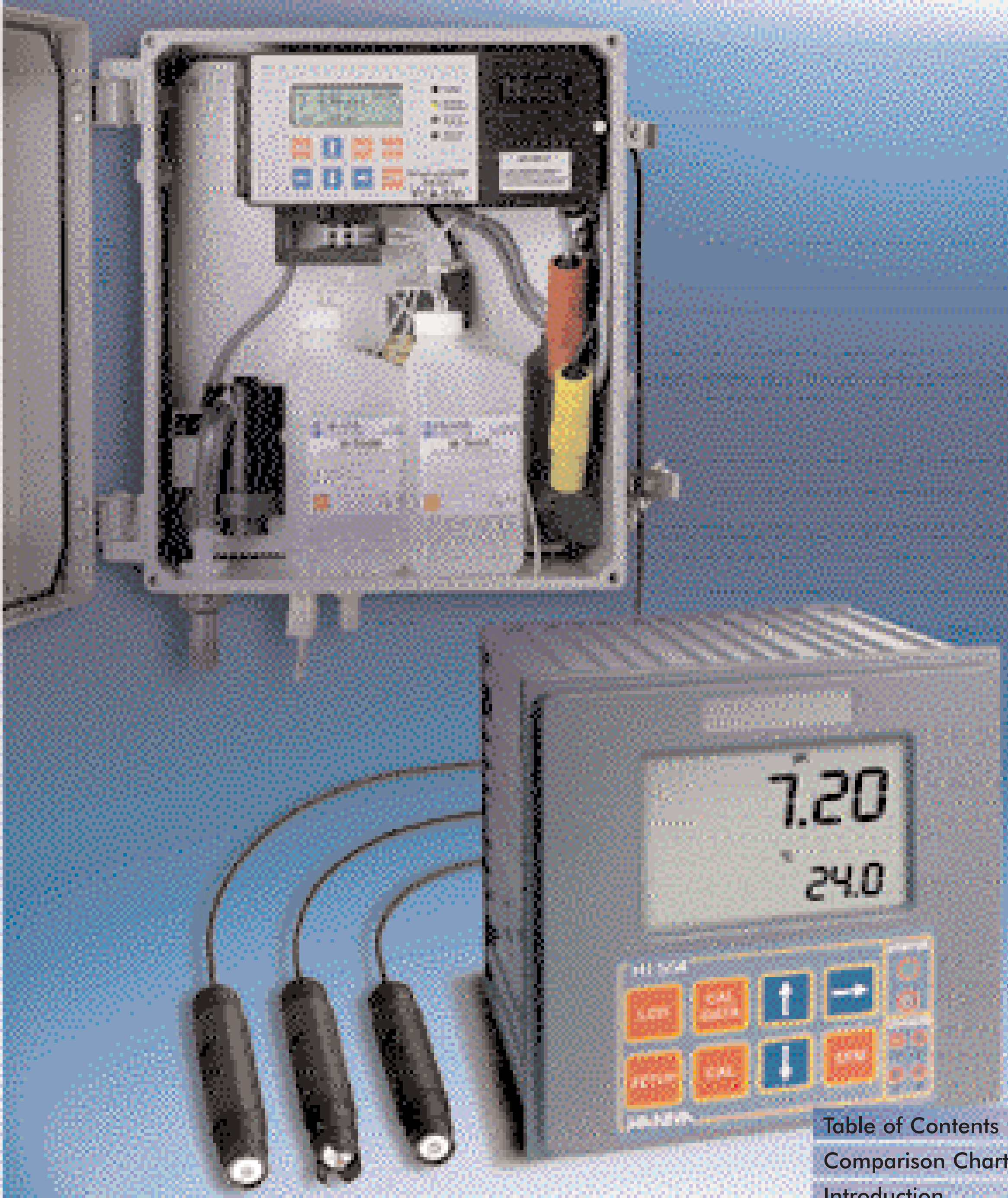
Process Instrumentation



Panel Mounted Instruments

Comparison Chart

	HI 700	HI 710	HI 8001	HI 8011	HI 8021	HI 8041	HI 8510	HI 8512	HI 8710	HI 8711	HI 8720	HI 8931	HI 943500	mV 600	mV 602	pH 500	pH 502	HI 504
pH Indicator							•											
pH Controller			•		•	•			•	•						•	•	•
EC Controller	•	•	•		•	•						•	•					
TDS Controller		•																
ORP Indicator								•										
ORP Controller											•			•	•			•
Fertigation Controller			•	•	•	•												
Menu-driven Display	•	•	•	•	•	•								•	•	•	•	•
Sensor Check																		•
Proportional Control	•	•	•	•	•	•								•	•	•	•	•
ON/OFF Control	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•
PID Control	•	•	•	•	•	•									•		•	•
Analog Output	•	•					•	•	•	•	•	•	•	•	•	•	•	•
Alarm	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•
RS232 Communication Port			•	•	•	•								•		•		
RS485 Communication Port	•	•													•		•	•
GSM / PSTN Control	•	•	•	•	•	•									•		•	•
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Wall Mounted Instruments

Comparison Chart

	HI 21	HI 22	HI 23	HI 24	HI 8002	HI 8012	HI 8022	HI 9910	HI 9911	HI 9912	HI 9913	HI 9914	HI 9920	HI 9923	HI 9931	HI 9934	HI 9935	PCA 310	PCA 320	PCA 330
Free Chlorine Controller																		•	•	•
Total Chlorine Controller																		•	•	•
pH Controller	•							•	•										•	•
ORP Indicator																				•
ORP Controller		•											•							
pH & ORP Controller										•										
EC Controller			•	•											•					
TDS Controller				•												•				
pH & EC Controller					•		•				•	•		•						
pH & TDS Controller																	•			
Fertigation Controller					•	•	•					•		•	•					
Menu-driven Display	•	•	•	•	•	•	•											•	•	•
Proportional Control	•	•	•	•		•		•	•	•	•	•	•		•	•	•	•	•	•
ON/OFF Control	•	•	•	•										•				•	•	•
PID Control			•	•			•													
Automatic Sampling																		•	•	•
Analog Output	•	•	•	•				•	•				•		•	•		•	•	•
Alarm	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
RS232 Communication Port					•	•	•													
RS485 Communication Port	•	•	•	•														•	•	•
GSM / PSTN Control	•	•	•	•	•	•	•											•	•	•
