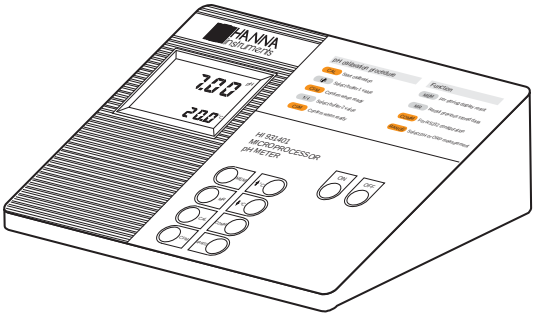
Instruction Manual

HI 9321
HI 931400
HI 931401

Microprocessor-based Bench pH/mV/°C Meters



HANNA instruments

www.hannainst.com

CE

These Instruments are in Compliance with the CE Directives

Dear Customer,

Thank you for choosing a Hanna Product. It is recommended that you read this instruction manual carefully before using the instrument. This manual will provide you with the necessary information for the correct use of the instrument, as well as a precise idea of its versatility. If you need more technical information, do not hesitate to e-mail us at tech@hannainst.com.

This instrument is in compliance with the CSA, UL and CE Directives.

TABLE OF CONTENTS

PRELIMINARY EXAMINATION

Remove the instrument from the packing material and examine it to make sure that no damage has occurred during shipping. If there is any damage, notify your Dealer or the nearest Hanna Customer Service Center.

Each meter comes supplied complete with:

- **HI 1131B** glass-body combination pH Electrode with 1 m (3.3') cable
- **HI 7669/2W** Temperature Probe
- **HI 76405** Electrode Holder
- pH 4.01 & 7.01 Buffer Solutions (20mL each)
- **HI 7071** Electrolyte Solution
- 12VDC Transformer (**HI 710005** or **HI 710006**)
- Dust cover

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

GENERAL DESCRIPTION

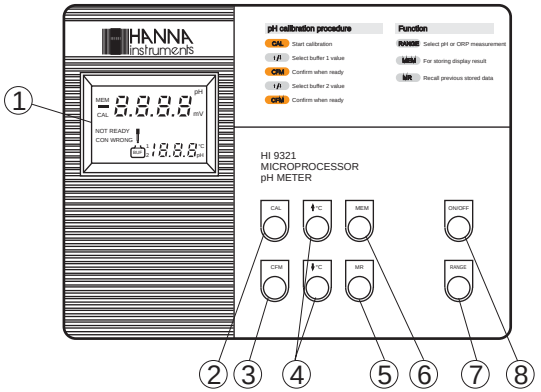
The Hanna Instruments **HI 9321**, **HI 931400** and **HI 931401** are microprocessor-based bench meters for pH, mV (ORP and ISE) and temperature measurements.

pH measurements are compensated for the temperature effect manually or automatically with the **HI 7669/2W** temperature probe.

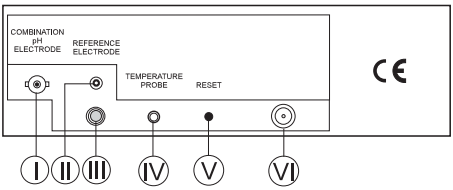
The meter comes equipped with a large LCD which shows the pH (or mV) and temperature simultaneously together with graphic symbols.

Through the RS 232C serial port you can transfer sample measurements to a PC (**HI 931400** and **HI 931401**).

FUNCTIONAL DESCRIPTION HI 9321

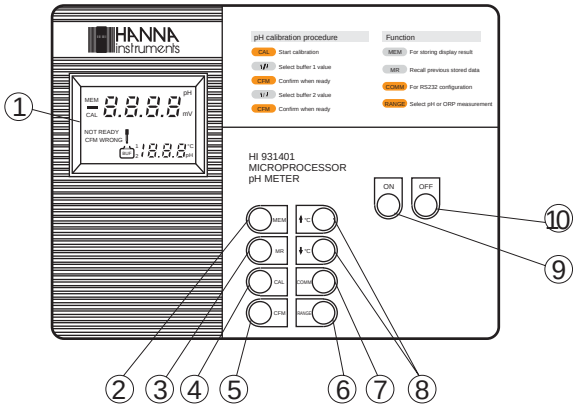


1. Liquid Crystal Display
2. **CAL** enters and exits calibration mode
3. **CFM** confirms calibration values
4. **↑°C** and **↓°C** manually set temperature and select pH buffer values
5. **MR** recalls the stored value
6. **MEM** stores a value in memory
7. **RANGE** selects measurement range
8. **ON/OFF** turns meter on and off

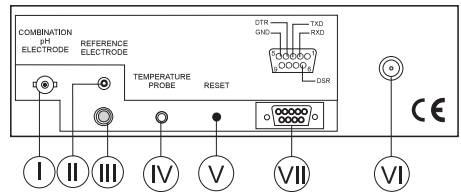


I. BNC Socket
II. Reference Electrode Socket
III. Reference Electrode Socket
IV. Temperature Probe Socket
V. Reset Button
VI. VDC Power Socket (for HI 710005 or HI 710006)

FUNCTIONAL DESCRIPTION
HI 931400 & HI 931401



1. Liquid Crystal Display
2. **MEM** stores a value in memory
3. **MR** recalls the stored value
4. **CAL** enters or exits calibration mode
5. **CFM** confirms calibration values
6. **RANGE** selects measurement range
7. **COMM** sets baud rate
8. **↑°C** and **↓°C** manually set temperature and select pH buffer values
9. **ON** turns meter on
10. **OFF** turns meter off



I. BNC Socket
II. Reference Electrode Socket
III. Reference Electrode Socket
IV. Temperature Probe Socket
V. Reset Button
VI. VDC Power Socket (for HI 710005 or HI 710006)
VII. RS 232C Socket

