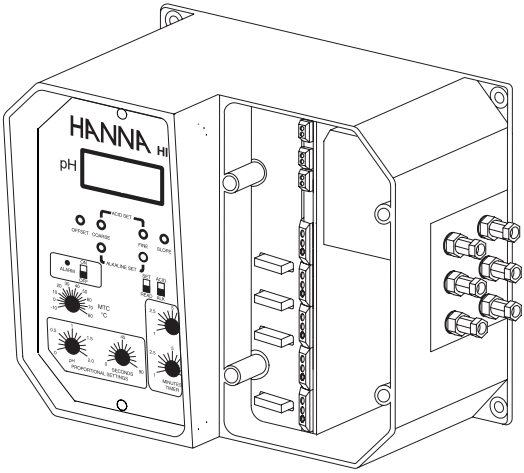
Instruction Manual

HI9910 • HI9911
HI9920

Wall Mounted
pH & ORP
Controllers



HANNA® instruments
www.hannainst.com

Dear Customer,

Thank you for choosing a Hanna Instruments® product.

Please read this instruction manual carefully before using the instrument. This manual will provide you with the necessary information for correct operations. If you need more technical information, do not hesitate to e-mail us at **tech@hannainst.com**.

These instruments are in compliance with the CE directives.

WARRANTY

All Hanna Instruments Office **controllers are warranted for two years** against defects in workmanship and materials when used for their intended purpose and maintained according to instructions. **Electrodes and probes are warranted for six months**.

Damages due to accidents, misuse, tampering or lack of prescribed maintenance are not covered. This warranty is limited to free of charge repair or replacement of the meter only, if any malfunctioning is due to manufacturing defects.

If service is required, contact your local Hanna Instruments Office. If under warranty, report the model number, date of purchase, serial number and the nature of the problem. If the repair is not covered by the warranty, you will be notified of the charges incurred. If the instrument is to be returned to Hanna Instruments, first obtain a Returned Goods Authorization Number from the Customer Service department and then send it with shipment costs prepaid. When shipping any instrument, make sure it is properly packaged for complete protection.

TABLE OF CONTENTS

PRELIMINARY EXAMINATION

Remove the instrument from the packing material and examine it carefully to make sure that no damage has occurred during shipping. If there is any noticeable damage, please contact your local Hanna Instruments Office.

Note: Save all packing materials until you are sure that the instrument functions correctly. Any defective item must be returned in the original packaging together with the supplied accessories.

Warning:

- Never install the controller outdoors, in a wet or humid area or under direct sun light. Nor install the controller where liquids may be sprayed or poured on it.
- The main power line of the instruments is protected by a 400 mA fuse, while the dosage and alarm terminals are protected by separate 2 A fuses. Use only the specified fuses for replacement.

GENERAL DESCRIPTION

HI9910, HI9911 and **HI9920** are wall-mounted pH and ORP regulators designed to meet a variety of process control requirements.

The electrode can be installed by simply plugging it to the universal BNC socket on the bottom of the meter.

These instruments also incorporate a triple contact alarm system for triggering an external control, as a buzzer, light or any other electrical device.

To avoid any interference, the recorder output terminals are isolated from the controller circuitry, and 0-20 or 4-20 mA output can be select by the user.

The housing is built for last with a rugged, modular, fiber-reinforced ABS material.

Choose the controller which better meets your needs among **HI9910** (single setpoint pH regulator), **HI9911** (dual setpoint pH regulator) or **HI9920** (single setpoint ORP regulator).

Each model is available in three versions, according to different power supply requirement: 115 Vac, 230 Vac or 100 Vac.

MECHANICAL LAYOUTS

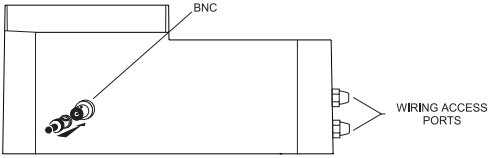


Fig.1

Figure 1: BNC plug for electrode and wiring access ports.

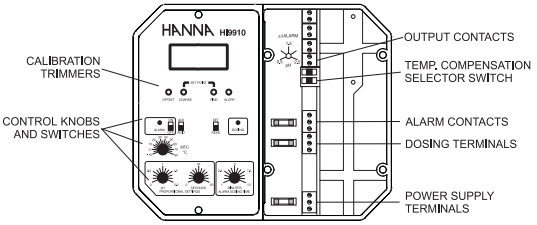


Fig.2

Figure 2: Controls and terminals of the **HI9910** pH controller. Layouts vary according to model.

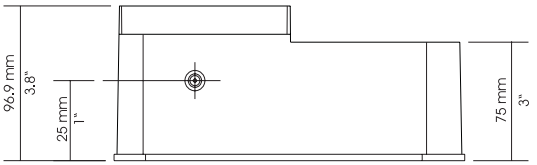


Fig.3

Figure 3: Dimensioned bottom view.

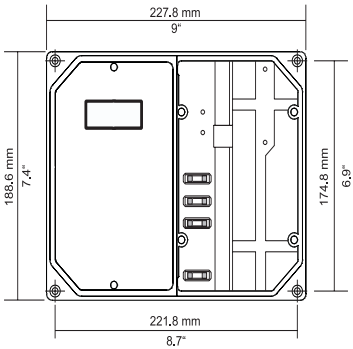
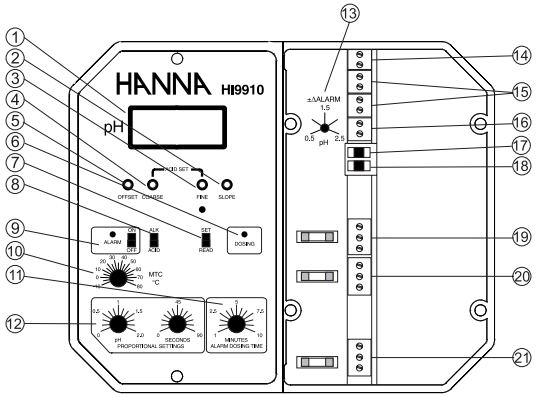


Fig.4

Figure 4: Dimensioned front view. The molded, mounting holes in the four corners provide for quick and secure installation. No additional hardware is needed for mounting. All electrical connections and controls are located on the front of the instrument, so that any adjustment can be made without needing to remove the unit.