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Dosing Pumps

Comparison Chart

	BL 1.5	BL 3	BL 5	BL 7	BL 10	BL 15	BL 20	BL 7916	BL 7917
pH Controller								•	
ORP Controller									•
Proportional Control								•	•
Analog Output								•	•
Alarm								•	•
Max Output (LPH) / Rated Pressure (bar)	1.5 / 13	2.9 / 8	5.0 / 7	7.6 / 3	10.8 / 3	15.2 / 1	18.3 / 0.5	13.3 / 0.5	13.3 / 0.5
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Transmitters

Comparison Chart

		HI 504900	HI 504901	HI 504902	HI 504903	HI 504910	HI 8614	HI 8615	HI 8936	HI 98143
Sensor Check						•				
Data Logging						•				
BNC Connector							•	•		•
Connection for wire probe						•			•	•
Pt100 / Pt1000 Input						•				
pH Transmitter						•	•			•
ORP Transmitter						•		•		
EC Transmitter									•	•
Menu-driven Display						•				
Automatic Sampling						•				
Output	4-20 mA						•	•	•	•
	Digital		•		•					
Alarm			•		•	•				
RS485 Communication Port		•	•	•	•	•				
GSM Transmission		•	•		•					
PSTN Transmission				•						
GSM / PSTN Control						•				
12-24 Vdc Power Supply		12 Vdc	12 Vdc	12 Vdc	12 Vdc	24 Vdc	24 Vdc	24 Vdc	24 Vdc	12-24 Vdc
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Process Instrumentation

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. These devices may include switches, power relays for driving dosing pumps, solenoid valves, mixer drives, etc.

Quite often users need to design a simple and remote solution close to the measurement point. To solve this problem, HANNA instruments® has designed a series of wall mounted instruments which do not require enclosures and housing for a multitude of connections and wiring. Almost the entire range of HANNA instruments® panel mount instrumentation is available in stand alone wall mountable versions for quick and easy "plug and play" installation.

HANNA instruments®' wide range of wall mount instrumentation also includes combination controllers for pH/ORP, or pH/conductivity applications.

HANNA instruments®' wall mounted controllers can be found in a variety of industries and applications, such as municipal, boiler and cooling towers, agriculture, greenhouses, electro-plating, etc.

