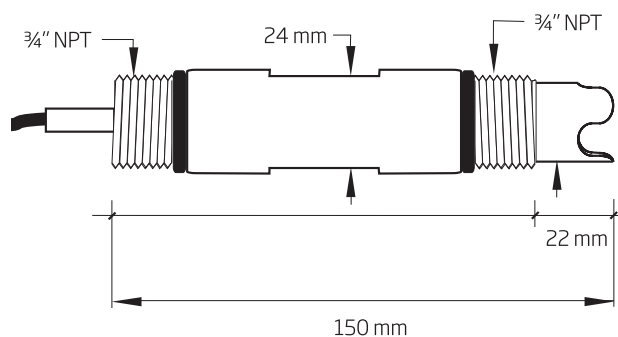
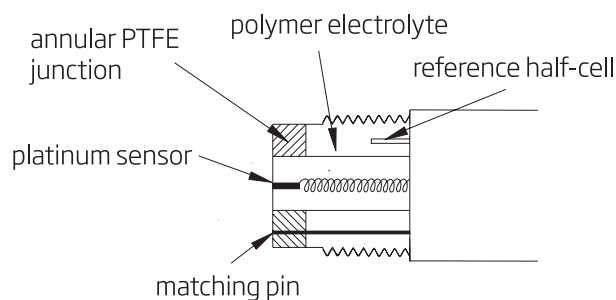
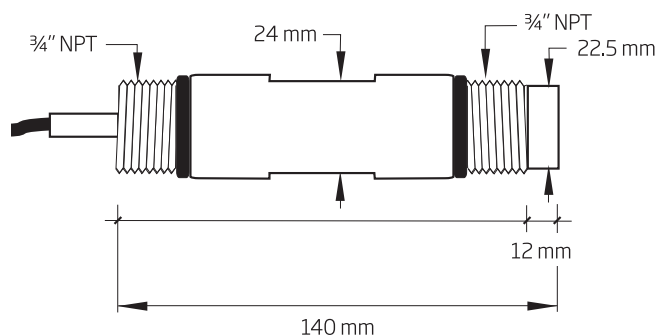
Choose your configuration:

- 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

**HI 10** 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.

HI 1006/5 Flat-tip pH electrode, 5 m cable



### 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

**HI 20** 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
HI 6100405	0-13	PVDF	double, PTFE	polymer	GP	-5 to 80 °C	–	6 bar (87 psi)	BNC	5 m
HI 6101405	0-13	PVDF	double, PTFE	polymer	GP	-5 to 80 °C	Pt100	6 bar (87 psi)	BNC + lead	5 m
HI 6101415	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
HI 6100605	0-12	PVDF	double, PTFE	polymer	LT	-10 to 80 °C	–	6 bar (87 psi)	BNC	5 m
HI 6101605	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
HI 6100805	0-14	PVDF	double, PTFE	polymer	HT	0 to 100 °C	–	6 bar (87 psi)	BNC	5 m
HI 6101805	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<sup>-</sup> MAX 2 G/L, TEMPERATURE MAX 60 °C, pH >2)

CODE	RANGE	BODY	JUNCTION	ELECTROLYTE	GLASS TYPE	TEMPERATURE	ATC	MAX PRESSURE	CONNECTOR	CABLE
HI 6100205	0-10	PVDF	double, PTFE	polymer	HF	-5 to 60 °C	–	6 bar (87 psi)	BNC	5 m
HI 6101205	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
HI 6200405	±2000 mV	PVDF	double, PTFE	polymer	-5 to 100 °C	–	6 bar (87 psi)	BNC	5 m

### GOLD TYPE ORP SENSORS

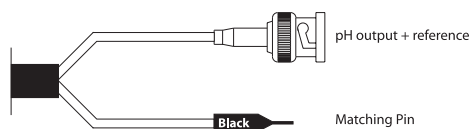
CODE	RANGE	BODY	JUNCTION	ELECTROLYTE	TEMPERATURE	ATC	MAX PRESSURE	CONNECTOR	CABLE
HI 6200505	±2000 mV	PVDF	double, PTFE	polymer	-5 to 100 °C	–	6 bar (87 psi)	BNC	5 m



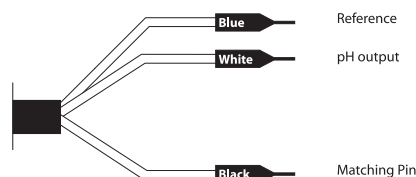
# Flat Tip Industrial Electrodes Electrical Connections and Installation

## Electrical Connections

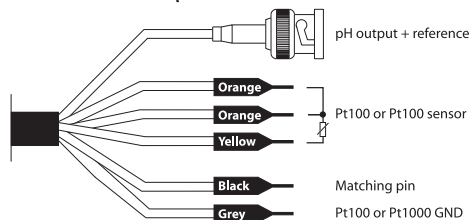
pH & ORP electrodes with BNC connector



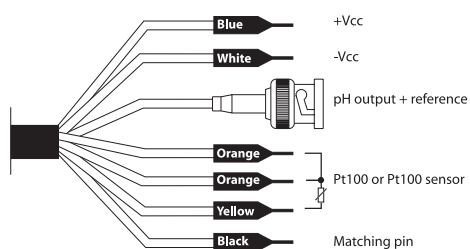
pH & ORP electrodes with direct wire connection



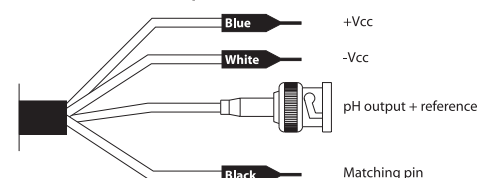
pH electrodes with BNC connector & Pt100 or Pt1000 temperature sensor



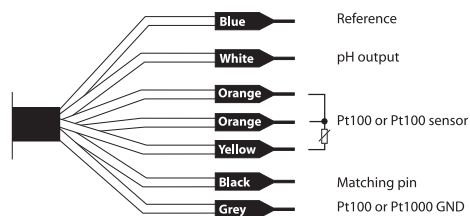
pH electrodes with BNC connector & Pt 100 temperature sensor, amplified



pH & ORP electrodes with BNC connector, amplified



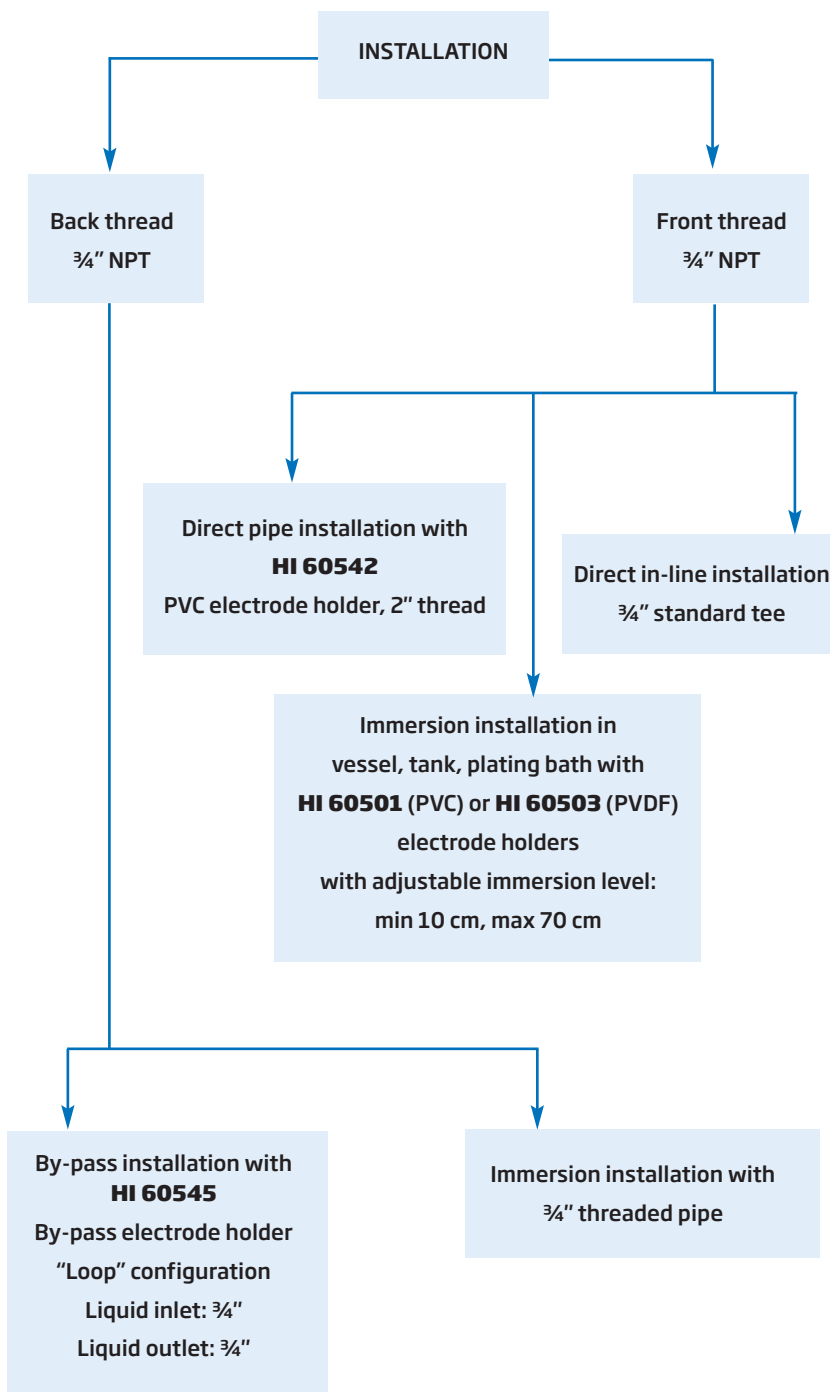
pH electrodes with direct wire connection & Pt100 or Pt1000 temperature sensor



## Installation

These electrodes have been designed with  $\frac{3}{4}$ " 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 result 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 useful life of the electrode.

