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BL931700	•									•	16.47
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Controller and Pump Systems

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BL 7917		•	•	1	1	•	16.60

Wall Mount Controllers

	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	Page
HI21	•				•	•	•	S or D	•	•		RS485	•			16.63
HI22		•			•	•	•	S	•	•		RS485	•			16.64
HI23			•		•	•	•	D	•		•	RS485	•			16.65
HI9913	•		•				•	S		•			•		•	16.66
HI9935	•			•			•	S		•			•		•	16.67
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HI98143-01	•		•	0-1 V		•		IP54		16.72
HI98143-04	•		•	0-4 V		•		IP54		16.72
HI98143-20	•		•	4-20 mA		•		IP54		16.72
HI98143-22	•		•	4-20 mA		•		IP54	•	16.72
HI8614N	•			4-20 mA	•	•		IP65		16.73
HI8614LN	•			4-20 mA	•	•	•	IP65		16.73
HI8615N		•		4-20 mA	•			IP65		16.73
HI8615LN		•		4-20 mA	•		•	IP65		16.73
HI8936 series			•	4-20 mA	•	•		IP65		16.74

BL120/BL121

pH/ORP Swimming Pool Controllers with Built-In Chemical Feed Pump

The BL120 and BL121 are an all-in-one solution for automatic control of pH and chlorine levels in swimming pool, hot tub, and spa water.

See page 16.16

PCA340

Chlorine, pH, and Temperature Analyzer

PCA340 analyzer is the newest addition to the PCA family and features two analog outputs. PCA340 features built in data logging, RS485 digital output, dosing relays, and alarm relays packaged in a wall mount Nema 4x enclosure.

See page 16.10

HI8000 Series

Fertigation Control Systems

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

HI8000 series models can be selected based on the irrigation and fertilization type.

Up to 10 irrigation programs can be set by the user with different irrigation parameters: irrigation periods, type of irrigation control, irrigated sectors and volume or irrigation time specified for each sector, conditions to start irrigation such as time, accumulated solar radiation, low level in tanks (hydroponic crops), temperature variations, linked to another program, priority of program, number of repetitions. For irrigation water, each program has a defined pH set point, EC set point (if the quantity of fertilizer is dosed according with conductivity), and receipt of fertilizers. Control of agitators is specified by programs according with the irrigation periods

See page 16.6

HI8000 Series

Fertigation Control Systems

- Connectivity
  - PC compatible
- Alarm
  - Alarm and warning system
- Backlight
  - Backlit, LCD display

Wall Mount

Variety and customization of models

A wide variety of models are available to cover the requirements of specific fertigation applications. The HI 8000 series are fully customizable and upgradable on the hardware and program level.

HI8000 series models can be selected based on the irrigation and fertilization type of control along with the additional features that are proper for the specific application.

Some of the most important criteria in selection of controller type are: number of irrigated sectors: 8, 16, 24, 32; type of irrigation control: in volume or in time; type of fertilizer control: by EC, by Volume, ratiometric; type of pH correction: acid or alkaline; control of incoming water: one, two or three sources of water; control of dosing with venturi or motorized electrovalves; redundancy of the conductivity or pH probes; mounting solution: panel or wall mounted.

Panel Mount

Irrigation control

Irrigation control differs based on the type of control: by irrigation water volume or by irrigation time; the number of sectors that have to be irrigated, the available sources of water for irrigation – one or more with or without reusing the irrigation drain water.

Irrigation control is started by opening the irrigation valves and starting the main irrigation pump. The control of all these elements is performed by the controller based on concepts of irrigation programs.

Irrigation programs

Up to 10 irrigation programs can be set by the user with different irrigation parameters: irrigation periods, type of irrigation control, irrigated sectors and volume or irrigation time specified for each sector, conditions to start irrigation such as time, accumulated solar radiation, low level in tanks (hydroponic crops), temperature variations, linked to another program, priority of program, number of repetitions. For irrigation water, each program has a defined pH set point, EC set point (if the quantity of fertilizer is dosed according with conductivity), and receipt of fertilizers. Control of agitators is specified by programs according with the irrigation periods.

Irrigation water

The quality of irrigation water is assured by proper control of pH and the quantity of nutrients (fertilizers) present in irrigation water.

Fertilization control

Fertilizer can be dosed during irrigation using the Venturi tubes principal or with motorized valves. The control of the quantity of dosed fertilizer can be performed using the volume counters. The system supports dosing from up to 4 fertilizer tanks with specific receipts.

The concentration of the fertilizer in irrigation water can be controlled based on the conductivity reading, proportional with irrigation water based on the receipt or ratiometric, in which case the certain quantity of fertilizers are added with the amount of programmed water.

pH control

The pH control is performed in order to adjust the pH of water to the irrigation program set point.

The pH correction can be performed with alkaline or acid solution based on the characteristic of the incoming water.

The control of pH and EC is performed with PID, PI or proportional control. The tuning of the PID control can be accomplished by the user manually, or automatically by the PID auto-tuning feature.

Agitators and filter cleaning

The automatic control of agitators used in fertilizers tanks and filter cleaning system complete the needs of a standard fertigation system.

In order to keep the fertilizer concentration constant before and during the irrigation program, the fertilizers are mixed in their tanks based on the agitators program. The system can manage up to two filters mounted to protect the probes and in-line dosing elements.

With differential presostates, the filters are monitored and when necessary, the irrigation programs are automatically suspended and washer filter cleaning is started. This process removes any deposits and sediments that may appear on filters to increase the systems life.

Redundancy of EC and pH probes

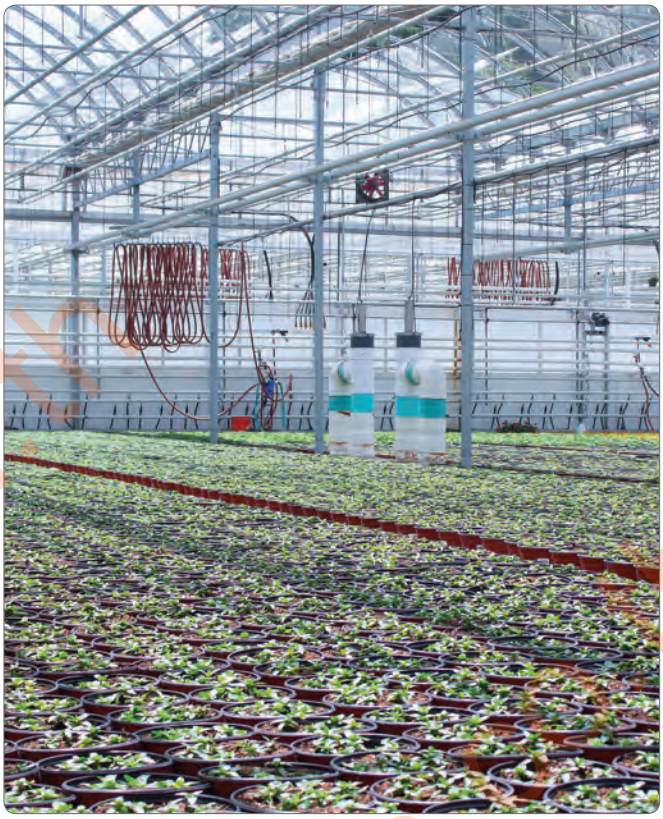
For safety reasons, the systems can be equipped with 2 conductivity probes and two pH electrodes in redundancy so that the system can generate an alarm in the case of reading differences between them. A third conductivity probe can be mounted to verify and compensate the incoming water conductivity.

Logging system

The logging of the controller can be selected on three levels: input reading variations, statistics of reading (average of pH and EC) or events (start of programs, opening valves, ...).

Alarm system

The alarms of these systems are related to measured water quality parameters like conductivity and pH: out of range, differential reading between redundant probes; over dosing of conductivity or acid or alkaline correction solution, tanks at low level or no dosing detected by counter movement. Similar alarms can be generated after the units self-diagnostic tests are run.



Sensor connections

All the sensors: EC, pH, temperature are connected to the controller via transmitters.

pH and EC are temperature compensated on the transmitter level. The output of analog transmitters can be calibrated at two points for pH and conductivity. Also, the controller offers a calibration in two points for pH and one point for conductivity.

User interface and digital connection

The user interface is based on an 4 x 20 character line LCD, organized for settings and consultancy. The UI has multi-language support.

The RS232 connection permits the connection to a PC.

Internal back-up system

The systems internal back-up power system offers a special feature; in the case of losing external power, the controller will stop the irrigations and memorize the irrigation programs that were not performed. The controller will start from the uncompleted programs after power has been restored. The programs will be executed based on their priority level with full respect of the quantity of irrigation water, pH level, and concentration of fertilizers.

Additional features that can be found are control of the external power supply and control of mixing of different water sources (clean water, drain irrigation water).

Two panel mount units used in a fertigation system

HI8001 (panel mount) and HI8002 (wall mount) models

The HI8001 and HI8002 fertigation controllers provide up to 10 programs to irrigate up to 32 sectors using time or volume irrigation control. Each irrigation program has one pH and one EC setpoint. The start condition of the program, the irrigation sectors and the time or volume for each sector are user defined. The irrigation water is pH corrected based on the pH control, with acid or alkaline solution and can contain nutrients for crops based on up to 4 fertilizer receipts. Correction of time or volume of irrigated water can be based on accumulated solar radiation or can be manually requested by user. Agitator control and filter cleaning control are performed automatically. The instruments read up to 3 EC probes, one to verify the incoming water EC, and the other two are in-line redundant for safety to measure the current irrigation water EC. The two pH electrodes are mounted in-line redundant for safety to read the irrigation water pH. The instruments provide an alarm system and logging organized on user selectable three levels.

HI8051 (panel mount) model

The HI8051 fertigation controller provides up to 10 irrigation programs to irrigate up to 24 sectors using time or volume control. Each irrigation program has one pH and one EC setpoint. The start condition of the program, the irrigation sectors and the time or volume for each sector are user defined. The irrigation water is pH corrected based on the pH control with acid or alkaline solution and can contain nutrients for crops based on up to 4 fertilizer receipts. Fertilizer dosing is performed based on the EC, volumetric or ratiometric control. Another important feature is the correction of irrigated water volume or time based on accumulated solar radiation or manually requested by user. Agitator control and filter cleaning control is performed automatically. The instrument reads up to 3 EC probes, one to verify the water incoming EC, and the other two redundant in-line for safety, to measure the current irrigation water EC. The two pH inputs are mounted in-line redundant for safety to read the irrigation water pH. This instrument provides an alarm system and logging organized on three user selectable levels. An important added feature is this models ability to mix 3 sources of incoming water. Fresh water, reused water and all dosing are performed based on the motorized valves that are activated by motors that allow different flows of the fertilizers, acid and alkaline solutions used for pH correction.

HI98143 pH/EC Transmitter

Models	HI8001/HI8002	HI8051
Irrigation control	Time/volume control, 10 programs/5 priority levels with up to 99 repetition	Time/volume control, 10 programs/5 priority levels with up to 99 repetition
Irrigation start condition	By Time, by solar radiation, by 5 external tank low level	By Time, by solar radiation, by 5 external tank low level
Fertilization control	By EC	By EC, By volume, Ratiometric
Fertilizers	Up to 4 valves	Up to 4 motorized valves
pH control/correction	Acid or alkaline	Acid or alkaline, motorized pump
Agitators control	Yes	Yes
Filter control/cleaning	2 differential presostate/2 filter cleaning relays	2 differential presostate/2 filter cleaning relays
Fertilizer tank levels/ counters control	Level	Level and counters
Irrigation counter	Yes	Yes
Acid/Alkaline tank level/ counter control	Level	Level and counter
EC inputs	Up to 3, 0.0 to 10 mS/cm	Up to 2, 0.0 to 10 mS/cm
pH inputs	Up to 2, 0.0 to 14.0 pH	1, 0.0 to 14.0 pH
Temperature Compensation	EC, pH	EC, pH
Solar radiation input	1; 0 to 2000 W/m2	No
Temperature	No	1
Wind speed	No	No
Engine power back-up	No	No
Irrigated sectors	Up to 32	Up to 24
Mixing source of water	No	Yes, 3 sources
PC connectivity	RS 232	
Alarms	Yes, user selectable levels	
Logging	Yes, three level	
Power Supply	115V/220V ±10% 50Hz/60Hz	
Environment	wall mounted: NEMA 4X specifications	
Dimensions	wallmounted: 280 x 330 x 165 mm (11.2 x 13.2 x 6.6"); panel mounted: 178 x 260 x 116 mm (7.1 x 10.4 x 4.6")	
Weight	wall mounted: 4.95 Kg (11 lb.); panel mounted: 3.4 Kg (7.5 lb.)	

Ordering Information

Each HI8000 Series model is supplied instructions.

Choose your configuration:

HI8001-0100U Fertigation controller with priorityfor pH and EC, panel mount, 8 sectors, English, 115V.

HI8001-0100D Fertigation controller with priorityfor pH and EC, panel mount, 8 sectors, English, 230V.

HI8001-0200U Fertigation controller with priority for pH and EC, panel mount, 16 sectors, English, 115V.

HI8001-0200D Fertigation controller with priority for pH and EC, panel mount, 16 sectors, English, 230V.

HI8001-0300U Fertigation controller with priority for pH and EC, panel mount, 16 sectors, English, 115V.

HI8001-0300D Fertigation controller with priority for pH and EC, panel mount, 16 sectors, English, 230V.

HI8001-0400U Fertigation controller with priority for pH and EC, panel mount, 32 sectors, English, 115V.

HI8001-0400D Fertigation controller with priority for pH and EC, panel mount, 32 sectors, English, 230V.

HI8002-0100U Fertigation controller with priority for pH and EC, wall mount, 8 sectors, English, 115V.

HI8002-0100D Fertigation controller with priority for pH and EC, wall mount, 8 sectors, English, 230V.

HI8002-0200U Fertigation controller with priority for pH and EC, wall mount, 16 sectors, English, 115V.

HI8002-0200D Fertigation controller with priority forpH and EC, wall mount, 16 sectors, English, 230V.

HI8002-0400U Fertigation controller with priority for pH and EC, wall mount, 32 sectors, English, 115V.

HI8002-0400D Fertigation controller with priority for pH and EC, wall mount, 32 sectors, English, 230V.

HI8051-0300U Acid based fertigation controller with dual pH control, differential EC control, actuator control, multiple dosing and irrigation pump control, panel mount, 24 sectors, English, 115V.

HI8051-0300D Acid based fertigation controller with dual pH control, differential EC control, actuator control, multiple dosing and irrigation pump control, panel mount, 24 sectors, English, 230V.

Required Accessories	**HI98143-22** pH/EC isolated transmitter, 4-20 mA sourcing current output *1 transmitter is needed in configuration with 1 EC probe and 1 pH probe (no probe redundancy feature)* *2 transmitters are needed in configuration with 2 EC probes and 2 pH probes (for probe redundancy feature)* *3 transmitters are needed in configuration with 3 EC probes and 2 pH probes (for probe redundancy feature and EC water incoming compensation)*
Recommended Accessories	**HI1001** "flow-thru", double junction pH electrode with BNC connector and 3 m (10') cable. *1 or 2 electrodes are needed (2 electrodes for probe redundancy feature)*
	HI3001 "flow-thru", 4 platinum ring EC probe with built-in temperature sensor & 3 m (10') cable. *1, 2 or 3 probes are needed (2 for probe redundancy feature; 3 for probe redundancy feature and EC water incoming compensation)*
	HI60542 Electrode Holder for Direct Pipe (Order according with the total amount of ordered probes)
	HI710005 115 VAC to 12VDC power adapter
	HI710006 230 VAC to 12VDC power adapter

pH electrodes begin on page 2.113; pH and ORP solutions begin on page 2.136;
EC solutions begin on page 5.34

PCA300 Family

Chlorine, pH, ORP and Temperature Analyzers

- Backlit LCD display
- Nema 4X protection
- DPD chlorine measurement method
- Colorimeter diagnostics
- Reagent reminder
- Amplified pH/temperature probe
- Data logging of up to 3500 measurements
- GLP data for review of calibration information
- Digital RS485 output
- Two analog outputs for recording or dosing devices (PCA340)
- Two dosing relays
- SPDT alarm relay
- SPDT system error relay
- Warning messages

The PCA family are process analyzers for the continuous measurement of chlorine, pH (PCA320, PCA330, PCA340) and temperature. These analyzers feature built in data logging, RS485 digital output, dosing relays, and alarm relays packaged in a wall mount Nema 4x enclosure. The PCA340 also features two analog outputs.

This family uses DPD Colorimetric method in which N, N-Diethyl-p-phenylenediamine indicator and a buffer are mixed together with the sample. The resulting chemical reaction causes a magenta color to form in the presence of chlorine. The color intensity is proportional to the concentration. The color intensity is measured photometrically (light source at a specific wavelength and a photodetector) and converted to chlorine concentration, in mg/L, which is displayed on the front panel. The sampling interval for chlorine measurement is adjustable from 3 to 90 minutes. These analyzers have a dosing relay for the addition of chlorine by a dosing pump or chlorine generator when a reading is below the programmable set point. The technology used by this family for chlorine measurement is the same as that found in portable and benchtop colorimeters providing for consistent results when performing process verification with one of those types of meters.

The PCA320, PCA330 and PCA340 also utilize the HI1005 amplified pH electrode with a built in pt100 temperature sensor and matching pin to measure both pH and temperature. The built in amplifier and matching pin provide for exceptional performance against any electrical noise generated by pumps and motors. These analyzers have a programmable dosing relay for the adjustment of pH. The dosing relay can be activated by either on/off or proportional control.

The PCA340 features two selectable 0-20 or 4-20 mA signal output that are scalable for the transmission of readings to external recording devices. The analog outputs can also be set for dosing and used with dosing pumps that accept a 4-20 mA analog input. The analog outputs can be used for any of the three measured parameters.

Through the system setup menu, users have the ability to enable or disable the low and high level of alarms for all parameters. The PCA family also offers overdosing protection that generates an alarm if something within the system is not working properly. The system will stop processes until the user corrects the error.

Backlit LCD Display

The PCA family has a backlit display that is easy to read from a distance and allows for up to three parameters to be displayed at a time.

Nema 4X Protection

These analyzers are enclosed in waterproof casing for superior protection against the elements. The front door of the case has a window for the measurement display while also shielding the DPD reagents from UV light to prevent premature degradation.

DPD Chlorine Measurement Method

The DPD colorimetric method is one of the most common and reliable methods to measure chlorine. The PCA family can use either free or total chlorine reagents and allow for 16,000 measurements to be performed.

Reagent Reminder

The PCA family has a reagent reminder feature to alert the user when the reagents are running low. When the reagents are changed the counter is reset and the meter automatically tracks the number of readings performed.

Colorimeter Diagnostics

Advanced diagnostics allow for easy troubleshooting of the colorimeter. In the setup menu it is possible to select an option that allows the user to determine the difference between a dark read (LED off) and a blank read (LED on). These analyzers also automatically perform this check in order to determine when to alert the user that the sample cell needs to be cleaned.

Amplified pH/Temperature Probe (PCA320, PCA330, PCA340)

An integrated pt100 temperature sensor allows for automatic temperature compensation of pH measurements and allows for monitoring temperature as well. The built in amplifier and matching pin provides for exceptional performance where other probes fail when placed in line with pumps and motors.

Data Logging

The analyzers can store up to 3500 readings (at least 7 days worth of records when set to a 3 minutes sampling interval) that can be reviewed or downloaded to a Windows compatible PC using the HI92500 software and the RS485 serial port. Logged records contain the date time and reading of all parameters measured along with any alarm status.

GLP Data

The GLP data allows for the user to review the data and time for the last Chlorine and pH calibration.

Digital RS485 Output

These analyzers have a RS485 digital output that allows for connection to a Windows compatible PC running the HI92500 software. The software allows for remote monitoring, review of logged data, events and errors, and executing setup options.

Two Analog Outputs (PCA340)

The PCA340 features two selectable 0-20 or 4-20 mA signal output that are scalable for the transmission of readings to external recording devices. The analog outputs can also be set for dosing and used with dosing pumps that accept a 4-20 mA analog input. The analog outputs can be used for any of the three measured parameters.

Two Dosing Relays

The dosing relays of these analyzers can be connected to a pH and/or chlorine dosing pumps. The chlorine relays are proportionally controlled while the pH relay can be set for on/off or proportional control. The proportional control offers very fine control of doing to prevent any overshoot and wastage of chemicals.

Alarm Relay

One SPDT alarm relay is provided that can be activated by adjustable upper and lower chlorine, pH and temperature limits.

Error Relay

One SPDT error relay is provided and is activated when an error is present including a problem with the colorimeter such as when the reagent counter has reached zero, or when a reading is outside the range for a measured parameter.

Warning Messages

Error messages are displayed when the reagents are expired or low and if the colorimeter cell needs to be cleaned.

See page 16.15 for spare parts and solutions

Specifications		PCA310	PCA320	PCA330	PCA340
Free and Total Chlorine	Range	0.00 to 5.00 mg/L (ppm)	0.00 to 5.00 mg/L (ppm)	0.00 to 5.00 mg/L (ppm)	0.00 to 5.00 mg/L (ppm)
	Resolution	0.01 mg/L (ppm)	0.01 mg/L (ppm)	0.01 mg/L (ppm)	0.01 mg/L (ppm)
	Accuracy	± 8% or ±0.05 mg/L whichever is greater	± 8% or ±0.05 mg/L whichever is greater	± 8% or ±0.05 mg/L whichever is greater	± 8% or ±0.05 mg/L whichever is greater
pH	Range	–	0.00 to 14.00 pH	0.00 to 14.00 pH	0.00 to 14.00 pH
	Resolution	–	0.01 pH	0.01 pH	0.01 pH
	Accuracy	–	±0.05 pH	±0.05 pH	±0.05 pH
ORP	Range	–	–	0 to 2000 mV	–
	Resolution	–	–	1 mV	–
	Accuracy	–	–	±1 mV	–
Temperature	Range	–	5.0 to 75.0 °C (41 to 167 °F)	5.0 to 75.0 °C (41 to 167 °F)	5.0 to 75.0 °C (41 to 167 °F)
	Resolution	–	0.1 °C	0.1 °C	0.1 °C
	Accuracy	–	±0.5°C	±0.5°C	±0.5°C
Additional Specifications	Chlorine Calibration	one-point process calibration			
	Chlorine Sampling Rate	adjustable from 3 to 90 minutes			
	Chlorine Dosage	proportional			
	Chlorine Delta	selectable from 0.1 to 5 mg/L (ppm)			
	pH Calibration	automatic one or two points; one point process calibration			
	pH Sampling Rate	adjustable from 3 to 120 seconds			
	pH Dosage	ON/OFF or proportional, relay or 4-20mA output			
	pH Delta	selectable from 0.1 to 2 pH (hysteresis adjustable from 0.05 to 2 pH)			
	Analog Output	–			(2) 4-20mA, 0-20mA for recorder or dosing
	Recorder Output	4-20mA, 0-20mA			–
	PC Connectivity	RS485 port, galvanically isolated			
	Baud Rate	1200, 2400, 4800, 9600 bps			
	Data Logging	up to 3500 data points			
	Alarm Relay	SPDT contact with 5A, 230V resistive load			
	Dosing Relay	SPDT contact with 5A, 230V resistive load			
	System Error	SPDT contact with 5A, 230V resistive load			
	Inlet Pressure	0.07 to 4 bar with no external pressure regulator (for pressure exceeding four bar an external pressure regulator is required)			
	Sample Flow	100 to 300 mL/min			
	Sample Temperature	5 to 40°C (41 to 104°F)			
	Sample Inlet/Outlet Connection	12mm (1/2") male NPT fitting			
	Drain Connection	10mm (3/8") barb			
	Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz; 20 VA			
	Enclosure	NEMA-4X standard, molded fiberglass polyester with transparent Lexan window			
	Dimensions / Weight	318 x 267 x 159 mm (12.5 x 10.5 x 6.25") / 5 kg (11 lb.) without reagents			

Ordering Information

Each PCA300 series model is supplied with reagent bottles (2), reagent caps (2), 1 DPD compound powder, tubing and instructions.;

PCA310-1 Free & total chlorine analyzer/control (115V);

PCA310-2 Free & total chlorine analyzer/control (230V);

PCA320-1 Free & total chlorine analyzer/control, pH control, temperature (115V);

PCA320-2 Free & total chlorine analyzer/control, pH control, temperature (230V) ;

PCA330-1 Free & total chlorine analyzer/control, pH control, ORP monitoring, temperature (115V);

PCA330-2 Free & total chlorine analyzer/control, pH control, ORP monitoring, temperature (230V)

PCA340-1 Free & total chlorine analyzer/control, pH control, temperature with dual analog outputs (115V);

PCA340-2 Free & total chlorine analyzer/control, pH control, temperature with dual analog outputs (230V)

Swimming Pools and Chlorine for Disinfection

In regards to swimming pool treatment, disinfection or sanitizing basically means to rid the pool of bather contamination, destroy bacteria, and control nuisance organisms like algae, which may occur in the pool, filtration equipment, and piping. Of the many techniques used (chlorine, bromine and iodine dosing systems), chlorine is the most common.

Chlorine

Chlorine is a strong oxidizing agent that destroys mostly organic pollutants and bacteria and can combine with nitrogen containing compounds, forming chloramines. When dosing chlorine for disinfection, only a portion of the dosed chlorine remains active to actually continue the disinfection process.

When free chlorine combines with a nitrogen containing compound it becomes a less efficient disinfectant called chloramines. The addition of these two parts gives total chlorine. The target is to keep free and total chlorine equal, and thus to maintain the combined chlorine concentration chloramines) near zero. The presence of chloramines is not desired because of the distinctive 'swimming pool' smell caused by combined chlorines like di-chloramines. Beside this unpleasant odor, chloramines can irritate the eyes and the mucous membranes.

Commercial chlorine for disinfection may be available as a gas (Cl_2), a liquid like sodium hypochlorite or bleach (NaOCl) or in a solid state like calcium hypochlorite, chloro-hydantoins or chloro-cyanuric acid compounds. These compounds, once dissolved in water do establish equilibrium between the hypochlorous acid (HOCl) and the hypochlorite ions (OCl^-). Although both forms are considered free chlorine, it is the hypochlorous acid that provides the strongest disinfecting and oxidising characteristic of chlorine solutions; the amount of hypochlorous acid in chlorinated water dependends upon the pH value of the solution. Changes in pH value will affect the HOCl equilibrium in relation to the hydrogen and hypochlorite ion; HOCl decreases and OCl^- increases as pH increases. At a low pH, almost all the free chlorine is in the molecular form HOCl and at a pH of around 7.5, the ratio between HOCl and OCl^- is 50:50. Since the ionic form OCl^- is a slow acting sanitizer while the molecular HOCl is a fast acting, it is important to regularly measure the pH. As a general rule a pH of about 7.2 is recommended to maintain fast acting disinfection conditions.

PCA Parts and Solutions

Graphic display with backlight

LED indicators for different working modes

Keyboard for all parameter settings

Peristaltic pump for accurate reagent dosage

Incoming pressure regulator

Buffer and indicator reagents for DPD method

Hinged cover with window for easy maintenance

Measurement cell with LCD light source

Port to quickly drain the measurement cell at the end of the cycle

External enclosure according to NEMA 4X standard for best protection

PCA Parts and Solutions

Parts

HI70473	PCA tubing kit, pressure regulator to drain (2). Each kit includes: transparent Tygon tubes 86L x 3.2ID mm (3.4 x 0.1") (Length x Internal Diameter) **(1, 2)** and 105 x 9.5 mm (4.1 x 0.4") **(3)**
HI70474	PCA peristaltic pump tubing kit (6). Each kit includes: non-transparent C-flex tubes 55L x 0.8ID mm (2.1 x 0.03") **(5)**
HI70475	PCA peristaltic pump tubing kit (2). Each kit includes: non-transparent C-flex tubes 55L x 0.8ID mm (2.1 x 0.03") **(5)**
HI70476	PCA reagent bottle tubing kit (6). Each kit includes: non-transparent C-flex tubes 155L x 0.8ID mm (6.1 x 0.03") **(11)**
HI70477	PCA tubing set for measuring cell (2). Each set includes: non-transparent C-flex tube 50L x 0.8ID mm (2.0 x 0.03") **(8)** and Y strainer **(7)**
HI70478	PCA tubing kit, bottle to pump (6). Each kit includes: non-transparent C-flex tube 150L x 0.8ID mm (5.9 x 0.03") **(4)**
HI70479	PCA tubing kit, pump to Y strainer (6 pcs). Each kit includes: non-transparent C-flex tube 150L x 0.8ID mm (5.9 x 0.03") **(6)**
HI70482	PCA filters. The kit includes 0.5 µm and 50 µm filters **(13)**
HI70496	Replacement filter, 0.5 µm **(15)**
HI70497	Replacement filter, 50 µm **(16)**
HI70483	PCA complete tubing kit. The kit includes: non-transparent C-flex tubes **(4, 6)** 150L x 0.8ID (5.9 x 0.03") (4 pcs), non-transparent C-flex tubes **(5)** 55L x 0.8ID (2.1 x 0.03") (2 pcs), non-transparent C-flex tubes **(8)** 50L x 0.8ID (2.0 x 0.03") and Y strainer **(7)**
HI70484	PCA complete tubing kit (3). Each kit includes: non-transparent C-flex tubes **(4, 6)** 150L x 0.8ID (5.9 x 0.03") (4 pcs), non-transparent C-flex tubes **(5)** 55L x 0.8ID (2.1 x 0.03") (2 pcs), non-transparent C-flex tubes **(8)** 50L x 0.8ID (2.0 x 0.03"), Y strainer **(7)**
HI70485	PCA stirrer motor
HI70486	PCA stirring bar **(2)**
HI70487/N	Measuring cell **(9)**
HI70488	Electrovalve, 24VAC/60Hz **(12)**
HI70489	Electrovalve, 24VAC/50Hz **(12)**
HI70492	Electrode holder (PCA330)
HI70493	Closing cap for electrode holder

Electrodes

HI1005	Amplified pH electrode with Matching Pin and Pt100 **(14)** (PCA320/330 only)
HI2008	Amplified ORP electrode with Matching Pin **(17)** (PCA330 only)

Reagent Sets

HI70431	Total Chlorine reagent set for PCA (buffer citrate), 500 mL (2)
HI70481	Total chlorine reagent set for PCA, 500 mL (2) + 5 powder sachets (DPD)
HI70491	Total chlorine reagent set for PCA, 500 mL (2) + 5 poweder sachets (DPD)
HI70430	Free chlorine reagents set for PCA (the most stable), recommended for long term measurements, 500 mL (2) + 6 g powder
HI70480	Free chlorine reagents set for PCA, recommended for short term measurements, 500 mL (2) + 5 sachets (DPD)
HI70490	Free chlorine reagents set for PCA, 500 mL (2) + 5 sachets (DPD)
HI70452	DPD reagent,5 sachets

Solutions

HI70460	Total chlorine indicator solution for PCA, 500 mL*
HI70461	Total chlorine buffer solution for PCA, 500 mL
HI70450	Free chlorine indicator solution for PCA, 500 mL*
HI70451	Free chlorine buffer solution for PCA, 500 mL
HI7004L	pH 4.01 buffer solution, 500 mL
HI7006L	pH 6.86 buffer solution, 500 mL
HI7007L	pH 7.01 buffer solution, 500 mL
HI7009L	pH 9.18 buffer solution, 500 mL
HI7010L	pH 10.01 buffer solution, 500 mL
HI7020L	200-275 mV buffer solution, 500 mL
HI7091L	Pretreatment reducing solution, 500 mL
HI7092L	Pretreatment oxidizing solution, 500 mL
HI70300L	Storage solution, 500 mL
HI7082	3.5M KCL electrolyte, 30 mL
HI7061L	Electrode cleaning solution, 500 mL

Software

HI92500	Windows® compatible software

* After addition of 5 powder sachets (HI70452-0)

BL120 and BL121

pH/ORP Swimming Pool and Spa Controllers with Built-In Chemical Feed Pumps

The BL120 and BL121 are an all-in-one solution for automatic control of pH and chlorine levels in swimming pool, hot tub, and spa water.

The BL120 and BL121 Swimming Pool Controller is a complete system designed for maintaining swimming pool, hot tub, and spa disinfection water quality. These controllers are available in two configurations. The basic version is the in-line model which allows for direct installation of probe and chemical injection fittings into existing piping. A panel mounted version with a bypass flow cell is also available. The bypass flow cell allows for calibration and maintenance of the probe without having to shut down the recirculation pump.

The BL120 and BL121 use a multiparameter digital HI1036-1802 probe that incorporates pH, ORP, and temperature sensors along with a matching pin. All readings are measured within the probe and the data transferred to the controller by a digital connection. Both a digital connection and matching pin provide for stable, reliable measurements. Without these two components, electrical noise from recirculation pumps and ground loops can interfere, causing erratic readings and premature probe failure.

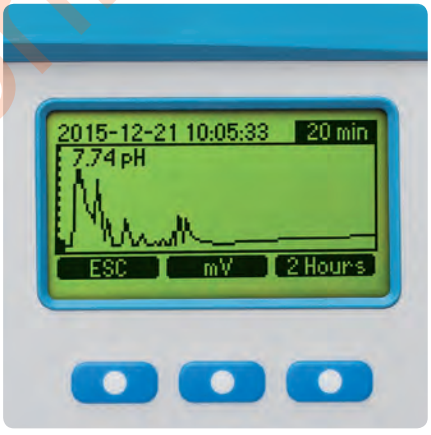
These controllers have two built-in peristaltic chemical feed pumps that are proportionally controlled with adjustable flow rates. One of the pumps is used to dose acid while the other is used to dose chlorine. The effectiveness of the available chlorine, as determined by ORP, is inversely related to the water's pH value. A pool with a fixed concentration of chlorine will show a decrease in ORP as the pH of the water increases. The BL120 and BL121 utilize a dosing consent feature that will not dose chlorine until the pH value is first corrected, since it is possible to have a low ORP value even though there is sufficient chlorine. The dosing consent feature will prevent chemical wastage and having a higher chlorine concentration level than desired.

For compliance monitoring, BL120 and BL121 have a built-in datalogger. Measurement readings are logged every 10 seconds with a new log starting for each new day or when the instrument is calibrated. Logged data include pH, ORP, and temperature values, last calibration data, setup configuration, and any event data.

For BL121 models, three 4-20 mA analog outputs are available for users that wish to connect to an external chart recorder or datalogger to monitor any of the three measured parameters. The outputs are scalable, offering increased flexibility and better resolution as needed.

Additional features of the BL121 include LED indicators for dosing, meter status and service, real-time graph display, programmable alarms, and password protection.

These controllers are an all-in-one solution for automatic control of pH and chlorine levels in swimming pool, hot tub, and spa water.



Three Display Modes

The versatile display of the BL120 and BL121 allows for three display modes. The LCD can display all three parameters at one time, a 3-second cycle of single parameters, or a real-time plot screen with options for parameter selection, zooming, and log recall.

Peristaltic Dosing Pumps

BL120 and BL121 are equipped with two peristaltic dosing pumps with replaceable chemical resistant tubing. A problem that occurs with chlorine dosing pumps is the formation of chlorine gas. When using a diaphragm pump, chlorine gas can collect in the pump head and cause the pump to lose prime; the buildup of chlorine gas is not a problem with peristaltic pumps that use rollers and tubing.

Automatic Proportional Pump Control

BL120 and BL121 feature proportionally controlled dosing pumps. Based on the sensitivity of the process to chemical addition, these controllers allow the user to adjust a proportional band. This setting determines the amount of time that the pumps are dosing as a percentage of the deviation from the set point. For example, a large body of water will use a small proportional band; having a small band (e.g., 0.1 pH) will ensure the pumps are dosing more often when the reading is close to the set point. For smaller bodies of water such as hot tubs or spas, it is more useful to set a larger proportional band (e.g.,1.0 pH); when the reading is close to the set point, the amount of time that the dosing pump is on is minimal to avoid large swings of pH or ORP. This valuable feature allows for very fine control in maintaining the desired set point.

Adjustable Flow Rate

The flow rate from the dosing pumps is adjustable from 0.5 to 3.5L/h. Larger bodies of water require more chemical to be dosed than small bodies since it takes more chemical to see a change in the reading. The adjustable flow rate, like the proportional band, allows for better control in maintaining a desired set point.