SPECIFICATIONS HI 9321 & HI 931400

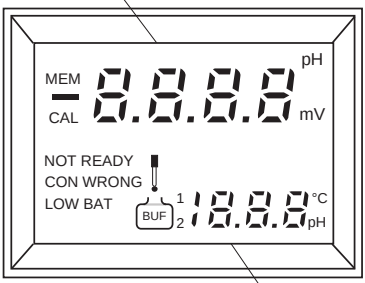
Range	**pH**	0.00 to 14.00
	ISE	±399.9 mV
	ORP	±1999 mV
	°C	0.0 to 100.0
Resolution	**pH**	0.01
	ISE	0.1 mV
	ORP	1 mV
	°C	0.1
Accuracy (@20°C/68°F)	**pH**	±0.01
	ISE	±0.2 mV
	ORP	±1mV
	°C	±0.5
Typical EMC Deviation	**pH**	±0.02
	ISE	±0.5 mV
	ORP	±1 mV
	°C	±2
pH Calibration		Automatic 1 or 2 points with 5 memorized buffers (4.01, 6.86, 7.01, 9.18, 10.01)
Temperature Compensation		Automatic or manual from 0 to 100°C (32 to 212°F)
Electrode		**HI 1131B** glass-body combination refillable pH electrode **(included)**
Temperature probe		**HI 7669/2W (included)**
Input impedance		$10^{12}\,\Omega$
Computer Interface		opto-isolated RS 232C (HI 931400 only)
Power supply		12 VDC (CSA, UL & CE approved) **(included)**
Environment		0 to 50°C (32 to 122°F) max. 95% RH non-condensing
Dimensions		230x170x70 mm (9.1x6.7x2.7")
Weight		1.3 kg (2.9 lb.); kit with holder: 3.2 kg (7 lb.)

SPECIFICATIONS HI 931401

Range	**pH**	0.00 to 14.00 / 0.000 to 14.000
	mV	±999.9 (ISE & ORP)
	°C	0.0 to 100.0
Resolution	**pH**	0.01 / 0.001
	mV	0.1
	°C	0.1
Accuracy (@20°C/68°F)	**pH**	±0.002 & ±0.01
	mV	±0.05% F.S.
	°C	±0.5
Typical EMC Deviation	**pH**	±0.01
	mV	±0.6
	°C	±0.5
pH Calibration		Automatic 1 or 2 points with 5 memorized buffers (4.01, 6.86, 7.01, 9.18, 10.01)
Temperature Compensation		From 0 to 100°C (32 to 212°F) manual or automatic with **HI 7669/2W** probe (**included**)
Electrode		**HI 1131B** glass-body combination refillable pH electrode (**included**)
Temperature probe		**HI 7669/2W** (**included**)
Input impedance		$10^{12}\,\Omega$
Computer Interface		Opto-isolated RS 232C (**included**)
Power supply		12 VDC (CSA, UL & CE approved) (**included**)
Environment		0 to 50°C (32 to 122°F) max. 95% RH non-condensing
Dimensions		230x170x70 mm (9.1x6.7x2.7")
Weight		1.3 kg (2.9 lb.); kit with holder: 3.2 kg (7 lb.)

FUNCTIONAL DESCRIPTION OF HI 9231 & HI 931400 LCD

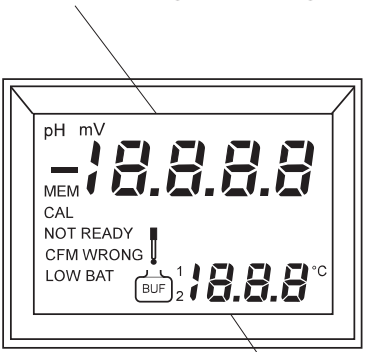
Primary Display



Secondary Display

FUNCTIONAL DESCRIPTION OF HI 931401 LCD

Primary Display



Secondary Display

OPERATIONAL GUIDE

ELECTRODE AND PROBE CONNECTIONS

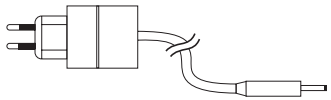
For combination **pH** or **ORP** electrodes (with internal reference) plug the electrode's BNC to the socket on the back of the meter (pages 4-5, # I).

For electrodes with a separate reference, connect the measuring electrode's BNC to the BNC socket (pages 4-5, # I) and the reference electrode plug to the other socket (pages 4-5, # II or III).

For **temperature** measurements and automatic temperature compensation connect the temperature probe to the appropriate socket (pages 4-5, # IV).

POWER CONNECTION

Plug the 12VDC transformer (**HI 710005** or **HI 710006**) into the DC socket (pages 4-5, # VI). Plug the transformer to the mains.

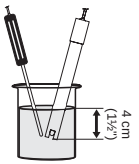


Note: Make sure the main line is protected by a fuse.

HI 931400 and **HI 931401** use an EEPROM to retain the pH, mV and temperature calibrations as well as the serial communication setting. The instrument will retain the data after a calibration or serial communication setting, even when it is unplugged.

pH MEASUREMENTS

To take a pH measurement simply submerge the tip (4cm/1½") of the electrode and the temperature probe into the sample to be tested.

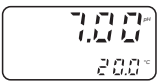


Turn the instrument on.

The meter automatically defaults to the pH measurement mode.

Allow a couple of minutes for the electrode to stabilize.

pH is displayed on the primary display and temperature on the secondary one.



In order to take accurate pH measurements, make sure that the instrument has been calibrated before use (see page 12).

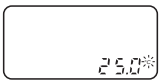
For more accurate results, it is recommended that the electrode is rinsed thoroughly with a liberal amount of the sample to be measured.

The pH reading is directly affected by temperature. In order for the meter to measure the pH accurately, temperature must be taken into consideration. A perfect equilibrium between the pH electrode and the sample can take up to 15 minutes.

To use the **Automatic Temperature Compensation** feature, submerge the **HI 7669/2W** temperature probe into the sample as close to the electrode as possible and wait for a couple of minutes.

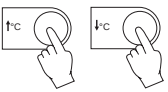
If the temperature of the sample is known or tests are always performed at the same temperature you can simply manually compensate for it. For this purpose the temperature probe must be disconnected.

The display will then show the default temperature of 25°C or the last recorded temperature reading with the "°C" symbol blinking.

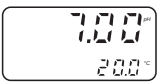


Note the temperature of the sample using a **ChecktempC** or an accurate reference thermometer.

The temperature can now be adjusted with the ↑°C and ↓°C keys.