Electrode body material is glass or PEI, while the junction is cloth or PTFE.

## ACCESSORIES

HI 740031 Spare replaceable battery for AmpHel® electrodes



### Extend Electrode Life

With the AmpHel® replaceable battery model, it is no longer necessary to throw away an electrode when the battery is exhausted.



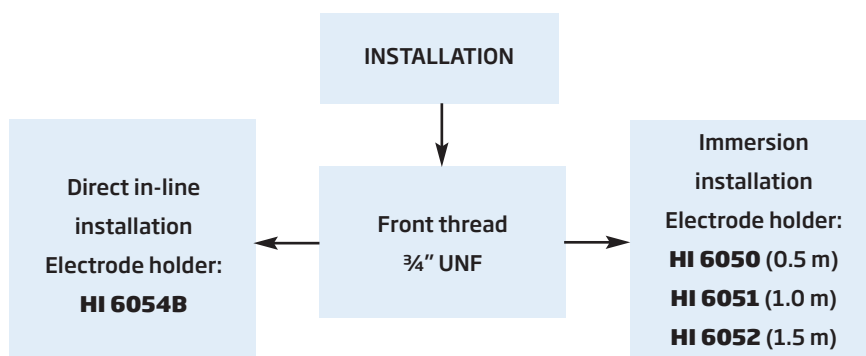
## HANNA GLASS SENSORS FOR PROCESS ELECTRODES

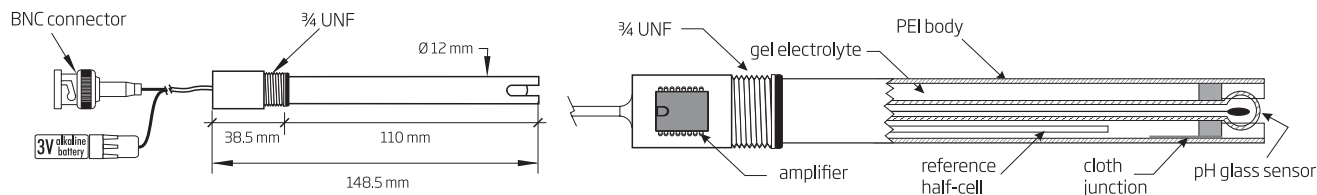
GLASS MEMBRANE	APPLICATION
GP	General Purpose
HT	High Temperature
LT	Low Temperature
HF	Samples with Fluoride

## 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.





### AMPHEL® pH ELECTRODES WITH REPLACEABLE BATTERY

GENERAL PURPOSE pH ELECTRODES								
CODE	BODY	JUNCTION	ELECTROLYTE	GLASS TYPE	TEMPERATURE	MAX PRESSURE	CONNECTOR	CABLE
HI 6291005	PEI	cloth	gel	GP	-5 to 80 °C	3 bar	BNC	5 m
HI 6291010	PEI	cloth	gel	GP	-5 to 80 °C	3 bar	BNC	10 m
HI 6291050	PEI	cloth	gel	GP	-5 to 80 °C	3 bar	BNC	15 m
HI 6294005	glass	cloth	gel	GP	0 to 60 °C	3 bar	BNC	5 m
HI 6294010	glass	cloth	gel	GP	0 to 60 °C	3 bar	BNC	10 m
LOW TEMPERATURE pH ELECTRODES								
CODE	BODY	JUNCTION	ELECTROLYTE	GLASS TYPE	TEMPERATURE	MAX PRESSURE	CONNECTOR	CABLE
HI 5291005	PEI	cloth	gel	LT	-10 to 80 °C	3 bar	BNC	5 m
HIGH TEMPERATURE pH ELECTRODES								
CODE	BODY	JUNCTION	ELECTROLYTE	GLASS TYPE	TEMPERATURE	MAX PRESSURE	CONNECTOR	CABLE
HI 8299505	glass	PTFE	polymer	HT	0 to 100 °C	3 bar	BNC	5 m
pH ELECTRODES FOR ACID SAMPLES WITH FLUORIDE IONS (F- MAX 2 G/L, TEMPERATURE MAX 60 °C, pH >2)								
CODE	BODY	JUNCTION	ELECTROLYTE	GLASS TYPE	TEMPERATURE	MAX PRESSURE	CONNECTOR	CABLE
HI 7291005	PEI	cloth	gel	HF	-5 to 60 °C	3 bar	BNC	5 m
HI 7299505	glass	PTFE	polymer	HF	-5 to 60 °C	3 bar	BNC	5 m

### AmpHel® pH ELECTRODES WITH INTERNAL BATTERY

CODE	BODY	JUNCTION	ELECTROLYTE	GLASS TYPE	TEMPERATURE	MAX PRESSURE	CONNECTOR	CABLE	
HI 2910B	PEI	cloth	gel	GP	-5 to 80 °C	3 bar (43.5 psi)	BNC	1 m	
HI 2910B/5	PEI	cloth	gel	GP	-5 to 80 °C	3 bar (43.5 psi)	BNC	5 m	
HI 2910D	PEI	cloth	gel	GP	0 to 80 °C	3 bar (43.5 psi)	DIN	5 m	
HI 2911B/5	PEI	PTFE	polymer	GP	-5 to 80 °C	3 bar (43.5 psi)	BNC	5 m	
HI 2911B/15	PEI	PTFE	polymer	GP	-5 to 80 °C	3 bar (43.5 psi)	BNC	15 m	

### AmpHel® ORP ELECTRODES WITH REPLACEABLE BATTERY

CODE	BODY	JUNCTION	ELECTROLYTE	PIN TYPE	TEMPERATURE	MAX PRESSURE	CONNECTOR	CABLE	
HI 6293005	PEI	cloth	gel	platinum	-5 to 80 °C	3 bar (43.5 psi)	BNC	5 m	
HI 6293010	PEI	cloth	gel	platinum	-5 to 80 °C	3 bar (43.5 psi)	BNC	10 m	
HI 6493005	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	
HI 2930B/5	PEI	cloth	gel	platinum	-5 to 80 °C	3 bar (43.5 psi)	BNC	5 m	
HI 2930B/10	PEI	cloth	gel	platinum	-5 to 80 °C	3 bar (43.5 psi)	BNC	10 m	
HI 2930B/15	PEI	cloth	gel	platinum	-5 to 80 °C	3 bar (43.5 psi)	BNC	15 m	
HI 2931B/5	PEI	PTFE	gel	platinum	-5 to 80 °C	3 bar (43.5 psi)	BNC	5 m	
HI 2931B/10	PEI	PTFE	gel	platinum	-5 to 80 °C	3 bar (43.5 psi)	BNC	10 m	
HI 2931B/15	PEI	PTFE	gel	platinum	-5 to 80 °C	3 bar (43.5 psi)	BNC	15 m	
HI 2931B/20	PEI	PTFE	gel	platinum	-5 to 80 °C	3 bar (43.5 psi)	BNC	20 m	
HI 2931B/35	PEI	PTFE	gel	platinum	-5 to 80 °C	3 bar (43.5 psi)	BNC	35 m	
HI 3930B	PEI	ceramic	gel	platinum	0 to 80 °C	1.5 bar (21.7 psi)	BNC	1 m	

# pH and ORP Electrodes for Continuous Flow-thru Monitoring

## Specifically Built for Industrial Applications

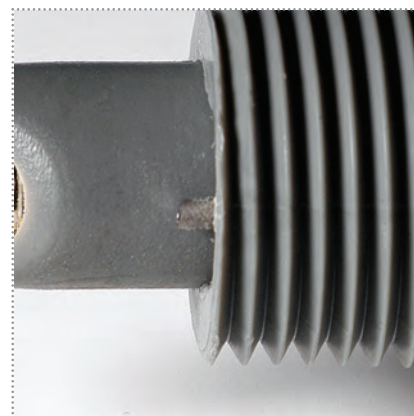
- ½" NPT external thread for in-line installation
- pH electrode with exclusive PTFE non-clogging membrane
- Double-junction technology
- PVDF body
- Models with built-in matching pin and amplifier

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).

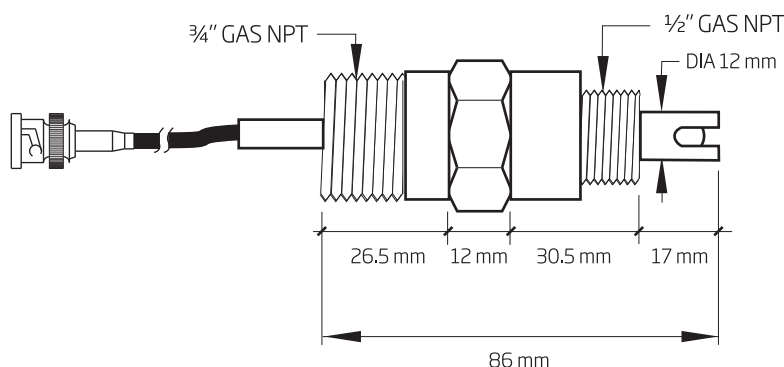
Both pH and ORP models are available, many of which include a built-in matching pin. Some models also feature a built-in amplifier, which allows for measurements to be taken far from the location of the instrument without requiring a transmitter.

HI 1000 and HI 2000 series incorporate a BNC connector that enables connection to any pH/ORP meter quick and easy; models with 3 or 5 meters (9.8 or 16 feet) cable are available.