Remote Monitoring and Control

It has become a common practice to assign specially trained operators to the tasks of plant maintenance. The plant managers and producers tend to concentrate all attention to controlling the actual process, leaving maintenance and support of the automated systems to the specialists.

When an installation does not perform properly, process instruments will usually alert the specialist with a visual or audible signal. If a specialist or operator is not available on the premises to correct the problem, the process may run or shut down improperly, possibly causing costly damage to product and/or equipment. Quite often the specialist can be contacted and informed that an alarm has been triggered. However, the operator could be hundreds of miles from the premises at the time and, quite often, production has to be interrupted while waiting for instruction or hands on intervention.

HANNA instruments® has provided a solution by designing process systems that can send alarm messages automatically to a cellular phone. As soon as the message is received, the specialist not only knows the source of the alarm, but can also connect and interact with the instrument via remote PC connection to determine the cause of the malfunction. This allows the specialist or operator the possibility to correct the malfunction or if necessary shut down the process correctly. Over 100 diagnostic messages can be sent directly to the user.

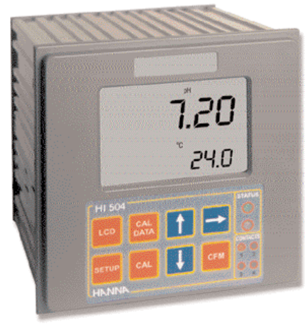
The HI 504900-1 module is programmed to be used in the United States; the HI 504900-2 is programmed to be used in Europe.

Calibration of a Process pH Meter

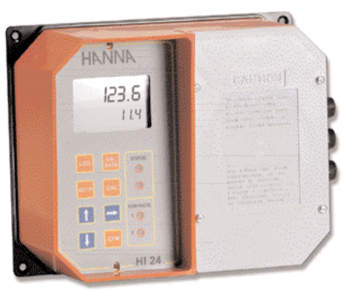
In industrial applications, the calibration of a pH meter often poses difficulties due to the distance between the electrode and the instrument. In addition, accessing the electrode for calibration may prove to be a challenge if it is installed in a pressurized line or large tank in a continuous process.

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 instruments® has devised 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.

HI 504

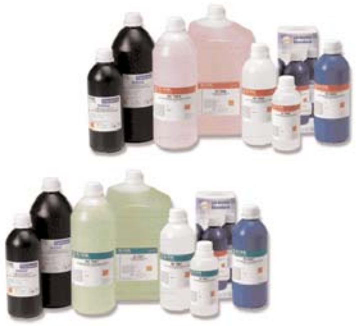


HI 24

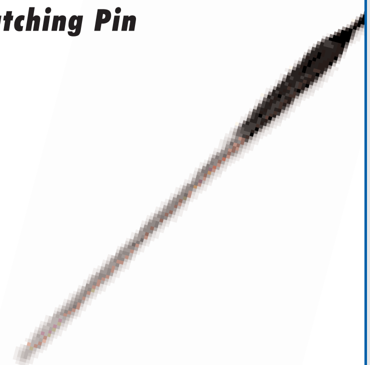


HANNA instruments

pH 4.01 and pH 7.01 Buffer Solutions



Matching Pin



HANNA instruments® *HI 504920 Model*

Using the HI 504920 portable pH meter with electrode, a maintenance technician or operator can simply take a sample measurement at or near the location of the sensor and automatically load it into memory. This is done without the need to remove the process electrode (sensor) from the line or tank.
Once the reading is taken and stored into memory, it is sent to a transmitter via an infrared connection. The transmitter automatically adjusts the pH value of the process instrument, possibly located hundreds of meters away.
The LCD of the portable pH meter will display an indication when the remote instrument has been calibrated and the process is complete.

pH Dependent ORP Control

ORP (Oxidation Reduction Potential) is predominately pH dependent. A change of one pH unit can shift the ORP of a solution by as much as 60 mV. ORP measurement and control is utilized in industrial processes for water treatment, cyanide oxidation and chromate reduction. Many instruments for controlling pH and ORP do not interact and normally operate independently. In this case it is possible that overdosing of an oxidant or reducing agent may occur if, for example, the pH is not controlled properly prior to obtaining the desired ORP.
An example of a worst case scenario would be at process start up with a pH level at 7.0 instead of the required 10.5 or 3. If at this point the ORP instrument activates a dosing pump before the pH controller has corrected the pH level, a disastrous reaction and contamination of the process will occur.
HANNA instruments® has devised a control system which prevents the ORP controller from dosing (i.e. sodium bisulfide and sodium hypochloride) whenever the pH value is not in the correct operating range, preventing a potentially dangerous and costly reaction.