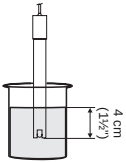
If the temperature probe is connected to the meter, the secondary LCD will display the measured temperature and the "°C" indicator will not blink. In this case, pressing ↑°C or ↓°C will not alter the temperature reading.



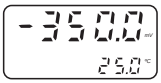
If measurements are taken in different samples successively, it is recommended that the electrode (and the temperature probe) be rinsed thoroughly with deionized, distilled or in the absence of both, tap water and then blot dry between each measurement.

ORP MEASUREMENTS

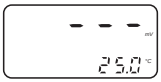
Press RANGE.



Submerge the ORP or ISE electrode tip (4cm/ 1½") into the sample.



Allow a few minutes for the reading to stabilize.



If readings are out of range "---" will appear on the LCD.

See also "Taking REDOX Measurements" on page 16.

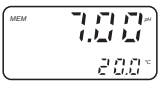
TEMPERATURE MEASUREMENTS

Taking a temperature measurement is very easy. Connect the **HI 7669/2W** temperature probe and turn the instrument ON.

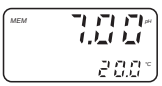
Dip the liquid/general purpose **HI 7669/2W** probe into the sample and allow the reading on the secondary display to stabilize.

HOLD FUNCTION

Press and hold MEM. The last reading will be frozen on the display until MEM is released. During this operation, the MEM indicator is also shown on the LCD.



Press MR and the previously memorized reading will be displayed with the MEM indicator on the LCD.



RESET BUTTON

The RESET button (see pages 4-5, #V) should be used when the instrument displays erroneous messages due to strong electrical interference or when the instrument's power supply was disconnected before the meter was switched off.

It is recommended to recalibrate the unit before proceeding.

pH CALIBRATION

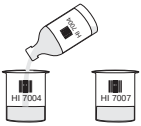
Calibrate the instrument often, especially if high accuracy is required.

The instrument should be re-calibrated for pH:

a) Whenever the pH electrode is replaced.
b) At least once a week.
c) After testing aggressive chemicals.
d) If higher accuracy is required.
e) After pressing RESET.

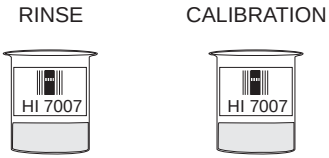
PREPARATION

Pour small quantities of the buffer solutions into clean beakers.



For accurate calibration and to minimize cross contamination use two beakers for each buffer solution. One for rinsing the electrode and a second for calibration.

To obtain accurate readings, use pH 7.01 and pH 4.01 if you are going to measure acidic samples or pH 7.01 and pH 10.01 for alkaline measurements.



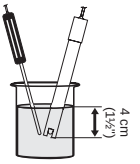
PROCEDURE

Calibration has a choice of 5 memorized buffers: 4.01, 6.86, 7.01, 9.18 and 10.01 pH.

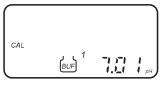
It is always recommended to perform a two-point calibration, first in an offset buffer (pH 6.86 or pH 7.01) and then a slope value (pH 4.01, pH 9.18 or pH 10.01). The pH meter however also provides for one-point calibration, as described below.

One-point calibration

- Immerse the pH electrode approximately 4 cm (1½") into a buffer solution of your choice (pH 4.01, 6.86, 7.01, 9.18 or 10.01) and stir gently. Attach the **HI 7669/2W** temperature probe and immerse it too in the buffer solution close to the pH electrode.



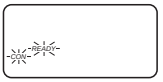
- Press CAL. The "CAL" and "BUF 1" indicators and "7.01" will be displayed.



- Press ↑°C or ↓°C until the secondary display shows the same value as the buffer solution.

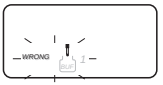
- If the pH electrode has not completely adjusted to the buffer value the LCD will blink "NOT READY".

Only when the reading is stable, "READY" and "CON" ("CFM" on HI 931401) will blink.



- Press CFM to confirm the calibration.

If the value measured by the meter is not close to the selected buffer, "WRONG BUF" and "WRONG ↑↓" will blink alternately (check the buffers to ensure the correct one has been used. If necessary change the buffer or even the electrode). If the reading is



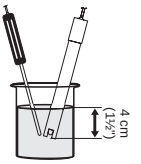
close to the selected buffer, the meter stores the reading. The buffer value is then displayed on the primary LCD and the secondary LCD will display "4.01".

- Press CAL and the meter exits the calibration mode.

Two-point calibration

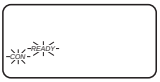
Any two of the 5 memorized buffer solutions that are more than 1 pH apart can be used for this purpose. However, it is recommended that pH 6.86 or 7.01 is chosen as the offset point and pH 4.01 (acidic) or pH 9.18/10.01 (alkaline) for the second (slope) calibration.

- Proceed as described in "One-point calibration" above but do not quit calibration by pressing CAL at the end.
- After the first calibration point is confirmed, immerse the pH electrode approximately 4 cm (1½") into the second buffer solution and stir gentlly. Attach the **HI 7669/2W** temperature probe and immerse it too in the buffer solution close to the pH electrode.



- Select the second buffer value on the secondary display by pressing ↑°C or ↓°C.

- When the "READY" and "CON" ("CFM" on HI 931401) symbols blink on the display the reading is stable and the calibration can be confirmed.



- Press CFM.

If the value measured by the meter is not close to the selected buffer solution, "WRONG BUF 2" and "WRONG !" will blink alternately (check the buffers to ensure the correct one has been used. If necessary change the buffer or even the electrode). If the reading is close to the selected buffer, the slope and the offset are calibrated. The values will be stored in memory and the meter will return to the operating mode.

Note: The meter will automatically skip the buffer that was used for the first calibration. pH 6.86 and pH 7.01 as well as 9.18 and 10.01 pairs of buffer solutions are also considered too close to allow an adequate two-point calibration. Consequently, after calibrating in one of the pair, the meter will also skip the other buffer.

Note: During calibration, the secondary LCD displays the selected buffer value.

Press RANGE and the temperature of the buffer will be displayed during calibration.

pH VALUES AT VARIOUS TEMPERATURES

Temperature has an effect on pH. The calibration buffer solutions are affected by temperature changes to a lesser degree than normal solutions. During calibration the meter will automatically calibrate to the pH value corresponding to the measured or set temperature.