Matching pin with differential input for grounding

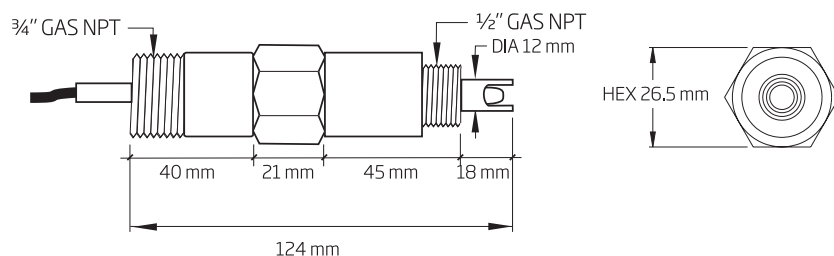
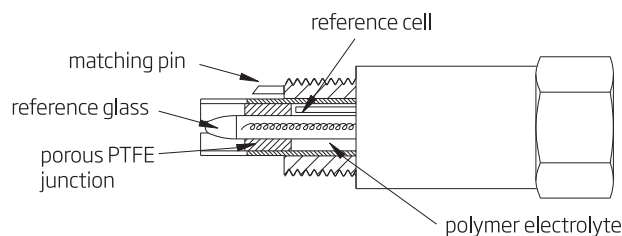
HI 1000 and 2000 series



### HI 1001 AND HI 1005 (pH ELECTRODES) AND HI 2001 (ORP ELECTRODE WITH PT SENSOR)

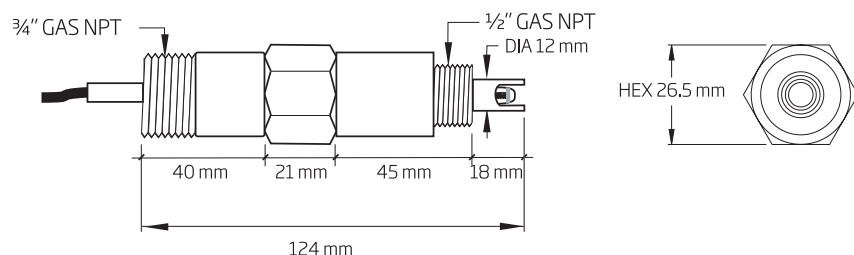
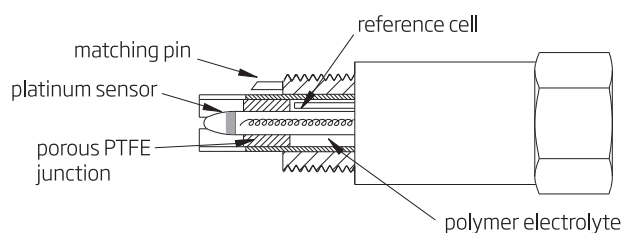
CODE	JUNCTION	ELECTROLYTE	TEMPERATURE	MAX PRESSURE	CONNECTOR	CABLE
HI 1001	double, PTFE	polymer	-5 to 80°C	6 bar (87 psi)	BNC	3 m
HI 1005	double, PTFE	polymer	-5 to 80°C	6 bar (87 psi)	DIN	0.5 m
HI 2001	double, PTFE	polymer	-5 to 80°C	6 bar (87 psi)	BNC	3 m





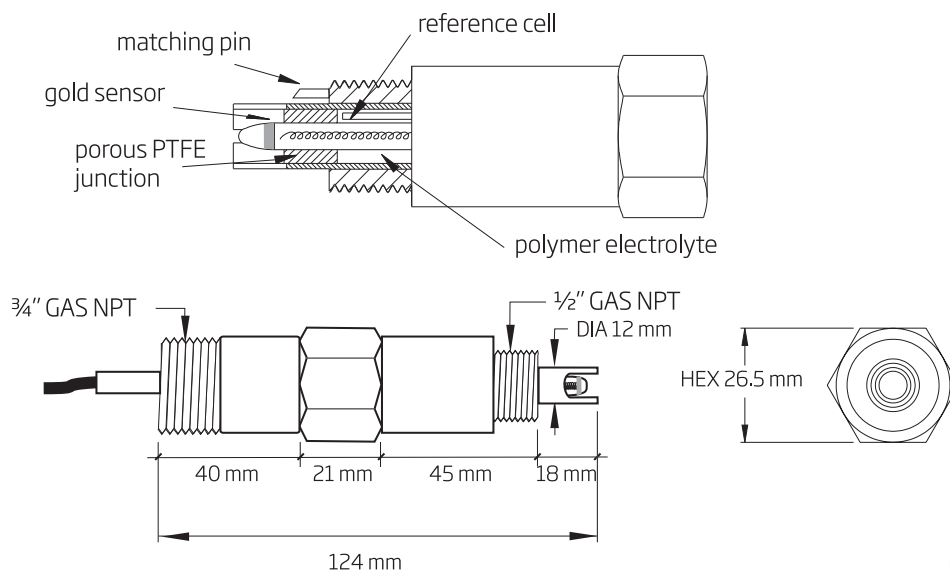
### HI 1000 SERIES: pH ELECTRODES

CODE	JUNCTION	ELECTROLYTE	MATCHING PIN	AMPLIFIER	TEMPERATURE	MAX PRESSURE	CONNECTOR	CABLE
HI 1002/3	double, PTFE	polymer	–	–	-5 to 80°C	6 bar (87 psi)	BNC	3 m
HI 1002/5	double, PTFE	polymer	–	–	-5 to 80°C	6 bar (87 psi)	BNC	5 m
HI 1002/10	double, PTFE	polymer	–	–	-5 to 80°C	6 bar (87 psi)	BNC	10 m
HI 1003/3	double, PTFE	polymer	yes	–	-5 to 80°C	6 bar (87 psi)	BNC	3 m
HI 1003/5	double, PTFE	polymer	yes	–	-5 to 80°C	6 bar (87 psi)	BNC	5 m
HI 1004/5	double, PTFE	polymer	yes	yes	-5 to 80°C	6 bar (87 psi)	spade lug	5 m
HI 1004/15	double, PTFE	polymer	yes	yes	-5 to 80°C	6 bar (87 psi)	spade lug	15 m



### HI 2000 SERIES: ORP ELECTRODES WITH PLATINUM SENSOR

CODE	JUNCTION	ELECTROLYTE	MATCHING PIN	AMPLIFIER	TEMPERATURE	MAX PRESSURE	CONNECTOR	CABLE
HI 2002/3	double, PTFE	polymer	–	–	-5 to 80°C	6 bar (87 psi)	BNC	3 m
HI 2002/5	double, PTFE	polymer	–	–	-5 to 80°C	6 bar (87 psi)	BNC	5 m
HI 2003/3	double, PTFE	polymer	yes	–	-5 to 80°C	6 bar (87 psi)	BNC	3 m
HI 2003/5	double, PTFE	polymer	yes	–	-5 to 80°C	6 bar (87 psi)	BNC	5 m
HI 2004/5	double, PTFE	polymer	yes	yes	-5 to 80°C	6 bar (87 psi)	spade lug	5 m
HI 2006/5	double, PTFE	polymer	yes	yes	-5 to 80°C	6 bar (87 psi)	BNC	5 m

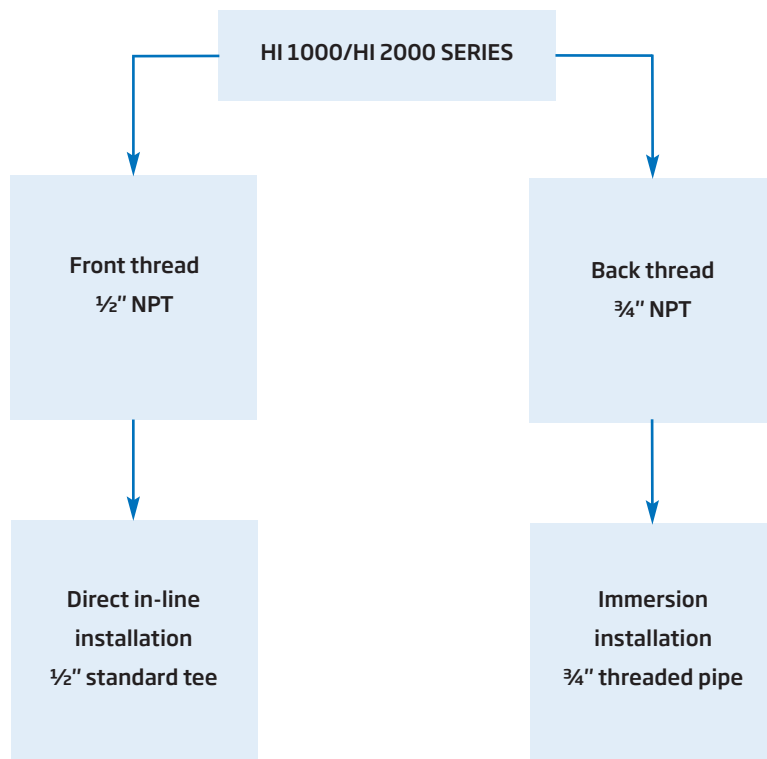


HI 2000 SERIES: ORP ELECTRODES WITH GOLD SENSOR

CODE	JUNCTION	ELECTROLYTE	MATCHING PIN	AMPLIFIER	TEMPERATURE	MAX PRESSURE	CONNECTOR	CABLE
HI 2012/3	double, PTFE	polymer	-	-	-5 to 80°C	6 bar (87 psi)	BNC	3 m
HI 2012/5	double, PTFE	polymer	-	-	-5 to 80°C	6 bar (87 psi)	BNC	5 m
HI 2013/3	double, PTFE	polymer	yes	-	-5 to 80°C	6 bar (87 psi)	BNC	3 m
HI 2013/5	double, PTFE	polymer	yes	-	-5 to 80°C	6 bar (87 psi)	BNC	5 m
HI 2005/5	double, PTFE	polymer	yes	yes	-5 to 80°C	6 bar (87 psi)	spade lug	5 m
HI 2008	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 1/2" external thread. No special holders are required: HI 1000 and HI 2000 series can be used with any standard 1/2" pipe tee available on the market. On the opposite end, these probes are provided with a 3/4" thread so that they can be attached to a pipe for dip applications.