The Solution to Ground Loop Effect; the Matching Pin

In process applications utilizing controllers and electrodes installed in-line or in tank, the potential matching pin is considered the "earth ground" connection 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 inert to chemical attack, usually stainless steel or titanium.
The matching pin is necessary when a process stream containing an electrode, whether in a pipe or tank, has a potential difference (voltage) with respect to "earth ground" which creates flow of electrical current. The matching pin essentially redirects the current from the reference cell of the process electrode (i.e. pH or ORP sensor). This prevents erratic readings and permanent damage to the reference cell of the electrode which significantly reduces its life span.
Potentials and transient current flow can also be caused by "leakage" of improperly insulated electrical equipment (pumps and stirrers), in addition to electrostatic charges introduced by the motion of mixer blades, or the existence of electric fields (electrolysis) present in plating baths.

The Effects of Ground Loop Current on Process pH and ORP Electrodes

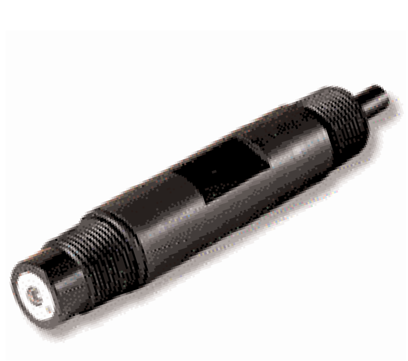
An electrochemical (combination) cell, such as a pH or ORP electrode, is comprised of 2 half cells; the measuring cell and the reference. Both are essential for the cell to function and each has a specific purpose.
The entire cell is considered galvanic in that no external power is supplied to the electrode and the voltage generated by each half cell is near to or at zero current. The generated potential of the measuring cell is proportional to the thermodynamic activity of the ion being measured in 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.

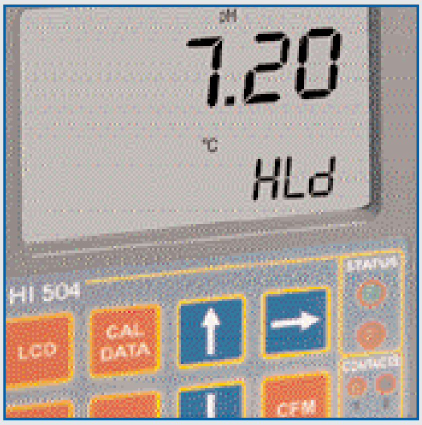
It is absolutely crucial that the potential produced by the reference half cell is consistent and stable (approx. 210 mV) regardless of the properties of the test solution and the working conditions. The only changing potential, as a result of the solution under test, is produced by the glass bulb of 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 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 electrode and meter, the process system is not isolated from potential difference and the resulting current flow.
It is possible, given that unwanted potentials exists 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. All 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 is 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 instruments® has responded to this problem by designing a complete series of process electrodes, each equipped with an integrated potential matching pin.

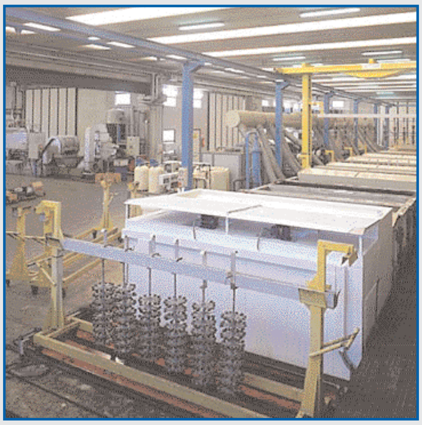
Sensor Check

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. 58.17 mV = 232.68 mV (value not compensated for temperature variations).

Flat Tip Electrode







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 posses 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 undetectable electrode failure.
In any given application, costly damage can be avoided by automatically and continually monitoring the condition of the process sensors. HANNA instruments® 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 leach out into solution. This creates an ionic connection between the internal silver reference and test solution, completing the circuit. As with any electrochemical connection, contamination is always a concern and possibility. 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 instruments® Sensor Check system monitors the reference junction every 5 seconds to ensure that the proper resistance is maintained. The user 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 HANNA instruments® HI 504 series of process pH/ORP controllers.

HI 504910