ORP (Chlorine) Dosing Consent

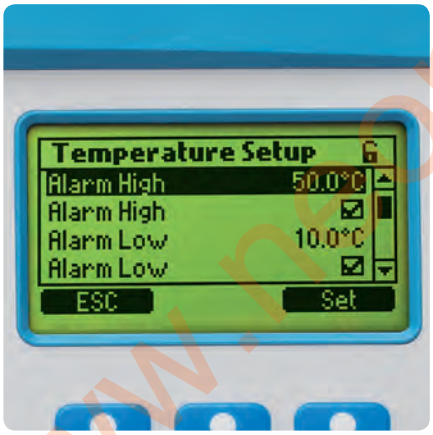
Both pH and ORP meters are commonly used with swimming pools. With chlorine disinfection there is an inverse relationship between pH and ORP. As the pH level increases, the ORP level decreases. The BL120 and BL121 utilize a dosing consent feature that will not dose chlorine until the pH value is first corrected since it is possible to have a low ORP value even though there is sufficient chlorine. The dosing consent feature prevents wastage of chemicals and avoids a higher than necessary chlorine concentration.

Acid and Chlorine Tank Level Inputs

The BL120 and BL121 allow for a connection to an optional level controller. This input is used to disable the dosing pumps when there is no chemical left in the reservoir tank.

Hold Input

It is possible to connect a flow switch mounted in-line or a mechanical relay that is connected to the recirculation pump power source to the hold input of these controllers. With no flow or when no power is applied to the recirculation pump, the hold circuit will disable the dosing pumps. This will prevent any dosing of chemical when there is no movement of water in the system.

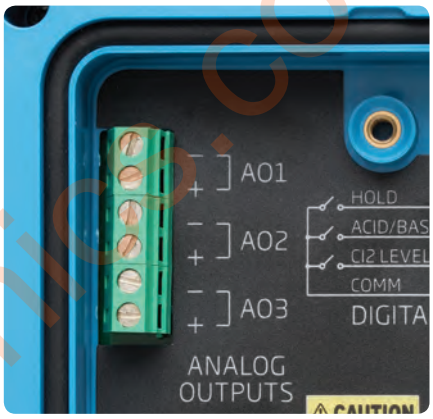


Programmable Alarm System

These controllers allow users to enable or disable the low and high level of alarms for all parameters: pH, ORP, and temperature. When an alarm is activated, all dosing will stop. The alarm system also offers overdosing protection in that if the value is not corrected within a specified time interval then the meter will go into alarm status.

Multicolored LED Indicators

BL120 and BL121 offers multiple LED indicators for status, servicing, and pump operation. The STATUS LED changes color based on operational state; a green LED means the water is within the desired parameter ranges, a yellow LED means that the controller needs attention, and a red LED identifies a problem in the system such as high and low pH, ORP and/or temperature readings. The SERVICE LED indicates any alarms and process errors experienced by the controller.



BL121 Analog Outputs

The BL121 controller offers three 4-20 mA outputs. Each output can be disabled or connected to an external recording device. Each of the three measured parameters (pH, ORP, and temperature) can be assigned to an analog output where the current signal will be proportional to the measured value. For more flexibility and better resolution, the analog output can be scaled; users can define any two points within a parameter range to correspond to the analog output span. For example, the controller assigns 0 pH to 4 mA and 14 pH to 20 mA as a default. The user can adjust the pH range to assign pH 6 to 4 mA and pH 8 to 20 mA. This adjustment allows better resolution in the range of interest.

Automatic Logging

The readings for each parameter are automatically logged every 10 seconds. A new log is started each time the instrument is calibrated or at the start of a new day. Logged data include pH, ORP, and temperature values, last calibration data, setup configuration, and any event data.

USB Connectivity

For review and storage the users can easily transfer data to a PC using a flash drive and the USB port.

Password Protected

BL120 and BL121 controllers feature a password protection solution that offers restricted access to calibration, setup, and review of logged data. The password can be set and enabled/disabled during general setup of the instrument.

Multiple Configurations

BL120 and BL121 swimming pool controllers are available in one of two configurations. The basic version is the in-line model which allows for direct installation of the probe and chemical injection fittings into existing piping.

A panel mounted version of these controllers with a bypass flow cell is also available. The bypass flow cell allows for calibration and maintenance of the probe without having to shut down the recirculation pump.

BL120-410
Flow Cell for
BL120-20 and
BL121-20

HI1036-1802 Multiparameter Digital pH, ORP, Temperature Probe

The HI1036-1802 is a digital combined probe that measures pH, ORP, and temperature. This probe also incorporates a potential matching pin. The 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.

The pH glass has been chosen to produce stable quick equilibration even in low conductivity waters. Additionally, the pH sensor is designed to produce a mV value near pH 4 (not pH 7 like typical pH sensors) should it stop working. A broken pH electrode that produces a mV value near pH 7 would produce an alarm state and disable any pump activated.

The ORP sensing surface is a large smooth surfaced platinum band that encircles the circumference of the temperature probe. It is referenced to Ag/AgCl reference electrode (3.5M KCl).

The ORP and pH sensors and reference electrode use a differential measurement technique which is known to stay in service and provide accurate measurements under adverse conditions that may cause conventional pH probes to produce erroneous measurements. The HI1036-1802 probe with its differential amplifiers greatly reduces inaccuracies caused by ground loops which may exist between process and instrument grounds. With the differential technique, a ground loop current will flow through the low impedance path of the matching pin thus providing immunity to the measurement signals. Additionally the probe converts these measurements to a digital signal to eliminate noise and static due to high impedance signals carried by cable.

The HI1036-1802 with the BL120 or BL121 pool controller helps to promote the health and safety of pool and spa water.

Specifications		BL120/BL121
pH	Range	0.00 to 14.00 pH
	Resolution	0.01 pH
	Accuracy (@25°C/77°F)	±0.05 pH
	Calibration	pH buffer calibration: automatic, two-point (4.01, 7.01, 10.01 pH) pH process calibration: one-point, manual input
	pH Dosing	proportional with adjustable set point and proportional band; delay to start at power-on and overdosing protection
mV	Range	±2000 mV
	Resolution	1 mV
	Accuracy (@25°C/77°F)	±5 mV
	ORP (mV) calibration	one-point, manual input
	ORP Dosing	proportional with adjustable set point and proportional band; delay to start at power-on and overdosing protection; pH dosing interlocked
Temperature	Range	-5.0 to 105.0°C (23.0 to 221.0°F)
	Resolution	0.1°C (0.1°F)
	Accuracy (@25°C/77°F)	±1°C (±1.8°F)
Additional Specifications	Temperature Compensation	automatic, -5.0 to 105.0°C (23.0 to 221.0°F) for pH
	Pump Control	automatic and manual modes; adjustable flow rate from 0.5 to 3.5 L/h
	Log Feature	automatic logging of pH, ORP, and temperature measurements, GLP and events including alarms, errors and power failure; capacity for 60 days with 10 second sampling interval; all data .csv files are transferred by USB flash drive
	Alarms	high and low with enable/disable option for all parameters; alarm is triggered when 5 consecutive readings are over/under threshold
	Alarm System	intuitive alert system based on LEDs; alarm filtering options; alarm relay control based on user setup
	Password Protection	setup, calibration and log recall options features are password protected
	Storage Interface	USB
	GLP	pH/ORP calibration information including date and time for pH/ORP sensors
	Alarm Relay Output (1)	SPDT 5A/230 VAC; activated by pH/ORP/temperature selectable alarm conditions
	BL121 Analog Outputs (3)	4 to 20 mA, sourcing, configurable; output impedance ≤ 500 Ohm; accuracy < 0.5 % FS; galvanically isolated up to 50 V relative to earth ground
	Auxiliary Inputs (3)	low level in acid/base tank (contact open); low level in chlorine tank (contact open); hold input (contact open)
	Digital Probe Input (1)	galvanic isolated digital input HI1036-1802 pH/ORP/temperature/matching pin combined probe with DIN waterproof connector
	Power Supply	100 – 240 VAC
	Power Consumption	10 VA
	Environment	0 to 50°C (32-122°F); max 95% RH non-condensing
	Dimensions	245 x 188 x 55 mm (73 mm with pumps); 9.6 x 7.4 x 2.2" (2.9" with pumps)
	Weight	1700 g (60 oz.)

Ordering Information

In-Line Configuration

BL120-10 pH/ORP/Temperature Pool Controller is supplied with HI1036-1802 pH/ORP/temperature digital probe with matching pin, 50 mm probe saddle (1), fitting for probe, chemical injectors (2), 50 mm saddle for injectors (2), peristaltic tubing (2), 5 m of injection tubing, aspiration filter (2), 20 ml sachets containing pH 7.01 buffer (3), 20 ml sachets containing pH 4.01 buffer (3), 250 ml bottle of 470 mV test solution, power cable and instruction manual.

BL121-10 pH/ORP/Temperature Pool Controller with analog output is supplied with HI1036-1802 pH/ORP/temperature digital probe with matching pin, 50 mm probe saddle (1), fitting for probe, chemical injectors (2), 50 mm saddle for injectors (2), peristaltic tubing (2), 5 m of injection tubing, aspiration filter (2), 20 ml sachets containing pH 7.01 buffer (3), 20 ml sachets containing pH 4.01 buffer (3), 250 ml bottle of 470 mV test solution, power cable and instruction manual.

User Panel Flow Cell Configuration

BL120-20 pH/ORP/temperature pool controller with flow cell is supplied with panel mounted flow cell, HI1036-1802 pH/ORP/temperature digital probe with matching pin, 50 mm probe saddle (1), fitting for probe, chemical injectors (2), 50 mm saddle for injectors (2), peristaltic tubing (2), 5 m of injection tubing, aspiration filter (2), 20 ml sachets containing pH 7.01 buffer (3), 20 ml sachets containing pH 4.01 buffer (3), 250 ml bottle of 470 mV test solution, power cable and instruction manual.

BL121-20 pH/ORP/temperature pool controller with flow cell and analog output is supplied with panel mounted flow cell, HI1036-1802 pH/ORP/temperature digital probe with matching pin, 50 mm probe saddle (1), fitting for probe, chemical injectors (2), 50 mm saddle for injectors (2), peristaltic tubing (2), 5 m of injection tubing, aspiration filter (2), 20 ml sachets containing pH 7.01 buffer (3), 20 ml sachets containing pH 4.01 buffer (3), 250 ml bottle of 470 mV test solution, power cable and instruction manual.

pH and ORP solutions begin on page 2.136

Process Instrumentation

The Hanna line of process instrumentation offers different solutions to control processes in which parameters like pH, ORP, Conductivity, TDS are important. Digital controllers offer a full package of features for process control with high levels of configuration for control and measurement parameters. Hanna solutions are designed for both accuracy of the reading and safety of the control process. The matching pin, sensor check, cleaning programs, auto-diagnostics, hold mode, alarm and warning system are all solutions to the same problem: measurement and control of processes has to be performed in safety from the process control point of view.

Typical feedback systems are based on a control loop, including sensors, controllers with control algorithms and actuators. The purpose of this system is to try to regulate a variable parameter at a set point or reference value. Different types of feedback control algorithms are available: on/off, linear, proportional or PID controllers. Open-loop control systems do not make use of feedback, and run only in preset ways.

Closed-loop control systems typically operate at a fixed frequency. The frequency of changes to the drive signal is usually the same as the sampling rate. After reading each new sample from the sensor, the controller reacts to the controlled system changed state by recalculating and adjusting the actuators drive signal. The controlled system responds to this change, another sample is taken, and the cycle repeats. Eventually, the controlled system should reach the desired state and the controller will cease making changes. The above frequency is fixed based on a setting of the time cycle according with the time necessary to the controlled system to react to the actuator adjustment.

An on-off controller is a feedback controller that switches the actuators drive signal between two states. They are often used to control an actuator that accepts a binary input, for example an on/off valve. A common issue in most applications of on-off feedback control is the wear of actuators such as relays and control valves when the measurement is closed to the set point and the system is starting a continuous on/off switching on each cycle (similar with a continuous oscillation around the set point).

Therefore, practical on-off control systems are designed to include hysteresis, usually in the form of a dead-band, a region around the set point value in which no control action occurs. The width of dead-band may be adjustable or programmable.

Linear control

Linear control is the first solution to on/off control issues. Linear control systems use linear negative feedback to produce a control signal mathematically based on other variables, with a view to maintaining the controlled process within an acceptable operating range. The output from a linear control system into the controlled process may be in the form of a directly variable signal, such as a motorized valve that may be 0 or 100% open or anywhere in between. Sometimes this is not feasible and so, after calculating the current required corrective signal, a linear control system may repeatedly switch an actuator, such as a pump, motor or heater, fully on and then fully off again, regulating the duty cycle inside the time cycle using pulse-width modulation.

Proportional control

Proportional negative-feedback systems are based on the difference between the required set point and measured value. This difference is called the error. Correction is applied in direct proportion to the current calculated error, in the correct sense so as to tend to reduce the error. The amount of corrective action that is applied for a given error is set by the gain or sensitivity of the control system. At low gains, only a small corrective action is applied when errors are detected: the system may be safe and stable, but may be low in response on large changing conditions; errors will remain uncorrected for relatively long periods of time. If the proportional gain is increased, such systems become more responsive and errors are dealt with more quickly. There is an optimal value for the gain setting when the overall system is said to be critically damped. Increases in loop gain beyond this point will lead to oscillations in the process. To resolve the two problems of low response time on one side or system oscillation on the other side, many feedback control schemes include mathematical extensions to improve performance. The most common extensions lead to proportional-integral-derivative control, or PID control. The PID control is formed from three controllers that treat the error in different way: proportional, derivative and integrative.

Derivative action

The biggest problem with proportional control is to reach new desired outputs quickly and to avoid overshoot and minimize ripple once you get there. Responding quickly imposes a high proportional gain, but minimizing overshoot and oscillation requires a small proportional gain. Achieving both at the same time may not be possible in all systems.

The derivative part is concerned with the rate-of-change of the error with time: If the measured variable approaches the set point rapidly, then the actuator is backed off early to allow it to coast to the required level; if the measured value begins to move rapidly away from the set point, extra effort is applied–in proportion to that rapidity–to try to maintain it. If derivative action is over-applied, it can lead to oscillations as well.

Integral Action

The integral term magnifies the effect of long-term steady-state errors, applying ever-increasing effort until they reduce to zero. If the actuator action being applied does not bring the controlled parameter up to set point, for whatever reason, integral action increasingly moves the proportional band relative to the set point until the error is reduced to zero and the set point is achieved.

PID Tuning

PID control is a very powerful and high quality solution for many control processes. The biggest problem of PID controllers is the tuning of the controller in accordance with the controlled system/parameter. Tuning control is not an easy operation and the controller and controlled system have to permit this. High level instruments offer the auto-tuning of controllers that is oriented to the automation of the controller reaction and do not request common PID tuning.

Input of the Controllers

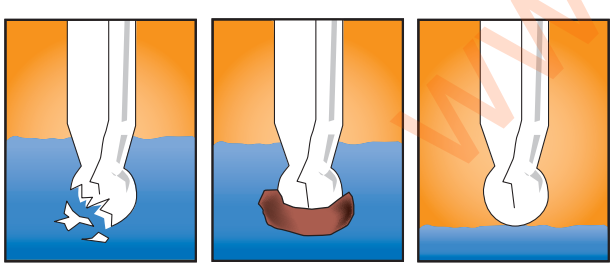
Controllers are in contact with the process based on the sensors and actuators. The sensors are the inputs of the controller, the actuators are the outputs of the controller. In Hanna controllers, the common inputs are the pH, ORP, conductivity, TDS along with temperature for temperature compensation. The probes are connected directly to the controller, or in case of extreme distances between controller and probe, through the transmitters (analog/digital).

Sensor Check™

A pH control system consists of a pH electrode in contact with a test solution, a connection cable, and a meter for measurements and adjustments. The instrument is typically set to control acid or alkaline dosage for the purpose of maintaining a desired pH value. Many efforts have been devoted to such functions as dosage in pipes or tanks, on/off or proportional control, Automatic Temperature Compensation, the use of amplifiers for distances exceeding 15 meters, panel or wall-mounted models, etc. However, little effort has been applied to determining when and what occurs when an electrode fails.

For example, let's assume a process electrode is installed in a tank of wastewater containing hexavalent chromium. The set point pH value is 3.0 and, every time this value rises, pumps or solenoid valves are activated to dose sulfuric acid to maintain the set point. Let's also assume that the process electrode becomes damaged and the pH bulb is broken. Under normal conditions, the electrode will produce a potential equal to the difference between the buffer inside the glass bulb (pH 7.0) and the liquid being tested (pH 3.0), i.e. pH (7.0-3.0) x approx. 59.16 mV = 236.64 mV (value not compensated for temperature variations).

Problems Detected by the Sensor Check™ System



Broken electrode | Dirty electrode | Electrode not immersed

Once the glass bulb is broken, a short circuit occurs between the reference wire of the glass electrode (bulb) and the reference electrode; as a result the complete electrode potential is 0 mV. When the instrument receives a 0 mV signal, it will read approximately pH 7.0 and will immediately start to dose sulfuric acid in order to lower the pH level of the tank. If the controller does not possess a timed override function to shut down automatically, the system will keep dosing in an attempt to reach the 3.0 pH set point. This will continue until the acid container becomes empty by which time the process stream will be dangerously contaminated. Even if a timed override is programmed into the controller, this will only limit the contamination. If the electrode fails near to the set point, the controller could dose for several minutes before the override shuts down the system.

This is just one of many possible examples of overdosing and contamination as a result of an undetectable electrode failure.

In any given application, costly damage can be avoided by automatically and continually monitoring the condition of the process sensors. Hanna has devised such a system. **The Sensor Check™ system automatically checks the condition of the process electrode every 5 seconds to ensure proper function.**

A pH glass electrode is a high impedance device (tens of MΩ at high temperatures, and up to 1,000 MΩ for temperatures close to zero). The Sensor Check™ system repeatedly checks the impedance of the cable and electrode to ensure it does not fall below the average value of the system (at least 10 MΩ). If a lower value is detected, indicating electrode failure, the instrument stops all dosage and activates an alarm that alerts the operator. By doing so, the Sensor Check™ system makes over dosage and contamination as a result of electrode failure a thing of the past.

Additionally, the Sensor Check™ system monitors the condition of the reference electrode. The pH measuring half cell may be intact and work normally, but problems may occur related specifically to the reference portion of the electrode. The purpose of the reference half cell portion of the electrode is to supply a consistent and stable potential that is independent of the liquid being tested. This stable potential is the reference value by which the measuring portion of the electrode is compared. As a result the potential difference between the measuring half cell and the reference is the value used by the instrument to produce the pH reading. The reference electrode must make contact with the test solution to complete an electrochemical connection. Unlike the measuring cell which is hermetically separated by means of a glass bulb, the reference cell contains a permeable membrane (reference junction) which allows electrolyte to diffuse into the solution. This creates an ionic connection between the internal silver reference and test solution, completing the circuit.

As with any electrochemical connection, the possibility of contamination is always a concern. When contamination occurs, the potential of the reference electrode changes and the pH reading is no

longer reliable. In addition, exposure to dirt and particles in the process stream may clog the porous reference junction, isolating the reference from the test liquid. If this occurs the electrochemical connection is broken and the electrode is essentially "unplugged" from the test solution making a correct pH reading impossible. This is why regular cleaning of the electrode system is a necessity. As with the pH bulb, the reference junction produces a measurable resistance value which under normal conditions is approximately 1,000Ω.

The Hanna Sensor Check™ system monitors the reference junction every 5 seconds to ensure that the proper resistance is maintained. Users can program a maximum value for the resistance similar to setting the pH set point. When the resistance of the clogged junction exceeds the set value, the instrument can stop dosage, trigger an alarm or automatic cleaning cycle. These features are present in the HI504 series of process pH/ORP controllers.

Ground loop current effect on process pH/ORP electrodes

An electrochemical (combination) cell, such as a pH or ORP electrode, is comprised of 2 half cells; the measuring cell and the reference.

Both are essential for the cell to function and each has a specific purpose. The entire cell is considered galvanic in that no external power is supplied to the solution. In many respects, the electrochemical cell is very much like a "wet cell" battery. In order for the measuring half cell to produce a readable measurement of a test solution, it must be compared to a stable reference potential. It is absolutely crucial that the potential produced by the reference half cell is consistent and stable (approx. 210 mV) regardless of the properties of the test solution and the working conditions. The only changing potential, as a result of the solution under test, is produced by the glass bulb of the measuring cell. The reference electrode must also make contact with the test solution to complete an electrochemical connection. Unlike the measuring cell which is hermetically separated by means of a glass bulb, the reference cell contains a permeable membrane (reference junction) which allows electrolyte to leach out into the solution. This creates an ionic connection between the internal silver reference and test solution completing the circuit. Hence the reference is now electrochemically connected to the solution which makes it vulnerable to transient electrical currents that may be present in the process.

Unlike with a portable battery powered pH meter and electrode, the process system is not isolated from potential difference and the resulting current flow. It is possible, given that unwanted potentials exist in the process, that the silver/silver chloride wire of the reference is exposed to current flow thousands of times higher than normal. In theory, this should not happen since most process instruments are powered at low voltage and the transformer inside the instrument will galvanically isolate the two potentials between the "process" and ground of the electrical system. This depends, therefore, on the quality of the instrument's input transformer. Even with the best isolation, capacitance may be generated between the instrument and the process stream. In this case, the reference electrode influenced by the resulting EMF can no longer function properly and as a result, the pH reading is lost.

By introducing the matching pin, which acts as a ground connection, the EMF is rerouted through the pin and galvanically isolated from the internal mass of the instrument. The instrument must be equipped electrically to perform this function. Hence, the matching pin can only be used with controllers provided with a differential input and circuit.

Few electrode and instrumentation manufacturers have paid the necessary attention to the matching pin and as a result it has been up to the user to devise makeshift ground connections that may or may not work correctly.

Hanna has responded to this problem by designing a complete series of process electrodes, each equipped with an integrated potential matching pin.

Matching Pin: The Ground Loop Effect Solution

In process applications utilizing controllers and electrodes installed in-line or in tank, the potential matching pin is considered the "earth ground" connection and is used to prevent ground loop effects from causing erratic readings and damage to the system. In fact, it is a grounding device with a pin made of a material (usually stainless steel or titanium) inert to chemical attack. The matching pin essentially redirects the current from the reference cell of the process electrode (i.e. pH or ORP sensor). Potentials and transient current flow can be caused by "leakage" of improperly insulated electrical equipment (pumps and stirrers), electrostatic charges introduced by the motion of mixer blades, or the existence of electric fields (electrolysis) present in plating baths.

Calibration of a Typical Process Meter

In industrial applications, the calibration of a meter often poses difficulties due to the distance between the electrode and the instrument. In addition, accessing the electrode for calibration may prove to be a challenge if it is installed in a pressurized line or large tank in a continuous process. Stopping a process frequently for the purposes of regular calibration may prove inconvenient and costly.

In laboratory applications, the task of calibration is significantly different because the electrode and the instrument are close together and easily manageable. To provide the same level of manageability in a process application, Hanna has developed a remote calibration method which allows the maintenance technician or operator the capability to calibrate the process controller without having direct access to it or without removing the electrode from the installation.

Analog or digital transmitters

In order to increase the distance between the sensor and the controller, different solutions were implemented: to amplify the sensor signal, to transform the signal into another type of signal in current or voltage using the analog transmitters, or to convert the signal from analog to digital and to transfer the reading in digital format. Based on this consideration Hanna supports all of these solutions on the sensor level and input of the controllers.

Controller Output

As mentioned earlier, actuators are the outputs of the controllers. The output to actuators on the controller side can be performed using a relay or analog output. Each of them is driven by the controller in accordance with the control method used. For example, an on/off control is common to be performed with a relay, a linear control with an analog output, and a duty cycle command using a solid state relay. Hanna controllers feature all of these options.

Alarms and warning

Controllers are designed to keep the controlled system/parameter within a certain area of values. In the event that parameters have gone out of range, the controller signals an alarm on the user interface and on an output such as an on/off relay according with the alarm status. The status of the controller and the process can be monitored using the analog output connected to a recorder or on the controller LCD.

Due to the complexity and importance of the controlled systems, the controllers incorporate a self-diagnostic feature. With this feature, the controller has the ability to check the most important functions, and in the event of failures, to take the actions that are necessary to minimize the effects of the problems. Hanna controllers have implemented both levels of protection: self-diagnostic and control of output in the event of failures.

Hold feature

The Hold feature suspends the measurement and control of functions of the instrument. The control and control relays are also disabled. If the meter is in idle or control mode and displaying measurements, then the last measured value (both for temperature and pH, ORP or conductivity/concentration) is frozen on the display. The LCD displays the "Hold" message.

The instrument enters Hold mode during the calibration, setup, in progress cleaning or every time when this function is started by: calibration, setup, cleaning in place, the hold digital insulated input (there are two digital insulated inputs: one for hold mode and one for the advanced cleaning) when it is on; normally the signal level is polled at least every 4 seconds, the proper key combination (CFM and up arrow keys together) for service; the same key combination is used both to start and stop the hold mode (the key combination acts in the same way as the hold digital input, the daily programmable control timing, an error event, the hold start/stop RS485 command.

The display will show dashes if the meter is put into the Hold mode before any readings have taken place.

After the Hold mode expires, the meter exits the hold mode, but control and alarms remain disabled for a user-selectable delay (0 to 99 seconds). In this situation, measurements are normally acquired, displayed and recorded through the analog or RS485 output.

Analog output

Hanna controllers feature settable analog outputs. The analog output can be linked to the measured input or to the output of the PID controller. In the first case the analog output will be connected to a recorder and in the second case it will be used to drive external devices such as actuators in a control system. A feature of the recorder output configuration is the ability to zoom a specific measurement range, to offer a higher resolution on the recorder output. Additionally, values that are out of the defined analog output range can be used to signal the alarm condition that appears.

The analog output is communally working in current and the standard ranges are 0 to 20 mA or 4 to 20 mA. The measured range is divided proportional with the analog output range. In some conditions the analog output can be set in voltage with commune ranges between 0 to 5V or 0 to 2V. The voltage is not commonly to be used for long distances due to the drop in voltage on the connection and wires.

Password protection

The controllers can be mounted to monitor and control important processes where unqualified personnel intervention is not accepted. Hanna digital controllers feature a password protection solution that offers restricted access to important features like calibration, setup and consultancy of logged data. The password can be set and enabled/disabled during the normal operations.

Panel Mount or Wall Mount Instruments

Most process instruments for measuring and controlling pH, ORP and conductivity are designed for installation in panel enclosures. Panel configurations are necessary when installing a variety of control devices in a confined space.

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

HI504

pH/ORP Digital Controller

with Sensor Check™

- Sensor Check™
  - Tells the user if there is something wrong with the electrode
- CAL Check™
  - Alerts users of calibration status
- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation
- Logging
  - Loging of up to 100 system events

HI504 Overview

HI504 is a PID, PI, proportional or on/off pH/ORP controller with one or two set points. The measurement configuration settings and control of pH and ORP are saved separately and permits users to switch between pH and ORP without losing settings. The pH channel can be calibrated in 2 calibration points. The instrument has a full auto diagnostic procedure. Sensor Check™ is also available for pH and ORP probes.

The temperature is continuously monitored using a temperature sensor (Pt100 or Pt1000 type) with automatic temperature compensation of pH.

One or two analog controller outputs (0-20 or 4-20 mA) can be configured for pH/ORP recording or controlling (only for models with PID), and relays can be used to control the process or be connected with alarm status.

Controller status is visable with LED's on the front panel and on the LCD display.

The controllers logging feature can save up to 6000 samples pH/°C or ORP and last 100 error, configuration, calibration and cleaning events. This information is accessible from a PC through RS485 and HI92500 software. The powerful HI92500 software has graphing capabilities and can print graphs directly or can be saved as a bitmap. Data can be exported in common spreadsheet formats.

Analog Output: Data Logging or PID Dosage Control

Models are available with one or two analog outputs. These outputs can be connected to a recorder for the catalogging of process data (pH/mV and temperature), or can be used for controlling dosing systems (pumps or electrovalves) using PID control.

Sensor Check™ pH/ORP

Sensor Check™ performs self-diagnostic and troubleshooting functions by continuously verifying the electrode status based on impedance movement of the glass and reference measurement. The internal circuit of the instrument executes two independent tests, one for the probe and one for the reference chamber, measuring the respective impedance values every 5 seconds. These tests last for a very short period to avoid electrolysis and polarization, which can be caused by a prolonged exposure to an electric current. The types of problems identified by Sensor Check™ are: pH electrode broken, reference electrode dirty, reference electrode or matching pin not immersed, clogged or dirty electrode junction, short-circuit between cables of pH and reference electrodes, signal problems from the cable or connector due to humid or dirty environments. The test is not limited to a simple signal that indicates an error in progress, but it reports the nature of the problem with a specific error code.

Programmable Cleaning Cycles

Heavy-duty applications often require almost continuous probe maintenance. Elements such as suspended solids, fat, oils, pigments and microorganisms can quickly deposit and soil the glass bulb of a pH probe, the sensor of an ORP probe or the reference junction. To solve these problems, the HI504 series has been equipped with an automatic cleaning system (simple or advanced, depending on model) with programmable cycles. The cleaning cycle is a simple wash with either water or detergent, programmed by setting the rinse time and the pause length. The advanced cleaning uses both water and detergent, and allows the user to program three stages, with the possibility to vary the sequence, the time, and the number of cycles. The advanced mode can also be triggered at any time from a remote control or through the isolated digital input on the rear panel, which can be connected to an external switch.

The controllers can also automatically activate both cleaning modes whenever Sensor Check™ reveals a soiled probe. A delay time can be set before restarting the reading after a cleaning cycle has taken place; this allows the probe to adjust to new operating conditions.

Logging of the Last 100 Events

With the HI504 series, it is possible to recall the sequence of the last 100 occurred events at any time: errors, calibrations performed, set parameter changes and cleaning cycles. Every code shown on the display corresponds to a certain type of event, error, or operation.

Programmable Hold System

The hold function allows the user to stop the regulating action of the controller for programmable time periods. It is possible to activate the hold periods in correspondence to programmed operations, such as plant maintenance and cleaning procedures.

Fail Safe Alarm System

Hanna's exclusive Fail Safe Alarm System protects against problems caused by power supply failure or signal interruption, which are typical risks in industrial environments. The system acts both on a hardware and a software level. The alarm relay functions in a normally closed condition, and is tripped when there is a power failure if, for example, the power cable is accidentally cut. This function is very important in industrial plants where alarms are usually not activated if there is a power supply interruption, which can cause serious damage due to a loss of control of the process plant. At the software level, the Fail Safe Alarm System function activates an alarm in case of abnormal circumstances, for example if the dosing contacts remain closed for an excessive period. The alarm condition is also indicated by a red LED, located directly on the front panel of the controller.

Specifications	HI504
Range	-2.00 to 16.00 pH; -2000 to 2000 mV; -30 to 130.0°C
Resolution	0.01 pH; 1 mV; 0.1°C (above -10 °C); 1°C (below -10°C)
Accuracy (@25°C/77°F)	±0.02 pH; ±2 mV; ±0.5°C (-9.9 to 130.0°C); ±1°C (-30 to -10°C)
Input Impedance	10^{12} Ohm
Digital Input for the pH/ ORP/°C Transmitter	RS485
Other Digital Insulated Inputs	two digital insulated inputs: one for hold and one for the advanced cleaning; ON state: 5 to 24 VDC
Digital Insulated Output	a digital insulated contact closed upon hold mode
Temperature Compensation	automatic or manual, -30 to 130°C
Temperature Probe	with three-wire or two-wire Pt100/Pt1000 sensor (with automatic recognition and damage test)
Power Supply (depending on model)	24 VDC/AC, 115 VAC ±10%, 230 VAC ±10% or 100 VAC ±10%; 50/60 Hz
Power Consumption	10 VA
Over Current Protection	400 mA 250V quick blow fuse
Max. Oscillation Frequency	8 MHz
Relays 1, 2, 3, 4	electromechanical relay SPDT contact outputs, 5A-250 VAC, 5A - 30 VDC (resistive load); fuse protected: 5A, 250V quick blow fuse
Alarm Relay	electromechanical relay SPDT contact output, 5A - 250 VAC, 5A - 30 VDC (resistive load) fuse protected: 5A, 250V quick blow fuse
Analog Output	two independent outputs, 0 - 22 mA (configuring as 0-20 mA or 4-20 mA)
Analog Output Resolution	0.1% f.s.
Analog Output Accuracy	± 2% f.s.
Data logging	6000 pH/°C or ORP samples
Environment	0 to 50°C (32 to 122°F); RH max 85% non-condensing
Casing	IP20 (housing); IP54 (front panel)
Weight	1.6 kg (3.5 lb.)
Ordering Information	Each HI504 model is supplied complete with mounting brackets and instructions. **Choose your configuration** **HI504222-1** dual setpoint, on/off and PID control, single analog output, 115V **HI504222-2** dual setpoint, on/off and PID control, single analog output, 230V **HI504224-0** dual setpoint, on/off and PID control, dual analog output, 24VDC/AC **HI504224-1** dual setpoint, on/off and PID control, dual analog output, 115V **HI504224-2** dual setpoint, on/off and PID control, dual analog output, 230V **HI504924-1** dual setpoint, advanced cleaning, on/off and PID control, dual analog output, 115V **HI504924-2** dual setpoint, advanced cleaning, on/off and PID control, dual analog output, 230V
Probes	**HI7610** Stainless steel Pt100 probe with front and back 1/2" NPT thread and 5 m (16.4') cable
	HI7611 Glass Pt100 probe with front and back 1/2" NPT thread and 5 m (16.4') cable

pH and ORP solutions begin on page 2.136

HI720

Conductivity Process Digital Controller

with Inductive Probe

- ATC
  - Automatic temperature compensation
- Logging
  - Logging of up to 100 system events

HI720 Overview

HI720 is a PID, PI, proportional or on/off EC/TDS controller with one or two set points and includes an inductive conductivity probe.

The measurement configuration settings and EC and TDS control are saved separately and permits users to switch between EC and TDS without losing settings. TDS or a specific user defined curve can be used for concentration.

Temperature is continuously monitored using a temperature sensor (Pt100 or Pt1000 type) with ATC of conductivity. Conductivity temperature compensation parameters are fully customizable: linear or non-linear temperature compensation, reference temperature and temperature coefficient. Users can define the specific curve of temperature compensation.

The working conductivity range is user selectable and the conductivity calibration in one point is performed in a value that corresponds to the measurement range.

One or two analog controller outputs (0-20 or 4-20 mA) can be configured for recording or controlling (only for models with PID), and up to 4 relays can be used to control the process or be connected with alarm status. Controller status is visable with LED's on the front panel and on LCD.

The controller logging feature can save the last 100 error, configuration, calibration and cleaning events. This information can be accessible from a PC through RS485 and HI92500 software. The controller also has a full auto diagnostic procedure. A cleaning procedure of the EC inductive probe is also available.