# Easy pH and ORP Electrodes with Quick and Easy BNC Connection

17



- BNC connector
- Submersion and in-line installation capability
- PEI and glass body

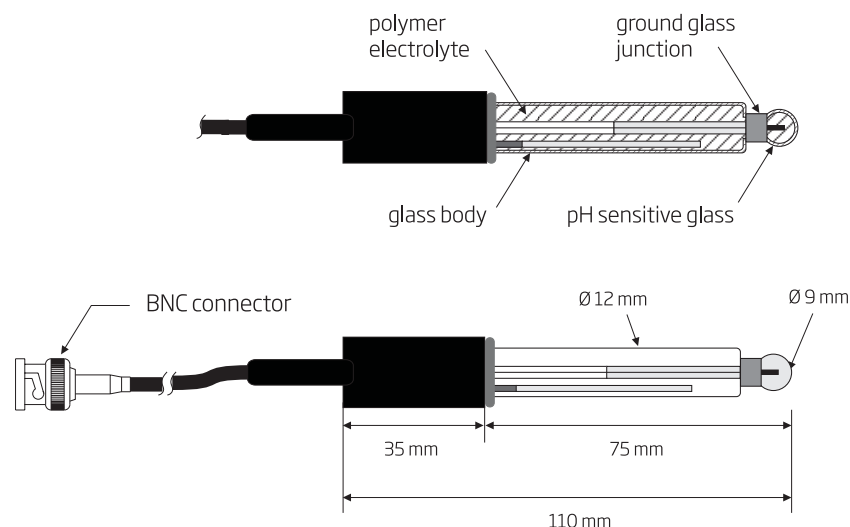
HANNA offers a wide range of combination pH and ORP electrodes specifically designed for needs of industrial users.

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 the BNC connection, select models offer a  $\frac{3}{4}$ " 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 bodied electrodes are easier to clean and recommended for use in aggressive chemicals.

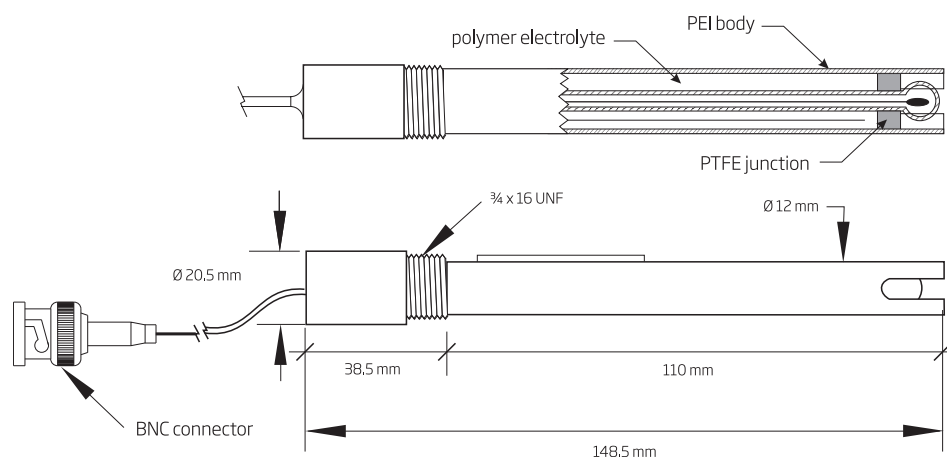
All pH and ORP electrodes can be mounted with the HANNA in-line and submersion assemblies.



## COMBINATION GLASS-BODY pH ELECTRODE

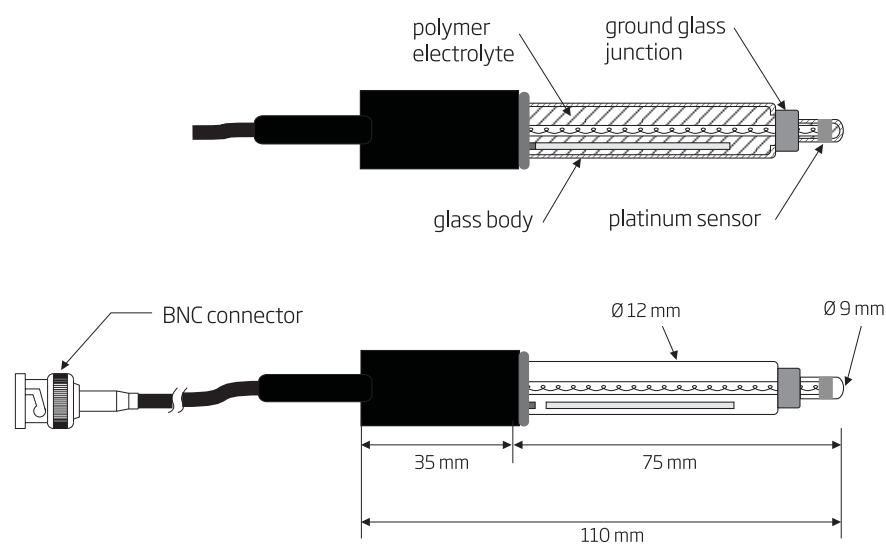
CODE	JUNCTION	ELECTROLYTE	TEMPERATURE	MAX PRESSURE	CONNECTOR	CABLE
HI 1090B/5	double, ground glass	polymer	-5 to 95°C (23-203°F)	3 bar (43.5 psi)	BNC	5 m

## Easy pH and ORP Electrodes with Quick and Easy BNC Connection



## COMBINATION PEI-BODY pH ELECTRODE

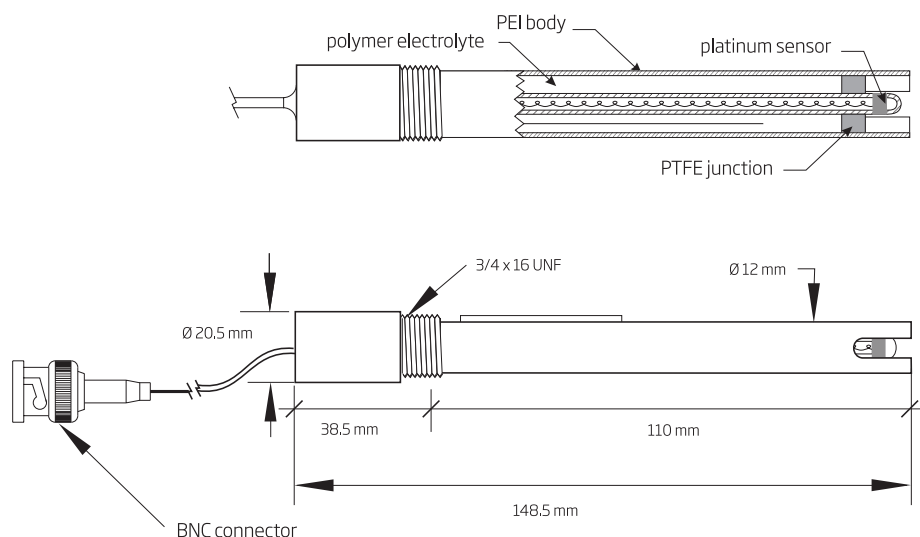
CODE	JUNCTION	ELECTROLYTE	TEMPERATURE	MAX PRESSURE	CONNECTOR	CABLE
HI 1210B/5	double, PTFE	polymer	-5 to 80°C	3 bar (43.5 psi)	BNC	5 m



## COMBINATION GLASS-BODY ORP ELECTRODE WITH PLATINUM SENSOR

CODE	JUNCTION	ELECTROLYTE	TEMPERATURE	MAX PRESSURE	CONNECTOR	CABLE
HI 3090B/5	double, ground glass	polymer	-5 to 95°C	3 bar (43.5 psi)	BNC	5 m





COMBINATION PEI-BODY ORP ELECTRODE WITH PLATINUM SENSOR

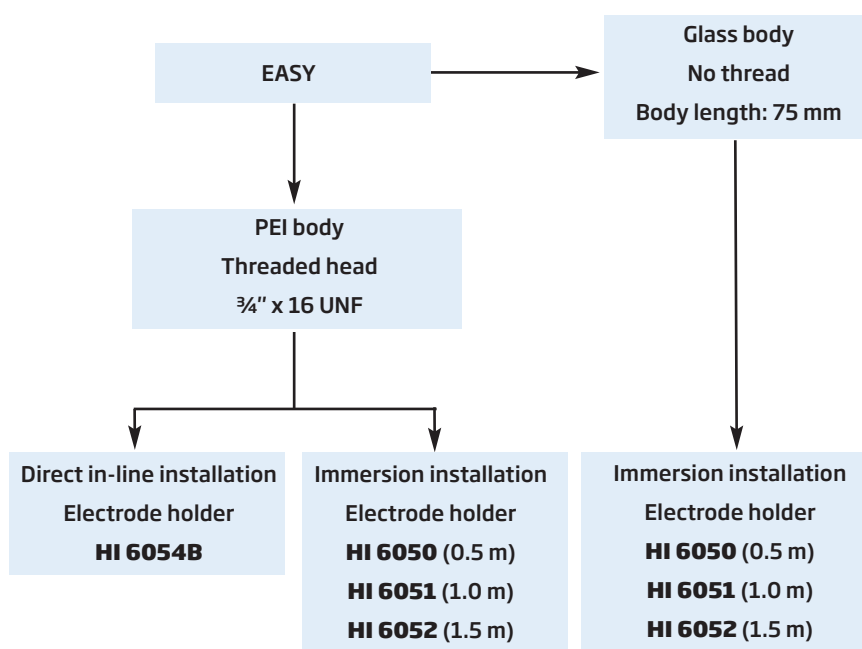
CODE	JUNCTION	ELECTROLYTE	TEMPERATURE	MAX PRESSURE	CONNECTOR	CABLE
HI 3210B/5	double, PTFE	polymer	-5 to 80°C	3 bar (43.5 psi)	BNC	5 m
HI 3130B	single, ceramic	gel	0 to 80°C	3 bar (43.5 psi)	BNC	1 m

## Installation

The installation of these electrodes is very flexible, because you can choose different mounting configurations.