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

For instance, if the buffer temperature is 25°C, the display will show pH 4.01 or 7.01 or 10.01. If the buffer temperature is 20°C, it will show pH 4.00/7.03/10.06 or at 50°C, the display will show pH 4.06/6.98/9.82.

TAKING REDOX MEASUREMENTS

An optional ORP electrode must be used to perform ORP measurements (see page 33).

Oxidation-reduction potential (REDOX) measurements provide the quantification of the oxidizing or reducing power of the sample tested.

To correctly perform a redox measurement, the surface of the ORP electrode must be clean and smooth.

When not in use, the tip of the electrode should be kept moist and safe from any mechanical stress which might cause damage to the glass/platinum sensing element.

TEMPERATURE AND mV CALIBRATION

The pH meter has been factory calibrated for temperature and mV. The temperature probes and ORP electrodes are interchangeable and no temperature or mV calibration is needed when they are replaced.

If, for any reason, the temperature or the mV measurements are inaccurate, temperature or mV recalibration should be carried out (see pages 24 and 25).

For an accurate recalibration, contact your dealer or the nearest Hanna Customer Service Center.

INTERFACE WITH PC

Data transmission from the instrument to the PC is now much easier with the new **HI 92000** Windows® compatible application software (optional). **HI 92000** also offers an on-line help feature.

Simply run your desired spread sheet and open the file downloaded by **HI 92000**. Data can be further elaborated with graphics, statistical analysis, etc. using the most diffused spread sheet programs (e.g. Excel©, Lotus 1-2-3©).

To install **HI 92000** you need a 3.5" drive and a few minutes to follow the instructions printed on the disk label.

In your copy of **HI 92000** you will also find a set of configuration files for your Windows Terminal® program to send commands directly from the PC keyboard (see appendix for commands description and usage).

To connect your meter to the PC use the optional **HI 920010** (available from your Hanna Dealer). Make sure that your meter is switched off and plug the connectors, one into the meter RS232C socket, the other into the serial port of your PC.

Note: Cables other than **HI 920010** may use a different configuration, in which case, communication between the meter and the PC may not be possible.

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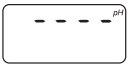
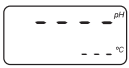
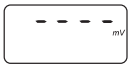
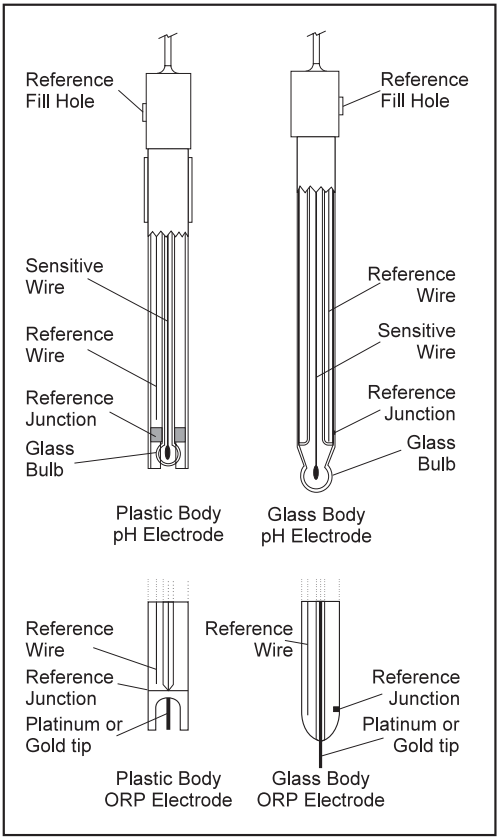
TROUBLESHOOTING GUIDE

Symptoms	Problem	Solution
The meter is slow in responding or gives faulty readings	The electrode is not working or the reference junction is clogged	Leave the electrode in a storage solution after cleaning the junction. If problem persists, replace the electrode
The meter does not accept the 2nd buffer solution for calibration	Out of order pH electrode	Follow the cleaning procedure. If this doesn't work replace the electrode
The reading drifts	Defective pH electrode	Replace the electrode
Display shows: 	Out of range pH scale	a) Recalibrate b) Make sure the pH sample is in the 0 to 14 range c) Check the electrolyte level and the general state of the pH electrode
Display shows: 	Out of range temperature scale	Make sure the temperature is in the 0 to 100°C range and the temperature probe is plugged in
Display shows: 	Out of range mV scale	Electrode not connected
Display shows: "WRONG  " and "WRONG "	Erroneous buffer solution used for offset calibration	Make sure the buffer setting is correct and the solution is fresh. Replace the buffer if necessary
	Defective electrode	Replace the electrode
Display shows: "WRONG  " and "WRONG  "	Erroneous buffer solution used for slope calibration	Make sure the buffer setting is correct and the solution is fresh. Replace the buffer if necessary
	Defective electrode	Replace the electrode
The meter does not work with the temperature probe	Out of order temperature probe	Replace the probe
The meter fails to calibrate or gives faulty readings	Out of order pH electrode	Replace the electrode

ELECTRODE CONDITIONING & MAINTENANCE



PREPARATION

Remove the protective cap.

DO NOT BE ALARMED IF ANY SALT DEPOSITS ARE PRESENT.

This is normal with electrodes and they will disappear when rinsed with water.

During transport tiny bubbles of air may form inside the glass bulb affecting proper functioning of the electrode. These bubbles can be removed by "shaking down" the electrode as you would do with a glass thermometer.

If the bulb and/or junction is dry, soak the electrode in **HI 70300** or **HI 80300** Storage Solution for at least one hour.

For refillable electrodes:

If the filling solution (electrolyte) is more than 2½ cm (1") below the fill hole, add **HI 7082** or **HI 8082** 3.5M KCl Electrolyte Solution for double junction or **HI 7071** or **HI 8071** 3.5M KCl + AgCl Electrolyte Solution for single junction electrodes.

For a faster response, unscrew the fill hole screw during measurements.

For AmpHel® electrodes:

If the electrode does not respond to pH changes, the battery is run down and the electrode should be replaced.

MEASUREMENT

Rinse the electrode tip with distilled water. Immerse the tip (bottom 4 cm /1½") in the sample and stir gently for a few seconds.