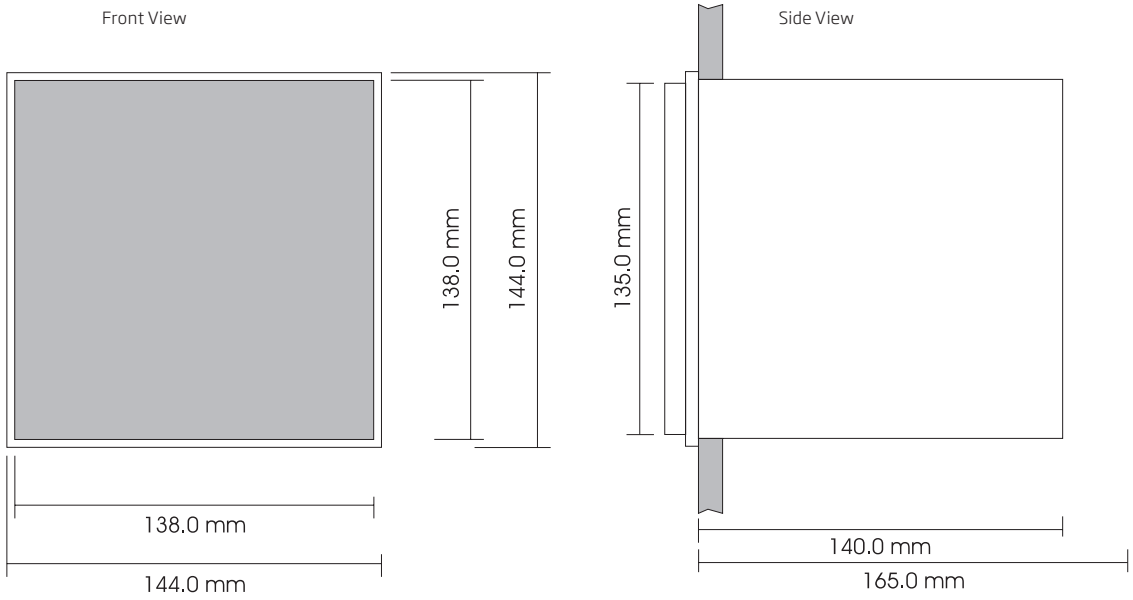
In-Line Cleaning

The cleaning feature allows an automatic cleaning action of the probe. To perform cleaning, the controller activates an external device (pump). Cleaning actions never take place if no relay is configured for cleaning. Cleaning can be of two types:

1. **Simple cleaning:** with water only, it can be triggered only by a timer (periodical cleaning) or by an error for which a cleaning action can be configured.
2. **Advanced cleaning (optional):** with water and detergent, it can be triggered by the following events:

Timer: Digital input or RS485 command (external trigger); Timer and digital input or RS485 command (external trigger); Timer masked by the digital input (i.e. disabled when the digital input is on); Error for which a cleaning action can be configured

Mechanical Dimensions



Specifications	HI720
Range	0 to 2000 mS/cm (autoranging); -30 to 130°C / -22 to 266°F
Resolution	1 µS/cm (0 to 1999 µS/cm); 0.01 mS/cm (2.00 to 19.99 mS/cm); 0.1 mS/cm (20.0 to 199.9 mS/cm); 1 mS/cm (200 to 2000 mS/cm); 0.1°C / 0.2°F
Accuracy (@25°C/77°F)	±2% f.s. (conductivity) / ±0.5°C / ±1°F
Temperature Compensation	automatic or manual, -30 to 130°C
Temperature Probe	three-wire or two-wire Pt100 or Pt1000 sensor with automatic recognition and damage test
Digital Input	digital transmitter, hold and advanced cleaning inputs
Digital Output	one digital insulated contact closed upon hold mode
Analog Output	one or two independent outputs; 0-22 mA (configuring as 0-20 mA or 4-20 mA)
Digital Serial Output	RS485
Dosing Relay	1, 2, 3 or 4 electromechanical relays SPDT; 5A-250 VAC, 5A-30 VDC (resistive load); fuse protected: 5A, 250 V fuse
Alarm Relay	1 electromechanical relay SPDT; 5A-250 VAC, 5A-30 VDC (resistive load); fuse protected: 5A, 250 V fuse
Installation Category	II
Power supply (depending on model)	24 VDC/ac, or 115 VAC or 230 VAC or 100 VAC ±10%, 50/60 Hz; fuse protected: 400 mA, 250 V fast fuse
Power Consumption	10 VA
Max Oscillation Frequency	8 MHz
Environment	0 to 50°C (32 to 122°F); RH max 85% non-condensing
Enclosure	single case 1/2 DIN
Weight	approximately 1.6 kg (3.5 lb.)
Ordering Information	Each HI720 model is supplied complete with mounting brackets and instructions. **Choose your configuration:** **HI720122-1** single setpoint, on/off and PID control, single analog output, 115V **HI720122-2** single setpoint, on/off and PID control, single analog output, 230V **HI720224-1** dual setpoint, on/off and PID control, dual analog output, 115V **HI720224-2** dual setpoint, on/off and PID control, dual analog output, 230V
Probes	**HI7610** Stainless steel Pt100 probe with front and back 1/2" NPT thread and 5 m (16.4') cable
	HI7611 Glass Pt100 probe with front and back 1/2" NPT thread and 5 m (16.4') cable
	HI7620 Stainless steel Pt1000 probe with PG 13.5 thread and 5 m (16.4') cable
	HI7621 Glass Pt1000 probe with PG 13.5

EC solutions begin on page 5.34

HI7650

Inductive Conductivity Probe

for HI720

EC Inductive Probe Theory of Operation

This instrument allows conductivity measurements without any electrical contact between electrodes and process fluid. The measurement is based on inductive coupling of two toroidal transformers by the liquid.

The instrument supplies a high frequency, reference voltage to the "Drive Coil", and a strong magnetic field is generated in the toroid.

The liquid passes through the hole in the toroid and can be considered as one turn secondary winding. The magnetic field induces a voltage in this liquid winding, the current induced in the flow is proportional to this voltage, and the conductance of the liquid one-turn winding is in accordance to Ohm's law.

The conductance is proportional to the specific conductivity and a constant factor determined by the sensor geometry and installation.

The liquid also passes through the second toroid and therefore the liquid turn can be considered as a primary winding of the second toroidal transformer. The current in the liquid will create a magnetic field in the second toroid, and the induced current can be measured as an output.

The output current of this "receive coil" is therefore proportional to the specific conductivity of process liquid.

For an inductive cell, the cell constant is defined as the measured conductivity, obtained by making a loop through the sensor with a resistor R, multiplied by that R value.

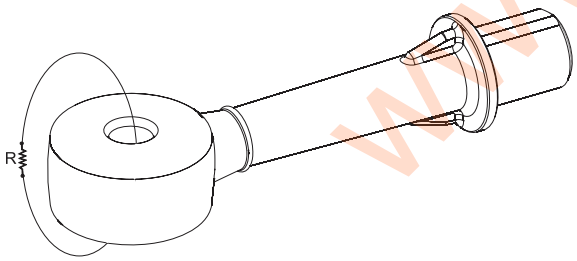
The cell constant depends only on the sensor geometry. However, when the probe is immersed in a liquid, the induced current in the solution is affected by the piping or any other container where the probe is inserted. This effect is negligible when there is an area of at least 3 cm of liquid around the cell.

Otherwise, it is necessary to multiply measurements by the installation factor: Conductivity = (cell constant)(installation factor)/(measured resistance).

The installation factor is < 1 for conductive piping/containers, and > 1 for nonconductive piping/containers.

Since this type of sensor has no electrodes, common problems such as polarization and contamination are eliminated and will not affect the performance of the electrodeless sensor.

Specifications	HI7650 Inductive Conductivity Probe	
Measuring Range	0 to 2000 mS/cm	
Accuracy	±2% f.s.	
Cell Constant	approx. 2.4 cm-1	
Protection Class	IP67	
Temperature Sensor	Pt100 to Pt1000 (depending on model)	
Temperature Response	90% of the final value, approximately 10 minutes	
Required Pipe Diameter	>80 mm (consider installation factor for pipe with diameter < 125 mm)	
Dimensions (probe only)	40 x 190 x 55 mm (1.57 x 7.48 x 2.16") ; head: 32 x OD 55 mm (1.25" x OD 2.16"n)	
Weight (probe only)	approximately 330 g (11.64 oz.)	
Ordering Information	**Choose your configuration**	
	HI7650-1105	PVC body, Pt100, 5 m cable
	HI7650-1110	PVC body, Pt100, 10 m cable
	HI7650-1115	PVC body, Pt100, 15 m cable



pH502

pH Digital Controllers

with Matching Pin and PID Control

- CAL Check™
  - Alerts users of calibration status
- ATC
  - Automatic temperature compensation
- 3 Point Calibration
  - Up to three point calibration

The pH502 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 pH502 takes the place of three instruments that only allow one configuration each. The pH502 line includes models that incorporate control through analog output to drive any compatible device, such as an electrovalve or pump. The solid state relay is available to ensure maximum life of the switching device. Each model has a differential input for a grounding bar to extend electrode life.

Fail Safe Alarm System protects against power interruption or line failure. 1, 2 or 3 point automatic calibration and manual or Automatic Temperature Compensation complete the features of this controller.

Specifications	pH502
Range	0.00 to 14.00 pH; -9.9 to 120°C
Resolution	0.01 pH; 0.1°C
Accuracy (@25°C/77°F)	±0.02 pH; ±0.5°C
Input Impedance	10^{12} Ohm
pH Calibration	automatic, one, two or three point, at pH 4.01, 7.01, 10.01
Temperature Compensation	automatic (with Pt100 probe) or manual from -9.9 to 120°C
Outputs	digital: RS485 bi-directional opto-isolated; or analog, galvanically isolated: 0-1 mA, 0-20 mA and 4-20 mA, 0-5 VDC, 1-5 VDC and 0-10 VDC
Set Point Relay	1 or 2 contact outputs SPDT 5A-250 VAC, 5A-30 VDC (resistive load) or 1 or 2 Solid State Relay (SSR), 1A, 250 VAC (resistive and inductive load), fuse protected (2A, 250V fast fuse)
Alarm Relay	one contact output SPDT, 5A-250 VAC, 5A-30 VDC (resistive load), fuse protected (5A, 250V fuse)
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz
Power Consumption	15 VA
Over Current Protection	400 mA 250V fast fuse
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Dimensions	panel cutout:140 x 140 mm, instrument: 144 x 144 x 170 mm
Weight	1.6 kg (3.5 lb.)
Ordering Information	Each pH 502 model is supplied complete with mounting brackets and instructions. **Choose your configuration** **pH502421-1** Dual setpoint with SSR relay, on/off and PID controls, analog output, 115V **pH502421-2** Dual setpoint with SSR relay, on/off and PID controls, analog output, 230V

pH solutions begin on page 2.136

pH500

pH Digital Controllers

with Matching Pin

- CAL Check™
  - Alerts users of calibration status
- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation
- 3 Point Calibration
  - Up to three point calibration

pH500 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 pH500 models are equipped with a bi-directional RS232 port. Push button password programming prevents tampering.

The Fail Safe Alarm System protects the pH500 against the pitfalls of process control, like power interruption or line failure. With pH500 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	pH500
Range	0.00 to 14.00 pH; -9.9 to 120°C
Resolution	0.01 pH; 0.1°C
Accuracy (@25°C/77°F)	±0.02 pH; ±0.5°C
Input Impedance	10^{12} Ohm
pH Calibration	automatic, one, two or three point, at pH 4.01, 7.01, 10.01
Temp. Compensation	automatic (with Pt100 probe) or manual from -9.9 to 120°C
Outputs	digital: RS232 bi-directional optoisolated; or analog, galvanically isolated: 0-1 mA, 0-20 mA and 4-20 mA,0-5 VDC, 1-5 VDC and 0-10 VDC
Set Point Relay	1 or 2 contact outputs SPDT 5A-250 VAC, 5A-30 VDC (resistive load), fuse protected (2A, 250V fast fuse)
Alarm Relay	1 contact output SPDT, 5A-250 VAC, 5A-30 VDC (resistive load), fuse protected (2A, 250V fast fuse)
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz
Power Consumption	15 VA
Over Current Protection	400 mA 250V fast fuse
Max. Oscillation Frequency	4 MHz
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Dimensions	panel cutout: 140 x 140 mm, instrument: 144 x 144 x 170 mm
Weight	1.6 kg (3.5 lb.)
Ordering Information	Each pH 500 model is supplied complete with mounting brackets and instructions. **Choose your configuration** **pH500111-1** single setpoint, on/off control, analog output, 115V **pH500111-2** single setpoint, on/off control, analog output, 230V **pH500121-1** single setpoint, proportional control, analog output, 115V **pH500121-2** single setpoint, proportional control, analog output, 230V **pH500211-1** dual setpoint, on/off control, analog output, 115V **pH500211-2** dual setpoint, on/off control, analog output, 230V **pH500221-1** dual setpoint, proportional control, analog output, 115V **pH500221-2** dual setpoint, proportional control, analog output, 230V **pH500222-1** dual setpoint, proportional control, RS232 output, 115V **pH500222-2** dual setpoint, proportional control, RS232 output, 230V

pH solutions begin on page 2.136

mV600

ORP Digital Controller

with Matching Pin

- CAL Check™
  - Alerts users of calibration status
- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation
- 2 Point Calibration
  - Up to two point calibration
- Connectivity
  - PC compatible

The mV600 controllers have been engineered with the same outstanding features as the pH500 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 mV600 models PC compatible. Wiring the controllers is simple with extractable terminal modules. A host of self-testing features and user friendly functions make mV600 a great value.

Specifications	mV600
Range	±2000 mV; -9.9 to 120°C
Resolution	1 mV; 0.1°C
Accuracy (@25°C/77°F)	±2 mV; ±0.5°C
Input Impedance	10^{12} Ohm
ORP Calibration	automatic, two point, at 0 and 350 or 1900 mV
Outputs	digital: RS232 bi-directional optoisolated; or analog, galvanically isolated: 0-1 mA, 0-20 mA and 4-20 mA, 0-5 VDC, 1-5 VDC and 0-10 VDC
Set Point Relay	1 or 2 contact outputs SPDT 5A-250 VAC, 5A-30 VDC (resistive load), fuse protected (2A, 250V fast fuse)
Alarm Relay	1 contact output SPDT, 5A-250 VAC, 5A-30 VDC (resistive load), fuse protected (2A, 250V fast fuse)
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz
Power Consumption	15 VA
Over Current Protection	400 mA 250V fast fuse
Max. Oscillation Frequency	4 MHz
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Dimensions	panel cutout: 140 x 140 mm, instrument: 144 x 144 x 170 mm
Weight	1.6 kg (3.5 lb.)
Ordering Information	Each mV 600 model is supplied complete with mounting brackets and instructions. **Choose your configuration** **mV600111-1** single setpoint, on/off control, analog output, 115V **mV600111-2** single setpoint, on/off control, analog output, 230V **mV600121-1** single setpoint, proportional control, analog output, 115V **mV600121-2** single setpoint, proportional control, analog output, 230V

ORP solutions begin on page 2.136

HI700 · HI710

Conductivity and TDS Digital Controllers

with Four-ring Potentiometric Probe

- CAL Check™
  - Alerts users of calibration status
- ATC
  - Automatic temperature compensation
- 2 Point Calibration
  - Up to two point calibration
- Backlight
  - Backlit, LCD display

The HI700 series of controllers offer state of the art specifications for your process control. They can be configured for ON/OFF, proportional, PI or PID control. Thanks to our exclusive technology, they can be customized to best fit your application. Bright LED's show the current status even from a distance. A menu-driven display aids the user throughout the operations with running messages and clear prompts. All relevant parameters can be simply adjusted and will remain memorized until overwritten.

With self-diagnostic features and extractable terminals, installation and maintenance are fast and simple. Password protection guarantees that the calibration and predetermined parameters cannot be altered unnecessarily. The controllers can operate with four-ring probe or 4-20 mA signal. They accept probes with or without a built-in Pt100 temperature sensor. HI710 includes all of the features of the HI700 and adds TDS measurement.

Specifications		HI700	HI710
Range	EC	0.0 to 199.9 µS/cm; 0 to 1999 µS/cm; 0.00 to 19.99 mS/cm; 0.0 to 199.9 mS/cm	0.0 to 199.9 µS/cm; 0 to 1999 µS/cm; 0.00 to 19.99 mS/cm; 0.0 to 199.9 mS/cm
	TDS	–	0.0 to 100.0 mg/L (ppm); 0 to 1000 mg/L (ppm); 0.00 to 10.00 g/L (ppt); 0.0 to 100.0 g/L (ppt)
	Temperature	-10.0 to 100.0°C	-10.0 to 100.0°C
Additional Specifications	Resolution	**EC:** 0.1 µS; 1 µS; 0.01 mS; 0.1 mS; 0.1 °C –	**EC:** 0.1 µS; 1 µS; 0.01 mS; 0.1 mS; 0.1 °C **TDS:** 0.1 ppm; 1 ppm; 0.01 g/L (ppt); 0.1 g/L (ppt)
	TDS Conversion Factor	–	adjustable from 0.00 to 1.00
	Accuracy (@25°C/77°F)	±0.5% f.s. (EC / TDS); ±0.5°C (0 to 70°C); ±1°C (outside)	
	EC Calibration	automatic or manual at 1 point	
	Temperature Compensation	automatic or manual, -10 to 100°C with adjustable temperature coefficient from 0.00 to 10.00%/°C	
	Outputs	analog: isolated 0-1 mA, 0-20 mA and 4-20 mA; 0-5 VDC, 1-5 VDC and 0-10 VDC or digital: RS485 bi-directional opto-isolated	
	Analog Input	4-20 mA	
	Set Point Relay	two contact outputs SPDT 5A-250 VAC, 5A-30 VDC (resistive load), fuse protected (2A, 250V fast fuse)	
	Alarm Relay	contact output SPDT 5A-250 VAC, 5A-30 VDC (resistive load), fuse protected (2A, 250V fast fuse	
	Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz	
	Power Consumption	15 VA	
	Over Current Protection	400 mA 250V fast fuse	
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
	Dimensions	panel cutout: 140 x 140 mm, instrument: 144 x 144 x 170 mm	
	Weight	1.6 kg (3.5 lb.)	

Ordering Information

Each HI700 and HI710 model is supplied with mounting brackets and instructions.

Choose your configuration

HI700221-1	dual setpoint, on/off and PID controls, analog output, 115V
HI700221-2	dual setpoint, on/off and PID controls, analog output, 230V
HI710221-1	dual setpoint, on/off and PID controls, analog output, 115V
HI710221-2	dual setpoint, on/off and PID controls, analog output, 230V
HI710222-1	dual setpoint, on/off and PID controls, RS485 output, 115V
HI710222-2	dual setpoint, on/off and PID controls, RS485 output, 230V

EC and TDS solutions begin on page 5.34

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

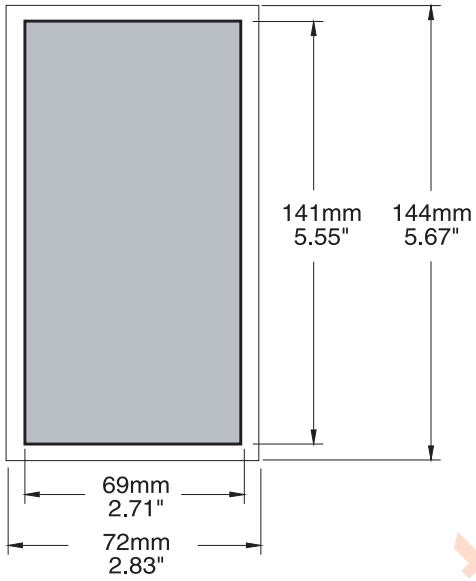
The controllers are housed in sturdy aluminum casings with ABS plastic front panels. The mounting brackets that are supplied with the meter, can be installed securely and quickly. When in operation, and with the transparent protective cover installed, the units comply with IP42 standards (see chart in 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

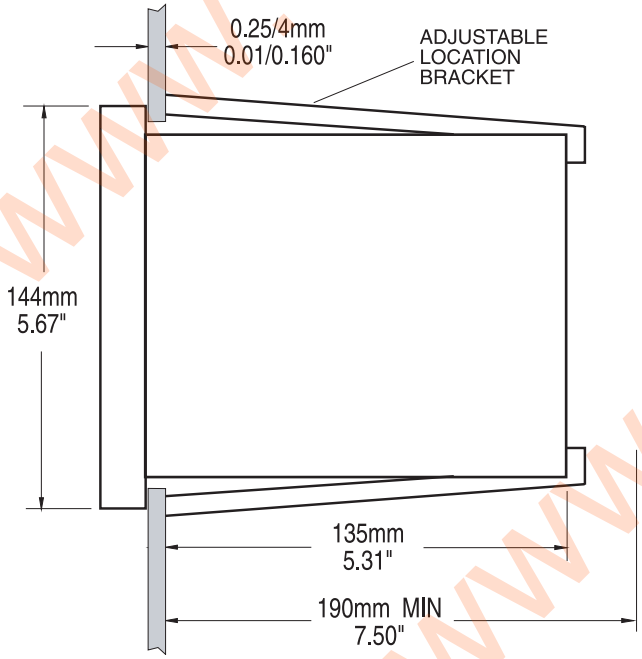
The LEDs on the front panel light up to indicate the current operational mode. The LEDs also blink at different rates to indicate multiple modes occurring simultaneously. This feature allows the user to evaluate the controller from a distance and clearly read which mode it is in.

Mechanical Dimensions for Panel Mounting

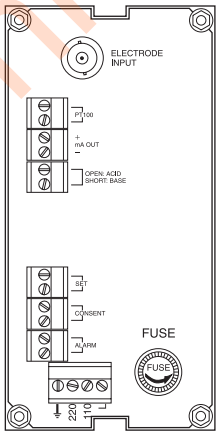
Analog Indicators and Controllers
HI8510 / HI8710 / HI8711 / HI8720 /
HI8931A / HI8931B / HI8931C / HI8931D / HI943500



Front View
Dimensions show the cutout size for installation and also the outside dimensions of the instrument panel.



Side View
Adjustable location brackets allow the instrument to slide into the cutout and will hold the unit securely in place. 190 mm (7.50") is the minimum amount of room required to install the indicator with the cables connected.



Rear View
Rear view of the HI8710 shows the typical electrical connections.

HI8510

pH Analog Indicator

with Self Diagnostic Test

- ATC
  - Automatic temperature compensation Backlight
- Backlit, LCD display

HI8510 is ideal for monitoring pH in process control. It can provide highly accurate pH measurements and display values on the easy to read LCD. BNC input, amplified probe input and input from transmitter are supported.

Designed for easy and fast installation, the HI 8510 is provided with membrane keypads on the front panel, large display, and auto-diagnostic functions to check pH electrode and instrument status. These instruments also provide ±5V power output and input terminals for amplified electrodes.

A removable, transparent splash-proof cover protects the front panel.

Specifications	HI8510	
Range	0.00 to 14.00 pH	
Resolution	0.01 pH	
Accuracy (@25°C/77°F)	±0.02 pH (0 to 100 °C); ±0.05 pH (-20 to 0 °C); ±0.5% (input transmitter)	
Input	high impedance 10^{12} Ohm; reference and matching pin inputs are available; 4-20 mA	
Power Output	±5 Vcc; 150 mA max load for amplified electrodes	
Calibration	offset: ±2 pH with OFFSET trimmer; slope: 80 to 110% with SLOPE trimmer	
Temperature Compensation	fixed or automatic with Pt100, from -20 to 100°C (-4 to 212°F)	
Recorder Output	0-20 mA or 4-20 mA (isolated)	
Backlight	continuous on	
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz	
Enclosure	flame retardant ABS body and front panel; transparent splash-proof front cover	
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing	
Panel Cutout	141 x 69 mm (5.6 x 2.7")	
Weight	1 kg (2.2 lb.)	
Ordering Information	The **HI8510** is supplied complete with mounting brackets and instructions.	
Accessories	**HI8427**	pH / ORP electrode simulator
	HI931001	pH / ORP electrode simulator with display
	HI8614N	pH transmitter
	HI8614LN	pH transmitter with display

pH solutions begin on page 2.136

HI8710

pH Analog Controller

with Self-Diagnostic Test

- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation
- Backlight
  - Backlit, LCD display

HI8710 is a panel mounted pH controller with self-diagnostic test capabilities. Users can set: the setpoint for acid or alkaline dosage, the tolerance of the setpoint before an alarm is activated, the dosage mode: automatic, continuous on or OFF and the over dosage control by setting the overtime dosage knob.

When used in conjunction with the HI8720 ORP controller, the ODCD* function will ensure that the ORP dosage will start only when the pH level is correct.

"Overtime dosage" function with selection knob and jumper for disable on the rear panel. If the dosing relay remains continuously activated for more than selected dosing time the alarm relay is activated, the alarm LED is blinking and the dosing relay is deactivated.

A removable, transparent splash-proof cover protects the front panel.

* ORP dosing consent device

Specifications	HI8710
Range	0.00 to 14.00 pH
Resolution	0.01 pH
Accuracy (@25°C/77°F)	±0.02 pH (0 to 100 °C); ±0.05 pH (-20 to 0 °C); ±0.5% (input from transmitter)
Input	high impedance 10^{12} Ohm; reference and matching pin inputs are available 4-20 mA
Power Output	±5 Vcc; 150 mA max load for amplified electrodes
Calibration	offset: ±2 pH with OFFSET trimmer; slope: 80 to 110% with SLOPE trimmer
Temperature Compensation	fixed or automatic with Pt100, from -20 to 100°C (-4 to 212°F)
Recorder Output	0-20 mA or 4-20 mA (isolated)
Set Point Relay	1, isolated, 2 A, max 240 V, resistive load, 1000000 strokes (not fuse protected)
Set Point Range	0.00 to 14.00 pH
Alarm Relay	1, isolated, 2 A, max 240 V, resistive load, 1000000 strokes (not fuse protected)
Alarm Range	0.2 to 3.00 pH
Consent Relay	1, isolated, 2 A, max 240 V, resistive load, 1000000 strokes (not fuse protected)
Dosing Control	OFF/AUTO/ON with selection switch
Over Dosing Control	adjustable, from 5 min to 60 min with knob or disable by wire strap - on rear panel
Backlight	continuous on
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz
Enclosure	flame retardant ABS body and front panel; transparent splash-proof front cover
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing
Panel Cutout	141 x 69 mm (5.6 x 2.7")
Weight	1 kg (2.2 lb.)
Ordering Information	The **HI8710** is supplied complete with mounting brackets and instructions.
Accessories	**HI8427** pH / ORP electrode simulator
	HI931001 pH / ORP electrode simulator with display
	HI8614N pH transmitter
	HI8614LN pH transmitter with display

HI8711

pH Analog Controller

with Dual Output and Self-Diagnostic Test

- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation
- Backlight
  - Backlit, LCD display

HI8711 allows the selection of two set points with two independent outputs for acid and alkaline dosages.

Each model accepts either a direct input from a pH or ORP electrode or from a transmitter through 4-20 mA input. The instrument also provides ±5V power output and input terminals for amplified electrodes. In addition, you can choose the output configuration for connecting a recorder or a PLC, between 0-20 or 4-20 mA.

The HI8711 incorporates adjustable overtime dosing protection from 5 to 60 minutes. If dosing exceeds selected time, the alarm will be triggered and the dosing contact will deactivate. This feature can be activated or deactivated.

A removable, transparent splash-proof cover protects the front panel.

Specifications	HI8711	
Range	0.00 to 14.00 pH	
Resolution	0.01 pH	
Accuracy (@25°C/77°F)	±0.02 pH (0 to 100 °C); ±0.05 pH (-20 to 0 °C); ±0.5% (input from transmitter)	
Input	high impedance 10^{12} Ohm; reference and matching pin inputs are available; 4-20 mA	
Power Output	±5 Vcc; 150 mA max load for amplified electrodes	
Calibration	offset: ±2 pH with OFFSET trimmer; slope: 80 to 110% with SLOPE trimmer	
Temperature Compensation	fixed or automatic with Pt100, from -20 to 100°C (-4 to 212°F)	
Recorder Output	0-20 mA or 4-20 mA (isolated)	
Set Point Relay	2, isolated, 2 A, max 240 V, resistive load, 1000000 strokes (not fuse protected)	
Set Point Range	alk. set: from 0.00 to 14.00 pH; acid set: from 0.00 to 14.00 pH	
Alarm Relay	1, isolated, 2 A, max 240 V, resistive load, 1000000 strokes (not fuse protected)	
Alarm Range	0.2 to 3.00 pH	
Dosing Control	OFF/AUTO/ON with selection switch	
Over Dosing Control	adjustable, from 5 min to 60 min with knob or disable by wire strap - on rear panel	
Backlight	continuous on	
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz	
Enclosure	flame retardant ABS body and front panel; transparent splash-proof front cover	
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing	
Panel Cutout	141 x 69 mm (5.6 x 2.7")	
Weight	1 kg (2.2 lb.)	
Ordering Information	The **HI8711** is supplied complete with mounting brackets and instructions.	
Accessories	**HI8427**	pH / ORP electrode simulator
	HI931001	pH / ORP electrode simulator with display
	HI8614N	pH transmitter
	HI8614LN	pH transmitter with display

pH solutions begin on page 2.136

HI8720

ORP Analog Controller

with Self-Diagnostic Test

- Backlight
  - Backlit, LCD display

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

When used in conjunction with the HI8710 pH controller, the ODCD (ORP dosing consent device) function (featured by the HI8710) will ensure that the ORP dosage will start only when the pH level is correct.

These instruments have been designed for easy and fast installation and are provided with membrane keypads on the front panel, large display, and autodiagnostic functions.

Each model accepts either a direct input from an ORP electrode or from a transmitter through 4-20 mA input. The instrument also provides ±5V power output and input terminals for amplified electrodes.

Moreover, you can choose the output configuration for connecting a recorder or a PLC, between 0-20 or 4-20 mA.

A removable, transparent splash-proof cover protects the front panel.

Specifications	HI8720
Range	±1999 mV
Resolution	1 mV
Accuracy (@25°C/77°F)	±5 mV; ±0.5% (input from transmitter)
Input	high impedance 10^{12} Ohm; reference and matching pin inputs are available; 4-20 mA
Power Output	±5 Vcc; 150 mA max load for amplified electrodes
Calibration	offset: ±200 mV with CAL trimmer;
Recorder Output	0-20 mA or 4-20 mA (isolated)
Set Point Relay	1, isolated, 2 A, max 240 V, resistive load, 1000000 strokes (not fuse protected)
Set Point Range	±1999 mV
Alarm Relay	1, isolated, 2 A, max 240 V, resistive load, 1000000 strokes (not fuse protected)
Alarm Range	10 to 300 mV
Dosing Control	OFF/AUTO/ON with selection switch
Over Dosing Control	adjustable, from 5 min to 60 min with knob or disable by wire strap - on rear panel
Backlight	continuous on
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz
Enclosure	flame retardant ABS body and front panel; transparent splash-proof front cover
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing
Panel Cutout	141 x 69 mm (5.6 x 2.7")
Weight	1 kg (2.2 lb.)
Ordering Information	The **HI8720** is supplied complete with mounting brackets and instructions.
Accessories	**HI8427** pH / ORP electrode simulator
	HI8615N ORP transmitter
	HI8615LN ORP transmitter with display

ORP solutions begin on page 2.141

HI8931AN · HI8931BN
HI8931CN · HI8931DN

EC Analog Controller

with Input from Probe or Transmitter

- ATC
  - Automatic temperature compensation
- Backlight
  - Backlit, LCD display

HI8931 is a panel mounted conductivity controller designed for simplicity of use. For in-line applications, use the HI7635 probe, while for tanks the HI7638 with external threads is recommended. These probes are provided with a built-in NTC sensor for temperature compensated conductivity measurements.

HI8931 also features a direct connection up to 20 m (67'), without needing to amplify the signal to the conductivity probe.

Using the HI8931 in conjunction with a 4-20 mA output transmitter (HI8936 or HI8936L series) will assure a strong, interference free signal at distances up to 300 meters (1000').

A removable, transparent splash-proof cover protects the front panel.

Specifications	HI8931AN	HI8931BN	HI8931CN	HI8931DN
Range	0.0 to 199.9 mS/cm	0.00 to 19.99 mS/cm	0 to 1999 µS/cm	0.0 to 199.9 µS/cm
Resolution	0.1 mS/cm	0.01 mS/cm	1 µS/cm	0.1 µS/cm
Accuracy (@25°C/77°F)	±2% F.S. (excluding probe error)	±2% F.S. (excluding probe error)	±2% F.S. (excluding probe error)	±2% F.S. (excluding probe error)
Input from Transmitter	HI8936A / AL	HI8936B / BL	HI8936C / CL	HI8936D / DL
Set Point Range	0.0 to 199.9 mS/cm	0.00 to 19.99 mS/cm	0 to 1999 µS/cm	0.0 to 199.9 µS/cm
Alarm Range	0.0 mS and 100.0 mS	0.00 mS and 10.00 mS	0 µS and 1000 µS	0.0 µS and 100.0 µS
Temp. Compensation	automatic, 0 to 60°C with β=2%/°C; see also transmitter HI8936			
Inputs	DIN (probe) or 4-20 mA (transmitter)			
Conductivity Probe	HI7635 for in-line applications or HI3001D for flow-thru (not included)			
Calibration	manual, two point, through offset and slope trimmers			
Recorder Output	0 to 20 mA or 4 to 20 mA (isolated)			
Set Point and Alarm Relay	1, Isolated, 2A, max. 240V, resistive load, 1,000,000 strokes			
Dosing Control	OFF/AUTO/ON with selection switch			
Over Dosing Control	adjustable, from 5 min to 60 min with knob or disable by wire strap - on rear panel			
Backlight	continuous on			
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz			
Enclosure	flame retardant ABS body and front panel; transparent splash-proof front cover			
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing			
Panel Cutout	141 x 69 mm (5.6 x 2.7")			
Weight	1 kg (2.2 lbs.)			
Ordering Information	The **HI8931** series is supplied with mounting brackets and instructions.			

EC solutions begin on page 5.34

HI943500A · HI943500B
HI943500C · HI943500D

EC Analog Controller

with Direct Input from Potentiometric Probe

- ATC
  - Automatic temperature compensation
- Backlight
  - Backlit, LCD display

These controllers allow direct connection of a potentiometric conductivity probe (HI7638) with a cable up to 20 m long, without needing a transmitter to amplify the signal.

The output configuration for connecting a recorder or a PLC can be chosen between 0-20 or 4-20 mA.

The LED on the front panel indicates the operating status of the controller.

The Automatic Temperature Compensation (ATC) is performed directly by the HI7638 probe with built-in temperature sensor.

A removable, transparent splash-proof cover protects the front panel.

Specifications	HI943500A	HI943500B	HI943500C	HI943500D
Range	0.0 to 199.9 mS/cm	0.00 to 19.99 mS/cm	0 to 1999 µS/cm	0.0 to 199.9 µS/cm
Resolution	0.1 mS/cm	0.01 mS/cm	1 µS/cm	0.1 µS/cm
Accuracy (@25°C/77°F)	±2% F.S.			
Calibration	manual, two point, through offset and slope trimmers			
Temperature Compensation	automatic, 0 to 60°C (32 to 140°F), with β=2%/°C			
Recorder Output	4-20 mA (isolated)			
Set Point Relay	1, isolated, 2A, max. 240 V, resistive load, 1,000,000 strokes			
Alarm Relay	1, isolated, 2A, max. 240 V, resistive load, 1,000,000 strokes			
Power Supply	115 or 230 VAC ±10% (user selectable); 50/60 Hz			
Enclosure	black anodized aluminum body; front panel with flame retardant ABS; transparent splash-proof front cover			
Environment	-10 to 50°C (14 to 122°F); RH max 95%			
Panel Cutout	141 x 69 mm (5.6 x 2.7")			
Weight	1 kg (2.2 lb.)			
Ordering Information	The **HI943500** series is supplied complete with mounting brackets and instructions.			
Probes	**HI7638**	PEI/glass body, 75 mm conductivity probe with internal temperature sensor and 3/8" NPT thread (immersion)		
	HI3001	PEI/PVDF body, 20 mm conductivity probe with internal temperature sensor, 1/2" NPT front thread (flow-thru) and 3/4" NPT back thread (submersion/pipe) mounting and 3 m (9.9') cable		
	HI3002	PEI/PVDF body, 60 mm conductivity probe with internal temperature sensor, 1/2" NPT front thread (flow-thru) and 3/4" NPT back thread (submersion/pipe) mounting and 3 m (9.9') cable		

EC solutions begin on page 5.34

HI8410

Dissolved Oxygen Controller

with Extended Range and Analog Output

- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation

The HI8410 is a panel mounted dissolved oxygen controller that is used to maintain and monitor the concentration of DO in a wide range of industrial process applications. The HI8410 uses a Galvanic probe that typically requires less maintenance than a Polarographic style making it ideal for long term monitoring.

The set point for controlling the activation of a relay is adjusted manually by the user. An alarm relay is also manually adjustable and is based upon a tolerance from the programmed setpoint. This controller features single set point calibration in zero oxygen solution.

The dosage mode: automatic, continuous ON or OFF and over dosage control by setting the overtime dosage trimmer. If the dosing relay remains continuously activated for more than the selected dosing time, the alarm relay is activated, the alarm LED will start blinking and the dosing relay will be deactivated. A jumper located on the controller's rear panel can disable the "over time dosage" function.