Models with glass body and no external thread can be installed on tanks using the HI 6050 electrode holder with sealing O-ring.

Models with a PEI body and 3/4" UNF thread or glass body and no thread can be easily installed directly in-line, using a T shape electrode holder, such as HI 6054B.



# 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)

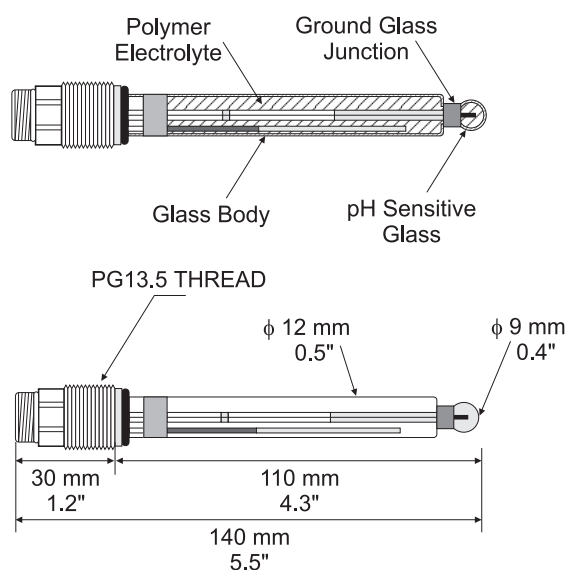
Electrodes featuring a T-connector have been designed by HANNA to gain the advantages of both PG 13.5 thread and screw cap. The PG 13.5 thread ensures proper in-line installation, furthermore, the user can quickly and easily perform all servicing and maintenance procedures. The screw cap allows for maximum versatility making it possible to connect a cable of different lengths. Easily detachable 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.

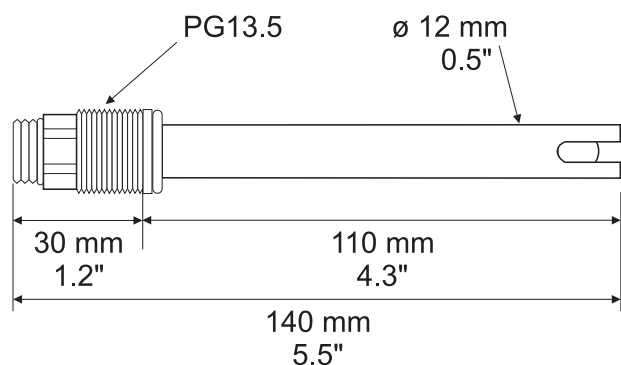
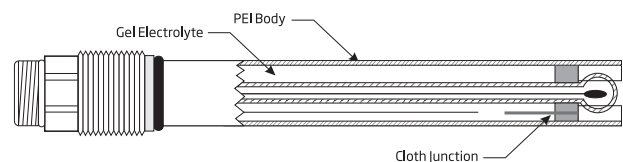
These sensors are also suitable to be operated with moderate pressure up to 3 bar (43.5 psi) and operating temperature limits of -5 up to 95°C (23 to 203°F).

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.

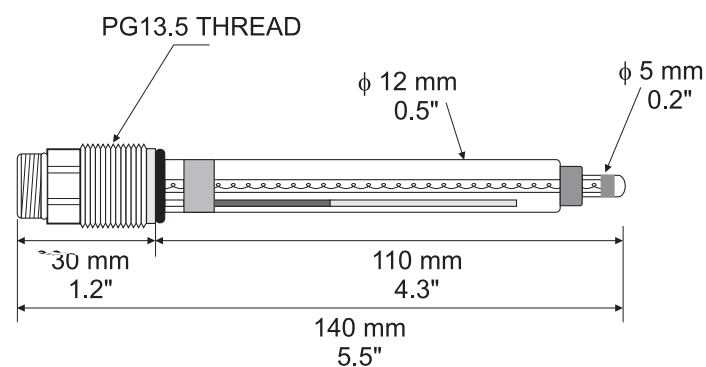
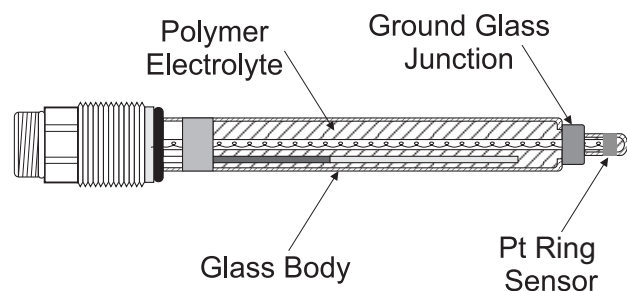


## COMBINATION GLASS-BODY pH ELECTRODE

CODE	JUNCTION	ELECTROLYTE	TEMPERATURE	MAX PRESSURE	CONNECTOR
HI 1090T	double, ground glass	polymer	-5 to 95°C (23 to 203°F)	3 bar (43.5 psi)	T-type
HI 1190T	double, PTFE	polymer	-15 to 80°C (5 to 176°F)	6 bar (87 psi)	T-type
HI 1191T	double, PTFE	polymer	-15 to 80°C (5 to 176°F)	8 bar (116 psi)	T-type
HI 1192T	double, PTFE	polymer	-15 to 80°C (5 to 176°F)	8 bar (116 psi)	T-type

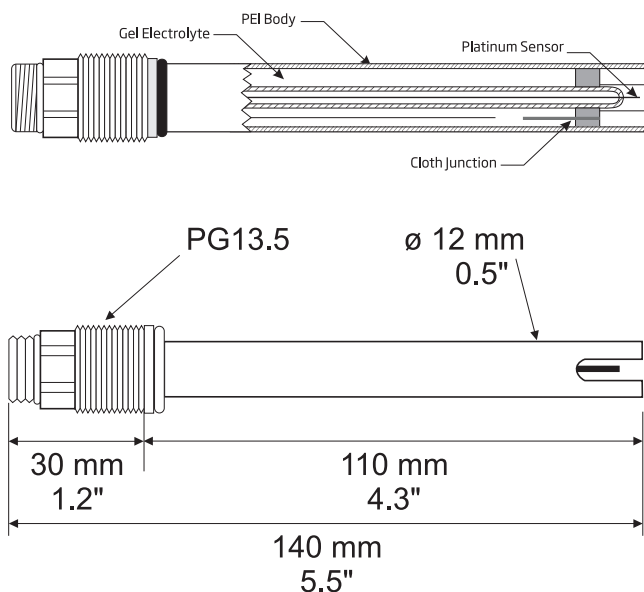
**COMBINATION PEI-BODY pH ELECTRODE**

CODE	JUNCTION	ELECTROLYTE	TEMPERATURE	MAX PRESSURE	CONNECTOR
HI 1210T	double, cloth	gel	-5 to 80°C (23 to 176°F)	3 bar (43.5 psi)	T-type
HI 1211T	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**

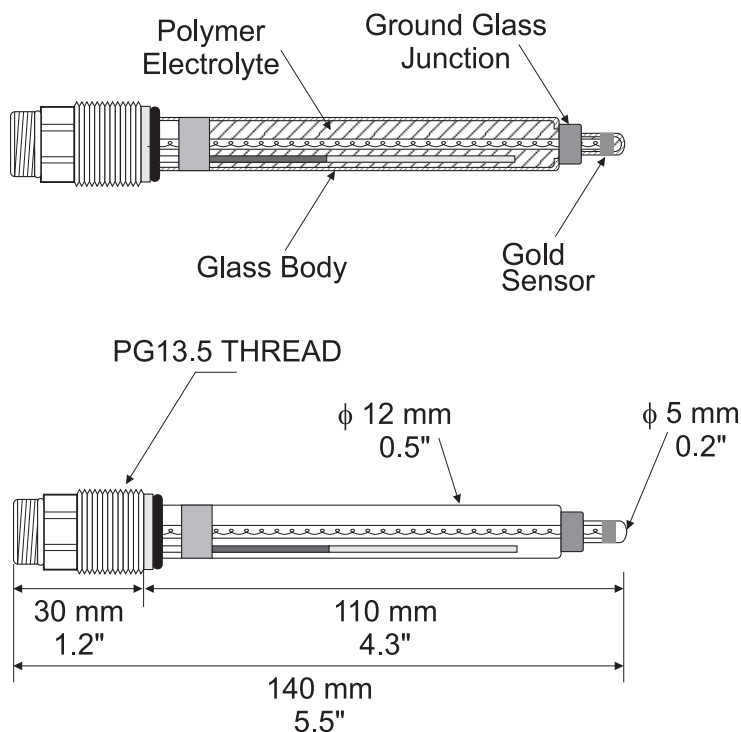
CODE	JUNCTION	ELECTROLYTE	TEMPERATURE	MAX PRESSURE	CONNECTOR
HI 3090T	double, ground glass	polymer	-5 to 95°C (23 to 203°F)	3 bar (43.5 psi)	T-type
HI 3190T	double, PTFE	polymer	-15 to 100°C (5 to 212°F)	6 bar (87 psi)	T-type
HI 3211T	double, cloth	gel	-5 to 80°C (23 to 176°F)	3 bar (43.5 psi)	T-type

## pH and ORP Electrodes with T-type Connection



## COMBINATION PEI-BODY ORP ELECTRODE WITH PLATINUM SENSOR

CODE	JUNCTION	ELECTROLYTE	TEMPERATURE	MAX PRESSURE	CONNECTOR	CABLE
HI 3210T	double, cloth	gel	-5 to 80°C (23-176°F)	3 bar (43.5 psi)	T-type	-