HI9910 FUNCTIONAL DESCRIPTION



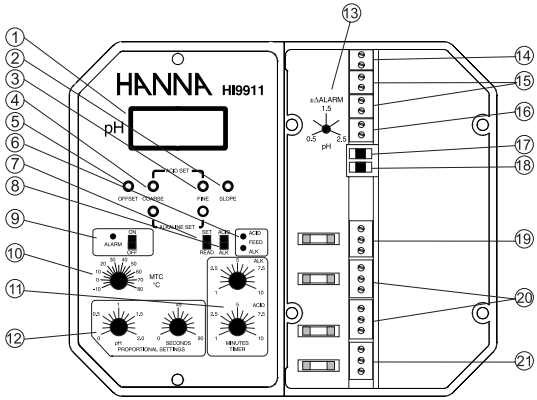
1. Liquid Crystal Display
2. Slope calibration trimmer
3. Setpoint trimmer for Fine adjustment
4. Setpoint trimmer for Coarse adjustment
5. Offset calibration trimmer
6. Dosing LED
7. READ/SET switch for selecting normal measurement or setpoint adjustment mode
8. Acid/Alkaline Dosage selection switch
9. Alarm LED and switch to disable the alarm
10. Manual Temperature Compensation knob
11. Overdosage timer knob
12. Proportional pH band and time cycle settings knobs
13. pH ΔAlarm setting trimmer (from 0.5 to 2.5 pH)
14. Short these terminals if no ground probe is used, or wire the ground probe to the Matching Pin terminal
15. Pt100 probe terminals
16. Recorder output contacts
17. Automatic or Manual Temperature Compensation selection switch
18. 0-20 mA or 4-20 mA isolated output selection switch
19. Triple contact alarm in a Normally Closed (NC) or a Normally Open (NO) position (2 A fuse protected)
20. Powered dosage terminals (Relay, 2 A fuse protected)
21. Power supply terminals (400 mA fuse protected)

HI9910 SPECIFICATIONS

RANGE	0.00 to 14.00 pH
RESOLUTION	0.01 pH
ACCURACY (@25 °C/77 °F)	±0.02 pH
TYPICAL EMC DEV.	±0.1 pH
mA OUTPUT	User-selectable, 0-20 mA or 4-20 mA over the 0-14 pH range with isolated output
CALIBRATION	Through "OFFSET" and "SLOPE" trimmers (Max. ±1.5 pH for offset and 80 to 110% for slope)
TEMPERATURE COMPENSATION	Manual from -10 to 80 °C (14 to 176 °F) or Automatic with a 3-wire Pt100 probe from 0 to 50 °C (32 to 122 °F)
SETPOINT RANGE	From 0.00 to 14.00 pH with 2 trimmers: "COARSE" for approx. regulation, "FINE" for fine tuning
PROPORTIONAL CONTROL	pH is user adjustable from 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/250Vac/30Vdc, resistive load, 1.000.000 strokes). The alarm is activated if pH varies by more than user-selectable interval (0.5 to 2.5 pH) from setpoint or due to overdosage
DOSING TERMINALS	Relay terminals (Max. 2A/250Vac/30Vdc, resistive load, 1.000.000 strokes) are activated whenever pH exceeds the "ACID" setpoint (Acid dosage) or falls below the "ALK" setpoint (Alkaline dosage)
ENVIRONMENT	-10 to 50 °C (14 to 122 °F); RH 95% non-condensing
CASE MATERIAL	Fiber-reinforced, flame-retardant ABS
POWER SUPPLY	**HI9910-1** : 115 Vac, 60 Hz **HI9910-2** : 230 Vac, 50 Hz **HI9910-3** : 100 Vac, 50/60 Hz
ENCLOSURE	181 x 221 x 142 mm (7.1 x 8.7 x 5.6")
WEIGHT	1.6 kg (3.5 lb.)

Unplug the instrument from the power supply before wiring or replacing the fuses.