"Automatic/Off/manual" dosing selection switch and LED on the front panel. In Automatic mode all the relays are controlled based on the measurement set point and alarm values. In OFF mode the dosing and alarm relays are always deactivated. The dosing LED is OFF (as relay status) and the ALARM LED is in accordance with the instrument set point, input reading, and ALARM. In ON (Manual) mode the dosing relay is always on. The alarm relay is still enabled. If an alarm occurs the dosing relay remains activated. If the over dose time exceeds the setting during manual mode, the alarm relay remains activated.

The D.O. probe is provided with a membrane covering the galvanic sensor and a built-in thermistor for temperature measurement and compensation.

Specifications	HI8410	
Range	0.0 to 50.0 mg/L (ppm) O_2; 0 to 600 % O_2; -5.0 to 50.0°C	
Resolution	0.1 mg/L (ppm) or 1% (O_2) / 0.1°C	
Accuracy (@25°C/77°F)	±1% of reading (O_2) / ±0.2°C	
Calibration	manual, one point, in saturated air	
Temp. Compensation	automatic, from -5 to 50°C (23 to 122 °F)	
Salinity Compensation	0 to 51 g/L (resolution 1 g/L)	
Probe (not included)	HI76410/4 with 4 m (13.1') cable or HI76410/10 with 10 m (32.8') cable	
Recorder Output	0 to 20 mA or 4 to 20 mA (isolated)	
Set point and Alarm Relay	1, isolated, 2A, max. 240V, resistive load, 1,000,000 strokes	
Set point Range	1 to 600 % O2; 0.1to 50.0 mg/L (mg/L (ppm) O_2	
Alarm Range	1.0 to 5.0 mg/L (ppm) O_2	
Hysteresis Range	0.5 to 2.4 mg/L (ppm) O_2	
Dosing Control	OFF/AUTO/ON with selection switch	
Over Dosing Control	adjustable, from 5 min to 60 min with knob or disable by wire strap - on rear panel	
Backlight	continuous on	
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz	
Enclosure	flame retardant ABS body and front panel; transparent splash-proof front cover	
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-conndensing	
Panel Cutout	141 x 69 mm (5.6 x 2.7")	
Weight	1 kg (2.2 lb.)	
Ordering Information	The **HI8410** is supplied complete with mounting brackets and instructions.	
Probes	**HI76410/4**	Galvanic DO probe (fixed) with internal temperature sensor, DIN connector and 4 m (13.1') cable
	HI76410/10	Galvanic DO probe (fixed) with internal temperature sensor, DINconnector and 10 m (32.8') cable

See page 6.28 for DO solutions

Any system can be cost effectively monitored 24/7

BL mini controllers are the perfect solution for water analysis and control

pH Mini Controllers

Monitoring and controlling pH in water conditioning and industrial applications is essential for water quality and maintaining infrastructure (piping and equipment). In the case of industrial effluent, neutralization of acidic waste is vital for environmental safety and public health. In boiler feed water conditioning, a pH of 8.5 is necessary to prevent scaling and corrosion of critical components. Maintaining a pH of 7.4 is fundamental for proper and efficient sanitization in swimming pools and spas. The efficacy of sanitizers, such as chlorine, is dependent on a controlled pH value.

ORP Mini Controllers

ORP (oxidation reduction potential) is the most dependable and consistent indicator of the sanitizing effectiveness of your pool, spa, or water treatment. As oxidizers, chlorine, peroxide, and ozone are added, the ORP value increases, providing a clear indication of the cleansing power of the water. Typically, an ORP value of 650 to 700 mV at a pH of 7.2 indicates that your water is properly treated and all harmful bacteria are killed in less than 1 second. ORP is also essential in chemical processing where reducing agents are used and a negative ORP value indicates proper neutralization.

Conductivity Mini Controllers

In water, an increase in conductivity indicates an increase in water hardness and a decrease in purity. Conductivity monitoring and control is essential in reducing water hardness and maintaining water quality. Water with a conductivity value of 0 to 140 µS/cm is considered "very soft," while 640 to 840 µS/cm is considered "hard" water. An increase in conductivity indicates an increase in the amount of damaging dissolved solids (salts) present in water. Conductivity monitoring and control is essential in industrial applications such as feed water control, blow down activation in cooling towers and water management. In these applications, high conductivity will cause scaling and corrosion of piping and damage to critical components.

TDS Mini Controllers

A TDS (total dissolved solids) measurement is an important indicator of water quality. An increase in TDS indicates an increase in the amount of dissolved solids (salts) present in the water. TDS monitoring and control is imperative in industrial applications such as feed water control, blow down activation in cooling towers and water management. In these applications, high TDS will cause scaling and corrosion of piping and damage to critical components.

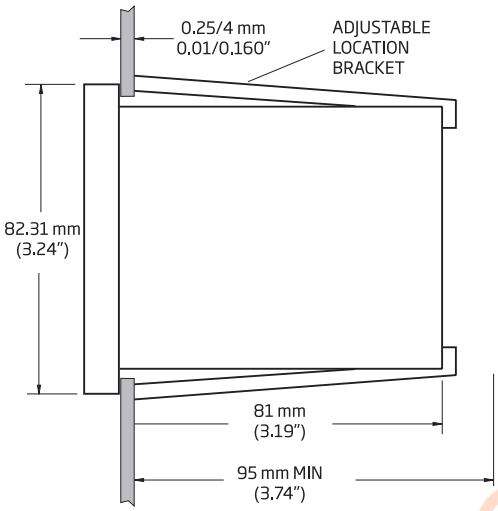
A TDS measurement is also an important indicator of the effectiveness of water conditioning, an increase in TDS indicates an increase in water hardness and a decrease in purity. This will affect the quality of drinking water, feed water and rinse water. TDS monitoring and control is crucial in reducing water hardness and maintaining water quality and usability.

Resistivity Mini Controller

Resistivity, measured in Ω•M, is the optimal way to measure the quality of water produced by high purity systems, such as reverse osmosis (RO) systems and water conditioning equipment. As resistivity is the inverse of conductivity, it provides a more accurate characterization of water with very low conductive ability. As filter systems become less effective, the resistivity value will decrease, indicating a need for maintenance and/or replacement of filters and critical components. Properly functioning RO and water conditioning systems will consistently produce water with resistivity readings in the range of 16 to 18 MΩ•cm.

Hanna Mini Controllers

BL Series Mechanical Dimensions

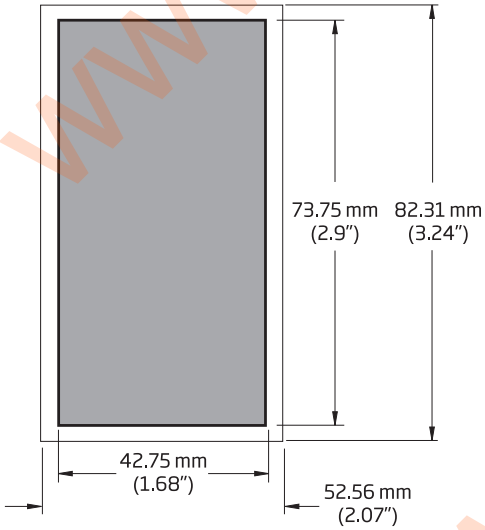


Side View

Side view of panel-mounted controllers.

Adjustable location brackets allow the controller to slide into the cutout and will hold the unit securely in place.

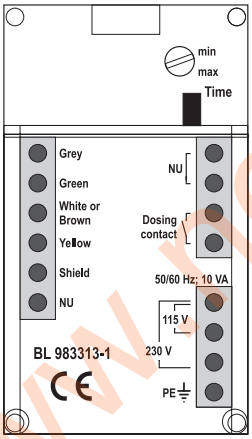
130 or 87 mm (depending on model) is the minimum amount of room required to install the meter with all wiring.



Front View

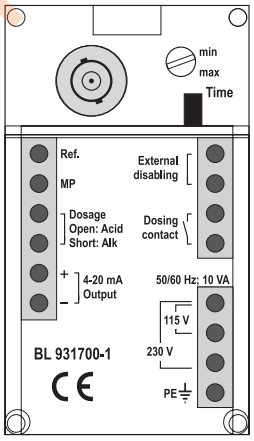
Front view of the panel-mounted units.

Dimensions show the cutout size for installation and also the outside dimensions of the panel.



Rear View

Rear view of the BL983313-1 with electrical connections.



Rear View

Rear view of the BL931700-1 with electrical connections.

BL981411

pH Mini Controller

- Easy to handle
- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

The BL981411 pH controller has been designed for easy, affordable installation in tight spaces, ideal for simple and effective process control. The unit is provided with high impedance pH input and can be used with any pH electrode with a standard BNC connector. Measurements are clearly displayed on the LCD, while the status LED indicates operating mode.

The BL981411 is also provided with a dosing relay. Selecting acid dosing will cause the relay to activate when the pH reading is higher than the setpoint. If the basic dosing is selected, the relay is activated when the pH reading falls below the setpoint.

Setpoint adjustment (from 0 to 14 pH) and calibration procedures are easily performed with trimmers on the front panel. Users can choose from automatic or manual dosing modes with a switch on the front panel. Manual control is particularly useful during maintenance operations, because it permits operators to enable or disable the dosing relay according to need. An overtime control system advises users when the relay is active too long, to help prevent overdosing.

Specifications	BL981411
Range	0.0 to 14.0 pH
Resolution	0.1 pH
Accuracy (@25°C/77°F)	±0.2 pH
Calibration	manual, through CAL (offset) trimmer
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 VDC
Dosing Selection	acid or alkaline contact open=acid dosage=relay ON if measurement > setpoint contact closed=alkaline dosage=relay ON if measurement < setpoint
Setpoint	adjustable from 0 to 14 pH
Overtime	adjustable, typically from 5 to approximately 30 minutes
Input Impedance	10^{12} Ohm
Power Supply	BL981411-0: 12 VDC adapter (included); BL981411-1: 115/230 VAC; 50/60Hz
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")
Weight	BL981411-0: 200 g (7.1 oz.); BL981411-1: 300 g (10.6 oz.)
Ordering Information	**BL981411-0** (12 VDC) and **BL981411-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.
Recommended Probe	**HI1001** PVDF body pH electrode with 1/2" NPT thread, BNC connector and 3 m (9.8') cable for continuous flow-thru monitoring (not included).

pH solutions begin on page 2.136

BL931700

pH Mini Controller

with 4-20 mA Recorder Output

- Easy-to-handle
- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

The BL931700 mini pH controller has been designed for easy, affordable installation in tight spaces to perform simple, yet effective process control. Thanks to its compact size, BL931700 can be installed right next to tanks or vats.

This versatile controller is ideal for a wide variety of applications, such as textiles, papers, photographic solutions, plating baths, chemicals and water treatment.

The BL931700 is provided with a selectable setpoint for acid or basic dosage.

Accuracy is ensured by two-point calibration, performed manually through trimmers on the front panel.

Users can choose automatic or manual dosing mode with a switch on the front panel. Manual control is particularly useful during maintenance operations, because it permits operators to enable or disable the dosing relay according to need. The overtime control system advises users when the relay is active for too long, helping to prevent overdosing.

In addition, this model features a 4-20 mA analog output for recorder connection.

Specifications	BL931700
Range	0.00 to 14.00 pH
Resolution	0.01 pH
Accuracy (@25°C/77°F)	±0.02 pH
Calibration	manual, through offset and slope trimmers
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 VDC
Dosing Selection	acid or alkaline contact open=acid dosage=relay ON if measurement > setpoint contact closed=alkaline dosage=relay ON if measurement < setpoint
Setpoint	adjustable from 0 to 14 pH
Overtime	adjustable, typically from 5 to approximately 30 minutes
Recorder Output	4 to 20 mA, accuracy ±0.20 mA, 500 Ω maximum load
Input Impedance	10^{12} Ohm
Power Supply	BL931700-0: 12 VDC adapter (included); BL931700-1: 115/230 VAC; 50/60Hz
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")
Weight	BL931700-0: 200 g (7.1 oz.); BL931700-1: 300 g (10.6 oz.)
Ordering Information	**BL931700-0** (12 VDC) and **BL931700-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.
Recommended Probe	**HI1001** PVDF body pH electrode with 1/2" NPT thread, BNC connector and 3 m (9.8') cable for continuous flow-thru monitoring (not included).

pH solutions begin on page 2.136

BL982411

ORP Mini Controller

- Easy to handle
- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

The BL982411 is an ORP mini controller for panel mounting, specially designed for swimming pools and spas. Thanks to its compact size, the BL982411 can be installed in small spaces. This controller is the ideal solution for those who have always checked ORP manually. With its automatic dosing, this mini controller will significantly reduce maintenance time.

The BL982411 can be used with any ORP electrode with a standard BNC connector. The status LED continuously indicates if the controller is in measurement, dosing or alarm mode.

The BL982411 is also provided with a relay for selecting the dosing direction, oxidizing or reducing.

Users can choose automatic or manual dosing mode with a switch on the front panel. Manual control is particularly useful during maintenance operations, because it permits operators to enable or disable the dosing relay according to need. The overtime control system advises users when the relay is active for too long, helping to prevent overdosage.

Specifications	BL982411
Range	0 to 1000 mV
Resolution	1 mV
Accuracy (@25°C/77°F)	±5 mV
Calibration	manual, with CAL trimmer
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 VDC
Dosing Selection	reducing or oxidizing, selectable on the back panel contact open=reductant dosage=relay ON if measure > setpoint contact closed=oxidant dosage=relay ON if measure < setpoint
Setpoint	adjustable, from 0 to 1000 mV
Overtime	adjustable, typically from 5 to approximately 30 minutes
Input Impedance	10^{12} Ohm
Power Supply	BL982411-0: 12 VDC adapter (included); BL982411-1: 115/230 VAC; 50/60Hz
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")
Weight	BL982411-0: 200 g (7.1 oz.); BL982411-1: 300 g (10.6 oz.)
Ordering Information	**BL982411-0** (12 VDC) and **BL982411-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.
Recommended Probe	**HI2001** PVDF body ORPelectrode with 1/2" NPT thread, BNC connector and 3 m (9.8') cable for continuous flow-thru monitoring (not included).

pH solutions begin on page 2.136

BL932700

ORP Mini Controller

with 4-20 mA Recorder Output

- Easy to handle
- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

The BL932700 is an ORP mini controller that has been designed for easy, affordable installation in tight spaces, ideal for simple yet effective process control. As a result of its compact size, the BL932700 can be installed right next to tanks or vats.

This versatile controller is ideal for many applications, such as ORP monitoring of bleaching processes, wastewater treatment and swimming pools. the BL932700 permits automatic control of installations that were previously checked manually.

The instrument can be set for reducing or oxidizing dosage. Setpoint adjustment and calibration are simply performed through trimmers on the front panel. Users can choose automatic or manual dosing mode with a switch on the front panel. Manual control is particularly useful during maintenance operations, because it permits operators to enable or disable the dosing relay according to need.

The overtime control system advises users when the relay is active too long, helping to prevent overdosage. In addition, this model features a 4-20 mA analog output for recorder connection.

Specifications	BL932700
Range	±1000 mV
Resolution	1 mV
Accuracy (@25°C/77°F)	±5 mV
Calibration	manual, with CAL trimmer
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 VDC
Dosing Selection	reducing or oxidizing, selectable on the back panel contact open=reductant dosage=relay ON if measure > setpoint contact closed=oxidant dosage=relay ON if measure < setpoint
Setpoint	adjustable from -1000 to 1000 mV
Overtime	adjustable, typically from 5 to approximately 30 minutes
Recorder Output	4 to 20 mA, accuracy ±0.20 mA, 500 Ω maximum load
Input Impedance	10^{12} Ohm
Power Supply	BL932700-0: 12 VDC adapter (included); BL932700-1: 115/230 VAC; 50/60Hz
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")
Weight	BL932700-0: 200 g (7.1 oz.) BL932700-1: 300 g (10.6 oz.)
Ordering Information	**BL932700-0** (12 VDC) and **BL932700-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.
Recommended Probe	**HI2001** PVDF body ORPelectrode with 1/2" NPT thread, BNC connector and 3 m (9.8') cable for continuous flow-thru monitoring (not included).

ORP solutions begin on page 2.141

BL983313 • BL983320 • BL983322

EC Mini Controllers

Measuring in µS/cm

- Adjustable setpoint
- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

These Hanna mini controllers have been specially designed for water conditioning and growing applications. Compact in size, they can be mounted in confined spaces or even right next to the vat or barrel containing the chemicals. These meters permit automatic control of installations previously checked manually.

EC measurements are shown on the display and the multi-colored LED continuously indicates if the mini controller is in measurement, dosing, or alarm mode.

Users can choose automatic or manual dosing mode with a switch on the front panel. Manual control is particularly useful during maintenance operations, because it permits operators to enable or disable the dosing relay according to need. The overtime control system advices users when the relay is active for too long, helping to prevent overdosage.

Specifications	BL983313	BL983320	BL983322
Range	0 to 1999 µS/cm	0.0 to 199.9 µS/cm	0.00 to 19.99 µS/cm
Resolution	1 µS/cm	0.1 µS/cm	0.01 µS/cm
Accuracy (@25°C/77°F)	±2% F.S.	±2% F.S.	±2% F.S.
Setpoint	adjustable from 0 to 1999 µS/cm	adjustable from 0 to 199.9 µS/cm	adjustable from 0 to 19.99 µS/cm
Temperature Compensation	automatic from 5 to 50°C (41 to 122°F) with β =2%/°C		
Calibration	manual, with CAL trimmer		
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 VDC contact closed when measure > setpoint		
Overtime	adjustable, typically from 5 to approximately 30 minutes		
Power Supply	models "-0": 12 VDC adapter (included) models "-1": 115/230 VAC; 50/60Hz		
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")		
Weight	models "-0": 200 g (7.1 oz.) models "-1": 300 g (10.6 oz.)		
Ordering Information	**BL983313-0** (12 VDC), **BL983313-1** (115/230V), **BL983320-0** (12 VDC), **BL983320-1** (115/230V), **BL983322-0** (12 VDC) and **BL983322-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.		
Recommended Probe	**HI7634-00** EC/TDS probe with internal temperature sensor and 2 m (6.6') cable (not included).		

EC solutions begin on page 5.34

BL983317 • BL983327

EC Mini Controllers

Measuring in mS/cm

- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

The BL983317 and BL983327 are panel-mounted mini controllers with output relays that have been designed for easy, affordable installation in tight spaces, ideal for simple yet effective process control.

Both instruments are provided with automatic compensation for variations in temperature. The probe (not included) is easy to clean and requires very little maintenance. The calibration is performed manually at one point, through a trimmer.

All wiring and connections to external devices are done through the terminals on the rear panel. The multi-color LED continuously indicates if the controller is in measurement, dosing, or alarm mode.

Users can choose automatic or manual dosing mode by a switch on the front panel. Manual control is particularly useful during maintenance operations because it permits operators to enable or disable the dosing relay according to need. To help prevent overdosing, the overtime control system advises users when the relay is active too long.

Specifications	BL983317	BL983327
Range	0.00 to 10.00 mS/cm	
Resolution	0.01 mS/cm	
Accuracy (@25°C/77°F)	±2% F.S.	
Temperature Compensation	automatic from 5 to 50°C (41 to 122°F) with β =2%/°C	
Calibration	manual, with CAL trimmer	
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 VDC	
	contact closed when measure < setpoint	contact closed when measure > setpoint
Setpoint	adjustable from 0 to 10 mS/cm	
Overtime	adjustable, typically from 5 to approximately 30 minutes	
Power Supply	models "-0": 12 VDC adapter (included) models "-1": 115/230 VAC; 50/60Hz	
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")	
Weight	models "-0": 200 g (7.1 oz.) models "-1": 300 g (10.6 oz.)	
Ordering Information	**BL983317-0** (12 VDC), **BL983317-1** (115/230V), **BL983327-0** (12 VDC) and **BL983327-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.	
Recommended Probe	**HI7632-00** EC/TDS probe with internal temperature sensor and 2 m (6.6') cable (not included).	

EC solutions begin on page 5.34

BL983315 • BL983319
BL983321 • BL983329

TDS Mini Controllers

- Adjustable overtime control
- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

These instruments have been designed for TDS control in hydroponics, horticulture and water conditioning. Compact in size, they can be mounted in confined spaces or even right next to the vat or barrel containing the chemicals. These meters permit automatic control of installations that were previously checked manually.

Readings are shown on the display and the multi-colored LED continuously indicates if the mini controller is in measurement, dosing, or alarm mode.

Users can choose automatic or manual dosing mode with a switch on the front panel. Manual control is particularly useful during maintenance operations, because it permits operators to enable or disable the dosing relay according to your need.

The overtime control system advises users when the relay is active too long, helping to prevent overdosage.

Specifications	BL983315	BL983319	BL983321	BL983329
Range	0.0 to 199.9 mg/L (ppm)	0 to 1999 mg/L (ppm)	0.00 to 19.99 mg/L (ppm)	0 to 999 mg/L (ppm)
Resolution	0.1 mg/L (ppm)	1 mg/L (ppm)	0.01 mg/L (ppm)	1 mg/L (ppm)
Accuracy (@25°C/77°F)	±2% F.S.	±2% F.S.	±2% F.S.	±2% F.S.
TDS Conversion Factor	0.5	0.65	0.5	0.5
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 VDC Contact close when measure:			
	> setpoint	< setpoint	> setpoint	> setpoint
Setpoint	adjustable from 0 to 199.9 mg/L (ppm)	adjustable from 0 to 1999 mg/L (ppm)	adjustable from 0 to 19.99 mg/L (ppm)	adjustable from 0 to 999 mg/L (ppm)
Temperature Compensation	automatic from 5 to 50°C (41 to 122°F) with β =2%/°C			
Calibration	manual, with CAL trimmer			
Overtime	adjustable, typically from 5 to approximately 30 minutes			
Power Supply	models "-0": 12 VDC adapter (included) models "-1": 115/230 VAC; 50/60Hz			
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")			
Weight	models "-0": 200 g (7.1 oz.) models "-1": 300 g (10.6 oz.)			
Ordering Information	**BL983315-0** (12 VDC), **BL983315-1** (115/230V), **BL983319-0** (12 VDC), **BL983319-1** (115/230V), **BL983321-0** (12 VDC), **BL983321-1** (115/230V), **BL983329-0** (12 VDC) and **BL983329-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.			
Recommended Probe	**HI7634-00** EC/TDS probe with internal temperature sensor and 2 m (6.6') cable (not included).			

TDS solutions begin on page 5.37

BL983318

TDS Mini Controllers

0 to 10,000 ppm

- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

The BL983318 is a mini controller that has been designed for easy, affordable installation in tight spaces, ideal for simple yet effective process control.

The BL983318 features automatic temperature compenstion and simple one-point calibration performed through the trimmer.

The multi-colored LED continuously indicates if the controller is in measurement, dosing, or alarm mode.

Wiring and external device connections are extremely simple to perform through the terminals on the rear of the instrument.

Users can choose automatic or manual dosing mode with a switch on the front panel. Manual control is particularly useful during maintenance operations because it permits operators to enable or disable the dosing relay according to need.

The overtime control system advises users when the relay is active too long, helping to prevent overdosage.

Specifications	BL983318
Range	0.00 to 10.00 g/L (ppt)
Resolution	0.01 g/L (ppt)
Accuracy (@25°C/77°F)	±2% F.S.
TDS Conversion Factor	0.5
Temperature Compensation	automatic from 5 to 50°C (41 to 122°F) with β=2%/°C
Calibration	manual, with CAL trimmer
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 VDC contact closed when measure > setpoint
Setpoint	adjustable from 0 to 10 ppt (g/L)
Overtime	adjustable, typically from 5 to approximately 30 minutes
Power Supply	BL983318-0: 12 VDC adapter (included) BL983318-1: 115/230 VAC; 50/60Hz
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")
Weight	BL983318-0: 200 g (7.1 oz.) BL983318-1: 300 g (10.6 oz.)
Ordering Information	**BL983318-0** (12 VDC) and **BL983318-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.
Recommended Probe	**HI7632-00** EC/TDS probe with internal temperature sensor and 2 m (6.6') cable (not included).

TDS solutions begin on page 5.37

BL983324

TDS Mini Controllers

- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

The BL983324 is a panel-mounted TDS controller, designed for easy installation, configuration and maintenance.

The meter is provided with a dosing relay that is activated when the TDS reading exceeds the setpoint value.

Measurements are compensated for temperature variations and are shown on the display automatically.

A multi-colored LED on the front panel continuously indicates if the mini controller is in measurement, dosing, or alarm mode.

Wiring and external device connections are extremely simple to perform through the terminals on the rear of the instrument.

Users can choose automatic or manual dosing mode with a switch on the front panel. Manual control is particularly useful during maintenance operations, because it permits operators to enable or disable the dosing relay according to need.

The overtime control system advises operators when the relay is active too long, helping to prevent overdosage.

Specifications	BL983324
Range	0.0 to 49.9 mg/L (ppm)
Resolution	0.1 mg/L (ppm)
Accuracy (@25°C/77°F)	±2% F.S.
TDS Conversion Factor	0.5
Temperature Compensation	automatic from 5 to 50°C (41 to 122°F) with β=2%/°C
Calibration	manual, with CAL trimmer
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 VDC contact closed when measure > setpoint
Setpoint	adjustable from 0 to 49.9 mg/L (ppm)
Overtime	adjustable, typically from 5 to approximately 30 minutes
Power Supply	BL983324-0: 12 VDC adapter (included) BL983324-1: 115/230 VAC; 50/60Hz
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")
Weight	BL983324-0: 200 g (7.1 oz.) BL983324-1: 300 g (10.6 oz.)
Ordering Information	**BL983324-0** (12 VDC) and **BL983324-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.
Recommended Probe	**HI7634-00** EC/TDS probe with internal temperature sensor and 2 m (6.6') cable (not included).

TDS solutions begin on page 5.37

BL983314

Resistivity Mini Controllers

- Fire-retardant casing
- Selectable overdose protection system
- Splash-resistant cover

The BL983314 is a simple to operate resistivity controller designed for ultra pure water, reverse osmosis, and water conditioning applications. The BL983314 resistivity controller is also ideal for continuous monitoring of process solutions. Setpoint and calibration are manually adjusted with a trimmer and the alarm relay allows for simple control.

Readings are automatically temperature compensated, with three different coefficients (β=2.4, 3.5 or 4.5 %/°C). The alarm contact can be used for connection to an alarm, pump, solenoid or dosing system.

The relay contact is open when readings are higher than the setpoint, while for measurements lower than setpoint, the relay contact is closed. The hysteresis is typically 0.20 MΩ•cm from the setpoint.

Measurements are displayed on the LCD and the multi-colored LED continuously indicates if the controller is in measurement, dosing, or alarm mode. Users can choose automatic or manual dosing mode with a switch on the front panel. Manual control is particularly useful during maintenance operations, because it permits operators to enable or disable the dosing relay according to need.

The overtime control system advises users when the relay is active for too long, helping to prevent overdosage.

Specifications	BL983314
Range	0.00 to 19.90 MΩ•cm
Resolution	0.10 MΩ•cm
Accuracy (@25°C/77°F)	±2% F.S.
Temperature Compensation	automatic and linear from 5 to 50°C (41 to 122°F)
Temperature Coefficient	β=2.4 ; 3.5 ; 4.5 %/°C selectable through jumper on the rear panel
Calibration	factory calibrated
Dosing Relay	maximum 2A (fuse protected), 250 Vac, 30 Vdc contact closed when measure < setpoint
Setpoint	adjustable from 0 to 19.90 MΩ•cm
Overtime	adjustable, typically from 5 to approximately 30 minutes
Power Supply	BL983314-0: 12 VDC adapter (included) BL983314-1: 115/230 VAC; 50/60Hz
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")
Weight	BL983314-0: 200 g (7.1 oz.) BL983314-1: 300 g (10.6 oz.)
Ordering Information	**BL983314-0** (12 VDC) and **BL983314-1** (115/230V) are supplied with mounting brackets, transparent cover and instruction manual.
Recommended Probe	**HI3314** resistivity probe with 2 m (6.6') cable (included)

HI7871 • HI7873

Mini Level Controllers

The HI7871 and HI7873 mini level controllers are ideal for liquid level control over distances of up to 100 m (330'). These instruments are highly compact and will fit in tight spaces.

These easy-to-use controllers are suited for nearly any liquid level application, such as industrial and municipal water treatment, nutrient tank control in farming, hydroponics, aquaculture and plating rinse baths.

The HI7871 features high and low level control, while the HI7873 includes an overflow alarm. Both instruments are connected to a two-wire transmitter (HI7874), which is ideal for level monitoring in remote applications.

A complete liquid level measuring system requires:

1) A controller (HI7871 or HI7873)
2) A bar holder with amplifier circuitry (HI7874)
3) A package of measuring bars (HI731324)
4) An undecal connector (HI7164)

HI7874
Level Transmitter with
HI 731324 Stainless Steel
Measuring Bars

Specifications	HI7871	HI7873
Transmission	max 100 m (330')	
Electrical Connection	HI7164 undecal connector (not included)	
Level Adjustment	high and low	high, low and overflow
Level Indication	high and low	high, low and overflow
Sensor Bars	three*	four **
Transmitter	HI7874 (not included)	HI7874 (not included)
Output Contact	one relay (2A/250 VAC, 30 VDC)	two relays (2A/250V, 30 VDC)
Power Supply	models "/115": 110/115 VAC; 50/60Hz models "/220": 220/240 VAC; 50/60Hz	
Environment	0 to 50°C (32 to 122°F); RH max 85% non condensing	
Dimensions	83 x 53 x 99 mm (3.3 x 2.1 x 3.9")	
Weight	250 g (8.8 oz)	
Ordering Information	**HI7871/115** (115V) is supplied with mounting brackets and instructions. **HI7871/220** (220V) is supplied with mounting brackets and instructions. **HI7873/115** (115V) is supplied with mounting brackets and instructions. **HI7873/220** (220V) is supplied with mounting brackets and instructions. **HI731324** measuring bar set for level controller	

*HI7871 requires 3 bars, one each for low and high levels and the third as a consent sensor.
**HI7873 requires 4 bars with the additional bar used for overflow measurement.

HI7874

Level Transmitter

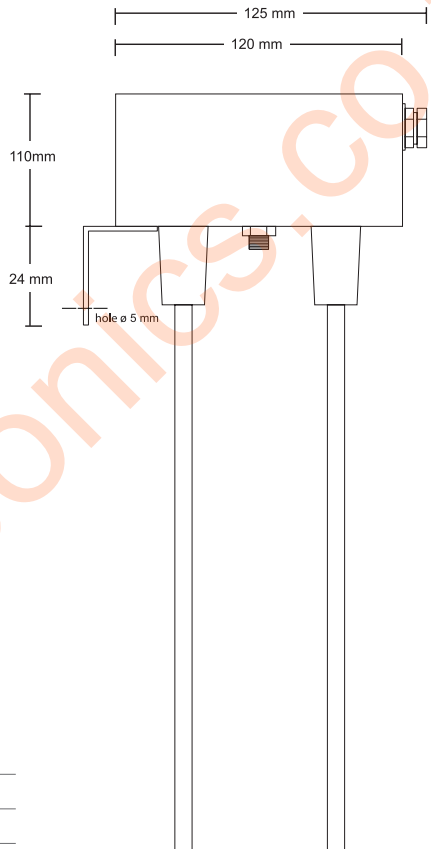
Accurate level control is critical to many industrial applications, especially for process adjustments using aggressive chemicals. Our sensor bars are built with stainless steel for long life, even in harsh conditions. These transmitters are easy to install and ideal for monitoring tanks and water conditioning plants.

The HI7874 transmitter was designed in conjunction with the HI7871 and HI7873 level controllers. The transmitter is housed in a durable and waterproof ABS body and allows the user to easily adjust the length of the sensor bars according to the specific need.

The HI7874 is supplied with a sturdy mounting bracket for quick and easy installation.

HI7874

Level Transmitter with HI731324
Stainless Steel Measuring Bars



Specifications	HI7874
Transmission	max 100 m (330')
Electrical Connection	two-wire terminal
Level Adjustment	high, low and overflow
Sensor Bars	three or four (not included)
Power Supply	from level controller
Environment	0 to 50°C (32 to 122°F); RH max 100%
Weight	550 g (1.2 lbs.)
Ordering Information	**HI7874** is supplied with mounting bracket and instructions. **HI731324** measuring bar set for level controller

MEADOS pH and ORP Measuring and Dosing System

Black Stone by Hanna

Two Advanced Instruments in One

MEADOS pumps combine the powerful Blackstone dosing pumps with Hanna pH/ORP controllers. This latest innovation eliminates the need for multiple units by combining a pH controller and chemical feed pump into one. No more complicated installations, wiring and compatibility problems. This compact unit features accurate regulation, proportional dosing, alarm and recorder signals and much more, all in one meter.

Easy Installation

Designed with mounting holes built into a rugged base, Blackstone pump/controllers are simple to install. They use a standard pH probe with a BNC connector to eliminate the need for any additional hardware. All of the controls and pump assemblies are conveniently located on the front of the unit. There is no need to uninstall the unit to access the pump head or control panel.

Rugged Construction

Blackstone pump/controllers are housed in rugged, fiber-reinforced polypropylene IP55 rated casings to prevent the ingress of liquids. The material used for the housing resists corrosion caused by most chemicals, protecting the unit from hazardous spills and splashes.

Superior Materials

Blackstone pumps use PVDF, FPM/FKM and PTFE materials for all components in contact with the chemicals being dosed. These materials have properties which enable them to resist even the most corrosive chemicals in the industry. The chemical resistance chart on page 17.54 shows how well PVDF, FPM/FKM and PTFE resist the harmful effects of different products.

Simple Pump Action

A positive displacement solenoid with few moving parts makes Blackstone pumps more reliable than motor driven pumps since there is no rotating parts, gears or cams; drastically reducing any chance of mechanical failure.

Proportional Dosing

The Blackstone controller/pump strokes at full capacity when the measured value deviates by more than 1.5 pH or 150 mV from the set value. A proportional control slows down the stroke rate as the measured value approaches the user selectable set points, avoiding overdosage of chemicals. This feature makes the pump's dosing more accurate, saves chemicals and eliminates unnecessary and costly corrections to your process, especially with slow reacting chemicals.

Isolated Recorder Output

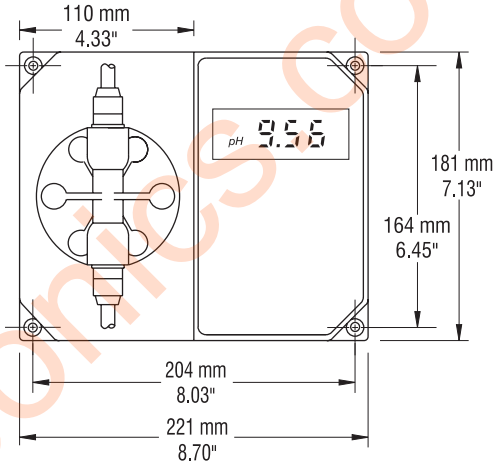
To enhance troubleshooting and the ability to record data while monitoring, Blackstone controller/pumps provide a recorder output. By simply attaching a recording device to the instrument's 4 to 20 mA output contacts, conveniently located on the front panel, you can obtain a hard copy of the results on demand.

Alarm Output

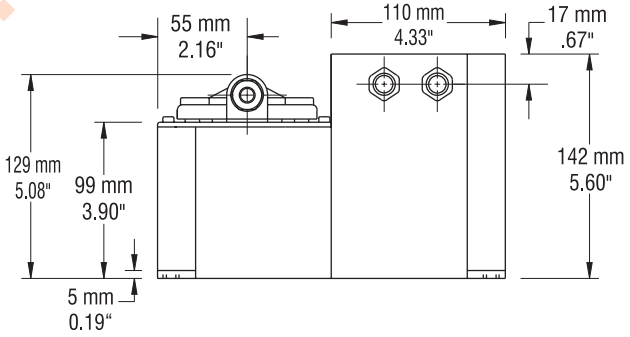
When monitoring and controlling pH and ORP levels in a process, it is very important that any potential problem does not go unattended. The Hanna MEADOS units incorporate an alarm system that will alert the user if the reaction is not within certain guidelines. The alarm of the BL7916 will be activated if the measured pH value is 2 pH units lower than the set point (if dosing acid, this indicates overdosage, a common symptom of siphoning). The alarm will also activate if the value is 2 pH higher than the set point (if dosing acid, this is an indication of insufficient dosage, a common symptom of the lack of chemicals). The BL7917's alarm will activate if the mV value is 200 mV lower than the set point (if dosing reducing chemicals, this indicates overdosage). The alarm will also activate if the value is 200 mV higher than the set point (if dosing reducing chemicals, this is an indication of lack of chemicals).