For a faster response and to avoid cross contamination of the samples, rinse the electrode tip with a few drops of the solution to be tested, before taking measurements.

STORAGE

To minimize clogging and assure a quick response time, the glass bulb and the junction should be kept moist and not allowed to dry out.

Replace the solution in the protective cap with a few drops of **HI 70300** or **HI 80300** Storage Solution or, in its absence, Filling Solution (**HI 7071** or **HI 8071** for single junction or **HI 7082** or **HI 8082** for double junction electrodes). Follow the Preparation Procedure above before taking measurements.

Note: NEVER STORE THE ELECTRODE IN DISTILLED OR DEIONIZED WATER.

PERIODIC MAINTENANCE

Inspect the electrode and the cable. The cable used for connection to the meter must be intact and there must be no points of broken insulation on the cable or cracks on the electrode stem or bulb. Connectors must be perfectly clean and dry. If any scratches or cracks are present, replace the electrode. Rinse off any salt deposits with water.

For refillable electrodes:

Refill the reference chamber with fresh electrolyte (**HI 7071** or **HI 8071** for single junction or **HI 7082** or **HI 8082** for double junction electrodes). Allow the electrode to stand upright for 1 hour.

Follow the Storage Procedure above.

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CLEANING PROCEDURE

General Soak in Hanna **HI 7061** or **HI 8061** General Cleaning Solution for approximately ½ hour.

Removal of films, dirt or deposits on the membrane/junction:

- *Protein* Soak in Hanna **HI 7073** or **HI 8073** Protein Cleaning Solution for 15 minutes.
- *Inorganic* Soak in Hanna **HI 7074** or **HI 8074** Inorganic Cleaning Solution for 15 minutes.
- *Oil/grease* Rinse with Hanna **HI 7077** or **HI 8077** Oil and Fat Cleaning Solution.

IMPORTANT: After performing any of the cleaning procedures rinse the electrode thoroughly with distilled water, refill the reference chamber with fresh electrolyte (not necessary for gel-filled electrodes) and soak the electrode in **HI 70300** or **HI 80300** Storage Solution for at least 1 hour before taking measurements.

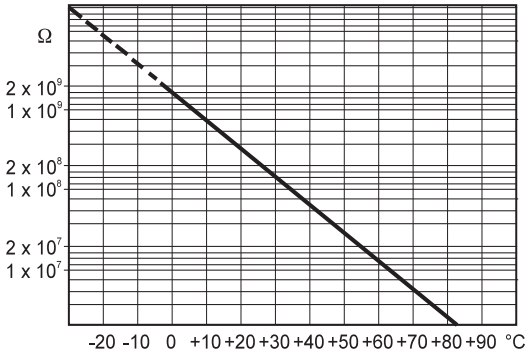
TROUBLESHOOTING

Evaluate your electrode performance based on the following.

- **Noise** (Readings fluctuate up and down) could be due to:
  - **Clogged/Dirty Junction:** Refer to the Cleaning Procedure above.
  - **Loss of shielding** due to low electrolyte level (in refillable electrodes only): refill with fresh **HI 7071** or **HI 8071** for single junction or **HI 7082** or **HI 8082** for double junction electrodes.
- **Dry Membrane/Junction:** Soak in **HI 70300** or **HI 80300** Storage Solution for at least 1 hour.
- **Drifting:** Soak the electrode tip in warm (approx. 50-60°C) Hanna **HI 7082** or **HI 8082** Solutions for one hour and rinse the tip with distilled water. Refill with fresh **HI 7071** or **HI 8071** for single junction electrodes and **HI 7082** or **HI 8082** for double junction electrodes (refillable electrodes only).
- **Low Slope:** Refer to the cleaning procedure above.
- **No Slope:** Check the electrode for cracks in glass stem or bulb and replace the electrode.
- **Slow Response/Excessive Drift:** Soak the tip in **HI 7061** or **HI 8061** Solutions for 30 minutes, rinse thoroughly in distilled water and then follow the Cleaning Procedure above.

TEMPERATURE-RESISTANCE CORRELATION FOR HANNA pH SENSITIVE GLASS

The resistance of glass electrodes partially depends on the temperature. The lower the temperature, the higher the resistance. It takes longer for the reading to stabilize if the resistance is higher. In addition, the response time will suffer to a greater degree at temperatures below 10°C.



Since the resistance of the pH electrode is in the 200 Mohm range, the current across the membrane is in the pico Ampere range. Large currents can disturb the calibration of the electrode for many hours.

For these reasons **high humidity environments, short circuits and static discharges** are detrimental for a stable pH reading.

The life of a conventional glass-body pH electrode also depends on the temperature. If constantly used at high temperatures, the electrode life is drastically reduced.

Typical Life of a Glass Electrode	
Ambient Temperature	**1- 3 years**
80-90°C	**Less than 4 months**
100-120°C	**Less than 1 month**

High concentrations of sodium ions interfere with readings in alkaline solutions. The pH at which the interference starts to be significant depends upon the composition of the glass. This interference is the alkaline error and causes the pH to be underestimated. Hanna's glass formulations have the indicated characteristics.

Alkaline Error

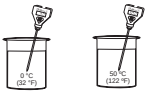
Sodium Ion Correction for the Glass at 20-25°C		
Concentration	pH	Error
0.1 Mol L^{-1} Na^{+}	13.00	0.10
	13.50	0.14
	14.00	0.20
1.0 Mol L^{-1} Na^{+}	12.50	0.10
	13.00	0.18
	13.50	0.29
	14.00	0.40

ADDITIONAL CALIBRATION PROCEDURES & INFORMATION (for technical personnel only)

TEMPERATURE CALIBRATION

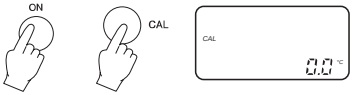
Initial Preparation

- Prepare a vessel containing ice and water and another one containing hot water (at a temperature of at least 50°C). Place insulation material around the container to minimize temperature changes.
- Use a **ChecktempC** or a calibrated thermometer with a resolution of 0.1 °C as a reference thermometer.