HI9911 FUNCTIONAL DESCRIPTION



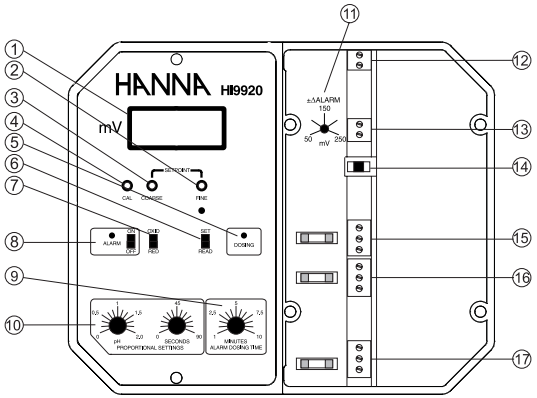
1. Liquid Crystal Display
2. Slope calibration trimmer
3. Setpoint trimmers for acid and alkaline feed, Fine tuning
4. Setpoint trimmers for acid and alkaline feed, Coarse adjustment
5. Offset calibration trimmer
6. Dosing LED's for acid and alkaline feed
7. READ/SET switch for selecting normal measurement or setpoint adjustment mode
8. Acid/Alkaline setpoint selection switch
9. Alarm LED and switch to disable the alarm
10. Manual Temperature Compensation knob
11. Two independent overdosage timers knobs
12. Proportional pH band and time cycle settings knobs
13. pH ΔAlarm setting trimmer (from 0.5 to 2.5 pH)
14. Short these terminals if no ground probe is used, or wire the ground probe to the Matching Pin terminal
15. Pt100 probe terminals
16. Recorder output contacts
17. Automatic or Manual Temperature Compensation selection switch
18. 0-20 mA or 4-20 mA isolated output selection switch
19. Triple contact alarm in a Normally Closed (NC) or a Normally Open (NO) position (2 A fuse protected)
20. Powered dosage terminals (Relay, 2 A fuse protected)
21. Power supply terminals (400 mA fuse protected)

HI9911 SPECIFICATIONS

RANGE	0.00 to 14.00 pH
RESOLUTION	0.01 pH
ACCURACY (@25 °C/77 °F)	±0.02 pH
TYPICAL EMC DEV.	±0.1 pH
mA OUTPUT	User-selectable, 0-20 mA or 4-20 mA over the 0-14 pH range with isolated output
CALIBRATION	Through "OFFSET" and "SLOPE" trimmers (Max. ±1.5 pH for offset and 80 to 110% for slope)
TEMPERATURE COMPENSATION	Manual from -10 to 80 °C (14 to 176 °F) or Automatic with a 3-wire Pt100 probe from 0 to 50 °C (32 to 122 °F)
SETPOINT RANGE	From 0.00 to 14.00 pH with 2 trimmers: "COARSE" for approx. regulation, "FINE" for fine tuning
PROPORTIONAL CONTROL	pH is user adjustable from 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/250Vac/30Vdc, resistive load, 1.000.000 strokes). The alarm is activated if pH varies by more than user-selectable interval (0.5 to 2.5 pH) from setpoint or due to overdosage
DOSING TERMINALS	Two sets of independent relay terminals (Max. 2A/250Vac/30Vdc, resistive load, 1.000.000 strokes) are activated whenever pH exceeds the "ACID" setpoint (Acid dosage) or falls below the "ALK" setpoint (Alkaline dosage)
ENVIRONMENT	-10 to 50 °C (14 to 122 °F); RH 95% non-condensing
CASE MATERIAL	Fiber-reinforced, flame-retardant ABS
POWER SUPPLY	**HI9911-1** : 115 Vac, 60 Hz **HI9911-2** : 230 Vac, 50 Hz **HI9911-3** : 100 Vac, 50/60 Hz
ENCLOSURE	181 x 221 x 142 mm (7.1 x 8.7 x 5.6")
WEIGHT	1.6 kg (3.5 lb.)

Unplug the instrument from the power supply before wiring or replacing the fuses.

HI9920 FUNCTIONAL DESCRIPTION



1. Liquid Crystal Display
2. Setpoint trimmer for Fine adjustment
3. Setpoint trimmer for Coarse adjustment
4. Calibration trimmer
5. Dosing LED
6. READ/SET switch for selecting normal measurement or setpoint adjustment mode
7. Oxidization/Reduction Dosage selection switch
8. Alarm LED and switch to disable the alarm
9. Overdosage timer knob
10. Proportional ORP band and time cycle settings knobs
11. ORP ΔAlarm setting trimmer (from 50 to 250 mV)
12. Short these terminals if no ground probe is used, or wire the ground probe to the Matching Pin terminal
13. Recorder output contacts
14. 0-20 mA or 4-20 mA isolated output selection switch
15. Triple contact alarm in a Normally Closed (NC) or a Normally Open (NO) position (2 A fuse protected)
16. Powered dosage terminals (Relay, 2 A fuse protected)
17. Power supply terminals (400 mA fuse protected)

HI9920 SPECIFICATIONS

RANGE	-500 to 1500 mV
RESOLUTION	1 mV
ACCURACY (@25 °C/77 °F)	±5 mV
TYPICAL EMC DEV.	±6 mV
mA OUTPUT	User-selectable, 0-20 mA or 4-20 mA over the -500 to 1500 mV range with isolated output
CALIBRATION	Through "CAL" trimmer
SETPOINT RANGE	From -500 to 1500 mV with 2 trimmers: "COARSE" for approx. regulation, "FINE" for fine tuning
PROPORTIONAL CONTROL	ORP setting is user adjustable from 0 to 200 mV and time cycle from 0 to 90 seconds
ALARM CONTACT	Terminals can be configured as Normally Open or Normally Closed (isolated output Max. 2A/250Vac/30Vdc, resistive load, 1.000.000 strokes). The alarm is activated if the ORP value varies by more than user-selectable interval (50 to 250 mV) from setpoint, or due to overdosage
DOSING TERMINALS	Relay terminals (Max. 2A/250Vac/30Vdc, resistive load, 1.000.000 strokes) are activated when mV exceeds the setpoint ("RED" dosage) or falls below the setpoint ("OXID" selection)
ENVIRONMENT	-10 to 50 °C (14 to 122 °F); RH 95% non-condensing
CASE MATERIAL	Fiber-reinforced, flame-retardant ABS
POWER SUPPLY	**HI9920-1** : 115 Vac, 60 Hz **HI9920-2** : 230 Vac, 50 Hz **HI9920-3** : 100 Vac, 50/60 Hz
ENCLOSURE	181 x 221 x 142 mm (7.1 x 8.7 x 5.6")
WEIGHT	1.6 kg (3.5 lb.)