Auxiliary Dosing Contacts

The auxiliary dosing contacts of the MEADOS units are closed whenever the pump is dosing. This solution offers considerable advantages, especially for small plants, where these pumps need to be the only equipment left running. This will spare other equipment such as mixers, priming pumps etc. With this feature activated, a mixer can be automatically started, when the pump is dosing.



Front View
This series of instruments will mount easily in your plant using a minimum of wall space. The controls and pump head are located in the front to allow easy access.



Bottom View
The controller/pump series of instruments are enclosed in a modular housing for maximum protection. These illustrations show the layout of the controller/pumps and how they utilize the one-piece polypropylene, injection-molded housing for rigidity.

Black Stone
by Hanna

BL7916

pH Controller and Pump

- pH controller and dosing pump
- ±0.01 pH accuracy
- Isolated 4 to 20 mA recorder output.
- Proportional dosing
  - Slows the pump down when the measured pH level approaches the set value, which ensures precise dosage and avoids costly waste of chemicals due to overdosage.
- Alarm contact
  - Activated whenever the pH value varies more than 2 pH units from the set point.
- Auxiliary contacts
  - Allow the user to attach a mixer or priming pump that is activated only when the pump is dosing.
- PVDF, FPM/FKM and PTFE materials
  - Used for all parts that come into contact with liquid.

Specifications	BL7916
Range	0.00 to 14.00 pH
Resolution	0.01 pH
Accuracy (@25°C/77°F)	±0.01 pH
Flow Rate	see table
Input Impedance	10^{12} Ohm
Dosage	proportional, acid or base, user selectable
Dosing Contact	1 isolated, 2A, max. 240V, resistive load, 1,000,000 strokes
Alarm Contact	1 isolated, 2A, max. 240V, resistive load, 1,000,000 strokes
Calibration	offset: ±1 pH with trimmer; slope: 85 to 115% with trimmer
Recorder Output	4-20 mA (isolated)
Power Supply	BL 7916-1: 115V ±15%; 50/60Hz (40W); BL 7916-2: 230V ±15%; 50/60Hz (40W)
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Dimensions	221 x 142 x 181 mm (8.7 x 5.6 x 7.1")
Weight	5 kg (11 lb.)
Ordering Information	**BL7916-1** is supplied with discharge and suction valves, polyethylene tubing, 115V power cable and instructions **BL7916-2** is supplied with discharge and suction valves, polyethylene tubing, 230V power cable and instructions

BL7916 PRESSURE/FLOW

BAR (PSI)	LPH (GPH)
0.5 (7.4)	13.3 (3.46)
1.0 (14.7)	11.7 (3.04)
2.0 (29.4)	10.1 (2.63)
3.0 (44.1)	9.0 (2.33)
4.0 (58.8)	7.8 (2.03)

pH solutions begin on page 2.136

BL7917

ORP Controller and Pump

Black Stone by Hanna

- ORP controller and dosing pumps
- ±5 mV accuracy
- Isolated 4 to 20 mA recorder output.
- Proportional dosing
  - Slows the pump down when the measured ORP level approaches the set value, to avoid over dosage of oxidizing or reducing agents.
- Alarm contact
  - Is activated whenever the ORP reading varies more than 200 mV from the setpoint.
- Auxiliary contacts
  - Allow users to attach a mixer or priming pump that is activated only when the pump is dosing
- PVDF, FPM/FKM and PTFE materials
  - are used for all parts that come into contact with liquid.

Specifications	BL7917
Range	-999 mV to +999 mV
Resolution	1 mV
Accuracy (@20°C/68°F)	±5 mV
Flow Rate	see table
Input Impedance	10^{12} Ohm
Dosage	proportional, oxidizing or reducing, user selectable
Dosing Contact	1 isolated, 2A, max. 240V, resistive load, 1,000,000 strokes
Alarm Contact	1 isolated, 2A, max. 240V, resistive load, 1,000,000 strokes
Recorder Output	4-20 mA (isolated)
Power Supply	BL 7917-1: 115V ±15%; 50/60Hz (40W) BL 7917-2: 230V ±15%; 50/60Hz (40W)
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Dimensions	221 x 142 x 181 mm (8.7 x 5.6 x 7.1")
Weight	5 kg (11 lb.)
Ordering Information	**BL7917-1** is supplied with discharge and suction valves, polyethylene tubing, 115V power cable and instructions. **BL7917-2** is supplied with discharge and suction valves, polyethylene tubing, 230V power cable and instructions.

BL7917 PRESSURE/FLOW

BAR (PSI)	LPH (GPH)
0.5 (7.4)	13.3 (3.46)
1.0 (14.7)	11.7 (3.04)
2.0 (29.4)	10.1 (2.63)
3.0 (44.1)	9.0 (2.33)
4.0 (58.8)	7.8 (2.03)

ORP solutions begin on page 2.141

Reliable, High Performance Wall Mounted Controllers

Hanna wall mounted pH, ORP, and conductivity controllers are specifically designed to meet your process control requirements. The controllers come equipped with power relays operating at a maximum of 2A (240V). Electrodes can be installed quickly and easily. Simply plug the universal BNC or DIN connector over the socket and twist it into a secured position. This feature greatly improves the reliability of your instrumentation by assuring a positive connection. Accurate measurements are displayed on a large LCD, enabling the operator to check the controller readings easily.

Alarm Feature

The Hanna wall mounted series of controllers incorporate a triple contact alarm system that allows the user to select whether the alarm contacts will be in a normally open or normally closed position. When the measured value of the meter is out of range, the alarm is activated. The alarm will also be activated if the unit loses power. When activated, the alarm contacts will open or close, triggering the mechanism of your choice, whether a buzzer, light or any other electrical device. The alarm is a necessity when the installation is in a remote location and corrective action must be taken immediately in the event of an out of range condition.

Isolated Recorder Output

The ability to record the data from the process you are monitoring greatly enhances process troubleshooting. By simply connecting a recorder to the controller's output terminals you are able to acquire a hard copy of the readings for demonstrative or analytical purposes. The recorder output terminals are isolated from the controller circuitry to avoid any interference and are user switchable between 0 to 20 mA or 4 to 20 mA.

High Impedance Input

The pH and ORP controllers come with high impedance 10^{12} Ω direct input from the electrode, ideal for applications with distances of up to 10 m (33'). The greater the distance between the controller and the sample, the greater the chance that line noise will occur, causing faulty readings. Use an AmpHel® pH electrode (available also with external battery) to greatly enhance the input signal allowing high accuracy at distances of up to 50 m (165').

Quality Construction

These controllers are housed in a rugged, modular, fiber-reinforced polypropylene housing. Polypropylene has properties that will resist the harmful effects of most chemicals. When in operation, and with the transparent protective cover installed, the units comply with the IP54 standards. The modular design isolates the controller circuitry from all contacts, assuring that there is no noise interference. The use of this rugged design protects the unit from the tough conditions associated with industrial environments, ensuring long periods of trouble-free operation.

HI2X Advanced Controllers

This line of industrial microprocessor controllers offers a wide range of features and functions such as single and dual set points, ON/OFF, proportional and PID control, relay outputs, bi-directional isolated RS485, isolated recorder outputs in mAmps and volts, differential input, control through analog output and Fail Safe features.

Wall-Mounted Process Controllers

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

HI2X help to prevent overdosing or costly system failures. You can set your high and low set point hysteresis bands independently to fine tune dosing processes with the ON/OFF controllers. Similarly, the proportional band and time period are user-programmable to save on slow reacting chemicals which are commonly overdosed.

All models offer an adjustable overdosing timer from 10 minutes to 7 days as the maximum time that the relay contacts may remain closed. An important feature in case of sudden chemical depletion, truncated intake or discharge tubing and other calamities.

Fail Safe Protection

The Fail Safe Alarms protect processes against critical errors arising from power interruptions, surges and human errors. The sophisticated yet easy to use system resolves these problems on two fronts: hardware and software. To eliminate blackout and line failure problems, the alarm function operates in a "normally closed" state and goes off if the wires are accidentally tripped, or when the power is down. This is an important feature since with most meters the alarm terminals close in abnormal situations, but no alarm is sounded with a line interruption, causing extensive damage. With our controllers, software is employed to set off the alarm in abnormal circumstances, for example, if the dosing terminals are closed too long a red LED will provide a visual warning signal.

Differential Input (Matching Pin)

All Hanna controllers in this family come with a differential input to prevent problems due to ground loop current. With this new feature, the life of the electrodes will be greatly extended.

Password Protection

The Hanna password protection feature keeps these controllers safe from tampering. Only users with the proper password can change the settings of these controllers.

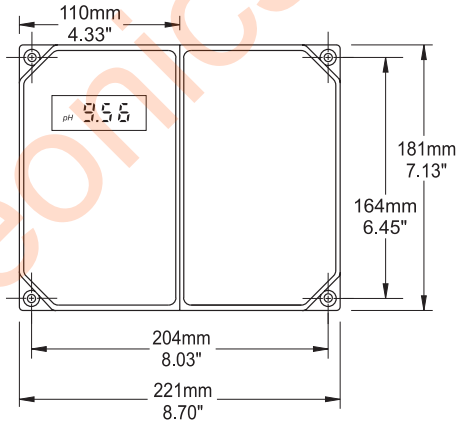
Simple Installation

These wall mounted controllers have mounting holes molded into the housing to assure simple, quick and secure installation without the need for additional hardware. Once all electrical connections are made, the protective cover can be installed over the front panel, making it possible to perform all adjustments without disassembling any part of the unit. Temperature probes can also be installed. Pumps to be used in conjunction with the controller simply plug into the controller's input and will be powered up through the unit's internal power supply.

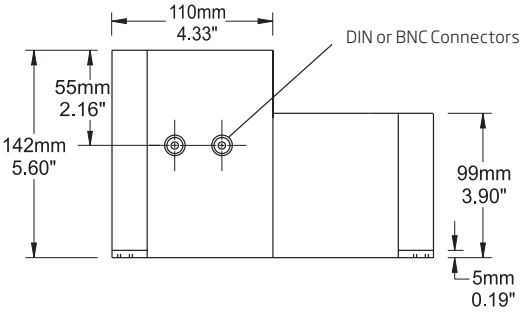
Mechanical Dimensions

The modular design isolates electrical connections in a closed compartment, while the control settings are accessible and can be made through the adjacent compartment.

Front View



Bottom View



HI21

Industrial Grade pH Digital Controllers

Wall Mounted with Matching Pin

- CAL Check™
  - Alerts users of calibration status
- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation
- 3 Point Calibration
  - Up to three point calibration at

The HI21 controllers are simple to operate, microprocessor-based pH process controllers packed with features. With HI21 quick one, two or three point calibration at pH 4.01, 7.01 and 10.01 comes standard and you can choose from ON/OFF, proportional and PID control to save on chemicals. These instruments have a differential input, extending electrode life by eliminating ground loop current through the reference.

Password protection prevents unauthorized modifications in settings or calibration. The Fail Safe Alarm System protects the HI21 against the pitfalls of process control, like power interruption or line failure.

Extractable terminal modules make wiring simple. A host of self-testing features and user-friendly functions make the HI21 a great value.

For more flexibility and better resolution for chart recorders, any two points between 0 and 14 pH can be chosen to correspond to the analog output spans. HI21 models are equipped with a bi-directional RS485 port, which allows remote control of the instrument from a PC.

Specifications	HI21
Range	0.00 to 14.00 pH; -9.9 to 120°C
Resolution	0.01 pH; 0.1°C
Accuracy	±0.02 pH; ±0.5°C
Input Impedance	10^{12} Ohm
pH Calibration	automatic, one, two or three point, at pH 4.01, 7.01, 10.01
Temperature Compensation	automatic (with Pt100 probe) or manual from -9.9 to 120°C
Analog Output	0 to 1 mA, 0 to 20 mA, 4 to 20 mA; 0 to 5 VDC, 1 to 5 VDC, 0 to 10 VDC
Digital Output	RS485
Relays 1 and 2	electromechanical relay SPDT contact outputs, 5A-250 VAC, 5A - 30 VDC (resistive load) (HI211YZ and HI212YZ), fuse protected: 5A, 250V fast fuse
Alarm Relay	electromechanical relay SPDT contact output, 5A - 250 VAC, 5A - 30 VDC (resistive load) fuse protected: 5A, 250V, 250V fast fuse
Power Supply Input	±5V (for amplified electrodes)
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz
Power Consumption	15 VA
Over Current Protection	400 mA, 250V, fast fuse
Environment	0 to 50°C (32 to 122°F); RH max. 85% non-condensing
Protection	IP 54
Dimensions	221 x 181 x 86 mm (8.7 x 7.1 x 3.4")
Weight	1.4 kg (3.1 lb.)
Ordering Information	Each HI21 model is supplied with instructions. **Choose your configuration** **HI21211-1** dual setpoint, on/off control, analog output, 115V **HI21211-2** dual setpoint, on/off control, analog output, 230V

pH solutions begin on page 2.136

HI22

Industrial Grade ORP Digital Controllers

Wall Mounted with Matching Pin

- CAL Check™
  - Alerts users of calibration status
- Alarm
  - Fail Safe Alarm System
- Connectivity
  - PC compatible

The HI22 has been engineered with the same outstanding quality and features as the HI21 meters.

The Fail Safe Alarm System protects these meters against the pitfall of process control, like power interruption or line failure. User selectable timing capability safeguards against overdosing and saves money while protecting the environment. RS485 capability makes this model PC compatible. The microprocessor memory is fully programmable and has a 3-month backup power supply.

These instruments have a differential input, extending electrode life by eliminating ground loop current through the reference. Users can choose between ON/OFF and proportional control as well as selectable current and voltage outputs. For more flexibility and better resolution for chart recorders, choose any two points between 0 and ±2000 mV to correspond to the analog output spans.

Wiring the controllers is simple with extractable terminal modules. A host of self-testing features and user-friendly functions make HI22 a great value.

Specifications	HI22
Range	±2000 mV; -9.9 to 120°C
Resolution	1 mV; 0.1°C
Accuracy (@25°C/77°F)	±2 mV; ±0.5°C
Input Impedance	10^{12} Ohm
ORP Calibration	automatic, at 0 and 350 or 1900 mV
AnalogOutput	0 to 1 mA, 0 to 20 mA, 4 to 20 mA; 0 to 5 VDC, 1 to 5 VDC, 0 to 10 VDC
Digital Output	RS485
Relays 1 and 2	electromechanical relay SPDT contact outputs, 5A-250 VAC, 5A - 30 VDC (resistive load) (HI221YZ), fuse protected: 5A, 250V fast fuse
Alarm Relay	electromechanical relay SPDT contact output, 5A - 250 VAC, 5A - 30 VDC (resistive load) Fuse protected: 5A, 250V, 250V fast fuse
Power Supply Input	±5V (for amplified electrodes)
Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz
Power Consumption	15 VA
Over Current Protection	400 mA, 250V, fast fuse
Environment	0 to 50°C (32 to 122°F); RH max. 85% non-condensing
Protection	IP 54
Dimensions	221 x 181 x 86 mm (8.7 x 7.1 x 3.4")
Weight	1.4 kg (3.1 lb.)
Ordering Information	Each **HI22** model is supplied complete with instructions. **Choose your configuration** **HI22111-1** single setpoint, on/off controls, analog output, 115V **HI22111-2** single setpoint, on/off controls, analog output, 230V

ORP solutions begin on page 2.141

HI23

Industrial Grade EC Digital Controllers

Wall Mounted with Four-ring Potentiometric Probe

- CAL Check™
  - Alerts users of calibration status
- ATC
  - Automatic temperature compensation

HI23 is a wall mounted, microprocessor conductivity controller that provides very accurate measurements due to the four-ring EC probe and Automatic Temperature Compensation (ATC) feature.

Users can choose among models featuring ON/OFF or PID control, analog input and output, double set point. The relay contacts can drive external devices such as pumps or electrovalves.

The input signal can come from a probe or a 4-20 mA transmitter. Models with the RS485 output option are also available. This option allows the user to insert the controller into a 2-wire RS485 network.

Specifications		HI23
EC	Range	0.0 to 199.9 µS/cm; 0 to 1999 µS/cm; 0.00 to 19.99 mS/cm; 0.0 to 199.9 mS/cm
	Resolution	0.1 µS/cm, 1 µS/cm; 0.01 mS/cm, 0.1 mS/cm
Temperature	Range	-10.0 to 100.0°C
	Resolution	0.1 °C
Additional Specifications	Accuracy	0.5% f.s. (EC); ±0.5 °C (0 to 70°C); ±1 °C (outside)
	Calibration	automatic, 1 point
	Temperature Compensation	automatic or manual from -10 to 100°C with Pt100 probe; β adjustable from 0.00 to 10.00%/°C
	Probe	four-ring conductivity probe with built-in 3-wire Pt100 temperature sensor or conductivity probe + external Pt100 (not included)
	Analog Input	4-20mA
	Analog Output	0-10 VDC, 0-5 VDC or 1-5 VDC; 0-1mA, 0-20 mA or 4-20mA
	RS485 baud rate	1200, 2400, 4800 and 9600
	Relays 1 and 2	electromechanical relay SPDT contact outputs, 5A-250 VAC, 5A - 30 VDC (resistive load) (HI211YZ and HI212YZ), fuse protected: 5A, 250V fast fuse
	Alarm Relay	electromechanical relay SPDT contact output, 5A - 250 VAC, 5A - 30 VDC (resistive load) fuse protected: 5A, 250V, 250V fast fuse
	Power Supply	115 VAC ±10% or 230 VAC ±10%; 50/60 Hz
	Power Consumption	15 VA
	Over Current Protection	400 mA, 250V, fast fuse
	Environment	0 to 50°C (32 to 122°F); RH max. 85% non-condensing
	Case Material	fiber-reinforced, self-extinguishing ABS
	Protection	IP54
	Dimensions	221 x 181 x 86 mm (8.7 x 7.1 x 3.4")
	Weight	1.6 kg (3.5 lb.)
Ordering Information	Each **HI23** model is provided with dual set point and is supplied complete with instructions.	
	Choose your configuration	
	HI23211-1	dual setpoint, on/off control, analog output, 115V
	HI23211-2	dual setpoint, on/off control, analog output, 230V

EC solutions begin on page 5.34

HI9913

Industrial Grade pH and Conductivity Controller

with Proportional Control of Fertilization

- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation

HI9913 is a 2-in-1 pH and conductivity controller engineered for dosage of fertilizer solutions in hydroponics and agriculture.

HI9913 measures pH from 0 to 14 and EC from 0 to 10 mS/cm. Two separate set points can be user adjusted from 4 to 7 pH and 0 to 6 mS/cm. The relays are activated when pH exceeds the set point or conductivity falls below the desired value. Two pumps or electrovalves can be wired directly to the controller and be powered through the terminal. The operator can adjust two independent proportional settings for pH and conductivity. The time cycle is adjustable from 0 to 90 seconds, while the proportional band is 0 to 2 for both pH and EC. A matching pin/ground probe can be connected to the appropriate terminals to eliminate interference and prolong the pH electrode's life.

HI9913 provides for an alarm relay which is activated in several circumstances. These include when the pH is below the set point by the operator-adjustable threshold of 0.5 to 2.5 pH, or EC exceeds the set point by a value in the 0.5 to 2.5 mS/cm range. The alarm goes off if the pH and/or conductivity are not corrected within the operator-determined time frame of 1 to 10 minutes. The alarm can be turned off during maintenance.

Fertilization status can be ascertained from a distance through dosage and alarm LED's.

HI9913 accepts pH electrodes with BNC and conductivity probes with DIN connectors.

Specifications	HI9913
Range	0.00 to 14.00 pH; 0.00 to 10.00 mS/cm
Resolution	0.01 pH; 0.01 mS/cm
Accuracy (@25°C/77°F)	±0.02 pH; ±2% f.s. EC
Input Impedance	10^{12} Ohm
Calibration	through "OFFSET" and "SLOPE" trimmers for pH, and "ZERO CAL" and "SLOPE CAL" for EC
Set point	from 4.0 to 7.0 pH and 1.0 to 4.0 mS/cm (EC)
EC Temperature Compensation	automatic, 0 to 50°C (32 to 122°F) with β=2%/°C
Proportional Control	two independent controls: pH from 0.0 to 2.0 and conductivity (EC) from 0.0 to 2.0 mS/cm with two separate time cycles from 0 to 90 seconds
Alarm Contact	terminals can be configured as normally open or normally closed (isolated output max. 2A, max. 240V, resistive load, 1,000,000 strokes). The alarm is activated if pH falls below the set point by the user selectable interval (0.0 to 2.0 pH), or conductivity exceeds the set point by more than the user selectable interval (0 to 2.0 mS/cm) or due to overdosage
Dosing Terminals	two sets of independent terminals (115 to 240V, Max.2A, 1,000,000 strokes) are activated whenever pH exceeds the pH set point and/or conductivity falls below the EC set point
Probe	any combination pH electrode with a universal BNC connector and Hanna conductivity four-ring potentiometric probe with built-in temperature sensor and DIN connector (not included)
Power Supply	±10% 115 VAC or 230 VAC ; 50/60 Hz
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing
Case Material	fiber-reinforced, self-extinguishing ABS
Dimensions	221 x 181 x 86 mm (8.7 x 7.1 x 3.4")
Weight	1.6 kg (3.5 lb.)
Ordering Information	**HI9913** is supplied complete with instructions.

pH solutions begin on page 2.136; EC solutions begin on page 5.34

HI9935

Industrial Grade pH and TDS Controller

with Proportional Control of Fertilization

- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation

HI9935 is a pH and TDS controller for fertilizer solution dosage in hydroponics.

HI9935 measures pH from 0 to 14 and TDS from 0 to 1999 mg/L (ppm). Two separate set points can be adjusted from 4 to 7 pH and 900 to 1800 ppm (mg/L). The relays are activated when the pH exceeds the set point or TDS falls below the desired value. Two pumps or electrovalves can be wired directly to the controller and be powered through the terminals. Independent proportional settings for pH and TDS can be adjusted from 0 to 90 seconds, 0 to 2.0 for pH and 0 to 400 mg/L (ppm) for TDS. A matching pin/ground probe can be connected to the appropriate terminals to extend electrode life and eliminate interference.

HI9935 provides for an alarm relay which is activated in several circumstances. These include when the pH is below the set points in the operator adjustable threshold of 0.5 to 2.5 pH, or similarly, TDS exceeding the set point by a value in the 50 to 450 mg/L (ppm) range. The alarm also goes off if the pH and/or TDS are not corrected within the operator determined time frame of 1 to 10 minutes. Moreover, the alarm configuration is switchable from a normally-closed to a normally-open state or turned off during maintenance. The fertilization status can be ascertained from a distance through dosage and alarm LED's.

HI9935 accepts pH electrodes with a BNC connector and TDS probes with a DIN connector.

Specifications	HI9935
Range	0.00 to 14.00 pH; 0 to 1999 ppm (mg/L)
Resolution	0.01 pH; 1 ppm (mg/L)
Accuracy (@25°C/77°F)	±0.02 pH; ±2% f.s. TDS
Input Impedance	10^{12} Ohm
Calibration	through "OFFSET" and "SLOPE" trimmers for pH, and "ZERO CAL" and "SLOPE CAL" for TDS
Set point	from 4.0 to 7.0 pH and 900 to 1800 ppm (mg/L)
TDS Conversion Factor	0.65 mg/L (ppm) = 1 µS/cm
TDS Temperature Compensation	automatic, 0 to 50°C (32 to 122°F) with β = 2%/°C
Proportional Control	two independent controls: pH from 0.0 to 2.0 and TDS from 0.0 to 400 ppm (mg/L) with two separate time cycles from 0 to 90 seconds
Alarm Contact	terminals can be configured as normally open or normally closed (isolated output max. 2A, max. 240V, resistive load, 1,000,000 strokes). The alarm is activated if pH falls below the set point by the user selectable interval (0 to 2 pH),or TDS exceeds the set point by more than the user selectable interval (0 to 400 ppm) or due to overdosage
Dosing Terminals	two sets of independent terminals (115 to 240V, max. 2A, 1,000,000 strokes) are activated whenever pH exceeds the pH set point and for the TDS falls below the TDS set point
Probe	any combination pH electrode with a universal BNC connector and Hanna TDS four-ring potentiometric probe with built-in temperature sensor and DIN connector (not included)
Power Supply	±10% 115 VAC or 230 VAC; 50/60 Hz
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing
Case Material	fiber-reinforced, self-extinguishing ABS
Dimensions	221 x 181 x 86 mm (8.7 x 7.1 x 3.4")
Weight	1.6 kg (3.5 lb.)
Ordering Information	**HI9935** is supplied complete with instructions. **Choose your configuration:** **HI9935-1** 115V **HI9935-2** 230V

pH solutions begin on page 2.136; TDS solutions begin on page 5.37

HI9910

Industrial Grade pH Controller

with Single Set point and Proportional Dosage

- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation

HI9910 is a pH controller with a single set point for proportional dosage of acid or alkaline solutions. Any pH electrode ending in a BNC connector can be directly attached to the controller. The proportional control can be fine tuned through two dials on the front panel. The time cycle is adjustable from 0 to 90 seconds and the proportional band from 0.0 to 2.0 pH. Coarse and fine as well as offset and slope trimmers make accurate setting and calibration easy and convenient. A pump or electrovalve can be wired directly to the controller and be powered through the terminals.

The HI9910 also provides for an alarm relay. The alarm is activated when the measurements stray away from the set point by a predetermined value in the 0.5 to 2.5 pH range. A maximum dosing time from 1 to 10 minutes can also be set, after which the alarm is activated to warn of an abnormality. The alarm can be configured in either normally-closed or normally-opened state. HI9910 also provides an isolated output signal which is user selectable between 0-20 or 4-20 mA. A dial on the front panel renders manual temperature compensation fast and easy.

For automatic temperature compensation, hook up a three wire Pt100 to the controller. To speed up wiring, the HI9910 comes with extractable terminal modules. Once wired up, the compartment containing the connections is protected behind a fire-retardant ABS panel. Several LED's show whether the set point or alarm relays are activated from a distance.

Specifications	HI9910
Range	0.00 to 14.00 pH
Resolution	0.01 pH
Accuracy (@25°C/77°F)	±0.02 pH
Calibration	through "OFFSET" and "SLOPE" trimmers (max. ±1.5 pH for offset and 80% to 110% for slope)
Temperature Compensation	automatic from 0 to 50°C with Pt100 probe or manual from -10 to 80°C
Set point	from 0.00 to 14.00 pH with "COARSE" and "FINE" trimmers with "ACID" or "ALK" (alkaline) selection
mA Output	user selectable 0 to 20 mA or 4 to 20 mA over the 0-14 pH range with isolated output
Proportional Control	pH is user adjustable from 0.0 to 2.0 and time cycle from 0 to 90 seconds
Alarm Contact	terminals can be configured as normally open or normally closed (isolated output max. 2A, max. 240V, resistive load, 1,000,000 strokes). The alarm is activated if pH varies by more than user selectable interval (0 to 2 pH) from set point or due to overdosage
Dosing Terminals	relay terminals (115 to 240V, max.2A,1,000,000 strokes) are activated when pH exceeds the set point with "ACID" dosage or falls below the set point with "ALK" selection (alkaline dosage)
Power Supply	±10% 115 VAC or 230 VAC; 50/60 Hz
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing
Case Material	fiber-reinforced, self-extinguishing ABS
Dimensions	221 x 181 x 86 mm (8.7 x 7.1 x 3.4")
Weight	1.6 kg (3.5 lb.)
Ordering Information	**HI9910** is supplied complete with instructions. **Choose your configuration** **HI9910-1** 115V **HI9910-2** 230V

pH olutions begin on page 2.136

HI9931

Industrial Grade EC Controller

with Proportional Fertilizer Dosing for Hydroponics Applications

- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation

HI9931 is a wall mounted meter that measures and controls conductivity in the 0 to 10 mS/cm range. A single set point allows for proportional dosage of fertilizer solutions. The proportional settings can be fine tuned through two conveniently positioned dials on the front panel. The time cycle is adjustable from 0 to 90 seconds and the proportional band from 0 to 1.6 mS/cm. Calibration and set points have a coarse and fine tuning trimmers. A pump or electrovalve can be wired directly to the controller and be powered through the terminals.

HI9931 also provides for an alarm relay which is activated when the measurements exceed the set point by a user selectable margin from 0.5 to 2.5 mS/cm. The alarm also triggers if, due to a malfunction, the continuous dosing time exceeds the operator adjustable period of 1 to 10 minutes. The alarm can be configured in either normally closed or open position and turned off during maintenance. HI9931 also provides an isolated output signal which is user selectable between 0-20 or 4-20 mA.

Hanna four-ring conductivity probes ending in a DIN connector can be quickly attached to the HI9931. Readings are automatically compensated for the effects of temperature in the 0 to 50°C (32 to 122°F) range. For quick and easy wiring, HI9931 comes with extractable terminal modules. Several LED's show whether the set point or alarm relays have been activated.

Specifications	HI9931
Range	0.00 to 10.00 mS/cm
Resolution	0.01 mS/cm
Accuracy	±2% f.s.
Calibration	through "ZERO CAL" and "SLOPE CAL" trimmers
Set point	from 0 to 10.00 mS/cm
Temperature Compensation	automatic, 0 to 50°C (32 to 122°F) with β= 2%/°C
Recorder Output	selectable at 0-20 mA or 4-20 mA (isolated)
Proportional Control	conductivity from 0.0 to 1.6 mS/cm and time cycle from 0 to 90 seconds
Alarm Contact	terminal can be configured as normally open or normally closed (isolated output max. 2A, max. 240V, resistive load, 1,000,000 strokes). The alarm is activated if conductivity exceeds by more than the user selectable interval (0 to 2.0 mS/cm) from the set point or due to overdosage
Dosing Terminals	relay (115 to 240V, max.2A, 1,000,000 strokes) is activated whenever conductivity falls below the setpoint
Probe	four-ring potentiometric with built-in temperature sensor and DIN connector (not included)
Power Supply	±10% 115 VAC or 230 VAC; 50/60 Hz
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing
Case Materials	fiber-reinforced, self-extinguishing ABS
Dimensions	221 x 181 x 86 mm (8.7 x 7.1 x 3.4")
Weight	1.6 kg (3.5 lb.)
Ordering Information	**HI9931** is supplied complete with instructions. **Choose your configuration** **HI9931-1** 115V **HI9931-2** 230V

EC solutions begin on page 5.34

HI9934

Industrial Grade TDS Controller

with Proportional Fertilizer Dosing for Hydroponics Applications

- Alarm
  - Fail Safe Alarm System
- ATC
  - Automatic temperature compensation

HI9934 is a wall mounted meter that controls TDS in the 0 to 1999 ppm (mg/L) range through a single set point for dosage of fertilizers. The proportional control can be fine tuned through the time cycle between 0 to 90 seconds and the proportional band from 0 to 400 ppm. Coarse and fine as well as a slope trimmer make for an accurate setting and calibration. A pump or electrovalve can be powered through the terminal. In addition to the set point relay, HI9934 also provides for an alarm relay. The alarm is activated when the measurements exceed the set point by a user selectable margin in the 50 to 450 mg/L (ppm) range. The alarm also triggers if, due to a malfunction, the continuous dosing time exceeds the operator adjustable period of 1 to 10 minutes. The alarm can be configured in either normally-closed or normally-open position and turned off during maintenance.

HI9934 also provides an isolated output signal which is user selectable between 0-20 or 4-20 mA.

Hanna instruments four-ring TDS probes with incorporated temperature sensor and DIN connector can be quickly attached to the controller. Readings are automatically compensated for temperature variations in the 0 to 50°C (32 to 122°F) range.

The extractable terminal wiring is through the side of the meter with washers and grommets. The compartment containing the connections is enclosed behind a fire-retardant ABS panel.

Specifications	HI9934
Range	0 to 1999 ppm (mg/L)
Resolution	1 ppm (mg/L)
Accuracy	±2% f.s.
Calibration	through "ZERO CAL" and "SLOPE CAL" trimmers
Set point	from 0 to 1999 ppm (mg/L)
TDS Conversion factor	0.65 mg/L (ppm) = 1 µS/cm
Temperature Compensation	automatic, 0 to 50°C (32 to 122°F) with β = 2%/°C
Recorder Output	selectable at 0-20 mA or 4-20 mA (isolated)
Proportional Control	TDS from 0 to 400 ppm and time cycle from 0 to 90 seconds
Alarm Contact	terminals can be configured as normally open or normally closed (isolated output max. 2A, max. 240V, resistive load, 1,000,000 strokes). The alarm is activated if TDS exceeds by more than the user- selectable interval (0 to 400 ppm) from the set point or due to overdosage
Dosing Terminals	relay (115 to 240V, max.2A, 1,000,000 strokes) are activated whenever TDS falls below the set point
Probe	four-ring potentiometric with built-in temperature sensor (not included)
Power Supply	±10% 115 VAC or 230 VAC; 50/60 Hz
Environment	-10 to 50°C (14 to 122°F); RH max 95% non-condensing
Case Material	fiber-reinforced, self-extinguishing ABS
Dimensions	221 x 181 x 86 mm (8.7 x 7.1 x 3.4")
Weight	1.6 kg (3.5 lb.)
Ordering Information	**HI9934** is supplied complete with instructions. **Choose your configuration** **HI9934-1** 115V **HI9934-2** 230V

TDS solutions begin on page 5.37

Analog Transmitters for pH, ORP and Conductivity

Two-Wire pH & ORP Transmitters

Two-wire transmitters are widely used for process control in industry. These instruments are particularly useful in industrial conditions where electrical interference is an important factor. By galvanically isolating the signals, any interference created is prevented from reaching the transmitter. Industrial environments are often associated with corrosive conditions, therefore any instrumentation used must be resistant to liquids and corrosion. Hanna transmitters meet all of these criteria and they only use two wires which reduces costs and eliminates the need for an expensive coaxial cable. Two-wire transmitters are ideal when used in remote applications that do not have AC power available.

As technology advances it is becoming more important to monitor certain processes closely, particularly from remote locations. Computers are commonly used to receive signals from transducers that have travelled a great distance (up to 300 meters, 1000'). When transmitting signals over such a distance, it is likely that a substantial portion of the signal will be absorbed by the resistance of the lines. Considerable differences in ground potentials and between the signal source and load, are inherent to long lines.

Powering the system with an AC supply is beneficial in eliminating this problem. One of the two wires is power ground return, while the other is the power supply. The power supply line acts in a dual manner, as a power supply, and as a signal carrier. This allows the transmitter to operate with 2 wires.

The signal current from the process controller is normally 4 to 20 mA. When the load is connected with the power supply return line, the signal current will be proportional in the range of 4 to 20 mA.

The ability to use a thinner gauge of wire greatly reduces the costs associated with the wiring of remote transmitters. Typically, a heavy gauge of shielded cable is required in order to minimize the ambient electrical noise from AC power sources, interference from electrical equipment, or various other sources of noise.

Thin wire will also provide better operation when the transmitter current output is a 4 to 20 mA signal. All of these features and many more, give Hanna transmitters the versatility to be used over long distances in almost any process control application.

Conductivity, Four-Ring Technology

Hanna conductivity transmitters use four-ring Potentiometric probes. As opposed to the more widely used 2-electrode Amperometric method, the four-ring Potentiometric method provides the highest accuracy and repeatability attainable. When measuring liquids that have a high conductivity, the 2-electrode system is susceptible to polarization. This condition makes it exceptionally difficult to obtain measurements with any accuracy. The polarization is directly related to the electrode's current load, and will cause a considerable, nonlinear drop in the voltage. As a result, the solution around the electrode simulates a low conductivity condition.

Four-ring electrodes eliminate the polarization effect by splitting the four rings into 2 current and 2 voltage electrodes. When placed in a conductive liquid, the 2 current electrodes take the alternating voltage and create a current. This alternating current produces a buffer field from which polarization is absent. The voltage is then measured in this field assuring no altered readings.

HI98143

pH and EC Transmitter

with Galvanic Isolated Output

- ATC
  - Automatic temperature compensation Connectivity
- PC compatible

The HI98143 series is designed to accept signals directly from a pH electrode and a conductivity probe at the same time.

Direct connection of the probes to the transmitter assure a positive electrical connection with no signal loss. This transmitter is ideal for remote process control applications.