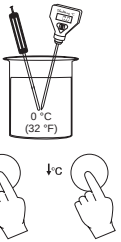


Procedure

- With the instrument off, press both CAL and ON keys simultaneously. The "CAL" indicator will be lit and the secondary LCD section will show 0.0°C.



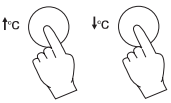
- Immerse the temperature probe in the vessel with the ice and water as near to the **ChecktempC** as possible.
- Wait for temperature reading to stabilize.
- Use the ↑°C or ↓°C keys to set the reading on the secondary LCD to that of ice and water.



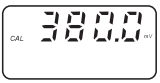
- Press CFM. The secondary LCD will show 50.0°C.

- Immerse the temperature probe in second vessel.

- When the temperature reading has stabilized, use the ↑°C or ↓°C keys to set the reading on the secondary LCD to that of the reference thermometer.



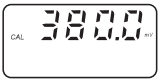
- Press CFM. The primary LCD section will show "380.0 mV".



- Complete your temperature calibration by pressing CAL if you do not want to perform mV calibration.

mV CALIBRATION

- Use a mV simulator with a range of ±500.0 mV and an accuracy of ±0.1 mV.
- Continuing from the temperature calibration, the primary LCD section will show "380.0 mV".



- Select 380.0 mV on the simulator.
- Wait for 3 sec., press CFM. The primary LCD will display the next reading to be selected on the simulator.

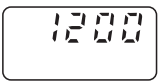
- Repeat previous two steps for -380.0 mV, 500.0 mV and -500.0 mV.
- At the end of the mV calibration, the meter will automatically return to the pH measurement mode.

INTERFACE WITH PC (HI 931400 & HI 931401)

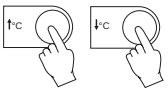
If you are not using Hanna Instruments **HI 92000** application software, please find below some additional information to help you link-up to your PC.

Setting the Baud Rate and the Command Prefix

The transmission speed (baud rate) of your meter and that of the external device must be the same. To set the baud rate of the meter press COMM, the primary LCD shows the current **baud rate**.



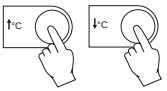
The following baud rate can be selected with ↑°C and ↓°C: 150, 300, 600, 1200 (factory setting) and 2400.



Press CFM to confirm the setting and the primary LCD shows the current **command prefix** (factory setting is 16).

Note: The Command Prefix must not be changed when using **HI 92000** Hanna Software.

Select a different command prefix (between 0 and 47) by pressing ↑°C and ↓°C.



Press CFM to confirm the setting.

Sending Commands from PC

With terminal programs such as Telix®, Windows Terminal®, it is possible to remotely control your meter. Use **HI 920010** cable to connect the meter to the PC, start the terminal program and set the communication options as follows: 8, N, 1, no flow control.

Command Types

To send a command to the pH meter the scheme is:

<DLE> <*command*> <CR>

This line makes the computer send a Data Link Escape character, the command expressed as a number (or a 3-character sequence) and a CR character.

Note: Windows Terminal® and all the other terminal programs that support the ANSI escape sequence, represent the DLE character by the string '^P' and the CR character by the string '^M'. E.g. the line '^PPHR^M' sets the range to pH.

Commands not requiring an answer from the pH meter:

PHR sets the range to pH
MVR sets the range to mV
CAL is equivalent to pressing the CAL key
CFM is equivalent to pressing the CFM key
UPC is equivalent to pressing the ↑°C key

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TELIX® is registered Trademark of "Deltacomm"

DWC is equivalent to pressing the ↓°C key
MEM is equivalent to pressing the MEM key
MRR is equivalent to pressing the MR key
COM is equivalent to pressing the COMM key
OFF is equivalent to pressing the OFF key

Commands requiring an answer:

pH? Causes the meter to send the pH value. If the reading is out of range "Err 1" is sent. If the range is set to mV, "Err 6" is sent.

MV? Causes the meter to send the mV value. If the reading is out of range "Err 2" is sent. If the range is set to pH, "Err 6" is sent.

TM? Causes the meter to send the temperature value. If the reading is out of range "Err 3" is sent.

These commands may be sent with either capital or small letters. Invalid commands will be ignored. The characters sent by the meter are always capital letters. When the meter receives an unknown or a corrupted command, it will send a character CAN (ASCII Code 24).

ACCESSORIES

pH CALIBRATION SOLUTIONS

HI 70004P pH 4.01 Buffer Sachets, 20mL, 25 pcs
HI 70007P pH 7.01 Buffer Sachets, 20mL, 25 pcs
HI 70010P pH 10.01 Buffer Sachets, 20mL, 25 pcs
HI 7004L pH 4.01 Buffer Solution, 460 mL
HI 7006L pH 6.86 Buffer Solution, 460 mL
HI 7007L pH 7.01 Buffer Solution, 460 mL
HI 7009L pH 9.18 Buffer Solution, 460 mL
HI 7010L pH 10.01 Buffer Sol., 460 mL

pH CALIBRATION SOLUTIONS IN FDA APPROVED BOTTLES

HI 8004L pH 4.01 Buffer Solution, 460 mL
HI 8006L pH 6.86 Buffer Solution, 460 mL
HI 8007L pH 7.01 Buffer Solution, 460 mL
HI 8009L pH 9.18 Buffer Solution, 460 mL
HI 8010L pH 10.01 Buffer Solution, 460 mL

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ELECTRODE STORAGE SOLUTION

HI 70300L Storage Solution, 460 mL

ELECTRODE STORAGE SOLUTION IN FDA APPROVED BOTTLES

HI 80300L Storage Solution, 460 mL

ELECTRODE CLEANING SOLUTIONS

HI 70000P Electrode Cleaning Sachets, 20 mL, 25 pcs
HI 7061L General Cleaning Sol., 460 mL
HI 7073L Protein Cleaning Sol., 460mL
HI 7074L Inorganic Cleaning Sol., 460mL
HI 7077L Oil & Fat Cleaning Sol.,460 mL

ELECTRODE CLEANING SOLUTIONS IN FDA APPROVED BOTTLES

HI 8061L General Cleaning Solution, 460 mL
HI 8073L Protein Cleaning Solution, 230 mL
HI 8077L Oil & Fat Cleaning Solution, 460mL