Unplug the instrument from the power supply before wiring or replacing the fuses.

CONNECTIONS & WIRING

- Unscrew the 4 screws on the right hand panel and remove the cover and the gasket. Thread the wires through the access ports on the right hand side of the controller.
- Wire the controller completely, connect all the external devices (pumps, alarm, electrode, etc.), set the alarm threshold and adjust the settings.
- Replace the cover, then connect the controller to the mains.

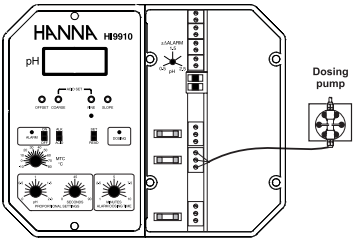
ELECTRODE CONNECTION

- Simply plug any combination pH or ORP electrode (such as **HI1002/3** or **HI2002/3**) to the BNC socket on the bottom of the casing and twist it into a secure position.
- All models are provided with the differential input feature to reduce electrical noise and interference, and come with the Matching Pin and Reference terminals shorted.

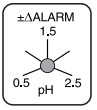
  If using no matching pin (ground probe), leave the terminals shorted.
- If using a probe for grounding purposes, wire it to the Matching Pin terminal on the right hand panel and remove the jumper.

RELAY CONNECTIONS

- Wire the external device(s), as pump or electrovalve, directly to the relay terminal strip (one for **HI9910** and **HI9920**, and two for **HI9911)** of the controller. The terminals are powered and no external power supply for pump or electrovalve is needed.



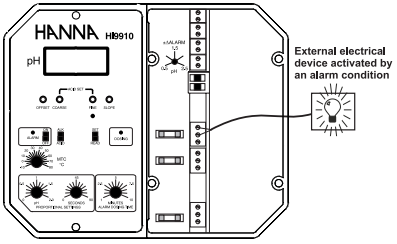
ALARM CONNECTIONS

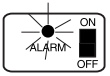


- The alarm threshold is user-selectable from 0.5 to 2.5 pH for **HI9910** and **HI9911**, or from 50 to 250 mV for **HI9920**, by turning the alarm trimmer with a small screwdriver.

  If the actual measurement is above or below the setpoint by a value greater than the selected threshold, the alarm terminal is activated. The alarm can be configured as Normally Closed ("NC") by connecting the external device to the COM and NC terminals or Normally Open ("NO") by connecting the external device to the COM and NO terminals.
- When the alarm is activated, the alarm LED turns on and the alarm contacts will open or close, triggering the external connected device.

  When the alarm is activated all the other terminals (such as dosing relays) are disactivated.





- The alarm ON/OFF switch can only disable the alarm terminal (e.g. the buzzer stops sound), while all the other functions, such as disactivation of the dosing relays, are not affected.
- The controllers provide for automatic fail-safe security by activating the alarm if there is a power failure, regardless of whether the NC or NO configurations were chosen.
- The alarm is also activated if the maximum dosage time is exceeded. The overdosage timer can be set from 1 to 10 minutes.

  For **HI9911**, two timers can be independently selected for acid and alkaline corrections.

- Once an alarm condition occurs, the alarm contact remains activated until the switch is manually put in the off position or the measurement returns to normal values.

- The alarm is activated for readings varying as follow:

HI9910: 0.5 to 2.5 pH (user-selectable) above or below the setpoint;

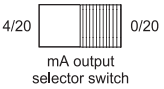
HI9911: 0.5 to 2.5 pH (user-selectable) lower than the ALKALINE setpoint or higher than the ACID setpoint;

HI9920: 50 to 250 mV (user-selectable) above or below the setpoint.

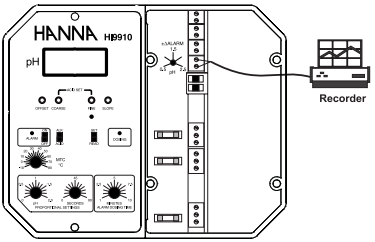
RECORDER OUTPUT CONNECTIONS

- The recorder output contacts are isolated from the controller circuitry to avoid interference.

  Before wiring, select the desired output (0-20 or 4-20 mA) with the selector switch.

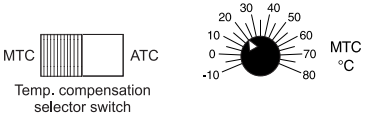


  The mA output value corresponds to the pH or ORP value over the whole measurement range. For example, when measuring pH 7, the output value is 10 or 12 mA depending from the selected output interval (0-20 or 4-20 mA respectively).

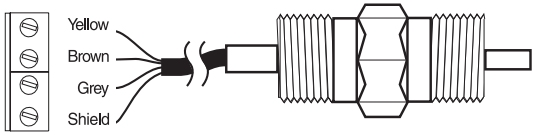


TEMPERATURE COMPENSATION (HI9910 & HI9911 only)

- **Manual Temperature Compensation:** move the selector switch to the MTC position, then manually set the temperature by turning the MTC knob to the correct working temperature.



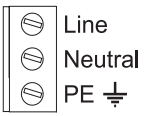
- **Automatic Temperature Compensation:** move the selector switch to the ATC position, then wire a Pt100 probe, such as **HI7610** to the proper terminals as indicated.



HI7610 is a probe with stainless steel body and 5 m cable.
For solutions not compatible with stainless steel, use the **HI7620** glass-body probe, or another appropriate 3-wire Pt100 probe.