Four models are available, transmitting a 0-1 V, 0-4 V or 4-20 mA signal. The output signals are proportional to the input signals but independent of changes in load or cable capacitance. Compensation for the effects of temperature for EC measurements are performed by the transmitters' Automatic Temperature Compenstion circuitry.

The transmitter can be connected to any pH or conductivity controller, recorder, PC or any data monitoring device that accepts 0 to 1 V, 0 to 4 V or 4 to 20 mA input. HI 98143 is an ideal tool for applications that require the monitoring of both pH and conductivity at the same time.

Specifications	HI98143-01 • HI98143-04 • HI98143-20 • HI98143-22
Range	0 to 14 pH; 0 to 10 mS/cm
Accuracy (@25°C/77°F)	±0.5% f.s. pH; ±2% f.s. EC
Calibration	manual, 2 point, through trimmers: pH: offset and slope trimmers; EC: 0 and 5 mS/cm trimmers
EC Temp. Compensation	automatic, 0 to 60°C (32 to 132°F) with β=2%/°C
pH Electrode	HI1001 pH electrode (suggested, not included), HI1283 matching pin (not included)
EC Probe	HI3001 (not included) with cell constant 2.1
Casing	IP54
Power Supply	12-24 VDC
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Dimensions	160 x 105 x 31 mm (6.3 x 4.1 x 1.2")
Weight	280 g (9.9 oz.)
Ordering Information	All **HI98143** models are supplied with instructions. **Choose your configuration** **HI98143-01** pH/EC transmitter with 0-1 V isolated output **HI98143-04** pH/EC transmitter with 0-4 V isolated output **HI98143-20** pH/EC transmitter with 4-20 mA isolated output **HI98143-22** pH/EC transmitter with 4-20 mA isolated output (specific for HI8000 controllers)

pH solutions begin on page 2.136; EC solutions begin on page 5.34

HI8614N · HI8614LN · HI8615N · HI8615LN

pH and ORP Transmitters

with 4-20 mA Galvanically Isolated Output

- ATC for pH models
  - Automatic temperature compensation
- Waterpoof
  - Water resistant
- Backlight
  - Backlit, LCD display for "L"models

HI8614LN with LCD

The HI8614N and HI8614LN are a water-resistant pH transmitters 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.

These transmitters can be connected to Hanna controller HI8510, HI8710 or HI8711, recorders, computers or any data monitoring device that accepts 4 to 20 mA input.

HI8615N and HI8615LN have been designed for transmitting ORP measurements from remote locations. These transmitters features two controls (one for 4 mA and one for 20 mA) to compensate for electronic drift and ambient temperature.

These transmitters can be connected to Hanna HI8512, HI8720, or any recorders, computers or any data monitoring device that accepts 4 to 20 mA input.

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

Specifications	HI8614N • HI8614LN	HI8615N • HI8615LN
Range	0.00 to 14.00 pH; 4-20 mA	±1999 mV; 4-20 mA
Resolution (for "L" models)	0.01 pH; 0.01 mA	1 mV; 0.01 mA
Accuracy (@20°C/68°F)	±0.02 pH; ±0.02 mA	±5 mV; ±0.02 mA
Calibration	offset: ±2 pH; ±2.2 mA; slope: 86 to 116%; ±0.5 mA	offset: ±100 mV; ±0.8 mA slope: 90 to 110%; ±0.8 mA
Temperature Compensation	fixed or automatic from 0 to 100°C (32 to 212°F) with Pt100 probe	–
Input Impedance	10^{12} Ohm	
Recorder Output	4-20 mA (isolated)	
Protection	IP65	
Power Supply	HI8614N: 18-30 VDC; HI8614LN: 20-36 VDC	HI8615N: 18-30 VDC; HI8615LN: 20-36 VDC
LCD display	only for HI8614LN	only for HI8615LN
Load	max 500 Ohm	
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
Dimensions	165 x 110 x 71 mm (6.5 x 4.3 x 2.8")	
Weight	1 kg (2.2 lb.)	
Ordering Information	**HI8614N** and **HI8614LN** (with display) is supplied with instructions.	**HI8615N** and **HI8615LN** (with display) is supplied with instructions.

HI8614N without LCD

pH and ORP solutions begin on page 2.136;

HI8936 Series

Conductivity Transmitters

to use with Four-ring Probe

- ATC
  - Automatic temperature compensation
- Backlight
  - Backlit, LCD display

HI8936 is a conductivity transmitter that utilizes a four-ring potentiometric probe. This probe is virtually immune to contamination by unclean solutions. This allows the transmitterto operate at peak performance at all times.

Temperature effects are compensated for by utilizing both the built-in temperature sensor on the probe and the transmitter's ATC circuitry with a d of 2%/°C.

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

HI8936 "L" versions allow easy verification and monitoring of measured values and is easier to calibrate and maintain.

The HI8936 series requires external power to the 4-20 mA current loop.

The HI8936 series should be used in conjunction with the HI7635 in-line probe or HI7638 platinum probe (see Process Electrodes and Probes).

ALN, BLN, CLN, and DLN with LCD

AN, BN, CN, and DN without LCD

Specifications	HI8936AN HI8936ALN	HI8936BN HI8936BLN	HI8936CN HI8936CLN	HI8936DN HI8936DLN
Range	0.0 to 199.9 mS/cm	0.00 to 19.99 mS/cm	0 to 1999 µS/cm	0.0 to 199.9 µS/cm
Resolution	0.1 mS/cm	0.01 mS/cm	1 µS/cm	0.1 µS/cm
Accuracy	±2% f.s. (excluding probe error)			
Calibration	manual, two point, with offset and slope trimmers			
Temperature Compensation	fixed or automatic from 0 to 50°C (32 to 122°F) with β=2%/°C			
Conductivity Probe	HI7635 for in-line applications (not included)			
Recorder Output	4-20 mA, not isolated, max 500 Ohm			
Protection	IP65			
Power Supply	without LCD: 12-30 VDC; with LCD: 17-36 VDC			
LCD Display	HI8936AN: no HI8936ALN: yes	HI8936BN: no HI8936BLN: yes	HI8936CN: no HI8936CLN: yes	HI8936DN: no HI8936DLN: yes
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing			
Dimensions	165 x 110 x 71 mm (6.5 x 4.3 x 2.8")			
Weight	1 kg (2.2 lb.)			
Ordering Information	All **HI8936** models are supplied complete with instructions.			

EC solutions begin on page 5.34

HI931002

4-20 mA Amperometer

Simulator and Calibrator

HI931002 is a portable instrument designed by the Plant Repair and Maintenance Operator for the MRO! This portable simulator can monitor and regulate 4-20 mA from practically any process meter with or without a voltage generator. The communication bus from process instrumentation can be simulated in any of the following modes:

- Passive drive/Calibrator mode:
  - HI931002 can set the 4-20 mA current values and the user can then adjust the process meter accordingly.
- Active drive/Simulator mode:
  - HI931002 simulates the correct current values as above in addition to providing power to the bus communication. Power is provided through an external adapter (included) which is connected to the simulator. This mode is ideal to calibrate chart recorders, pressure transducer or current indicators.
- Passive measurement/Tester mode:
  - HI931002 practically becomes an Amperometer. It measures and displays the mA (or pH) values transmitted by the process meter.
- Active measurement/Tester mode:
  - Same as above in addition to providing voltage to the 4-20 mA bus.

HI931002 can measure incoming current, provide power, and simulate 4-20 mA output to calibrate your process meter. A large LCD shows values on the display. You can select between drive and measurement modes through a switch on the front panel and two dials allow for quick adjustment of the current.

Specifications		HI931002
Ranges	Active Drive	2.00 to 19.99 mA; -1.50 to 14.00 pH
	Passive Drive	2.00 to 19.99 mA; -1.50 to 14.00 pH
	Active Measure	0.00 to 19.99 mA; -3.50 to 14.00 pH
	Passive Measure	0.00 to 19.99 mA; -3.50 to 14.00 pH
Additional Specifications	Resolution	0.01 mA; 0.01 pH
	Accuracy (@20°C/68°F)	±0.01 mA; ±0.01 pH
	Input Resistance	20Ω
	Fuse	5 x 20 mm, 200 mA, 250V
	Power Supply	9V; approximately 1600 hours of continuous use; or 12 VDC adapter (included)
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Dimensions	180 x 83 x 40 mm (7.1 x 3.3 x 1.6")
	Weight	320 g (11.3 oz.)
Ordering Information	**HI931002** is supplied with 1 m (3.3') connection cable, battery, 12 VDC adapter and instructions.	

BlackStone Chemical Dosing Pumps

Versatility

BlackStone pumps have been designed to meet the ever changing needs of industry. With their broad, flat base and mounting holes for tank, shelf or floor mounting (horizontal), the pumps can be easily mounted anywhere in your plant. The rear of the pump housing also provides mounting holes to facilitate vertical mounting: wall, tank or machine. Since the pump valve assembly and controls for the unit are located on the front of the pump, there is never a problem with installation or flow adjustments.

Simple Operation

BlackStone pumps are equipped with a single control for pump output. The external flow rate control (potentiometer) on the face of the pump allows you to adjust the percentage of flow from 0 to 100% of the pump's rated capacity. This feature eliminates the need to worry about stroke lengths and power settings. An LED indicator lights up each time a stroke begins, allowing the user to assess the stroke rate from a distance.

High Quality Materials

BlackStone pumps have been manufactured with the highest level of mechanical precision from materials chosen for their inherent ability to resist the effects of aggressive chemicals. When you select a Blackstone pump, you are eliminating the time consuming effort involved in picking the right material for your application. Blackstone pumps are supplied with the highest quality material as standard equipment–not optional. The diaphragm utilizes one-piece construction of PTFE, which unlike conventional laminated diaphragms, will stand up to the test of time and wear. Ball valves are constructed in glass.

The pumphead and O-rings are made of PVDF, PTFE and FPM/FKM which offer unsurpassed resistance. The chemical resistance chart (right) shows how well PVDF and PTFE stand up to some of the most aggressive chemicals.

Chemical Resistance Guide*

Chemical	PVC	PP	Hypalon	FPM/ FKM	PVDF	PTFE
Acetic Acid, 80%	D	B	A	E	A	A
Bleach	A	B	A	A	A	B
Citric Acid	A	A	A	A	A	A
Copper Cyanide	A	A	X	B	A	A
Copper Sulfate	A	A	B	B	A	A
Ferric Chloride	A	A	B	B	A	A
Ferric Sulfate	A	A	B	B	A	A
Hydrazine	X	X	B	B	A	A
Hydrochloric Acid (concentrated)	A	A	B	B	A	A
Hydrochloric Acid (diluted)	A	A	B	B	A	A
Hydrofluoric Acid (diluted)	D	B	D	A	A	A
Hydrogen Sulfide	C	A	B	B	A	A
Magnesium Nitrate	A	A	A	A	A	A
Magnesium Sulfate	A	A	A	A	A	A
Nitric Acid, 50%	A	C	E	A	A	A
Phosphoric Acid	B	B	A	B	A	A
Plating Baths	A	A	C	A	A	A
Potassium Cyanide	A	A	B	B	A	A
Potassium Nitrate	A	A	B	B	A	A
Propyl Alcohol	C	X	B	B	A	A
Soaps	A	A	B	B	A	A
Sodium Bicarbonate	A	A	A	A	A	A
Sodium Bisulfite	A	A	A	A	A	A
Sodium Hydroxide, 50%	A	A	B	E	A	A
Sodium Hypochlorite, 18%	A	A	A	D	A	A
Sulfuric Acid (concentrated)	A	A	B	A	A	A
Tanning Reagents	A	A	A	X	A	A
Trichloretane	E	C	E	A	A	A

* PARTIAL LISTING

Symbol Key

A - Excellent	B - Good	C - Fair	D - Acceptable (limited use)	E - Not recommended	X - Unknown

BL Series Dosing Pumps

BlackStone's positive displacement solenoid driven pumps use a minimum number of moving parts, therefore reducing the chance of mechanical failure. Part wear and oiling associated with motor driven pumps (ball-bearings, gear drives and cams) are not a concern with these pumps. Blackstone pumps are more accurate than standard pumps due to the positive displacement design ensuring each stroke is identical to the strokes before and after it, thus keeping the flow rate consistent.

A wide range of BlackStone pumps with different dosing capacities are available for your specific dosing needs. Each pump is supplied with discharge and suction valves.

Part Number	Max Output	Rated Pressure	Dosing Frequency strokes/min
With Large Diaphragm			
BL20	18.3 lph (4.8 gph)	0.5 bar (7.4 psi)	120
BL15	15.2 lph (4.0 gph)	1 bar (14.5 psi)	120
BL10	10.8 lph (2.9 gph)	3 bar (43.5 psi)	120
BL7	7.6 lph (2.0 gph)	3 bar (43.5 psi)	120
With Small Diaphragm			
BL5	5.0 lph (1.3 gph)	7 bar (101.5 psi)	120
BL3	2.9 lph (0.8 gph)	8 bar (116 psi)	120
BL1.5	1.5 lph (0.4 gph)	13 bar (188.5 psi)	120

Specifications	BL Series
Max Output	see table above
Pump Casing	fiber-reinforced polypropylene
Materials	pumphead in PVDF, diaphragm in PTFE, glass ball valves and O-rings in FPM/FKM, polyethylene 5 x 8 mm tubing
Self-priming	max height: 1.5 m (5 feet)
Power Supply	110/115 VAC or 220/240 VAC, 50/60Hz
Max Power Consumption	approximately 200 W
Protection	IP65
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Dimensions	194 x 165 x 121 mm (7.6 x 6.5 x 4.8")
Weight	approx. 3 kg (6.6 lb.)

Ordering Information

BL1.5-1	1.5 LPH flow rate
BL1.5-2	1.5 LPH flow rate
BL3-1	2.9 LPH flow rate
BL3-2	2.9 LPH flow rate
BL5-1	5.0 LPH flow rate
BL5-2	5.0 LPH flow rate
BL7-1	7.6 LPH flow rate
BL7-2	7.6 LPH flow rate
BL10-1	10.8 LPH flow rate
BL10-2	10.8 LPH flow rate
BL15-1	15.2 LPH flow rate
BL15-2	15.2 LPH flow rate
BL20-1	18.3 LPH flow rate
BL20-2	18.3 LPH flow rate

-1 = 110/115 VAC power supply
-2 = 220/2400 VAC power supply

Accessories

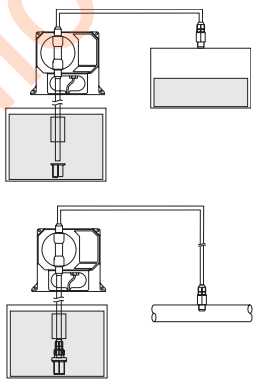
HI721004**	Injection valve assembly
HI721005**	Foot valve assembly
HI721101	Pumphead, O-ring, screws and washer
HI721102	Discharge valve assembly
HI721103	Suction valve assembly
HI721008	Ceramic weight (4)
HI720011D	Magnet and coil for BL pumps (230VAC)
HI720011U	Magnet and coil for BL pumps (115VAC)
HI720025	Pump body
HI720034	Magnet pump head assembly for BL pumps
HI721001	Complete pumphead with valves
HI72001	Tube nut. 5 x 8 mm dia. (100 pcs)
HI721009	Diaphragm
HI721010	PTFE coated O-ring for pump head
HI721011	Aluminum piston, insulation disk, washer and springs replacement kit for BL pump
HI721013	Piston set for BL pump
HI721014	Bottom housing and housing seal
HI721104	Small diaphragm for BL pumps
HI721105	BlackStone spare pump head
HI721106	BlackStone pump head assembly

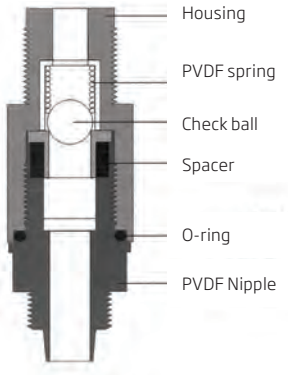
** Required for operation

Rugged Design

Blackstone pumps are completely sealed during assembly and offer IP65 protection against splashes and spills providing excellent protection even in hostile environments. The fiber-reinforced polypropylene housing stands up to aggressive chemicals while offering superior strength under tough industrial conditions.

Typical Installations

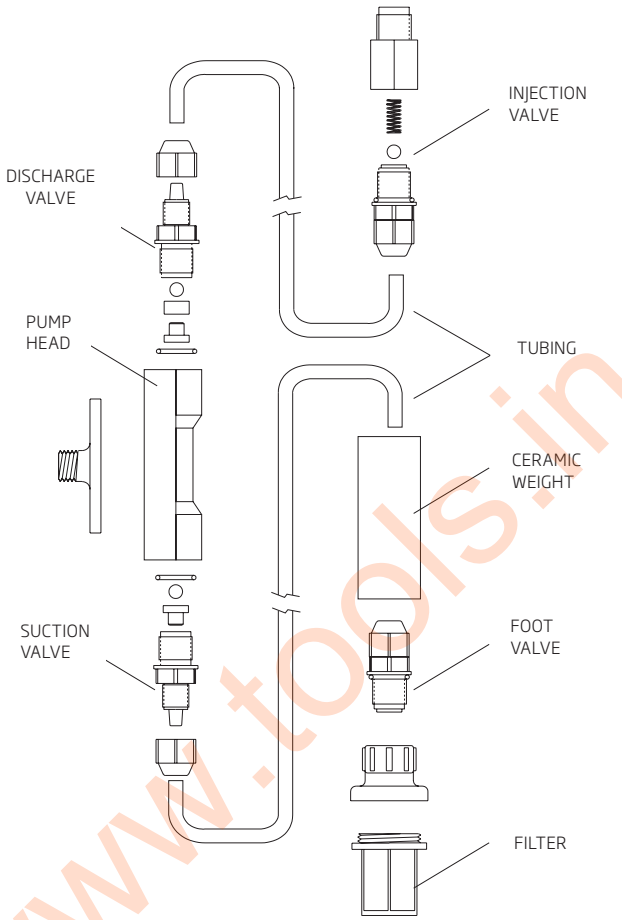


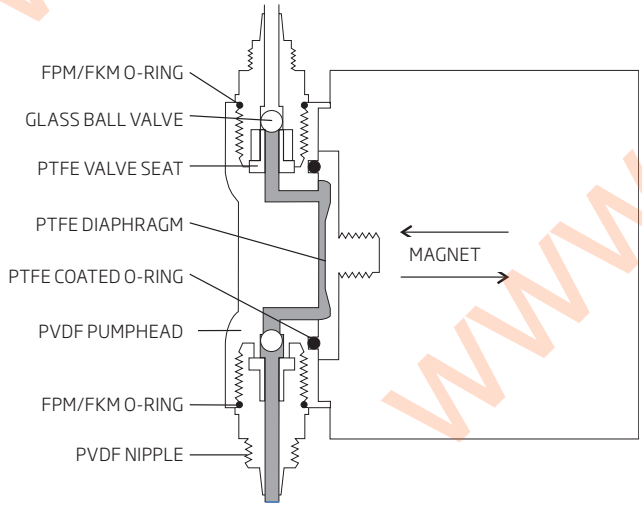


Replacement Parts

for BlackStone Chemical Dosing Pumps

Assembly Diagram

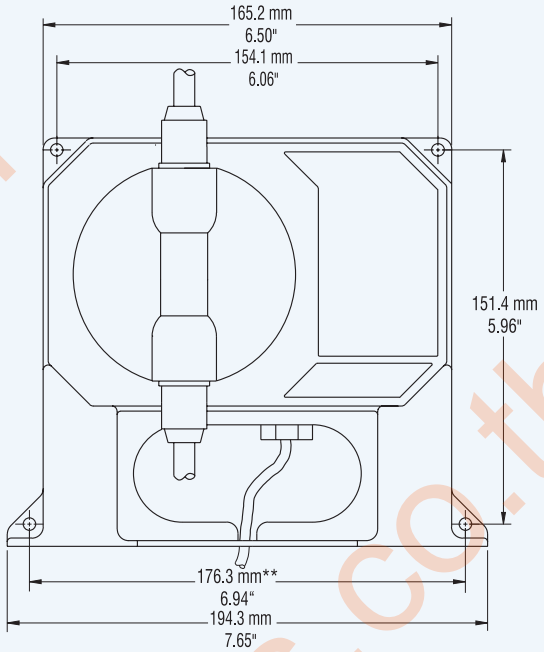




Mechanical Dimensions

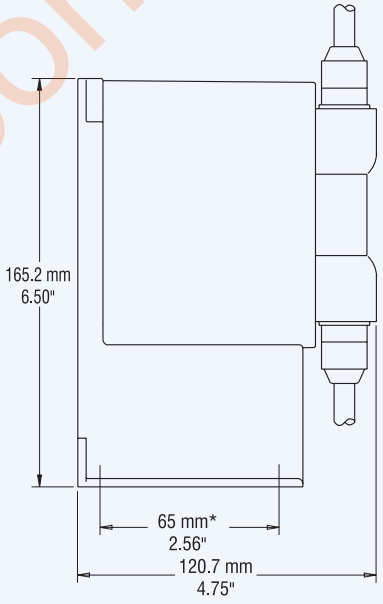
for BlackStone Chemical Dosing Pumps

Front View



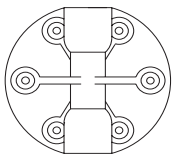
** Dimensions for floor and wall mounting

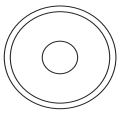
Side View

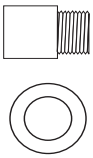


* Dimensions for floor mounting

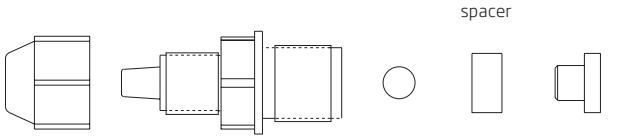
HI721101


pumphead

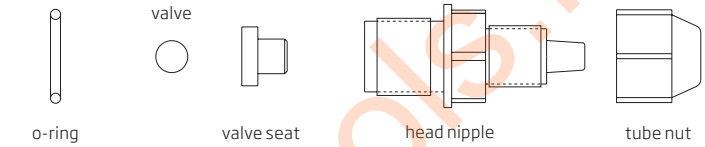

PTFE coated o-ring


6 screws and washers

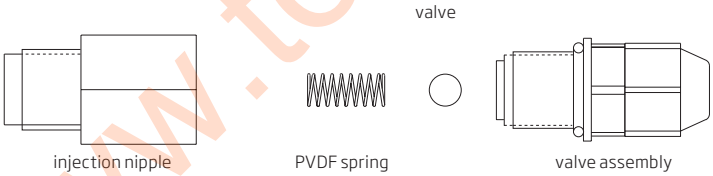
HI721102



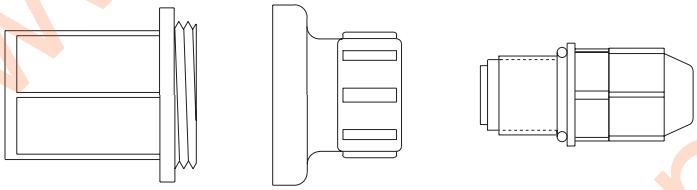
HI721103



HI721004



HI721005

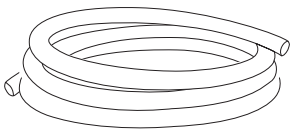


HI721003

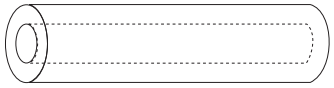
HI721006


PVDF spring

HI720032


LDPE hose

HI721008


ceramic weight

Ordering Information

HI721101

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

HI721102

This kit contains all the necessary replacement parts for your discharge valve assembly. Complete with a FPM/FKM O-ring, glass valve ball, the valve spacer and seat, head nipple and the tube nut to secure the assembled parts.

HI721103

Suction valve assembly, complete with a FPM/FKM O-ring, glass valve ball, the valve spacer and seat, head nipple and the tube nut to secure the assembled parts.

HI721004

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

HI721005

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

HI721003

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

HI721006

This kit contains 4 PVDF springs.

HI720029

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

HI720030

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

HI720031

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

HI720032

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

HI721008

This kit contains 4 ceramic weights.

HI740156

This kit contains 3 valve seats.

Electrodes Designed and Manufactured by Hanna

Process Electrodes

A Worldwide Leader in Electrode Manufacturing

Since the beginning of the 1990's Hanna has been a leader in the research & development of pH and ORP electrodes. Today, Hanna is proud to present the latest family of industrial electrodes, the Flat Tip Series, which completes the wide range of Hanna probes for any process application. All Hanna industrial pH and ORP electrodes are combination type, i.e. the reference half cell and the measurement half cell are assembled in the same body.

Industrial Electrodes and Probes


HI1000/HI2000 Series


Standard


AmpHel®


Flat Tip

Reference Half Cell

The reference half cell provides a known and stable reference potential. During the normal electrode life span, this potential can vary, possibly signaling the end of the electrode's life.

- The main causes of reference potential variation are:
  - Electrolyte contamination
  - Dilution
  - Electrochemical reaction
  - Junction clogging

As a result of many years of experience and electrode testing in industrial applications, Hanna has found the solutions for all these challenges.

Electrolyte Contamination

The contamination of the reference half cell is linked to the diffusion of external substances into the reference chamber (strong oxidants, reductants, complexing agents).

The combination of Hanna double junction technology with a polymer reference electrolyte, reduces the diffusion process rate and keeps the reference potential stable for long periods of time.

Dilution

When the reference cell containing concentrated 3.5M KCl electrolyte comes in contact with a less concentrated aqueous sample, diffusion of the electrolyte into the sample will occur. This process causes a progressive dilution of the reference electrolyte with a consequent variation of the reference potential.

Hanna double junction technology and the use of a large electrolyte volume (up to three times greater than traditional electrodes) makes this dilution effect negligible.

Electrochemical Reaction

In many industrial applications, it is possible to get a potential difference between the measuring point and the instrument. This inconvenience originates from electrical currents that destroy the Ag/AgCl element of the reference half-cell and also creates non-stable, interfering potentials.

Hanna's simple and effective solution to this challenge is the matching pin built-in to each industrial electrode. The matching pin is a stainless steel or titanium element that is connected to the instrument to prevent grounding problems, and to prolong electrode life.

Junction Clogging

Typical industrial applications require continuous monitoring of pH and ORP. Periodic cleaning and maintenance of the electrode junction ensure a stable and repeatable contact between sample and junction. The frequency of these cleaning procedures depends on the shape of the junction and material.

Hanna industrial electrodes are provided with different types of junctions. In particular, the porous PTFE junction used for the flat tip electrodes, which can provide optimum performance for months without requiring any maintenance.

Measurement Half Cell

All Hanna industrial pH electrodes include a measurement cell with a glass sensor. A glass sensor is the only answer for most industrial requirements. Below is a list of the main causes of shortened glass sensor life, for which Hanna has developed different types of specialized glass:

- High temperature
- Low temperature
- Acid samples containing fluoride

Electrodes Designed and Manufactured by Hanna

Process Electrodes

Built for Everyday, Demanding Use

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

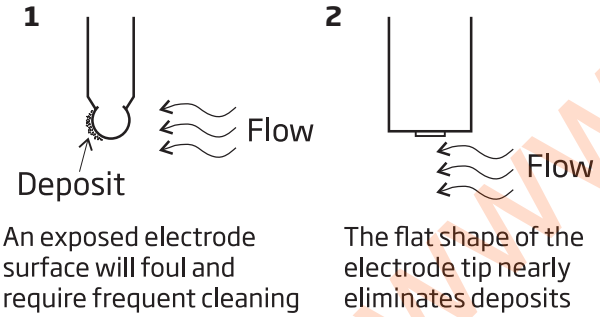
Glass Type	Application	pH Range	Temperature Range
LT	low temperature	0 to 12	-10 to 80°C
HT	high temperature	0 to 14	0 to 100°C
HF	acid samples with fluoride	0 to 10	-5 to 60°C

Mechanical Stress

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

Our Flat Tip electrodes are the best answer to this problem. The flat tip virtually eliminates deposits that can foul the electrode, significantly reducing necessary maintenance.

Flat Tip Advantages



An exposed electrode surface will foul and require frequent cleaning

The flat shape of the electrode tip nearly eliminates deposits

Electrode Body Material: Glass, PVDF or PEI

Glass

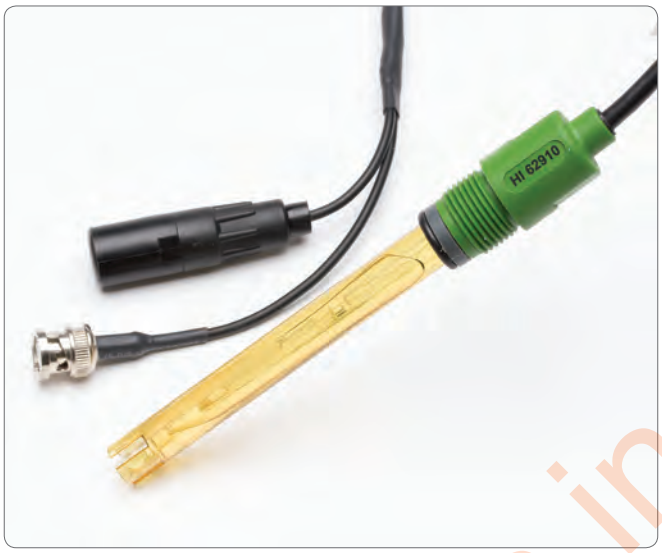
The glass body electrode can withstand high pressure and high temperature applications. The glass body also offers high resistance to aggressive chemicals (only fluoridic acid and strong alkaline solutions can damage glass).

PVDF

The PVDF body used for the Flat Tip Series withstands high pressure and high temperature applications, and guarantees a high chemical and mechanical resistance. These characteristics makes the PVDF material the most recommended for many industrial applications. PVDF is also non-toxic and compatible with food applications.

PEI

PEI is a special plastic material used first to produce electrodes by Hanna. PEI electrodes proved to be ideally suited to field applications, as well as industrial environments. An electrode with a PEI body represents a very good combination of chemical, mechanical, and thermal resistance which can be used in non-critical applications (e.g. swimming pools), or with portable meters for routine field monitoring and control, such as wells, lakes and rivers, and discharges of tanks and reservoirs.



AmpHel®: Why and Where to Use It

pH electrode glass sensors have a high impedance of typically 100 Mohm, but can reach 800 Mohm depending on the temperature. This is a very weak signal available for accurate measurements. Impedance this high is difficult to handle especially between the electrode and the instrument. Normally this distance is covered by special cables with very high shielding and electrical insulation. Even with these cables, distances cannot be longer than 5 meters.

In industrial installations it is not easy to limit the distance between the electrode and the measuring instrument to 5 meters . Quite often, the recording instruments are located in separate areas from where the pH is measured. To avoid this limitation, a pH amplifier can be used.

Amplifiers are usually available with water-tight casings and can be used under extremely harsh conditions. The pH amplifier needs a power supply and usually must also provide for galvanic insulation between the power supply and the amplification circuit. At times it is difficult to have a power supply close to the measuring electrode. In such a case, 2-wire amplifiers and a 4-20 mA output can solve the problem (see HI8614 and HI8614L produced by Hanna).

Such amplifiers need instruments with 4-20 mA input in place of, or in parallel with, the BNC connector (some instruments are not provided with this option).

To overcome the instrument limitation, in 1988, Hanna produced the AmpHel® electrode (Amplified pH electrode). The AmpHel® electrodes feature an internal, high impedance pH amplifier with the required batteries.

An AmpHel® electrode has a life of approximately 3 years from the day it was produced. Taking into consideration that an average life for a pH electrode is one year, this should not be considered a limitation.

The output is still with 2 wires, as in the case of the typical coaxial cable, but it has a low impedance, and allows connections up to 75 meters long without delays in the measurements.

Cable Leakage

A high impedance coaxial cable, when installed more than 5 meters away from the electrode, could also be subject to current leakage. Quite often the installers place it in underground ducts as done with any other electric cable. During the installation of the cable, the insulation may become scratched by rubbing against the pipes or sharp corners. Underneath the insulation there is a screen connected to the reference electrode.

If the cable is in an underwater duct, it could happen that, sometime during the year, the reference electrode (the screen) could come into contact with the humid environment and, thus, with the grounding circuit of the electrical installations. Under these conditions, the pH electrode cannot take reliable measurements and can give erroneous readings. Without any reference to the measurement, the actual reading can be many pH units off. This is another solid reason for avoiding cables longer than 5 meters.

Electrode-Cable Connection

Some German manufacturers have produced pH electrodes with a coaxial connector mounted directly at one end of the electrode, i.e. without cable. The intention was to replace the electrode, without having to replace the connecting cable which remains attached. But as time passed, such an intention has proven to be harmful.

In fact, in many cases, the electrode is placed inside an electrode holder, which protects it from test liquid (tank measurement). Moisture forms inside the holder because of temperature changes from day to night. This moisture reduces the connector insulation, and the signal to the electrode drops.

When an electrode leaks, the generated emf drops and the reading drifts toward the pH 7 value. Therefore, for example, instead of pH 3, the measurement can be pH 3.5 or 4. This reading may result in a dosage that is harmful to the system.

Potential Matching Pin

In many industrial applications, especially in plating baths, grounding loop current is a very common problem.

When a traditional electrode/controller system is used with the electrode reference connected both to the electrode and to the instrument, a current flow occurs through the reference half cell, causing fluctuations in reading and serious damage to the Ag/AgCl

Electrodes Designed and Manufactured by Hanna

Process Electrodes

element. The potential matching pin shields the reference from external electrical fields. Shown above, the matching pin allows the measurement to stabilize and ensures effective process regulation. In order to function properly, the matching pin has to be continuously immersed in the measured solution and for this reason is placed near the electrode junction.

Temperature Effect

Sample temperature is an important parameter for solutions with a pH different from 7.0. In fact at pH 7.0, temperature compensation is not required.

Due to a built-in temperature sensor, there is only one electrode to install. Also due to its proximity to the pH sensor, the built-in temperature sensor ensures fast, accurately compensated readings even during sudden temperature fluctuations.

A Specific Electrode for Each Application

The table to the right lists the most common industrial applications with the corresponding, recommended Hanna electrodes.

For each application, several models are available, with different options for the following characteristics:

- Electrode dimensions
- Connection type
- Installation requirement
- Optional configurations (matching pin, Pt100 or Pt1000 sensor)

Hanna produces a wide range of industrial electrodes, for any specific application need.

Common Industrial Applications

Application	pH Electrode Series	Code
Domestic Wastewater Sewage, Septic Tank Treatment	easy	**HI1090B/5**
Industrial Wastewater	flat tip	**HI1006-2005**
	HI1000	**HI1003/5**
	easy	**HI1210B/5**
Food Industry (Beer, Jam, Diary Products)	flat tip	**HI1006-2005**
	easy	**HI1090B/5**
Chemical Neutralization	flat tip	**HI1006-2005**
	easy	**HI1210B/5**
Potable Water (>400µS/cm)	flat tip	**HI1006-2005**
	HI1000	**HI1001**
	easy	**HI1210B/5**
Cooling Towers	AmpHel®	**HI6291005**
	HI1000	**HI1002/5**
	easy	**HI1210B/5**
Water Softening	flat tip	**HI1006-2005**
	AmpHel®	**HI6291005**
	HI1000	**HI1001/5, HI1002/5**
	easy	**HI1210B/5**
Demineralization	flat tip	**HI1006-2005**
	easy	**HI1090B/5**
Low Conductivity Solutions	flat tip	**HI1006-2005**
Swimming Pools	flast tip	**HI1006-2005**
Sea Water	easy	**HI1090B/5**
Galvanic Baths	flat tip	**HI1006-3005**
	AmpHel®	**HI8299505**
	HI1000	**HI1003/5**
	easy	**HI1210B/5**
Sugar Industry, Paper Industry	flat tip	**HI1006-2005**
	easy	**HI1090B/5**
Textile Industry, Tanneries	flat tip	**HI1006-3005**
	AmpHel®	**HI8299505**
Acid Samples with Fluoride Ions	flat tip	**HI1006-4005**

Application	ORP Electrode Series	CODE
Oxidation of Cyanide and Nitrite	flat tip	**HI2004-2005**
Ozonization & Oxidant Products	AmpHel®	**HI6493005**
Reductant Products (Chromate Reduction)	AmpHel®	**HI6293005**
	HI2000	**HI2003/5**
	easy	**HI3210B/5**
Swimming Pools	HI2000	**HI2001, HI2003/5**
	easy	**HI3210B/5**

Flat Tip Industrial Electrodes

Select the flat tip electrode that best fits your process requirements by choosing from the following technical characteristics:

1. Junction

Three junction types are available:

- Annular non-clogging PTFE junction, for testing solutions with high content of suspended solids or for high pressure installation
- Open junction, ideal for wastewater analysis
- Ceramic junction

2a. pH Electrodes

Hanna has developed four types of specialized glass. First is a durable sensor glass for general purpose, industrial use. This glass can withstand the stress of daily use. The remaining types of electrode glass allow continuous monitoring in highly acidic solutions containing fluoride ions, as well as high or low temperature process and streams significantly increase the electrode life.