REFILL ELECTROLYTE SOLUTIONS

HI 7071 3.5M KCl + AgCl Electrolyte, 4x50mL, for single junction electrodes
HI 7072 1M KNO_3 Electrolyte, 4x50 mL
HI 7082 3.5M KCl Electrolyte, 4x50 mL, for double junction electrodes

REFILL ELECTROLYTE SOLUTIONS IN FDA APPROVED BOTTLES

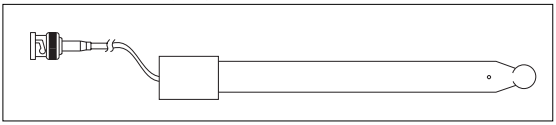
HI 8071 3.5M KCl + AgCl Electrolyte, 4x50mL, for single junction electrodes
HI 8072 1M KNO_3 Electrolyte, 4x50 mL
HI 8082 3.5M KCl Electrolyte, 4x50 mL, for double junction electrodes

ORP PRETREATMENT SOLUTIONS

HI 7091L Reducing Pretreatment Solution, 460 mL
HI 7092L Oxidizing Pretreatment Solution, 460 mL

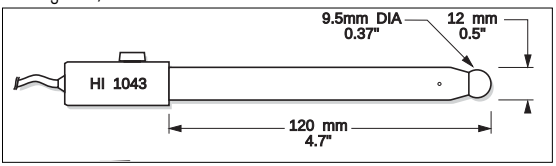
pH & ORP ELECTRODES

All electrodes part numbers ending in B are supplied with a BNC connector and 1 m (3.3') cable.



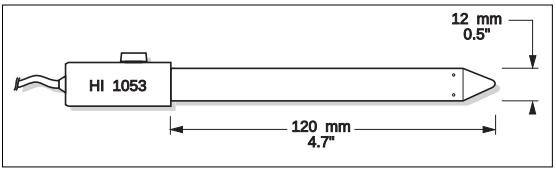
HI 1043B

Glass-body, double junction, refillable, combination **pH** electrode. Use: strong acid/alkali.



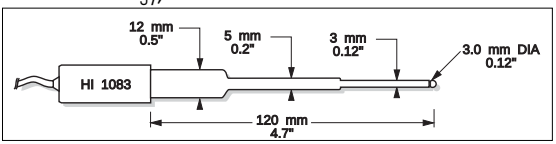
HI 1053B

Glass-body, triple ceramic, conic shape, refillable, combination **pH** electrode. Use: emulsions.



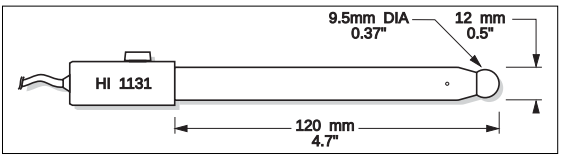
HI 1083B

Glass-body, micro, Viscolene, non-refillable, combination **pH** electrode. Use: biotechnology, micro titration.



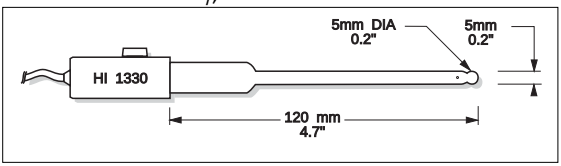
HI 1131B

Glass-body, single junction, refillable, combination **pH** electrode. Use: general purpose.



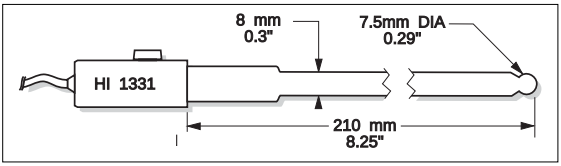
HI 1330B

Glass-body, semimicro, single junction, refillable, combination **pH** electrode. Use: laboratory, vials.



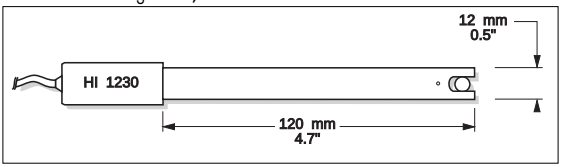
HI 1331B

Glass-body, semimicro, single junction, refillable, combination **pH** electrode. Use: flasks.



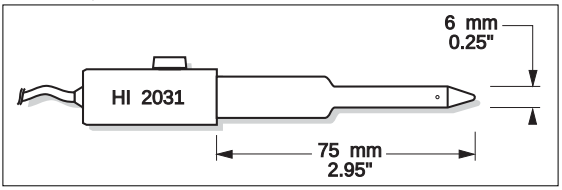
HI 1230B

Plastic-body (Ultem®), double junction, gel-filled, combination **pH** electrode. Use: general, field.



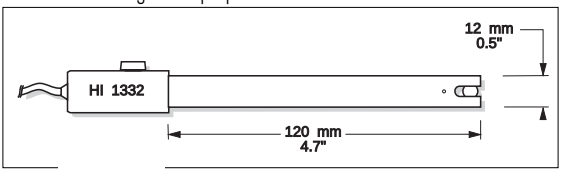
HI 2031B

Glass-body, semimicro, conic, refillable, combination **pH** electrode. Use: semisolid products.



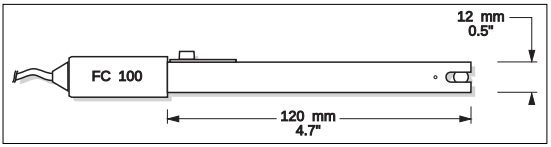
HI 1332B

Plastic-body (Ultem®), double junction, refillable, combination **pH** electrode. Use: general purpose.



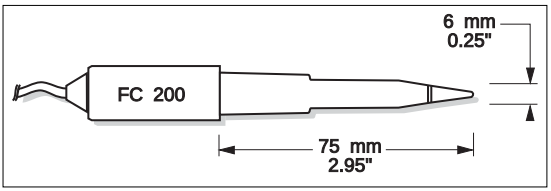
FC 100B

Plastic-body (Kynar®), double junction, refillable, combination **pH** electrode. Use: general purpose for food industry.