MAIN POWER SUPPLY CONNECTION

- For each model (**HI9910**, **HI9911**, **HI9920**) three versions are available, according to different power supply requirement:
  version -1 works at 115 Vac; 60 Hz
  version -2 works at 230 Vac; 50 Hz
  version -3 works at 100 Vac; 50/60 Hz
- Before connecting the unit to the mains, make sure that the controller is completely wired and that all the external devices (as pump, alarm, electrode, etc.) have been connected.
- Wire the external power supply to the three terminals as indicated; reattach the cover making sure the gasket is in place, and tight the 4 screws.



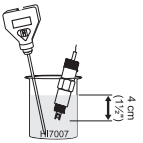
- Only then connect the controller to the mains.

pH CALIBRATION (HI9910 and HI9911)

Properly connect the pH electrode and wire the separate ground probe (if used) to the controller, then plug the meter to the mains.

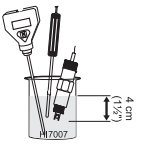
It is recommended to perform calibration at a temperature similar to that of the sample to be monitored.

Use a Checktemp (or another accurate thermometer) as reference for temperature.



Remove the electrode protective cap.

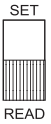
During calibration, move the electrode and the separate ground probe (if in use) together from one buffer to the next.



If no separate ground probe is used, make sure that the Reference and the Matching Pin terminals are shorted.

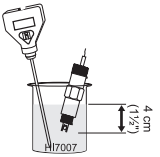
If the pH electrode incorporates a ground probe/matching pin (as for example HI1003/3), remove the jumper.

Set the SET/READ switch to "READ" position.

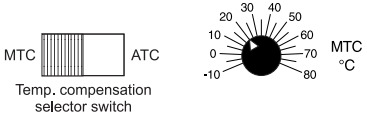


OFFSET ADJUSTMENT:

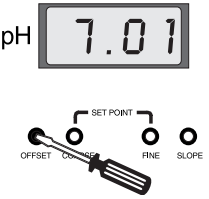
- Rinse the electrode (and ground probe) with pH7.01 solution (**HI7007**), then immerse the tip(s) in pH7.01 buffer. An immersion level of about 4 cm (1.5") is recommended.



- Place the Checktemp thermometer in the buffer solution. Adjust the knob to show the same temperature as that measured by the Checktemp and make sure the selector switch is in the MTC position.



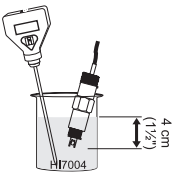
- Wait for the reading to stabilize and then adjust the "OFFSET" trimmer to display the buffer pH value at the measured temperature, e.g. pH7.01 if the temperature is 25 °C (77 °F).



- Refer to the table at page 25 for the appropriate buffer value at a given temperature, and adjust the trimmer accordingly.

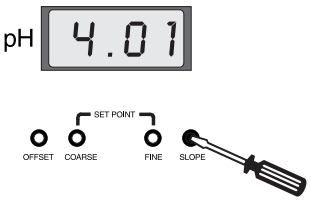
SLOPE ADJUSTMENT:

- Rinse the electrode (and ground probe) thoroughly with water and immerse the tip(s) in pH4.01 (**HI7004**) or pH10.01 (**HI7010**) buffer solution. An immersion level of about 4 cm (1.5") is recommended.



Note: Use pH4.01 if monitoring acidic solutions; use pH10.01 for alkaline samples.

- Stir the electrode and wait for the display to stabilize before adjusting the "SLOPE" trimmer to display the buffer pH value at the measured temperature, e.g. pH4.01 (or pH10.01) if the temperature is 25 °C (77 °F).



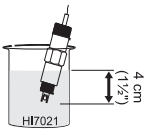
- Refer to the table at page 25 for the appropriate buffer value at a given temperature, and adjust the trimmer accordingly.

The pH calibration is now complete.

ORP CALIBRATION (HI9920)

Properly connect the ORP electrode and wire the separate ground probe (if used) to the controller, then plug the meter to the mains.

Remove the electrode protective cap.
Immerse the electrode and the ground probe (if in use) in the reference solution. An immersion level of about 4 cm (1.5") is recommended.

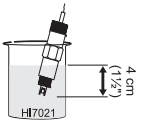


If no separate ground probe is used, make sure that the Reference and the Matching Pin terminals are shorted.

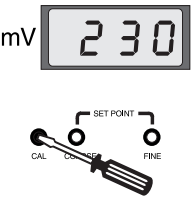
If the ORP electrode incorporates a ground probe/matching pin (as for example HI2003/3), remove the jumper.

Set the SET/READ switch to "READ" position.

Immerse the electrode in a solution of known ORP (mV) value and wait for a few minutes for the reading to stabilize.



Adjust the CAL trimmer to display the known value, for example 230 mV.

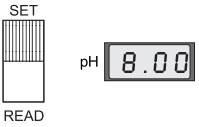


SETPOINT ADJUSTMENT

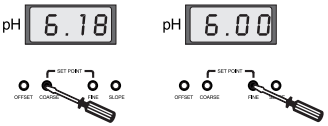
The electrode and the ground probe (if in use) have to be properly installed and calibration performed.

FOR HI9910

Set the SET/READ switch to "SET" position; the display shows the previously set value (e.g. pH8.00).

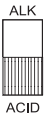


Using a small screwdriver, first adjust the value through the COARSE trimmer and then tune it through the FINE trimmer until the desired setpoint value is displayed (e.g. pH6.00).



DOSING SELECTION

Select the desired dosing, acid or alkaline, through the ALK/ACID switch.



To dose acidic substances/solutions and lower the pH value, set the selector switch to "ACID"; to dose bases or alkaline solutions and increase the pH value, select "ALK".