2b. ORP Electrodes

ORP electrodes are provided with a platinum sensor for most applications, while a gold sensor is required for measurement of cyanide or highly oxidative environments.

3. Temperature Sensor

The pH electrodes with built-in 3-wire Pt100 or Pt1000 temperature sensor allow for the temperature compensation of pH readings as well as temperature measurements.

4. Connection Type

Electrodes are wired for direct connection to a transmitter or process controller, or with the standard BNC connector.

5. Built-in Amplifier

Models with a built-in amplifier are necessary for long distance measurements, where it is not possible to install a transmitter.

The internal amplifier can be powered directly from select Hanna process controllers or a power source that supplies the appropriate voltage.

6. Cable Length

Non-amplified electrodes are provided with a 5, 10 or 15 m cable (16', 33' or 49'), while the amplified models are provided with a 15, 25, 50 or 75 m cable (49, 82, 164 or 246').

- Self-cleaning flat tip sensor
- Significantly reduced maintenance requirement
- Models especially designed for plating baths
- PVDF body
- Three junction types: ceramic, PTFE and open
- Built-in potential matching pin
- Three different glass type pH sensors
- ORP electrodes with platinum or gold sensor
- Models with built-in Pt100 or Pt1000 temp. sensor
- Internal amplifier models powered by the process controller
- 3/4" NPT external thread on both ends for easy installation

Hanna presents a series of combination pH and ORP electrodes, including more than 300 models, incorporating over 20 years of electrode manufacturing experience.

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

The PVDF body offers a higher level of mechanical and temperature resistance. Moreover, the PVDF material is non-toxic and compatible with food applications.

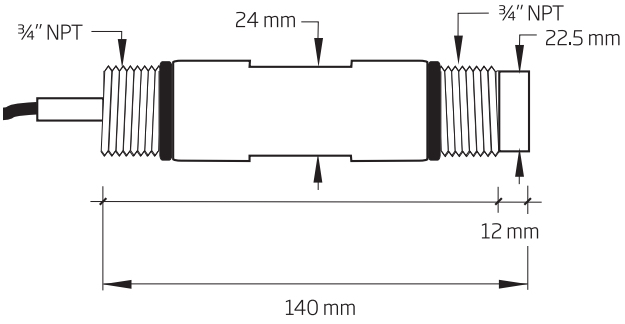
Each pH and ORP electrode is provided with an internal matching pin that can avoid typical problems caused by grounding loop current, such as:

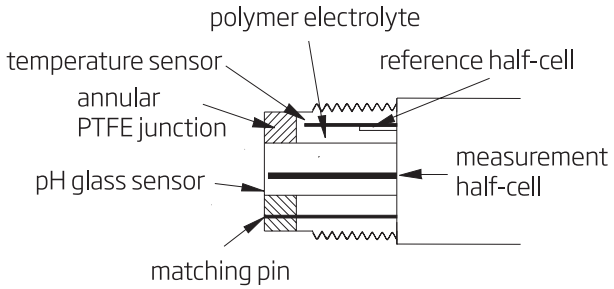
- progressive damage of the electrode
- fluctuating measurements
- poor process regulation

Glass Type	Application	pH Range	Temperature Range
LT	low temperature	0 to 12	-10 to 80°C
HT	high temperature	0 to 14	0 to 100°C
HF	acid samples with F- (*)	0 to 10	-5 to 60°C

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

Flat Tip Industrial pH Electrodes





Flat Tip pH Electrodes: Ordering Information

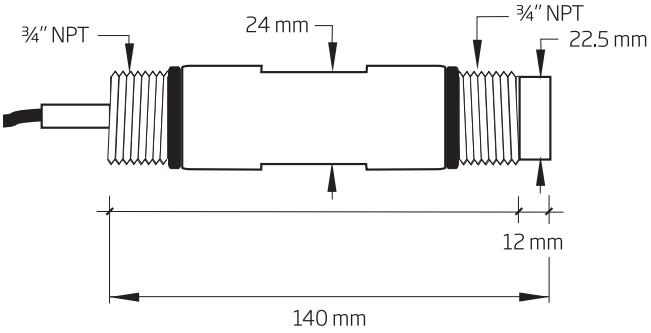
Choose your configuration:		
w =	**06**	PTFE junction
	16	ceramic junction
	26	open junction*
x =	**1**	LT (Low Temperature) glass sensor
	2	GP (General Purpose) glass sensor
	3	HT (High Temperature) glass sensor; titanium matching pin
	4	HF (Fluoride resistant) glass sensor
y =	**0**	BNC connector
	1	direct wire connection
	2	BNC connector + Pt100
	3	direct wire connection + Pt100
	4	BNC connector + Pt1000
	5	direct wire connection + Pt1000
	6	amplified electrode with BNC connector
	7	amplified electrode with BNC connector + Pt100
z =	**05, 10, 15** Cable length (meters); for non-amplified electrodes	
	15, 25, 50, 75 Cable length (meters); for amplified electrodes	

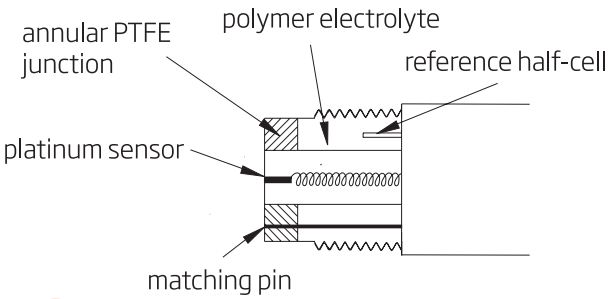
HI10 [w] – [x] [y] [z]

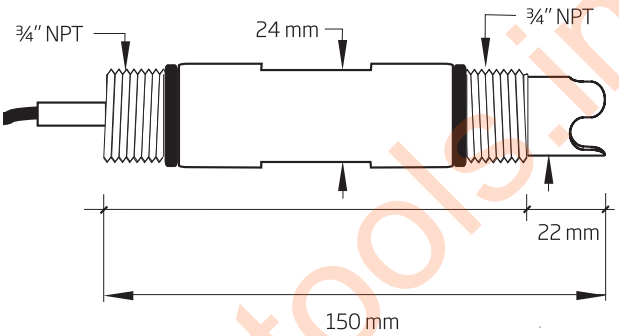
* Open junction is available only with GP glass sensor.

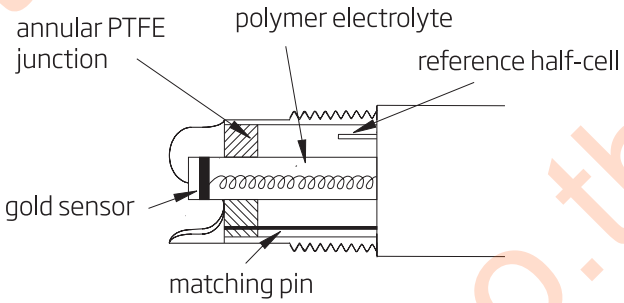
Note: The internal amplifier can be powered directly from select Hanna process controllers or a power source that supplies the appropriate voltage.

Flat Tip Industrial ORP Electrodes









Flat Tip ORP Electrodes: Ordering Information

Choose your configuration:		
w =	**04**	PTFE junction
	14	ceramic junction
	24	open junction
x =	**1**	platinum sensor
	2	gold sensor
y =	**0**	BNC connector
	1	direct wire connection
	6	amplified electrode with BNC connector
z =	**05, 10, 15**	Cable length (meters); for non-amplified electrodes
	15, 25, 50, 75	Cable length (meters); for amplified electrodes

HI20 [w] – [x] [y] [z]

Note: The internal amplifier can be powered directly from select Hanna process controllers or a power source that supplies the appropriate voltage.

AmpHel® Flat Tip Industrial Electrodes

- AmpHel® amplified
- Matching pin
- Flat tip
- PVDF body

AmpHel® Flat-tip pH Electrodes

General Purpose pH Electrodes

Code	Range	Body	Junction	Electrolyte	Glass Type	Temperature	ATC	Max Pressure	Connector	Cable
HI6100405	0-13	PVDF	double, PTFE	polymer	GP	-5 to 80 °C	–	6 bar (87 psi)	BNC	5 m
HI6101405	0-13	PVDF	double, PTFE	polymer	GP	-5 to 80 °C	Pt100	6 bar (87 psi)	BNC + lead	5 m
HI6101415	0-13	PVDF	double, PTFE	polymer	GP	-5 to 80 °C	Pt100	6 bar (87 psi)	BNC + lead	15 m

Low Temperature pH Electrodes

Code	Range	Body	Junction	Electrolyte	Glass Type	Temperature	ATC	Max Pressure	Connector	Cable
HI6100605	0-12	PVDF	double, PTFE	polymer	LT	-10 to 80 °C	–	6 bar (87 psi)	BNC	5 m
HI6101605	0-12	PVDF	double, PTFE	polymer	LT	-10 to 80 °C	Pt100	6 bar (87 psi)	BNC + lead	5 m

High Temperature pH Electrodes

Code	Range	Body	Junction	Electrolyte	Glass Type	Temperature	ATC	Max Pressure	Connector	Cable
HI6100805	0-14	PVDF	double, PTFE	polymer	HT	0 to 100 °C	–	6 bar (87 psi)	BNC	5 m
HI6101805	0-14	PVDF	double, PTFE	polymer	HT	0 to 100 °C	Pt100	6 bar (87 psi)	BNC + lead	5 m

pH Electrodes for Acid Samples with Fluoride Ions (F- max 2 g/L, Temperature Max 60 °C, pH >2)

Code	Range	Body	Junction	Electrolyte	Glass Type	Temperature	ATC	Max Pressure	Connector	Cable
HI6100205	0-10	PVDF	double, PTFE	polymer	HF	-5 to 60 °C	–	6 bar (87 psi)	BNC	5 m
HI6101205	0-10	PVDF	double, PTFE	polymer	HF	-5 to 60 °C	Pt100	6 bar (87 psi)	BNC + lead	5 m

AmpHel® Flat-tip ORP Electrodes

Platinum Type ORP Sensors

Code	Range	Body	Junction	Electrolyte	Temperature	ATC	Max Pressure	Connector	Cable
HI6200405	±2000 mV	PVDF	double, PTFE	polymer	-5 to 100 °C	–	6 bar (87 psi)	BNC	5 m

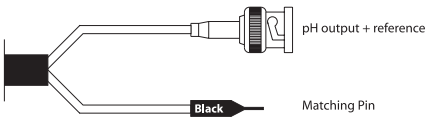
Gold Type ORP Sensors

Code	Range	Body	Junction	Electrolyte	Temperature	ATC	Max Pressure	Connector	Cable
HI6200505	±2000 mV	PVDF	double, PTFE	polymer	-5 to 100 °C	–	6 bar (87 psi)	BNC	5 m

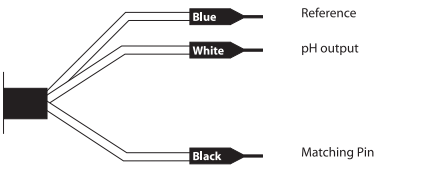
Flat Tip Industrial Electrodes Electrical Connections and Installation

Electrical Connections

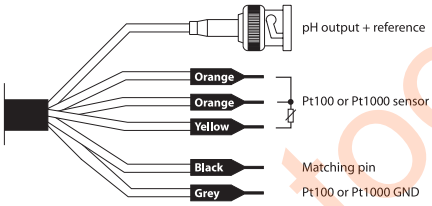
pH & ORP electrodes with BNC connector



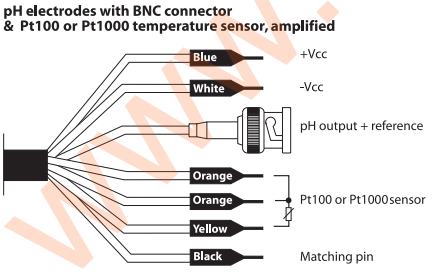
pH & ORP electrodes with direct wire connection



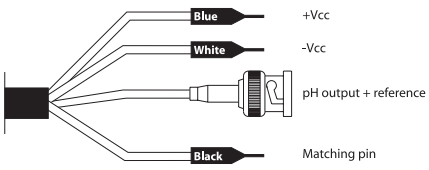
pH electrodes with BNC connector & Pt100 or Pt1000 temperature sensor



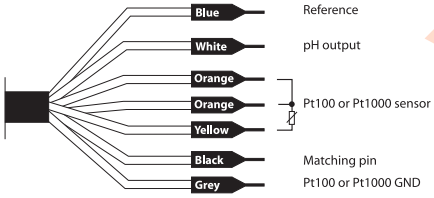
pH electrodes with BNC connector & Pt100 or Pt1000 temperature sensor, amplified



pH & ORP electrodes with BNC connector, amplified



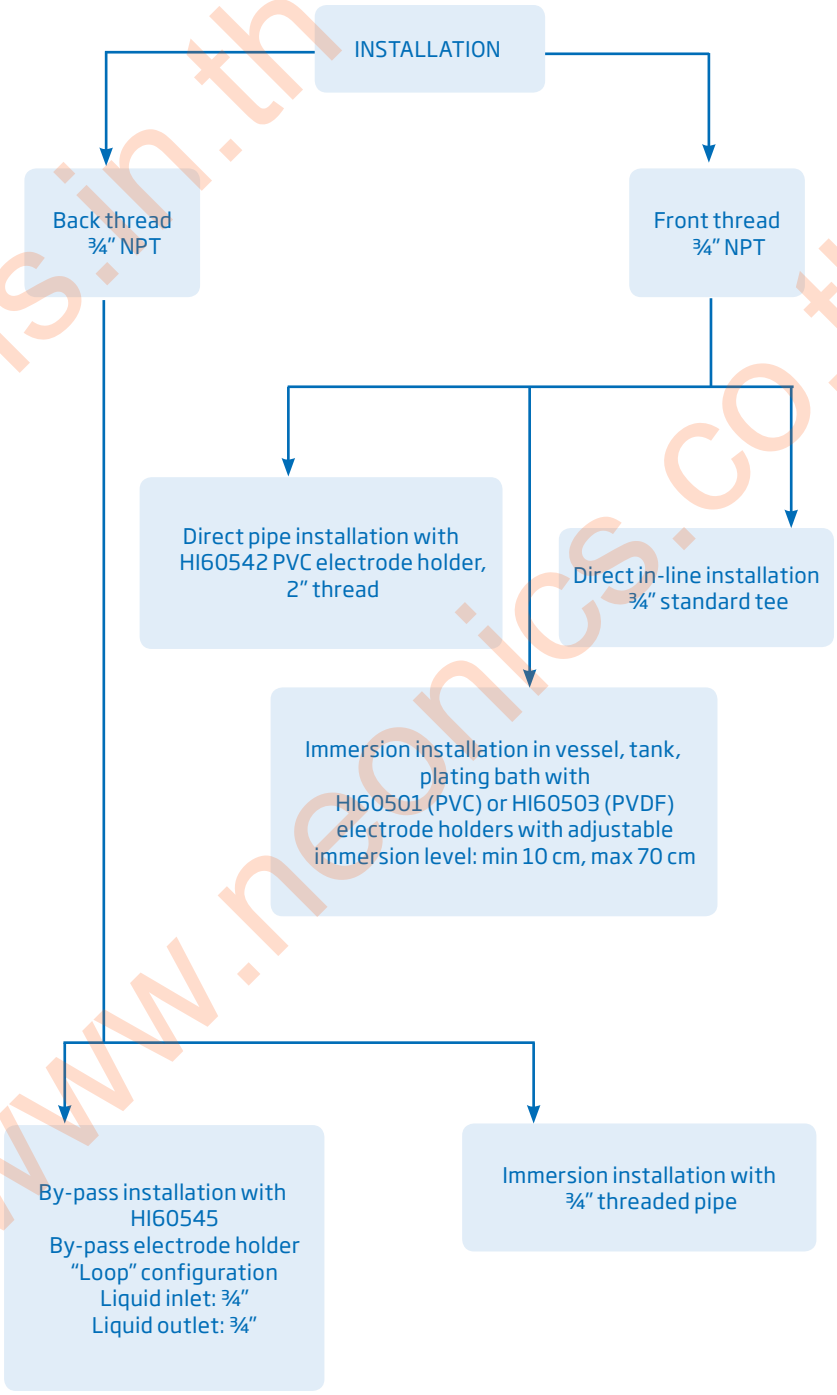
pH electrodes with direct wire connection & Pt100 or Pt1000 temperature sensor



Installation

These electrodes have been designed with ¾" external thread on both ends for easy installation.

Hanna also provides a series of probe holders for in-line, tank or by-pass installations for these electrodes, as shown below.



Amplified pH and ORP AmpHel® Electrodes

- Strong signal up to 75 meters (246')
- Low noise coaxial cables are no longer required
- Measurements in unclean samples and high humidity conditions
- Models with external replaceable battery, for longer electrode life
- Glass sensor for specific applications

Due to the high resistance of the glass membrane, conventional electrodes require a high impedance measurement system. Inadequate insulation of the connectors and cables results in erroneous readings due to leakage or noise. For conventional electrodes, the lead is therefore limited to typically less than 15-20 meters. Hanna AmpHel® electrodes incorporate a miniaturized amplifier which resolves most of the problems associated with high impedance signals. The amplifier circuitry is located right on top of the electrode and is completely sealed. As a result, a strong, low impedance signal is emitted and ordinary connectors with long unshielded cables can be used. This breakthrough technology provides a stable signal for industrial monitoring as well as a major saving in low noise coaxial cable costs. In some cases, the need for a transmitter is also eliminated, resulting in further cost reductions.

For those applications that have been proven particularly hostile to electrodes, Hanna has developed four types of specialized glass. First is an extremely durable sensor glass for general purpose and industrial use. This glass can withstand the stress of daily use. The remaining types of electrode glass allow continuous monitoring in highly acidic solutions containing fluoride ions, as well as high or low temperature process streams, without significantly reducing the life of the electrode.

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

Hanna Glass Sensors for Process Electrodes

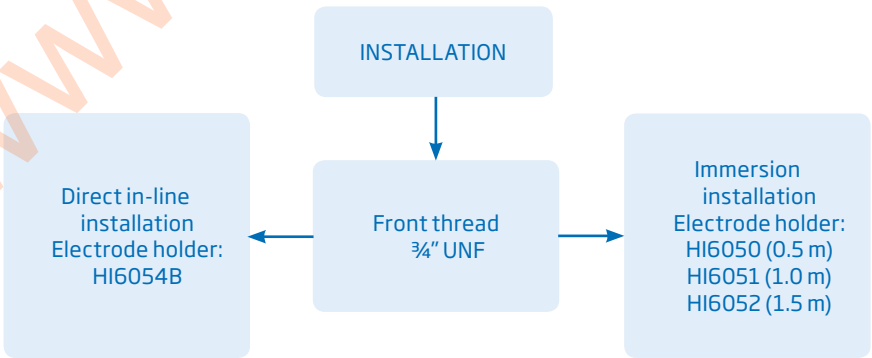
Glass Membrane	Application
GP	General Purpose
HT	High Temperature
LT	Low Temperature
HF	Samples with Fluoride

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

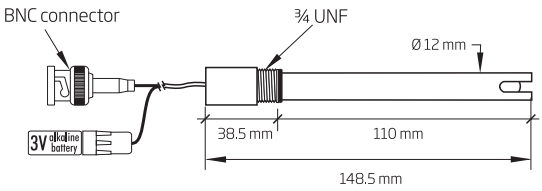
Easy Installation

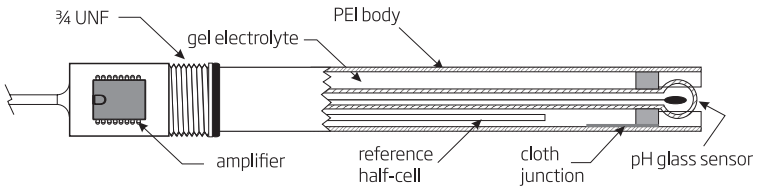
Models with glass body and PTFE junctions are recommended for in-line installations.

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.



Amplified pH and ORP AmpHel® Electrodes





AmpHel® pH Electrodes with Replaceable Battery - General Purpose pH Electrodes

Code	Body	Junction	Electrolyte	Glass Type	Temperature	Max Pressure	Connector	Cable
HI6291005	PEI	cloth	gel	GP	-5 to 70 °C	3 bar	BNC	5 m
HI6291010	PEI	cloth	gel	GP	-5 to 70 °C	3 bar	BNC	10 m

AmpHel® pH Electrodes with Replaceable Battery - High Temperature pH Electrodes

Code	Body	Junction	Electrolyte	Glass Type	Temperature	Max Pressure	Connector	Cable
HI8299505	glass	PTFE	polymer	HT	0 to 100 °C	3 bar	BNC	5 m


HI2911


HI2931

AmpHel® pH Electrodes with Internal Battery

Code	Body	Junction	Electrolyte	Glass Type	Temperature	Max Pressure	Connector	Cable
HI2910B	PEI	cloth	gel	GP	-5 to 70 °C	3 bar (43.5 psi)	BNC	1 m
HI2910B/5	PEI	cloth	gel	GP	-5 to 70 °C	3 bar (43.5 psi)	BNC	5 m
HI2911B/5	PEI	PTFE	polymer	GP	-5 to 80 °C	3 bar (43.5 psi)	BNC	5 m

AmpHel® ORP Electrodes with Replaceable Battery

Code	Body	Junction	Electrolyte	PIN Type	Temperature	Max Pressure	Connector	Cable
HI6293005	PEI	cloth	gel	platinum	-5 to 80 °C	3 bar (43.5 psi)	BNC	5 m
HI6493005	PEI	cloth	gel	gold	-5 to 80 °C	3 bar (43.5 psi)	BNC	5 m

AmpHel® ORP Electrodes with Internal Battery

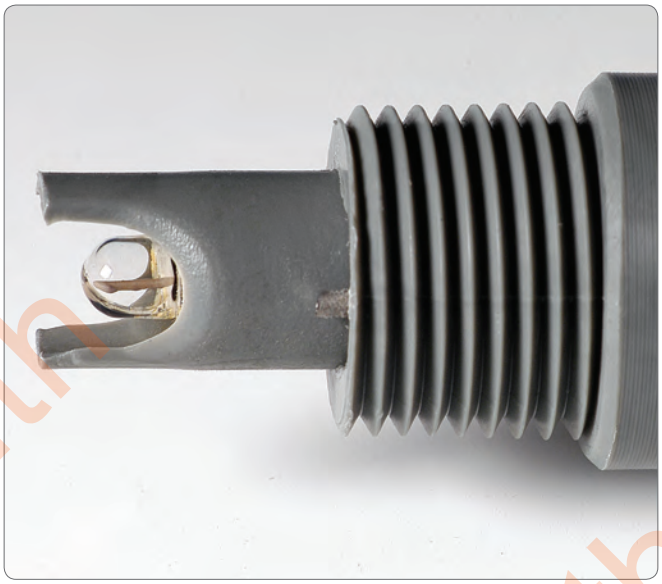
Code	Body	Junction	Electrolyte	PIN Type	Temperature	Max Pressure	Connector	Cable
HI2930B/5	PEI	cloth	gel	platinum	-5 to 80 °C	3 bar (43.5 psi)	BNC	5 m
HI2931B/5	PEI	PTFE	gel	platinum	-5 to 80 °C	3 bar (43.5 psi)	BNC	5 m

HI1000 and HI2000 Series

pH and ORP Electrodes for Continuous Flow-thru Monitoring

Specifically Built for Industrial Applications

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



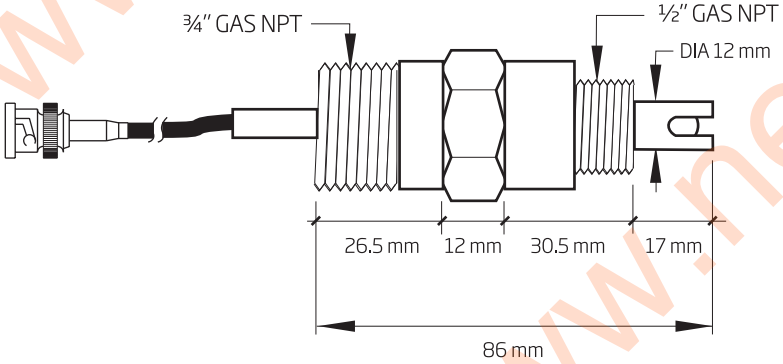
Matching pin with differential input for grounding

In order to reduce normal contamination coming from industrial use, these electrodes combine a polymer reference and double-junction technology. With this technology, no refilling is required and the electrode can be used in samples such as organic compounds, proteins and heavy metals. In addition, the pH electrodes use a unique annular PTFE junction that minimizes clogging.

These industrial probes have a glass body electrode for use in aggressive chemicals and are easy to clean. A PEI protective sleeve gives the electrodes resistance against mechanical stress. Operating limits are -5 to 80°C (23 to 176°F) and pressure up to 6 bar (87 psi).

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

HI1000 and HI2000 series incorporate a BNC connector that enables connection to any pH/ORP meter quickly and easily. Models with 3 or 5 meters (9.8 or 16 feet) cable are available.



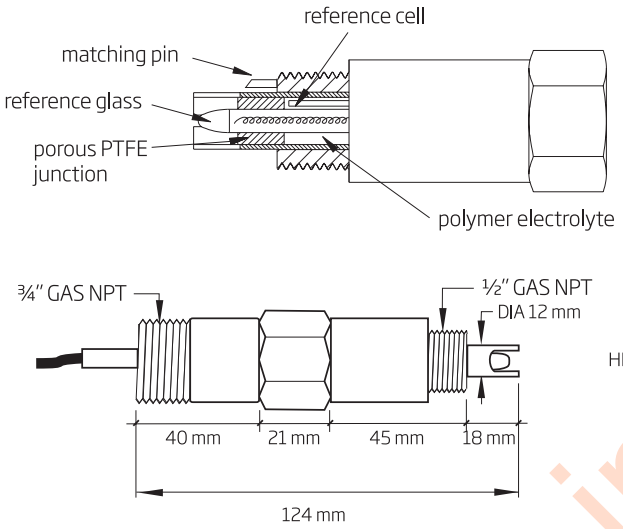
HI1000 and 2000 series

HI1001 and HI 1005 (pH Electrodes) and HI2001 (ORP Electrode with Pt sensor)

Code	Junction	Electrolyte	Temperature	Max Pressure	Connector	Cable
HI1001	double, PTFE	polymer	-5 to 80°C - HT	6 bar (87 psi)	BNC	3 m
HI1005	double, PTFE	polymer	-5 to 80°C	6 bar (87 psi)	DIN	0.5 m
HI2001	double, PTFE	polymer	-5 to 80°C	6 bar (87 psi)	BNC	3 m

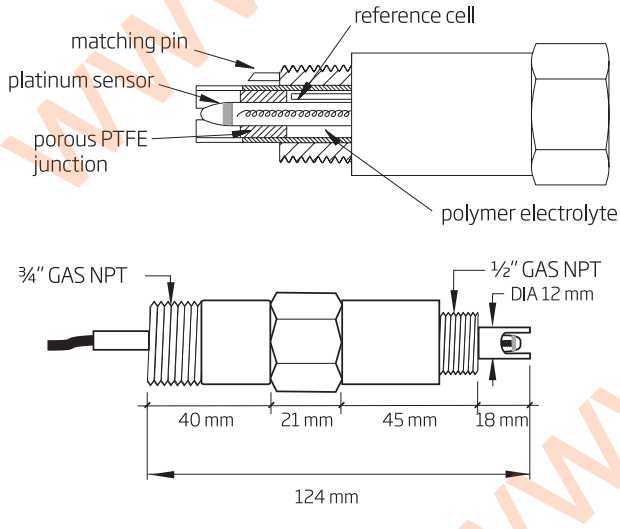
pH and ORP Electrodes for Continuous Flow-thru Monitoring

Specifically Built for Industrial Applications



HI1000 Series: pH Electrodes

Code	Junction	Electrolyte	Matching Pin	Amplifier	Temperature	Max Pressure	Connector	Cable
HI1002/3	double, PTFE	polymer	–	–	-5 to 80°C - HT	6 bar (87 psi)	BNC	3 m
HI1002/5	double, PTFE	polymer	–	–	-5 to 80°C - HT	6 bar (87 psi)	BNC	5 m
HI1002/10	double, PTFE	polymer	–	–	-5 to 80°C	6 bar (87 psi)	BNC	10 m
HI1003/3	double, PTFE	polymer	yes	–	-5 to 80°C - HT	6 bar (87 psi)	BNC	3 m
HI1003/5	double, PTFE	polymer	yes	–	-5 to 80°C - HT	6 bar (87 psi)	BNC	5 m
HI1004/15	double, PTFE	polymer	yes	yes	-5 to 80°C	6 bar (87 psi)	spade lug	15 m



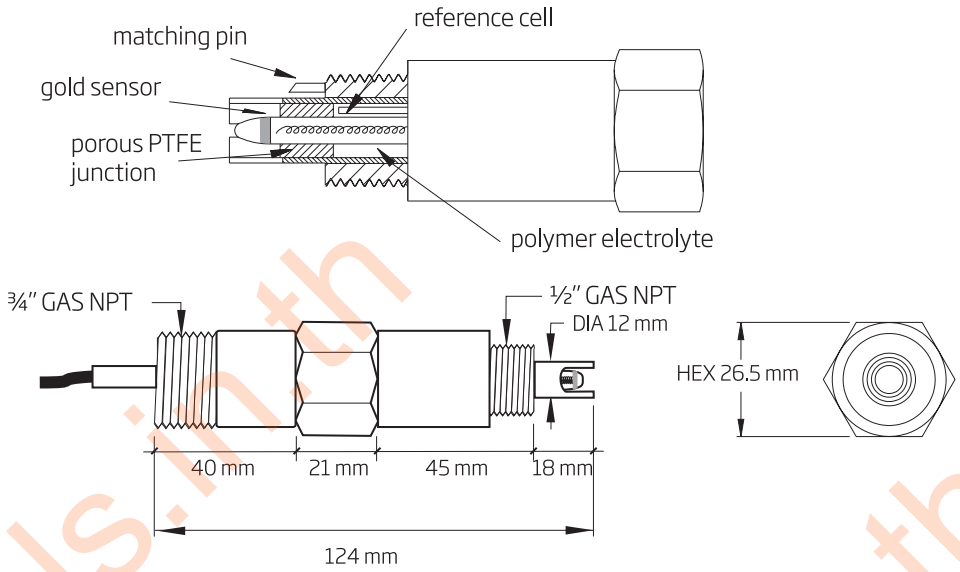
HI2000 Series: ORP Electrodes with Platinum Sensor

Code	Junction	Electrolyte	Matching Pin	Amplifier	Temperature	Max Pressure	Connector	Cable
HI2002/3	double, PTFE	polymer	–	–	-5 to 80°C	6 bar (87 psi)	BNC	3 m
HI2002/5	double, PTFE	polymer	–	–	-5 to 80°C	6 bar (87 psi)	BNC	5 m
HI2003/3	double, PTFE	polymer	yes	–	-5 to 80°C	6 bar (87 psi)	BNC	3 m
HI2003/5	double, PTFE	polymer	yes	–	-5 to 80°C	6 bar (87 psi)	BNC	5 m

HI1000 and HI2000 Series

pH and ORP Electrodes for Continuous Flow-thru Monitoring

Specifically Built for Industrial Applications

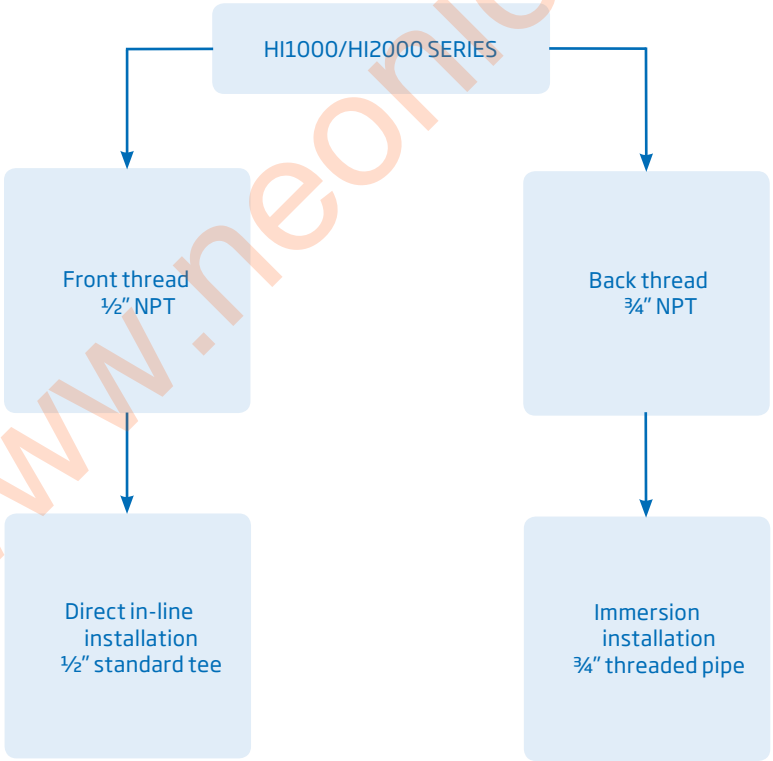


HI2000 Series: ORP Electrodes with Gold Sensor

Code	Junction	Electrolyte	Matching Pin	Amplifier	Temperature	Max Pressure	Connector	Cable
HI2008	double, PTFE	polymer	yes	yes	-5 to 80°C	6 bar (87 psi)	DIN	0.5 m

Installation

These sensors have a hex-shaped body for easy installation, requiring no special tools. Continuous in-line mounting is possible due to the ½" external thread. No special holders are required: HI1000 and HI2000 series can be used with any standard ½" pipe tee available on the market. On the opposite end, these probes are provided with a ¾" thread so that they can be attached to a pipe for dip applications.



Easy pH and ORP Electrodes

with Quick and Easy BNC Connection

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

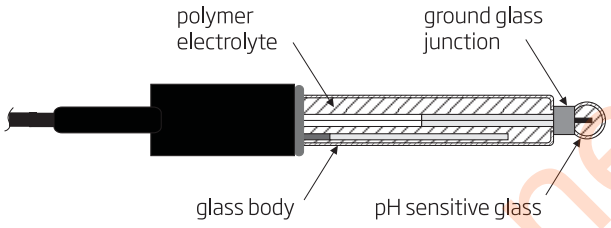
Hanna offers a wide range of combination pH and ORP electrodes specifically designed for the needs of industrial users.

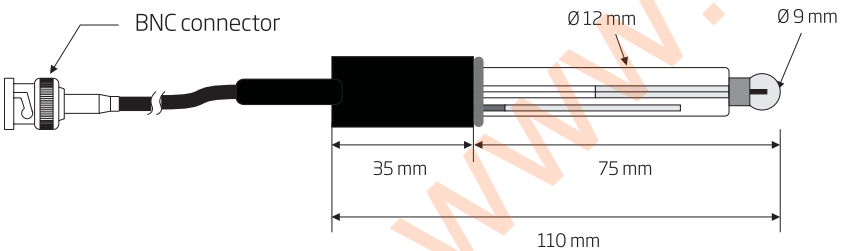
In order to reduce contamination problems, all electrodes are gel or polymer filled and feature double-junction technology.

The BNC connector allows quick and easy connection to any pH/ORP meter or transmitter. In addition to this type of connection, select models offer a ¾" UNF thread for secure in-line installation.