## COMBINATION GLASS-BODY ORP ELECTRODE WITH GOLD SENSOR

CODE	JUNCTION	ELECTROLYTE	TEMPERATURE	MAX PRESSURE	CONNECTOR	CABLE
HI 4190T	double, PTFE	polymer	-5 to 80°C (23 to 176°F)	3 bar (43.5 psi)	T-type	-
HI 4290T	single, ground glass	polymer	-5 to 80°C (23 to 176°F)	3 bar (43.5 psi)	T-type	-





CODE	HI 101	HI 102	HI 201
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 (86 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	HI 101/3 adapter with 3 m (9.9') cable	HI 101/3 adapter with 3 m (9.9') cable	HI 101/3 adapter with 3 m (9.9') cable
Recommended Use	Immersion	In-line	Immersion

HI 7635 • HI 7636

## In-line Conductivity Probes

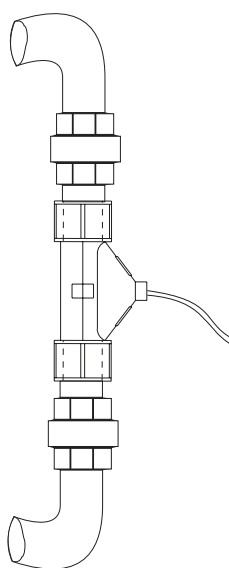
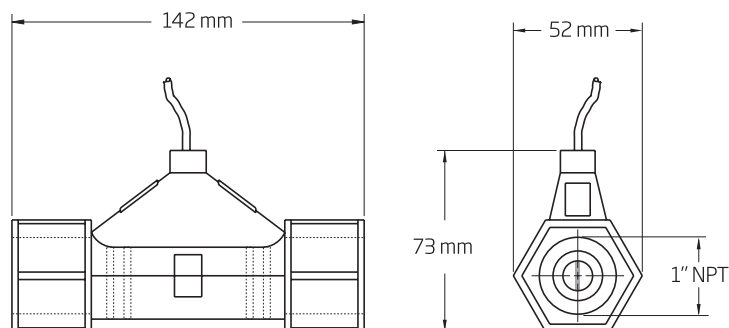
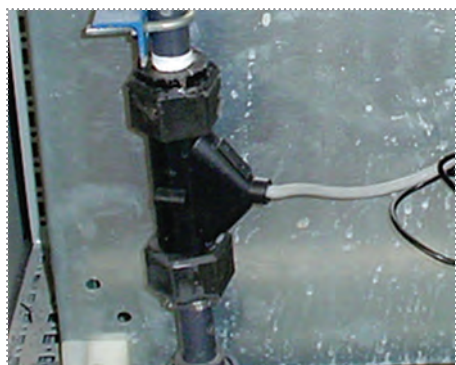
### Flow-thru Conductivity Probes

The wide range of HANNA conductivity probes includes flow-thru and dip models for industrial applications.

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 HI 8936 transmitters while others provide a DIN connection.



Typical connection of the HI 7635 (or HI 7636) probe and the HI 8936 transmitter to the HI 8931 controller.

#### SPECIFICATIONS

CODE	TEMPERATURE COMPENSATION	BODY	OPERATING TEMPERATURE	MAX PRESSURE (@25°C/77°F)	CABLE/ CONNECTION
HI 7635	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
HI 7635D	automatic, 0 to 50°C with NTC sensor	polypropylene	0 to 80°C (32 to 176°F)	5 bar	4 m (13.1')/DIN
HI 7636	–	polypropylene	0 to 80°C (32 to 176°F)	5 bar	4 m (13.1')/Color coded wires

# In-line Conductivity Probes with Platinum Ring

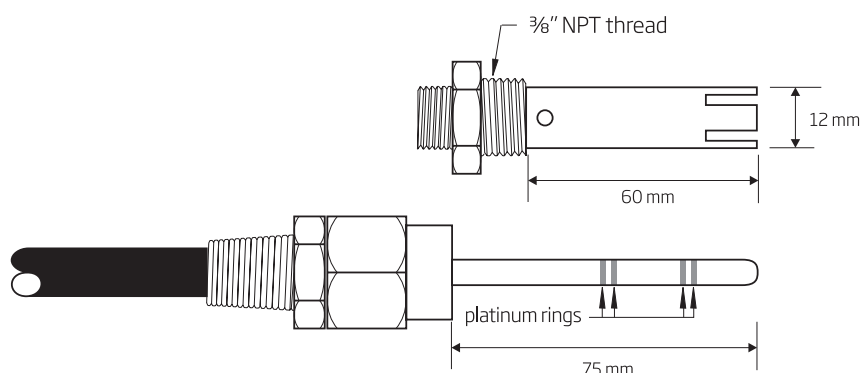


HI 7638

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 for the HI 7638 and HI 7639 allows automatically temperature compensated measurements and features easy operation and maintenance.

HI 7638 and HI 7639 are provided with a 4 m cable incorporating color coded wires for easy connection to HI 8936 transmitters while HI 7640 provides a DIN connection.



## SPECIFICATIONS

CODE	TEMPERATURE COMPENSATION	BODY	OPERATING TEMPERATURE	MAX PRESSURE (@25°C/77°F)	CABLE/ CONNECTION
HI 7638	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
HI 7638/5	automatic, 0 to 50°C with NTC sensor	PEI and glass	0 to 120°C (32 to 248°F)	5 bar (72.5 psi)	5 m (16.4')/Color coded wires
HI 7638/10	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
HI 7638/20	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
HI 7639	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
HI 7639/5	automatic, 0 to 50°C with Pt100 sensor	PEI and glass	0 to 120°C (32 to 248°F)	5 bar (72.5 psi)	5 m (16.4')/Color coded wires
HI 7639/10	automatic, 0 to 50°C with Pt100 sensor	PEI and glass	0 to 120°C (32 to 248°F)	5 bar (72.5 psi)	10 m (32.8')/Color coded wires
HI 7639/15	automatic, 0 to 50°C with Pt100 sensor	PEI and glass	0 to 120°C (32 to 248°F)	5 bar (72.5 psi)	15 m (49.2')/Color coded wires
HI 7639/20	automatic, 0 to 50°C with Pt100 sensor	PEI and glass	0 to 120°C (32 to 248°F)	5 bar (72.5 psi)	20 m (65.6')/Color coded wires
HI 7639/30	automatic, 0 to 50°C with Pt100 sensor	PEI and glass	0 to 120°C (32 to 248°F)	5 bar (72.5 psi)	30 m (98.4')/Color coded wires
HI 7639D	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')/DIN
HI 7639D/5	automatic, 0 to 50°C with Pt100 sensor	PEI and glass	0 to 120°C (32 to 248°F)	5 bar (72.5 psi)	5 m (16.4')/DIN
HI 7640	–	PEI and glass	0 to 120°C	5 bar (72.5 psi)	3 m (9.9')/Color coded wires

HI 3001 • HI 3001D • HI 3011

## Flow-thru Conductivity Probes

### Four-ring and Platinum Sensors

These four-ring probes measure conductivity with platinum sensors. They come with standard 1/2" external thread on the front for flow-thru mounting and 3/4" threads on the back for submersion or pipe mounting.

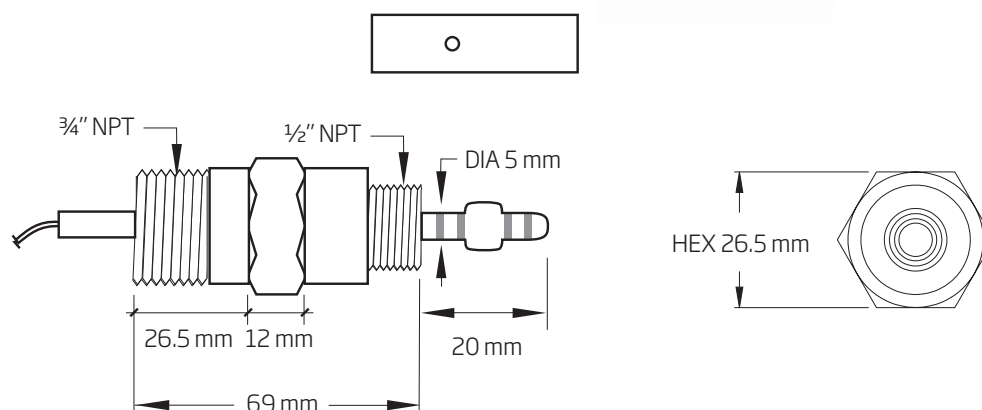
These probes feature 3 m (9.9') of cable and the protective cover is made of PEI and can be removed for quick maintenance. These probes can withstand temperatures up to 80°C (176°F) and 6 bars (87 psi) of pressure.

In addition, HI 3001 houses an NTC sensor for Automatic Temperature Compensation.

Model HI 3001D with DIN connector is to be used with the HI 99xx series of wall-mounted controllers.



HI 3001



### SPECIFICATIONS

CODE	TEMPERATURE COMPENSATION	BODY	OPERATING TEMPERATURE	MAX PRESSURE (@25°C/77°F)	CONNECTOR	CABLE
HI 3001	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')
HI 3001/5	automatic, 0 to 60°C with NTC sensor	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	–	5 m (16.4')
HI 3001/10	automatic, 0 to 60°C with NTC sensor	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	–	10 m (32.8')
HI 3001D	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')
HI 3001D/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')
HI 3001D/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')
HI 3001D/15	automatic, 0 to 60°C with NTC sensor	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	DIN	15 m (49.2')
HI 3003/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')
HI 3011	–	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	–	3 m (9.9')

\*for HI 9914 only



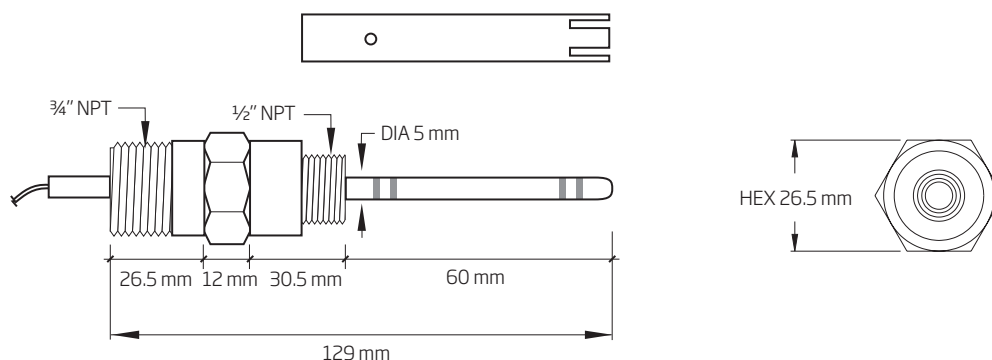


HI 3002

### Four-ring and Platinum Sensors

The HI 3002 and HI 3012 four-ring probes measure conductivity with platinum sensors. They come with standard 1/2" external thread on the front for flow-thru mounting and 3/4" 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. HI 3002 also houses an NTC temperature sensor for automatically temperature compensated measurements.