Dosing acidic solution, example

Setpoint = pH6.00

Measured value = pH7.00

To reach the setpoint value it is necessary to dose acid: move the switch to "ACID" position.

Dosing alkaline solution, example

Setpoint = pH6.00

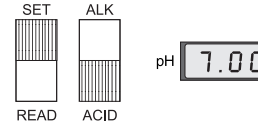
Measured value = pH4.00

To reach the setpoint value it is necessary to dose base: move the switch to "ALK" position.

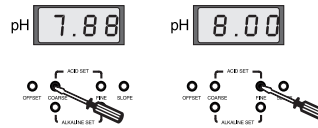
FOR HI9911 (DUAL-POINT ADJUSTMENT)

a) ACID SETPOINT and DOSAGE

To set the upper limit and direct the controller to lower the pH value, set the SET/READ switch to "SET" and the ALK/ACID switch to "ACID"; the display shows the higher setpoint (e.g. pH7.00).

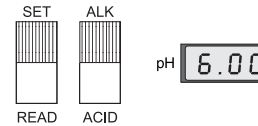


Using a small screwdriver, adjust the two "ACID SET" trimmers. First adjust the "COARSE" trimmer and then tune through the "FINE" trimmer until the desired setpoint value is displayed (e.g. pH8.00).

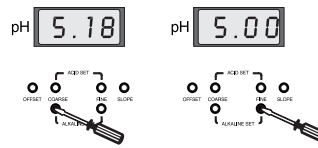


b) ALKALINE SETPOINT and DOSAGE

To set the lower limit and direct the controller to increase the pH value, set the SET/READ switch to "SET" and the ALK/ACID switch to "ALK"; the display shows the lower setpoint (e.g. pH6.00).



Using a small screwdriver, adjust the two "ALKALINE SET" trimmers. First adjust the "COARSE" trimmer and then tune through the "FINE" trimmer until the desired setpoint value is displayed (e.g. pH5.00).



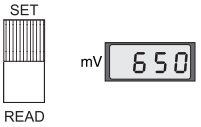
Notes:

- The "FINE" trimmer can adjust up to ±1.5 pH.
- If the **HI9911** is used for a single-point dosage, it is recommended to operate as follows:
  if dosing acid solution, adjust the "ALKALINE SET" trimmers to 0.00 pH and set the "ACID SET" trimmers to the desired value;
  if dosing alkaline solution, adjust the "ACID SET" trimmers to 14.00 pH and set the "ALKALINE SET" trimmers to the desired value.

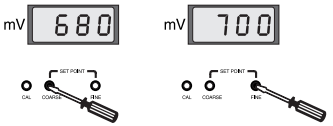
FOR HI9920

Set the SET/READ switch to "SET" position; the display shows the previously set value (e.g. mV650).

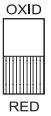
Using a small screwdriver, first adjust the value through the COARSE



trimmer and then tune it through the FINE trimmer until the desired setpoint value is displayed (e.g. mV700).



DOSING SELECTION



Select the desired dosing, reductant or oxidant, through the OXID/RED switch.

For reducing dosage and lowering the mV value, set the selector switch to "RED"; for oxidizing dosage and increasing the mV value, select "OXID".

Dosing reducing substances, example

Setpoint = mV650

Measured value = mV700

Move the switch to "RED" position.

Dosing oxidizing substances, example

Setpoint = mV650

Measured value = mV500

Move the switch to "OXID" position.

TAKING MEASUREMENTS

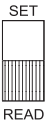
Before taking any measurements, make sure that the controller has been calibrated, and that alarm threshold and setpoint values have been set.

Connect the electrode and wire the ground probe (if used) to the controller.

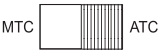
Remove the electrode protective cap.

Ensure that the electrode is properly installed and permanently immersed in the solution of at least 4 cm (1.5").

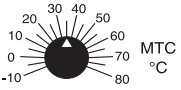
Check that the SET/READ selector switch is set to "READ" position.



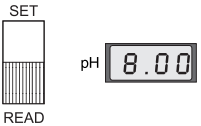
If using a temperature probe for compensate readings (**HI9910** and **HI9911**), make sure that this probe is also immersed in the solution and that the MTC/ATC selector switch is set to "ATC".



For manual temperature compensation, the selector switch has to be on "MTC" position and the knob adjusted to the temperature of the solution.

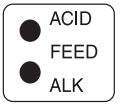


The actual pH (or ORP) value of the solution is displayed on the LCD.

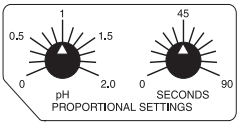


All controllers visualize the dosing status through a LED. In **HI9910** and **HI9920** models the DOSING LED lights up when the controller is in pH or ORP dosage mode and the terminals are activated.

In **HI9911** two LED's visualize the dosing status: one refers to ACID and one to ALK (alkaline) dosage, and light up according to the activated terminals.



PROPORTIONAL CONTROL



In order to optimize the controlling process and reduce the amount of chemicals used, it is recommended to set an appropriate proportional dosage.

All models allow to set a proportional band ("Delta" = 0 to 2.0 pH or 0 to 200 mV) as well as a time cycle (from 0 to 90 seconds). The proportional dosage is obtained by personalizing the duty cycle and frequency of the dosing relay activation/deactivation cycle.