PEI and glass body electrodes are available. PEI bodied electrodes are rugged and suitable for applications in which the capability to resist stress is needed. Glass body electrodes are easier to clean and recommended for use in aggressive chemicals.

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



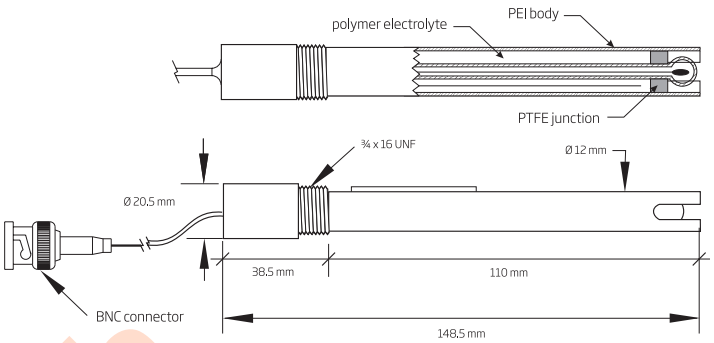


Combination Glass-body pH Electrode

Code	Junction	Electrolyte	Temperature	Max Pressure	Connector	Cable
HI1090B/5	double, ground glass	polymer	-5 to 95°C (23-203°F) - HT	3 bar (43.5 psi)	BNC	5 m

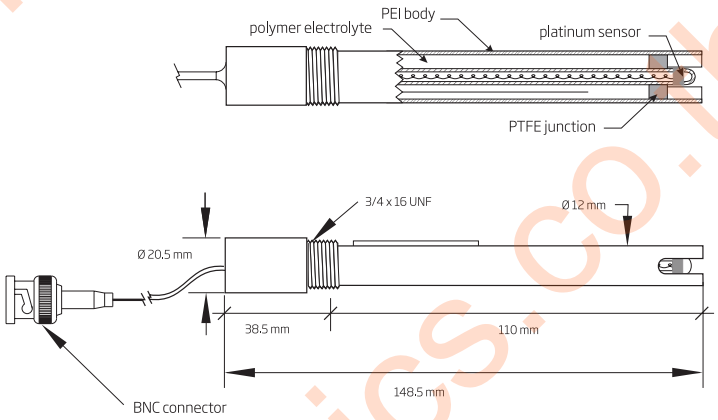
Easy pH and ORP Electrodes

with Quick and Easy BNC Connection



Combination PEI-body pH Electrode

Code	Junction	Electrolyte	Temperature	Max Pressure	Connector	Cable
HI1210B/5	double, PTFE	polymer	-5 to 80°C - GP	3 bar (43.5 psi)	BNC	5 m



Combination PEI-body ORP Electrode with Platinum Sensor

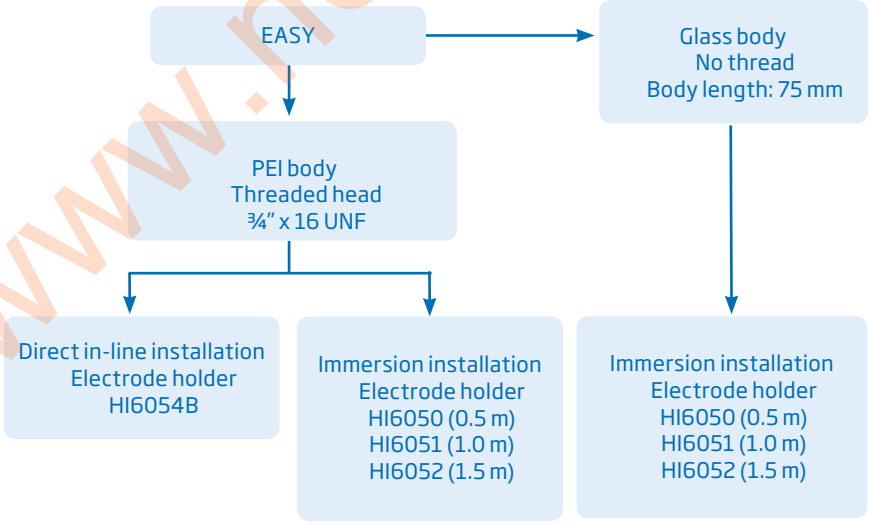
Code	Junction	Electrolyte	Temperature	Max Pressure	Connector	Cable
HI3210B/5	double, PTFE	polymer	-5 to 80°C	3 bar (43.5 psi)	BNC	5 m
HI3130B	single, ceramic	gel	0 to 80°C	3 bar (43.5 psi)	BNC	1 m

Installation

These electrodes feature flexible installation, with different mounting configurations available

Models with a glass body and no external thread can be installed on tanks using the HI6050 electrode holder with sealing O-ring.

Models with a PEI body and ¾" UNF thread or glass body and no thread can be easily installed directly in-line, using a T-shaped electrode holder, such as HI6054B.



pH and ORP Electrodes

with T-type Connection

- Screw cap connector and PG 13.5 thread
- Easy operation
- Double-junction technology
- Pressure up to 3 bar (43.5 PSI)

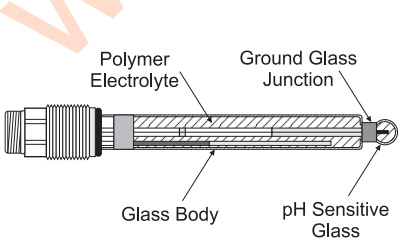
Electrodes featuring a T-connector have been designed by Hanna to take advantage of both PG 13.5 thread and screw cap. The PG 13.5 thread ensures proper in-line installation; furthermore, the user can quickly and easily perform all servicing and maintenance procedures. The screw cap allows for maximum versatility making it possible to connect a cable of different lengths. Easily detacheable cables make electrode replacement simple.

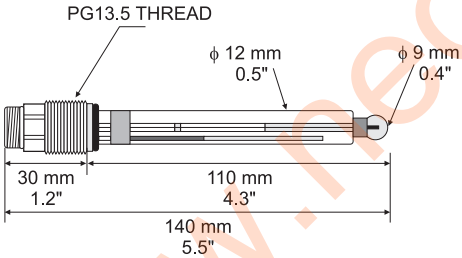
Many models are available to choose from, all of which feature a double junction of gel polymer filling to ensure long electrode life and reliability in harsh environments. In addition, users can select from ground-glass or cloth junction technology to meet the needs of their specific application.

Electrodes featuring a PEI body are ideal for use in moderately aggressive liquids, such as in wastewater, while electrodes featuring glass bodies are recommended with more aggressive chemicals, such as in galvanic applications.

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

Hanna electrode holders and assemblies are featured at the end of this section for in-line and submersion applications. These optional accessories can be dismantled and reassembled easily without requiring any special tools.



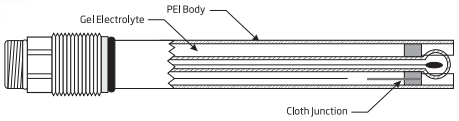


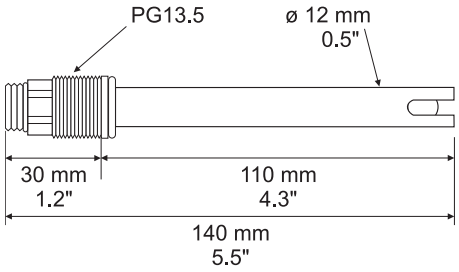
Combination Glass-body pH Electrode

Code	Junction	Electrolyte	Temperature	Max Pressure	Connector
HI1190T	double, PTFE	polymer	-15 to 80°C (5 to 176°F) - LT	6 bar (87 psi)	T-type
HI1191T	double, PTFE	polymer	-15 to 80°C (5 to 176°F) - LT	8 bar (116 psi)	T-type
HI1192T	double, PTFE	polymer	-15 to 80°C (5 to 176°F) - LT	8 bar (116 psi)	T-type

pH and ORP Electrodes

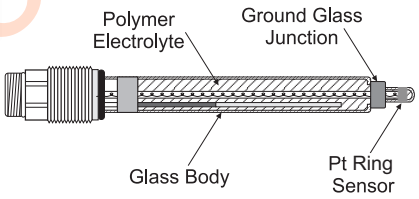
with T-type Connection

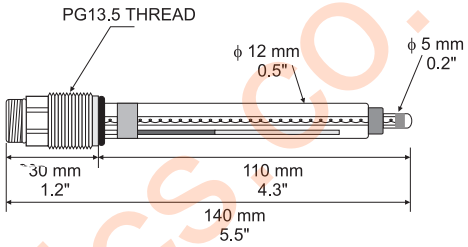




Combination PEI-body pH Electrode

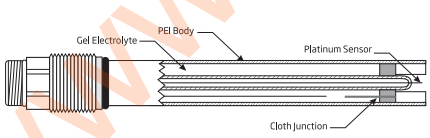
Code	Junction	Electrolyte	Temperature	Max Pressure	Connector
HI1210T	double, cloth	gel	-5 to 80°C (23 to 176°F) - GP	3 bar (43.5 psi)	T-type
HI1211T	double, PTFE	polymer	-5 to 80°C (23 to 176°F) - HT	3 bar (43.5 psi)	T-type

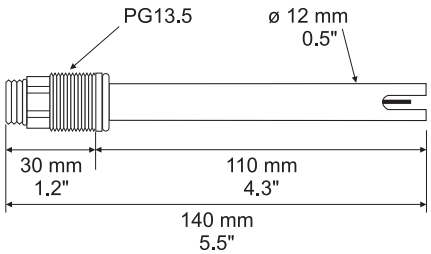




Combination Glass-body ORP Electrode with Platinum Sensor

Code	Junction	Electrolyte	Temperature	Max Pressure	Connector
HI3090T	double, ground glass	polymer	-5 to 95°C (23 to 203°F)	3 bar (43.5 psi)	T-type
HI3190T	double, PTFE	polymer	-15 to 100°C (5 to 212°F)	6 bar (87 psi)	T-type
HI3211T	double, cloth	gel	-5 to 80°C (23 to 176°F)	3 bar (43.5 psi)	T-type



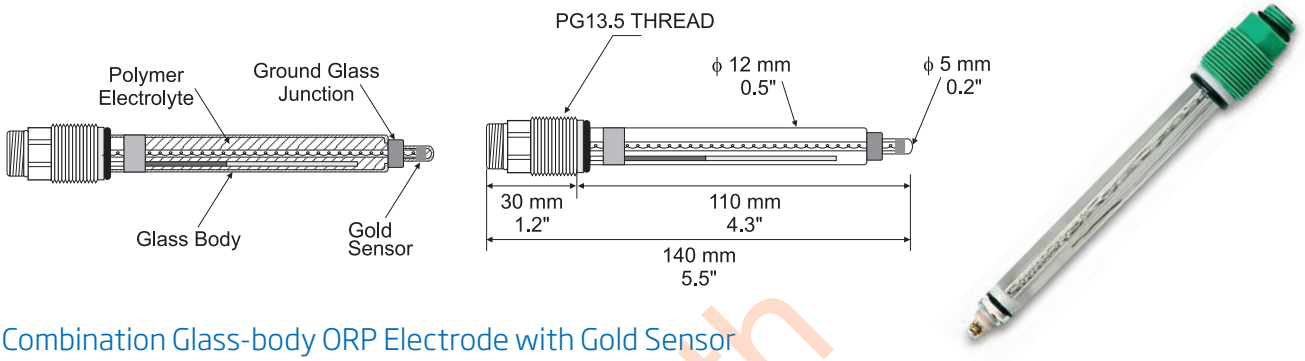


Combination PEI-body ORP Electrode with Platinum Sensor

Code	Junction	Electrolyte	Temperature	Max Pressure	Connector
HI3210T	double, cloth	gel	-5 to 80°C (23 to 176°F)	3 bar (43.5 psi)	T-type

pH and ORP Electrodes

with T-type Connection



Combination Glass-body ORP Electrode with Gold Sensor

Code	Junction	Electrolyte	Temperature	Max Pressure	Connector
HI4190T	double, PTFE	polymer	-5 to 80°C (23 to 176°F)	3 bar (43.5 psi)	T-type
HI4290T	single, ground glass	polymer	-5 to 80°C (23 to 176°F)	3 bar (43.5 psi)	T-type

pH and ORP Immersion and In-Line Electrodes

Code	HI101	HI102	HI201
Description	submersible pH electrode	in-line pH electrode	submersible ORP electrode
Reference	double, Ag/AgCl	double, Ag/AgCl	double, Ag/AgCl
Junction / Flow Rate	PTFE	PTFE	PTFE
Electrolyte	polymer	polymer	polymer
Max Pressure	6 bar (25°C)	6 bar (25°C)	6 bar (25°C)
Range	pH: 0 to 13	pH: 0 to 13	pH: 0 to 13
Recommended Operating Temp.	20 to 40°C (68 to 104°F) - GP	20 to 40°C (68 to 104°F) - GP	20 to 40°C (68 to 104°F)
Tip /Shape	flat	flat	flat, platinum
Temperature Sensor	no	no	no
Amplifier	no	no	no
Body Material	PVC	PVC	PVC
Connector	BNC female	BNC female	BNC female
Connection Cable	HI101/3 adapter with 3 m (9.9') cable	HI101/3 adapter with 3 m (9.9') cable	HI101/3 adapter with 3 m (9.9') cable
Recommended Use	Immersion	In-line	Immersion

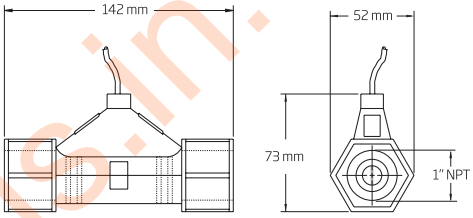
HI7635

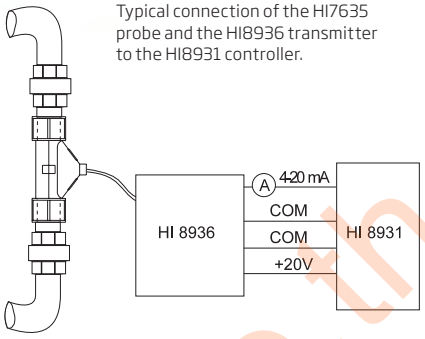
In-line Conductivity Probes

These conductivity probes combine the proven four-ring potentiometric method of measuring conductivity with platinum sensors. The universally acclaimed four-ring method provides an exceptionally stable measurement over a wider range. These probes do not suffer polarization, nor do they need frequent calibration or cell changes.

The built-in temperature sensor (select models) allows automatically temperature compensated measurements and features easy operation and maintenance.

The majority of probes are provided with a 4 m cable incorporating color coded wires for easy connection to HI8936 transmitters while others provide a DIN connection.





Typical connection of the HI7635 probe and the HI8936 transmitter to the HI8931 controller.

Code	Temperature Compansation	Body	Operating Temperature	Max Pressure (@25°C/77°F)	Cable/ Connection
HI7635	automatic, 0 to 50°C with NTC sensor	polypropylene	0 to 80°C (32 to 176°F)	5 bar	4 m (13.1')/Color coded wires

HI7638 · HI7639

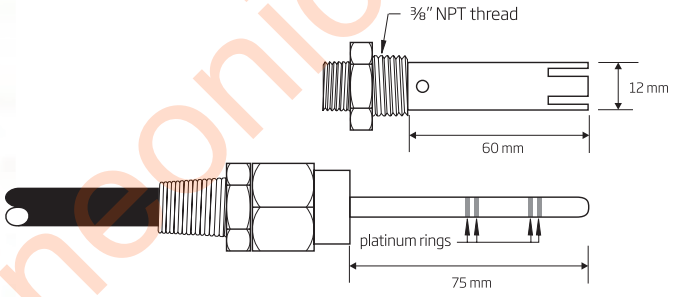
In-line Conductivity Probes

with Platinum Ring

These conductivity probes combine the proven four-ring potentiometric method of measuring conductivity with platinum sensors. The universally acclaimed four-ring method provides an exceptionally stable measurement over a wider range. These probes do not suffer polarization, nor do they need frequent calibration or cell changes.

HI7638 and HI7639's built-in temperature sensor allows automatically temperature compensated measurements and features easy operation and maintenance.

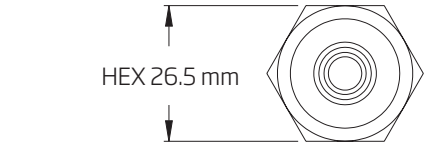
HI7638

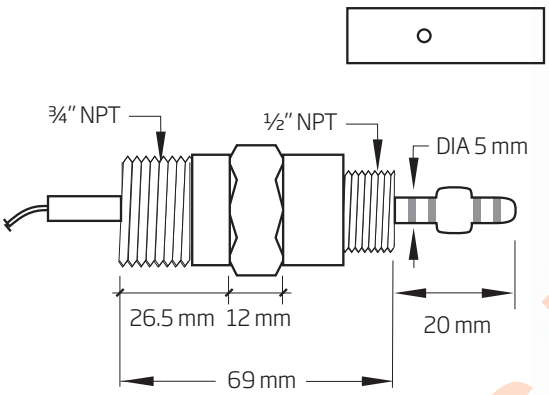


Code	Temperature Compensation	Body	Operating Temperature	Max Pressure (@25°C/77°F)	Cable/Connection
HI7638	automatic, 0 to 50°C with NTC sensor	PEI and glass	0 to 120°C (32 to 248°F)	5 bar (72.5 psi)	3 m (9.9')/Color coded wires
HI7638/10	automatic, 0 to 50°C with NTC sensor	PEI and glass	0 to 120°C (32 to 248°F)	5 bar (72.5 psi)	10 m (32.8')/Color coded wires
HI7638/20	automatic, 0 to 50°C with NTC sensor	PEI and glass	0 to 120°C (32 to 248°F)	5 bar (72.5 psi)	20 m (65.6')/Color coded wires
HI7639	automatic, 0 to 50°C with Pt100 sensor	PEI and glass	0 to 120°C (32 to 248°F)	5 bar (72.5 psi)	3 m (9.9')/Color coded wires

HI3001 · HI3001D · HI3011

Flow-thru Conductivity Probes






HI3001

These four-ring probes measure conductivity with platinum sensors. They come with standard ½" external thread on the front for flow-thru mounting and ¾" threads on the back for submersion or pipe mounting.

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

In addition, HI3001 houses an NTC sensor for Automatic Temperature Compensation.

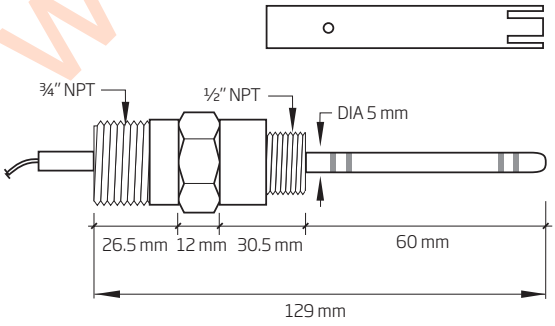
Model HI3001D with DIN connector is to be used with the HI99xx series of wall-mounted controllers.

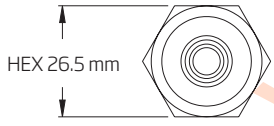
Code	Temperature Compensation	Body	Operating Temperature	Max Pressure (@25°C/77°F)	Connector	Cable
HI3001	automatic, 0 to 60°C with NTC sensor	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	–	3 m (9.9')
HI3001D	automatic, 0 to 60°C with NTC sensor	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	DIN	3 m (9.9')
HI3001D/5	automatic, 0 to 60°C with NTC sensor	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	DIN	5 m (16.4')
HI3001D/10	automatic, 0 to 60°C with NTC sensor	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	DIN	10 m (32.8')
HI3003/D*	automatic, 0 to 60°C with NTC sensor	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	DIN	3 m (9.9')
HI3011	–	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	–	3 m (9.9')

*for HI9914 only

HI3002

Submersion Probes






HI3002

The HI3002 four-ring probe measure EC with platinum sensors. It comes with standard ½" external thread on the front for flow-thru mounting and ¾" threads on the back for submersion or pipe mounting. Probes incorporate 3 m (9.9') of cable.

The protective probe cover is made of PEI and can be removed for quick maintenance. These probes can withstand temperatures up to 80°C (176°F) and 6 bars (87 psi) of pressure. HI3002 also houses an NTC temperature sensor for automatically temperature compensated measurements.

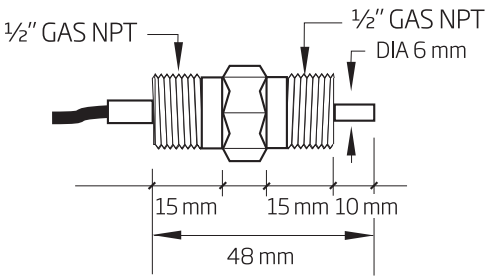
Code	Temperature Compensation	Body	Operating Temperature	Max Pressure (@25°C/77°F)	Connector	Cable
HI3002	automatic, 0 to 60°C with NTC sensor	PEI and PVDF	0 to 80°C (32 to 176°F)	6 bar (87 psi)	–	3 m (9.9')

HI7610 · HI7611

Stainless Steel Temperature Probes

- Flow-through and immersion mounting
- High accuracy
- Stainless steel model with ½" GAS NPT external thread
- Glass version with high chemical resistance and PG 13.5 external thread

HI7610, HI7611



HI7610 and HI7611 are temperature probes with 3-wire Pt100 or Pt1000 sensors. These probes provide accurate and effective temperature compensation. They can be used with a vast array of industrial pH, ORP and conductivity controllers on the market, as well as our pH 500, mV 600, HI700 and HI504 series.

HI7610 and HI7611 are constructed of stainless steel for additional ruggedness. They incorporate ½" external threads on both ends to facilitate inline and immersion installations.

HI7610 and HI7611 Industrial Temperature Probes

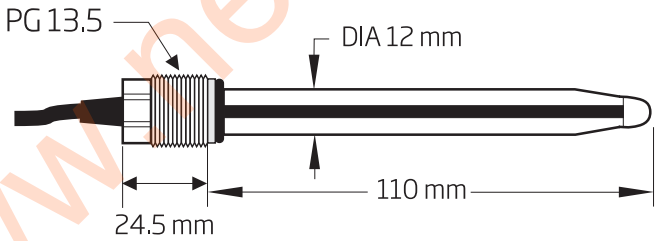
Code	Temperature Sensor	Body	Max Pressure	Cable Length
HI7610	Pt100	stainless steel	8 bar	5 m (16.4')
HI7611	Pt1000	stainless steel	8 bar	5 m (16.4')

HI7620 • HI7621

Glass Body Probes

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

HI7621

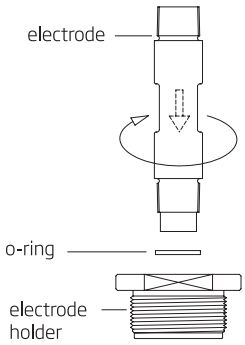


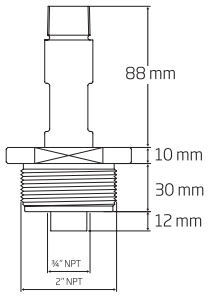
HI7620 and HI7621 are temperature probes with 3-wire Pt100 or Pt1000 sensors. These probes provide accurate and effective temperature compensation. They can be used with a vast array of industrial pH, ORP and conductivity controllers on the market, as well as our pH500, mV600, HI700 and HI504 series.

HI7620 and HI7621 are made with a glass body in order to provide greater resistance against aggressive chemicals. They also come with a standard PG 13.5 external thread so that they may be used with our HI6054T holder as well as other common probe holders.

HI7620 and HI7621 Industrial Temperature Probes

Code	Temperature Sensor	Body	Max Pressure	Cable Length
HI7620	Pt100	glass	3 bar	5 m (16.4')
HI7621	Pt1000	glass	3 bar	5 m (16.4')





HI60542

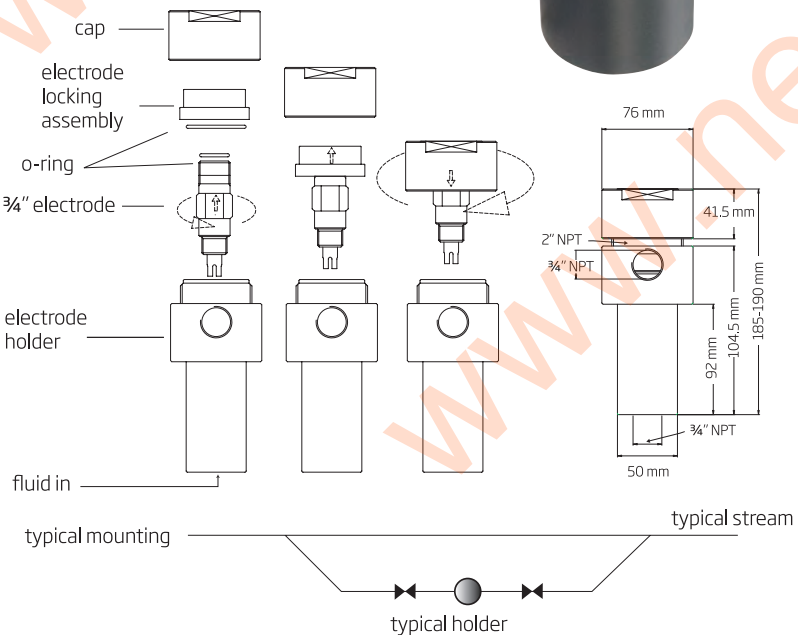
In-line Electrode Holder

for Direct Pipe Installation

HI60542 is a two inch NPT in-line PVC electrode holder ideal for direct pipe installation.

HI60542 has been designed specifically to be used with Hanna ¾" NPT process electrodes with built-in temperature sensor and matching pin.

Specifications	HI60542
Electrode Holder Material	PVC
O-ring Material	NBR (Buna N)
Minimum Temperature	-10 °C
Maximum Temperature	+60 °C
Maximum Pressure	8 bar @25°C or 3 bar @50°C



HI60545

By-pass Loop Electrode Holder

No Downtime

HI60545 is an electrode holder designed for use in a bypass loop configuration.

HI60545 allows easy maintenance and calibration without shutting down the process. The design of HI60545 assures that the glass sensor remains wet even when system is not under pressure.

HI60545 is only for use with Hanna 1006 series probes that have a ¾" NPT fitting.

Specifications	HI60545
Electrode Holder Material	PVC
O-ring Material	NBR (Buna N)
Minimum Temperature	-10 °C
Maximum Temperature	+60 °C
Maximum Pressure	8 bar @25°C or 3 bar @50°C

HI6050

Submersible Electrode Holder

These electrode mounting systems are constructed in rugged PVC and will resist most of the chemicals associated with wastewater treatment.

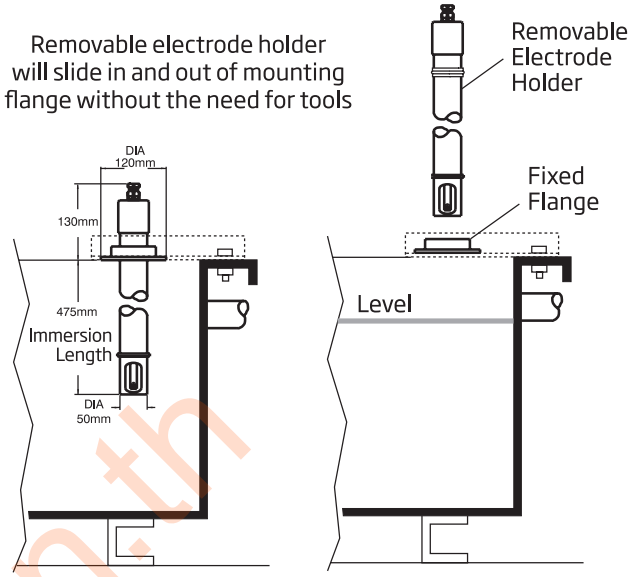
They are easy to install and require no tools for maintenance, making weekly electrode inspection and meter calibration a quick and easy task.

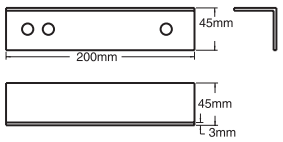
The mounting flange is a rugged PVC piece that mounts directly to the stainless steel brackets on tanks.

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

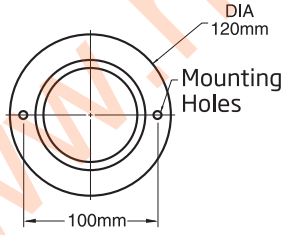
The electrode slides into the holder and is hand tightened into place. The cable from the electrode will lead up through the holder and out through the cap on top. The cable is also shielded inside the holder to prevent any damage to the insulation. The protective cap is removable to allow for quick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

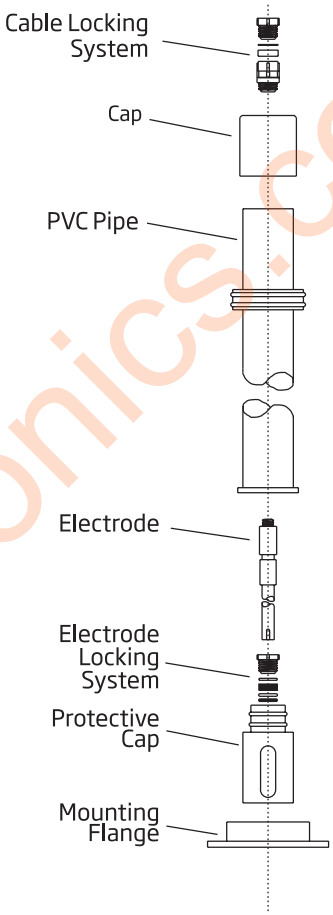
Removable electrode holder will slide in and out of mounting flange without the need for tools





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





Specifications	Total Length	Weight	Submersion Length
HI6050	605 mm (23.8")	0.8 kg (26 oz.)	475 mm (18.7")
HI6051	1105 mm (43.5")	1.2 kg (44 oz.)	975 mm (38.4")
HI6052	1605 mm (63.2")	2.0 kg (71 oz.)	1500 mm (59.1")

HI6054B · HI6054T

Electrode Holders

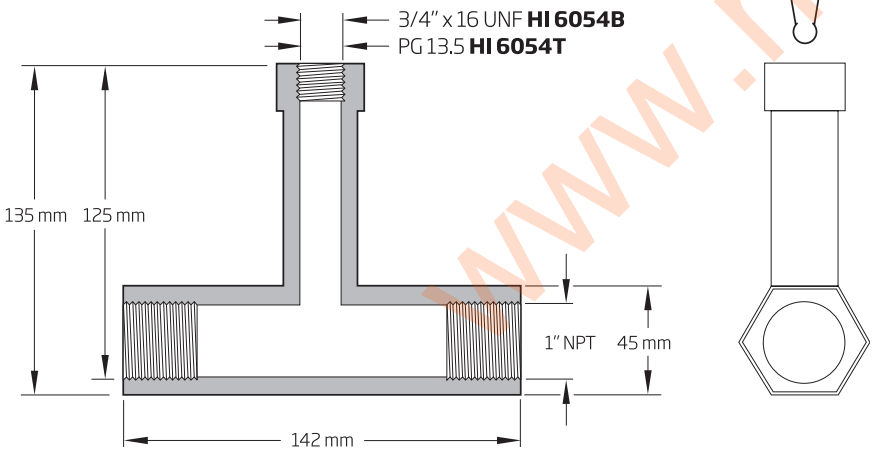
for In-line Applications

The HI6054 is a rugged, fiber-reinforced polypropylene in-line electrode holder.

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

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

The HI6054B and HI6054T are designed specifically to work with Hanna electrodes with external thread of ¾" x 16 UNF and PG 13.5 respectively.



Actual Installation Examples

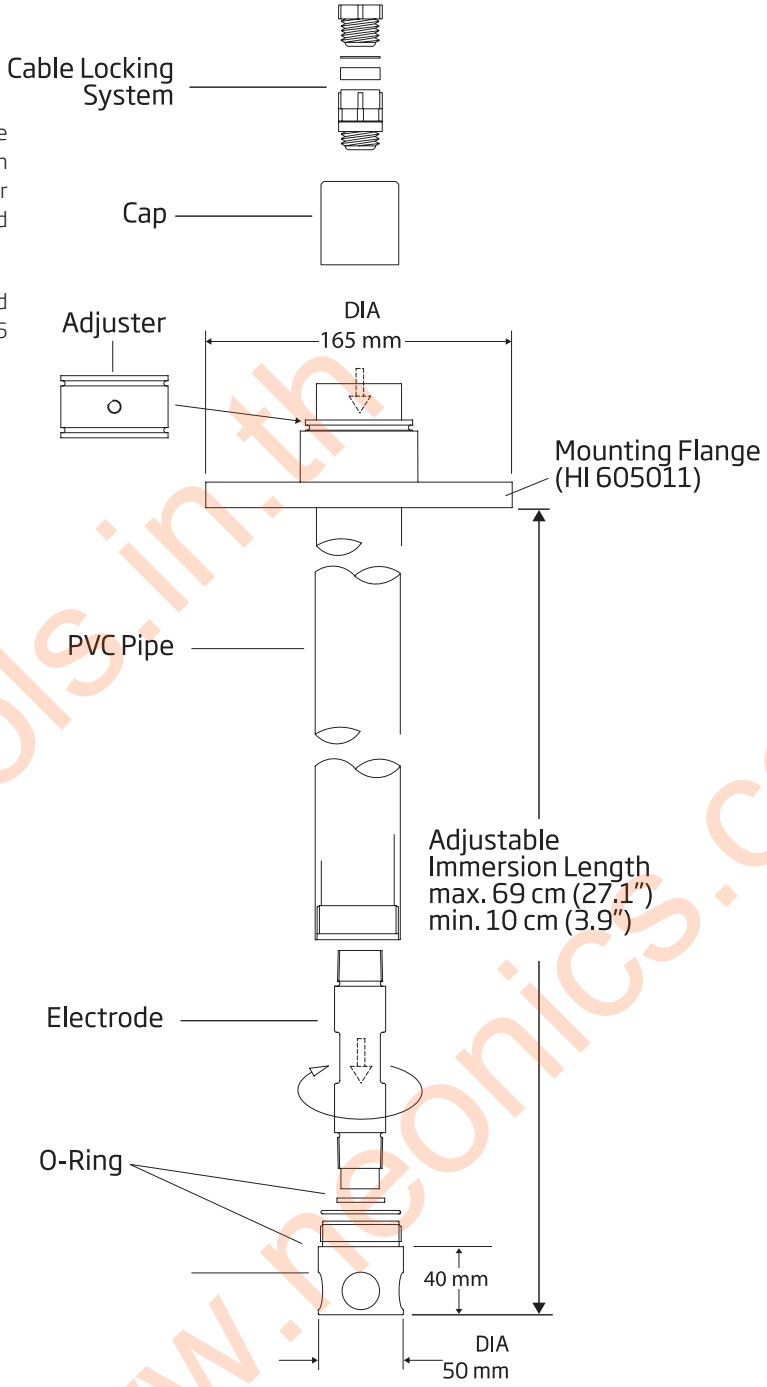
HI60501 · HI60503

Immersion Electrode Holders

for Tanks, Vessels, Baths and Open Channels

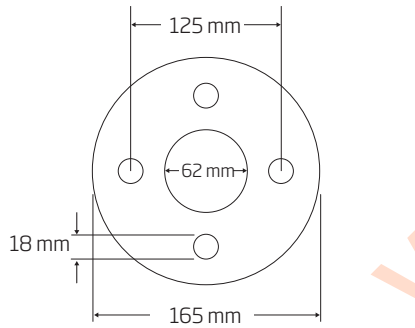
These electrode holders have an adjustable length and have been designed for immersion applications. Simply set the flange adjuster and the flange (HI605011) to the required length and install.

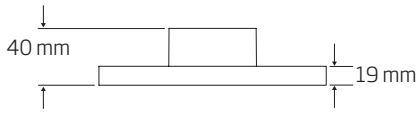
These holders have been designed specifically to be used with Hanna 1006 series probes that have a ¾" NPT fitting.



HI60503

HI 605011 mounting flange





Specifications	HI60501	HI60503
Electrode Holder Material	PVC	PVDF
O-ring Material	NBR (Buna N)	NBR (Buna N)
Minimum Immersion Level	10 cm (3.9")	10 cm (3.9")
Maximum Immersion Level	69 cm (27.1")	69 cm (27.1")
Minimum Temperature	-10°C (14°F)	-15°C (5°F)
Maximum Temperature	+60°C (140°F)	+100°C (212°F)