#### SPECIFICATIONS

CODE	TEMPERATURE COMPENSATION	BODY	OPERATING TEMPERATURE	MAX PRESSURE (@25°C/77°F)	CONNECTOR	CABLE
HI 3002	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')
HI 3002/10	automatic, 0 to 60°C with NTC sensor	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	–	10 m (32.8')
HI 3002D/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')
HI 3002D/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')
HI 3002D/15	automatic, 0 to 60°C with NTC sensor	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	DIN	15 m (49.2')
HI 3012	–	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	–	3 m (9.9')

HI 7610 • HI 7611

## Stainless Steel Temperature Probes

- Flow-thru 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

HI 7610 and HI 7611 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, HI 700 & HI 504 series.

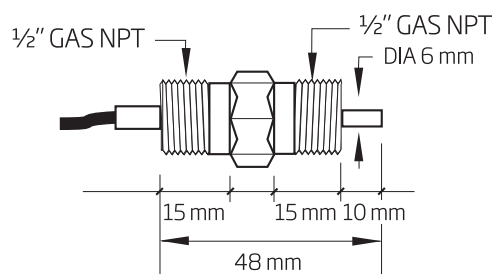
HI 7610 and HI 7611 are constructed of stainless steel for additional ruggedness. They incorporate ½" external threads on both ends to facilitate inline and immersion installations.

### HI 7610 AND HI 7611 INDUSTRIAL TEMPERATURE PROBES

CODE	TEMPERATURE SENSOR	BODY	MAX PRESSURE	CABLE LENGTH
HI 7610	Pt100	stainless steel	8 bar	5 m (16.4')
HI 7611	Pt1000	stainless steel	8 bar	5 m (16.4')



HI 7610, HI 7611



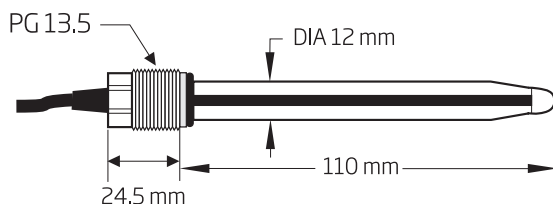
HI 7620 • HI 7621

## Glass Body Probes

- Flow-thru and immersion mounting
- High accuracy
- Glass body with high chemical resistance and PG 13.5 external thread

HI 7620 and HI 7621 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, HI 700 & HI 504 series.

HI 7620 and HI 7621 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 HI 6054T holder as well as other common probe holders.



### HI 7620 AND HI 7621 INDUSTRIAL TEMPERATURE PROBES

CODE	TEMPERATURE SENSOR	BODY	MAX PRESSURE	CABLE LENGTH
HI 7620	Pt100	glass	3 bar	5 m (16.4')
HI 7621	Pt1000	glass	3 bar	5 m (16.4')

HI 7621



HI 60542

## In-line Electrode Holder for Direct Pipe Installation

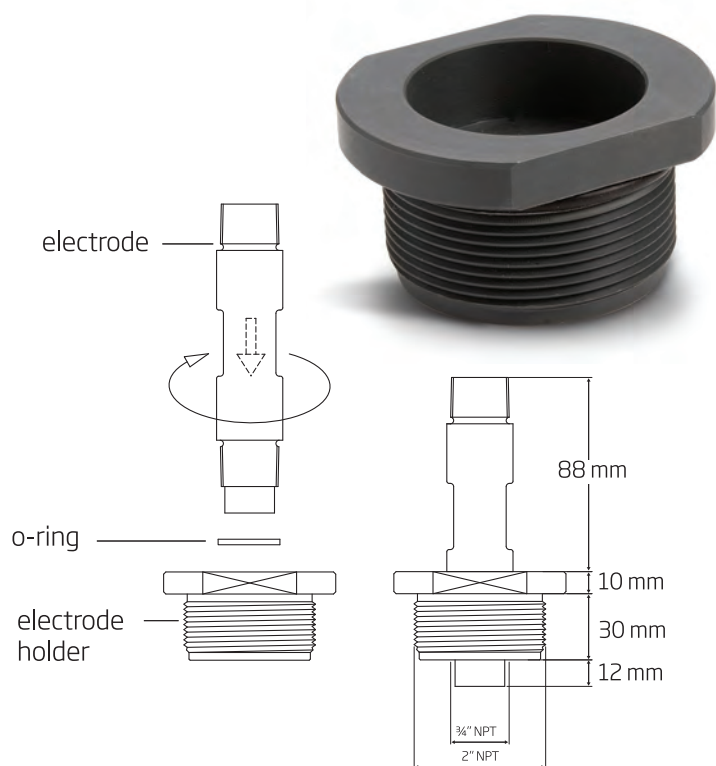
HI 60542 is a two inch NPT in-line PVC electrode holder ideal for direct pipe installation.

HI 60542 has been designed specifically to be used with HANNA  $\frac{3}{4}$ " NPT process electrodes with built-in temperature sensor and matching pin.

SPECIFICATIONS	HI 60542
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

### ACCESSORIES

HI 60542-0 1 set of O-rings



HI 60545

## By-pass Loop Electrode Holder

### No Downtime

HI 60545 is an electrode holder designed for use in a bypass loop configuration.

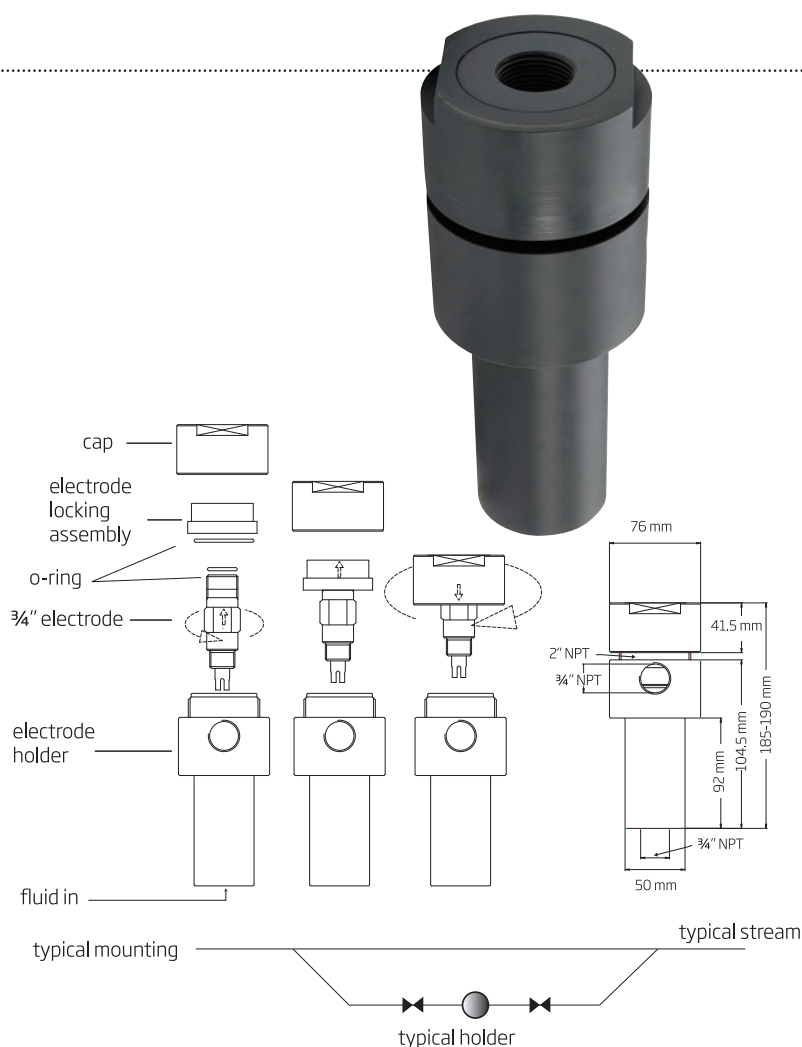
HI 60545 allows easy maintenance and calibration without shutting down the process. The design of HI 60545 assures that the glass sensor remains wet even when system is not under pressure.

HI 60545 is only for use with HANNA 1006 series probes that have a  $\frac{3}{4}$ " NPT fitting.

SPECIFICATIONS	HI 60545
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

### ACCESSORIES

HI 60545-0 1 set of O-rings



HI 6050

## 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.

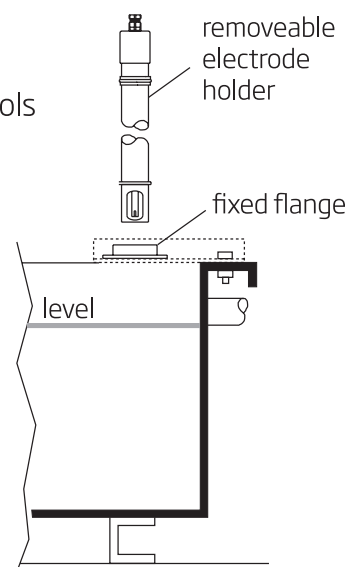
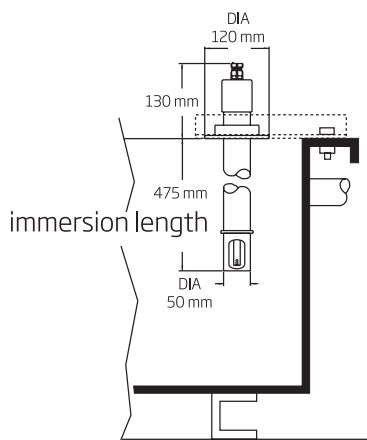
The mounting flange is a rugged PVC piece that mounts directly to the stainless steel brackets on your tank.