The controller will enter proportional dosage at setpoint. Then it will keep the dosing relay activated for a period proportional to the difference between the measurement and the setpoint over the cycle. When the measurement reaches the setpoint ± (depending on control direction) the selected "Delta", the dosing relay is always on.

pH proportional control, example

Setpoint = 5.00 pH

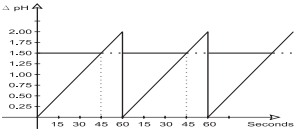
Reading = 6.50 pH

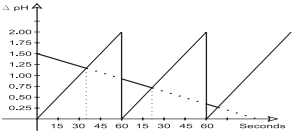
Reading - Setpoint = 1.5 pH

Proportional settings: pH set to 2 and time cycle to 60 seconds.

The controller doses acidic solution to lower the pH value to the desired limit.

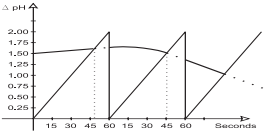
Since it is 1.50/2.00 = 75% away from the ideal setting, it will keep activated the dosing terminals for 75% of the time over the predetermined 60 seconds. The relay is hence theoretically activated for 45 seconds and off for 15 seconds.





The controller prevent over dosage with fast responding samples or highly concentrated chemicals, or under dosage with slow reacting or weak chemicals, stopping the dosage as soon as the difference between the reading and the setpoint intersects the proportional line, as shown in the graphs.

This means shortening the dosage time if the chemicals have reacted quickly or lengthening it if the measured pH continues to drift from the ideal setpoint as can be seen from the graphs.



ORP proportional control, example

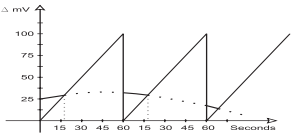
Setpoint = 725 mV

Reading = 700 mV

Setpoint - Reading = 25 mV

Proportional settings = mV set to 100 and time cycle to 60 seconds.

The controller will dose reductants to lower the ORP value to the desired value. Since it is 25/100 = 25% away from the ideal setting, it will keep activated the dosing relay for 25% of the time over the predetermined 60 seconds.



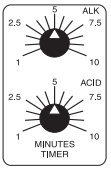
The terminals are hence activated for 15 seconds and off for 45 seconds until the next cycle.

Notes:

- If the setting is left at 0 pH or 0 mV, the controller will operate with no proportional dosage, with an hysteresis of approximately 0.1 pH or 7 mV.
- Do not set the time cycle to zero. This will cause the relay to chatter and can be detrimental to system and pumps.

OVERDOSAGE TIMER

All models provide for an overdosage alarm system ranging from 1 to 10 minutes. The maximum time interval for the dosing terminals continuously activated is user-selectable through a knob on the front panel. If this period elapses, the alarm terminals are activated and dosage disactivated, to ensure that chemicals do not run out, or pumps or electrovalves do not cease to function properly.



The **HI9911** model provides for two independent time controls, one for acid dosage and one for alkaline.

pH VALUES AT VARIOUS TEMPERATURES

Please refer to the below table for a more accurate pH calibration:

TEMP		pH VALUES				
°C	°F	**4.01**	**6.86**	**7.01**	**9.18**	**10.01**
0	32	4.01	6.98	7.13	9.46	10.32
5	41	4.00	6.95	7.10	9.39	10.24
10	50	4.00	6.92	7.07	9.33	10.18
15	59	4.00	6.90	7.04	9.27	10.12
20	68	4.00	6.88	7.03	9.22	10.06
25	77	4.01	6.86	7.01	9.18	10.01
30	86	4.02	6.85	7.00	9.14	9.96
35	95	4.03	6.84	6.99	9.10	9.92
40	104	4.04	6.84	6.98	9.07	9.88
45	113	4.05	6.83	6.98	9.04	9.85
50	122	4.06	6.83	6.98	9.01	9.82
55	131	4.07	6.84	6.98	8.99	9.79
60	140	4.09	6.84	6.98	8.97	9.77
65	149	4.11	6.85	6.99	8.95	9.76
70	158	4.12	6.85	6.99	8.93	9.75

Examples: if the buffer temperature is 25 °C (77 °F), calibrate the meter to read 4.01, 7.01 or 10.01 on the display; if the temperature is 20 °C, calibrate to 4.00, 7.03 or 10.06; if the temperature is 50 °C, calibrate to 4.06, 6.98 or 9.82.

REDOX MEASUREMENT (HI9920 only)

Redox measurements allow the quantification of the oxidizing or reducing power of a solution, and are commonly expressed in mV.

Oxidation may be defined as the process during which a molecule (or an ion) loses electrons and reduction as the process by which electrons are gained.

Oxidation is always coupled together with reduction so that as one element gets oxidized, the other is automatically reduced, therefore the term oxidation-reduction is frequently used.

Redox potentials are measured by an electrode capable of absorbing or releasing electrons without causing a chemical reaction with the elements with which it comes into contact.

The electrodes most usually available for this purpose have gold or platinum surfaces; gold possesses a higher resistance than platinum in conditions of strong oxidation such as cyanide, while platinum is preferred for the measurements of oxidizing solutions containing halides and for general use.

When a platinum electrode is immersed in an oxidizing solution a monomolecular layer of oxygen is developed on its surface. This layer does not prevent the electrode from functioning, but it increases the response time. The opposite effect is obtained when the platinum surface absorbs hydrogen in the presence of reducing mediums. This phenomenon is rough on the electrode.

To make accurate redox measurements the surface of the electrode must be clean and smooth. At certain mV and pH values, the ORP electrode requires a considerable amount of time before it reads the proper value. This is at times due to the fact that it is moving from a reducing to an oxidizing state. Once it reaches a stable condition though, it reacts rapidly to changes.

Hence when the process is first set up allow sufficient time for the ORP electrode to adapt itself to the sample stream.

As with pH electrodes, gel-filled redox electrodes are more suitable for industrial applications due to less maintenance requirements.

In the event that measurements are made in solutions containing heavy doses of sulfide or protein, the diaphragm of the reference electrode must be cleaned more often.

In order to test if the ORP electrode is functioning properly, immerse it into a **HI7021** solution. The measured value should be between 240 ±20 mV.

When not in use, the electrode tip and the reference junction should be kept moist: put a few drops of **HI70300** storage solution in the protective cap should before storing the electrode.

If the electrode has been left dry, soak it overnight in a **HI70300** storage solution before using it, or allow more time upon installation for its stabilization.

Keep the electrode far from any mechanical stress which might cause damages.

Install the electrode in such a way that it is constantly immersed in the sample under control (stream or tank) and does not dry up.

Note: For industrial applications, it is always good practice to keep at least one spare electrode handy. When anomalies are not resolved with a simple maintenance, replace the electrode to see if the problem is alleviated.

SUGGESTED INSTALLATIONS for pH/ORP ELECTRODES

The electrode should be installed in such a way that its tip permanently lies in the solution to be monitored.

SHORT DISTANCE, INDOOR INSTALLATION

Due to the low currents involved, a very high grade of insulation is required and a dry environment is needed in order to obtain a level of insulation not lower than $10^{12}\,\Omega$.

This type of connection is very delicate and requires constant attention to maintain proper operating conditions.

Conventional electrodes may be used for indoor applications but the cable length should not exceed 10 m (33').

MEDIUM DISTANCE, INDOOR/OUTDOOR INSTALLATION

When an outdoor installation is required, it is normally necessary to install a transmitter to obtain accurate readings at distances from 10 to 50 m (33-165').

Since the introduction of AmpHel® electrodes these distances are no longer a problem: connect the meter directly to an AmpHel electrode, saving the cost of a transmitter.

The standard cable length of the AmpHel® electrodes is 5 m (16.5'). Additional lengths of regular cable, up to 50 m (165'), can be installed without special connectors.

It is recommended to use coaxial cables, which provide excellent insulation, even though AmpHel® electrodes can operate with both.

AmpHel electrodes have a built-in micro-amplifier in the electrode cap to boost the signal, drastically reducing susceptibility to noise and drift.

For more details about these or other specially made electrodes, consult the Hanna Instruments Office process and water treatment literature, or contact the nearest Hanna Instruments Office Service Center.

ACCESSORIES

pH ELECTRODES

HI1002/3 PTFE double-junction electrode with external threads

HI1003/3 PTFE double-junction electrode with external threads and matching pin

HI2911B/5 Amplified electrode with PTFE double-junction and BNC connector

ORP (Pt) ELECTRODES

HI2002/3 PTFE double-junction electrode with external threads

HI2003/3 PTFE double-junction electrode with external threads and matching pin

HI2931B/5 Amplified electrode with PTFE double-junction and BNC connector

ORP (Au) ELECTRODES

HI2012/3 PTFE double-junction electrode with external threads

HI2013/3 PTFE double-junction electrode with external threads and matching pin

Hanna Instruments® manufacturers hundreds of pH and ORP electrodes for a wide variety of process and water treatment applications. For a complete list, consult our web site at **www.hannainst.com** or contact your local Hanna Instruments Office.

pH CALIBRATION SOLUTIONS

HI7004L pH4.01 buffer solution, 500 mL bottle

HI7007L pH7.01 buffer solution, 500 mL bottle

HI7010L pH10.01 buffer solution, 500 mL bottle

ORP SOLUTIONS

HI7021L Test solution 240 mV, 500 mL bottle

HI7092L Pretreatment oxidizing solution, 500 mL bottle

MAINTENANCE SOLUTIONS

HI70300L Storage solution, 500 mL bottle

HI7061L General purpose cleaning solution, 500 mL bottle

HI7073L Protein cleaning solution, 500 mL bottle

OTHER ACCESSORIES

BL PUMPS	Dosing pumps (several models are available, with flow rates from 1.5 to 18.3 lph / 0.4 to 4.8 gph)
ChecktempC	Pocket-size thermometer (-50.0 to 150.0 °C)
ChecktempF	Pocket-size thermometer (-58.0 to 302.0 °F)
HI6050	Submersible electrode holder (605 mm/23.8" total length)
HI6051	Submersible electrode holder (1105 mm/43.5" total length)
HI6054B	Electrode holder for in-line applications
HI7610	Stainless steel Pt100 probe with 5 m cable
HI7620	Glass body Pt100 probe with 5 m cable
HI8427	pH and ORP Electrode Simulator and high impedance tester with 1 m (3.3') Coaxial Cable ending with a male BNC connector (**HI7858/1**)
HI931001	pH and ORP Electrode Simulator with display and 1 m (3.3') Coaxial Cable ending with a male BNC connector (**HI7858/1**)

Recommendations for Users

Before using these products, make sure that they are entirely suitable for the environment in which they are used.

Operation of these instruments in residential areas could cause unacceptable interference to radio and TV equipment.

The glass bulb at the end of the pH electrode is sensitive to electrostatic discharges. Avoid touching this glass bulb at all times. During operation, ESD wrist straps should be worn to avoid possible damage to the electrode by electrostatic discharges.

Any variation introduced by the user to the supplied equipment may degrade the instrument's EMC performance.

To avoid electrical shock, do not use this instrument when voltages at the measurement surface exceed 24 Vac or 60 Vdc.

To avoid damages or burns, do not perform any measurement in microwave ovens.

Unplug the instruments from power supply before replacing the fuse or making any electrical connections.

SALES AND TECHNICAL SERVICE CONTACTS

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Greece:
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Indonesia:
Tel. (21) 4584.2941 • Fax (21) 4584.2942

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