The figure illustrates the suggested bracket dimensions used for mounting. Once mounted to your tank, the electrode holder is a sturdy, protective housing that will extend the life of your electrodes.

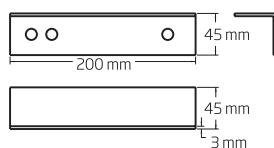
The electrode slides into the holder and is hand tightened into place. The cable from the electrode will lead up through the holder and out through the cap on top. The cable is also shielded inside the holder to prevent any damage to the insulation. The protective cap is removable to allow for quick and simple electrode maintenance and replacement.



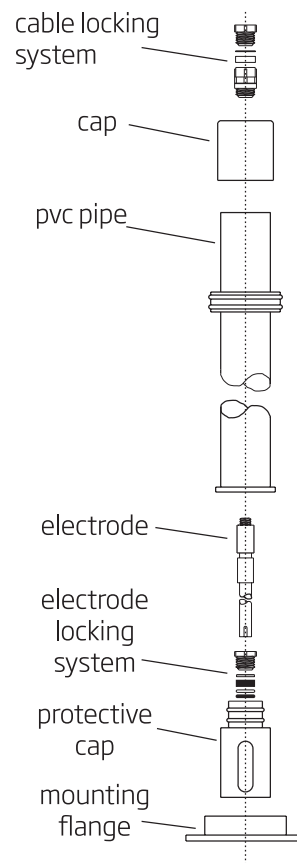
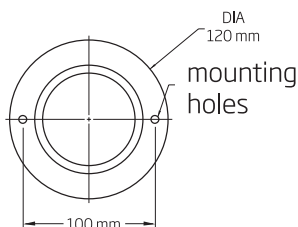
removable electrode holder will slide in and out of mounting flange without the need for tools



PVC construction requires no tools for maintenance



suggested dimensions of stainless steel mounting brackets to mount the flange onto the tank



SPECIFICATIONS	TOTAL LENGTH	WEIGHT	SUBMERSION LENGTH
HI 6050	605 mm (23.8")	0.8 kg (26 oz.)	475 mm (18.7")
HI 6051	1105 mm (43.5")	1.2 kg (44 oz.)	975 mm (38.4")
HI 6052	1605 mm (63.2")	2.0 kg (71 oz.)	1500 mm (59.1")



# Electrode Holders for In-line Applications

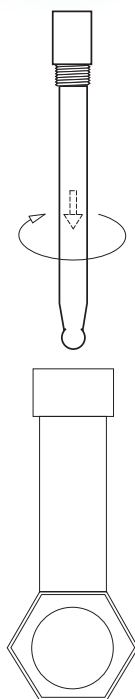
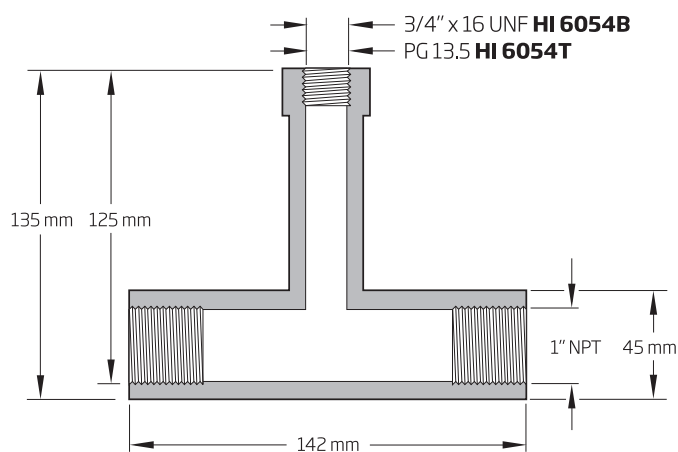
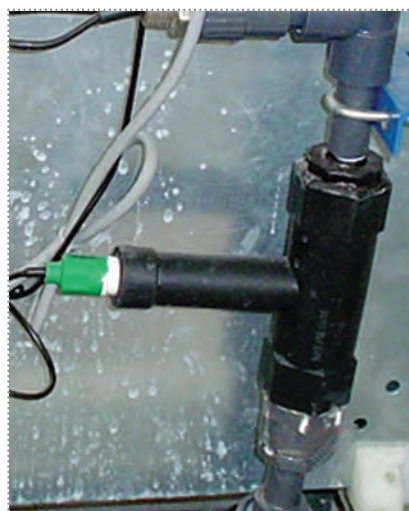


The HI 6054 is a rugged, fiber-reinforced polypropylene in-line electrode holder.

Simply install the holder in the line so that liquid will always be present inside the holder.

Once installed, the electrode will remain in contact with the fluid at all times, allowing the most accurate readings possible.

The HI 6054B and HI 6054T are designed specifically to work with HANNA electrodes with external thread of  $\frac{3}{4}$ " x 16 UNF and PG 13.5 respectively.

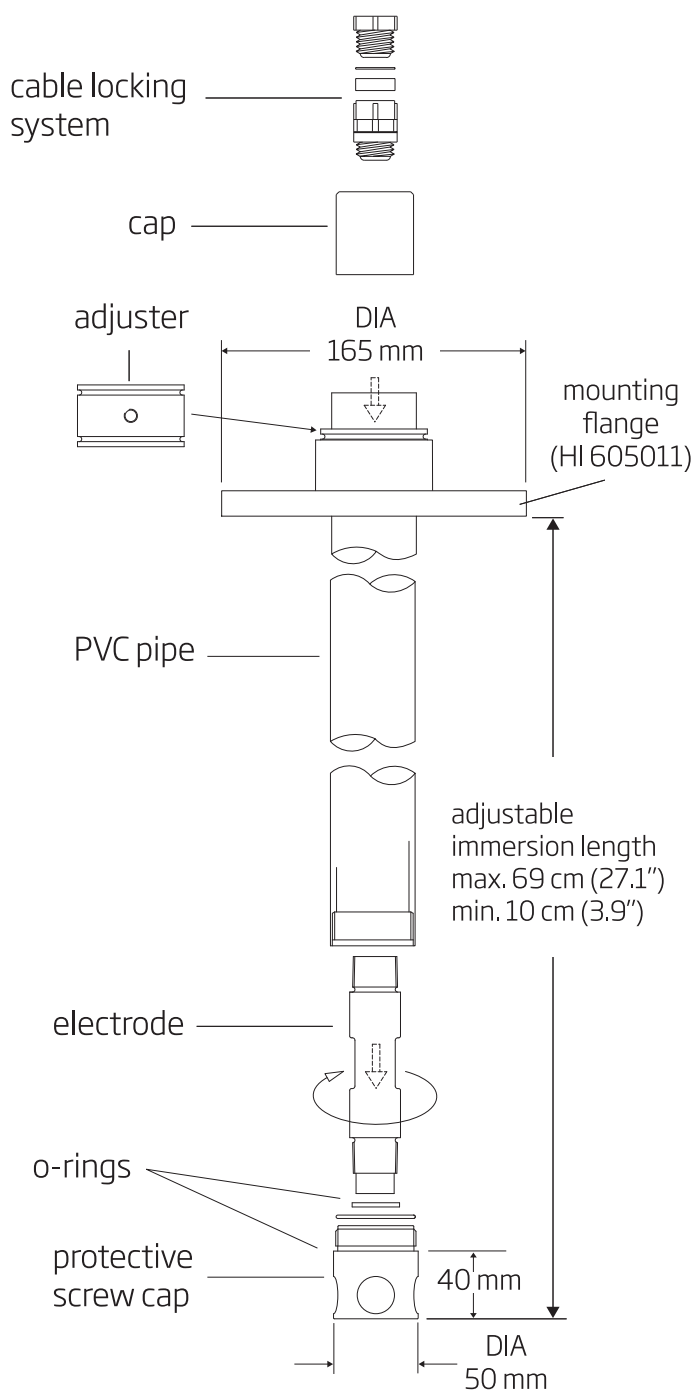
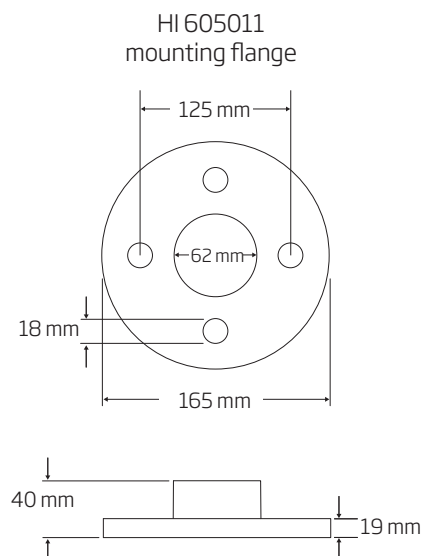


HI 60501 • HI 60503

## Immersion Electrode Holders for Tanks, Vessels, Baths and Open Channels

These electrode holders are adjustable length and have been designed for immersion applications. Simply set the flange adjuster and the flange (HI 605011) to your required length and install.

These holders have been designed specifically to be used with HANNA 1006 series probes that have a 3/4" NPT fitting.



HI 60503

### ACCESSORIES

HI 605011 PVC mounting flange  
HI 60501-0 1 set of O-rings

SPECIFICATIONS	HI 60501	HI 60503
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)