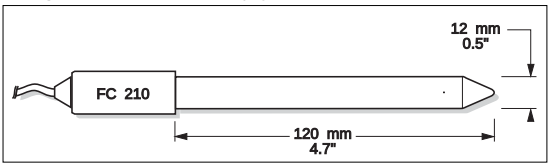
FC 200B

Plastic-body (Kynar®), open junction, conic, Viscolene, non-refillable, combination **pH** electrode. Use: meat & cheese.



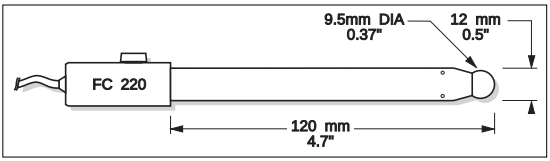
FC 210B

Glass-body, double junction, conic, Viscolene, non-refillable, combination **pH** electrode. Use: milk, yogurt.



FC 220B

Glass-body, triple-ceramic, single junction, refillable, combination **pH** electrode. Use: food processing.



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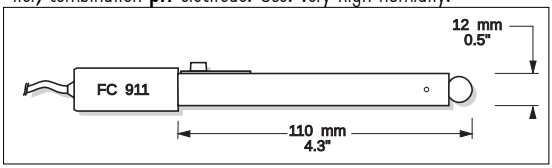
Kynar® is registered Trademark of "Pennwalt Corp."

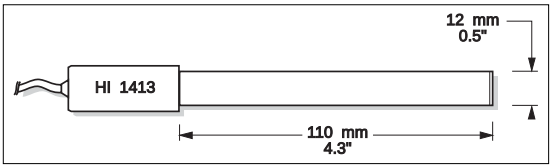
FC 911B

Plastic-body (Kynar®), double junction, refillable with built-in amplifier, combination **pH** electrode. Use: very high humidity.



HI 1413B

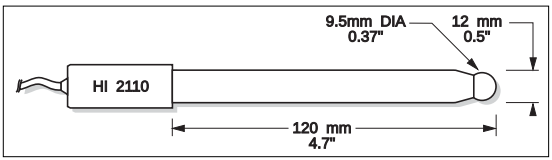
Glass-body, single junction, flat tip, Viscolene, non-refillable, combination **pH** electrode. Use: surface measurement.



Half-cell electrodes:

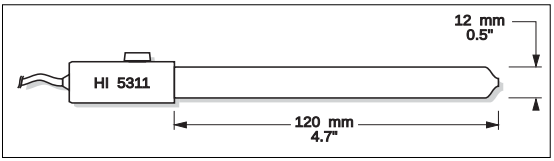
HI 2110B

Glass-body, **single half-cell pH** electrode. Use: general purpose.



HI 5311

Glass-body, Ag/AgCl **reference half-cell** electrode, double junction, refillable with 4mm plug with 1m (3.3') cable. Use: general purpose with wide temperature range.



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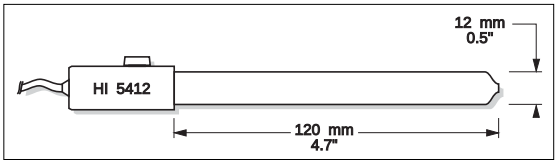
HI 5412

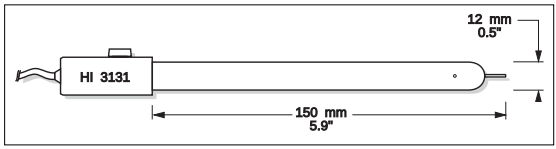
Glass-body, single Calomel **reference half-cell** electrode, refillable with 4mm plug with 1m (3.3') cable. Use: general purpose with constant temperature range.



ORP electrodes:

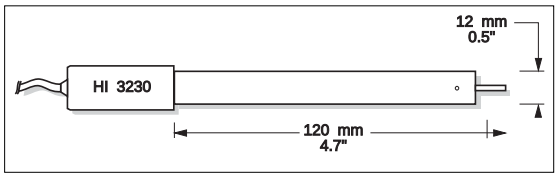
HI 3131B

Glass-body, refillable, combination platinum **ORP** electrode.
Use: titration.



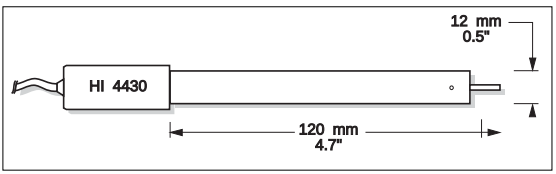
HI 3230B

Plastic-body (Ultem®), gel-filled, combination platinum **ORP** electrode. Use: general purpose.



HI 4430B

Plastic-body (Ultem®), gel-filled, combination gold **ORP** electrode. Use: general purpose.



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ACCESSORIES

HI 710005	Transformer 110VAC to 12 VDC
HI 710006	Transformer 220VAC to 12 VDC
ChecktempC	Pocket-size thermometer (range -50.0 to 150.0°C)
HI 76405	Electrode holder
HI 7669/2W	Temp. probe with 1 m (3.3') cable
HI 92000	Windows® compatible software
HI 920010	9 to 9-pin RS232 cable

Windows® is registered Trademark of "Microsoft Co."

WARRANTY

The Hanna Instruments **HI 9321, HI 931400, HI 931401** pH meters **are warranted for two years** against defects in workmanship and materials when used for its intended purpose and maintained according to the instructions.

The probes and the electrodes are warranted for a period of six months.

Damages due to accident, 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 the dealer from whom you purchased the instrument. If under warranty, report the model number, date of purchase, serial number and the nature of the failure. If the repair is not covered by the warranty, you will be notified of the charge for repair or replacement. If the instrument is to be returned to Hanna Instruments, obtain a Return Goods Authorization from the Customer Service Department first and then send it with shipment cost prepaid. When shipping any instrument, make sure it is properly packaged for complete protection.

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CE DECLARATION OF CONFORMITY

HANNA instruments

CE

DECLARATION OF CONFORMITY

We

Hanna Instruments Italia Srl
via E.Fermi, 10
35030 Sarmeola di Rubano - PD
ITALY

herewith certify that the bench pH meters

HI 9321 **HI 931400** **HI 931401**

have been tested and found to be in compliance with EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC according to the following applicable normatives:

EN 50082-1: Electromagnetic Compatibility - Generic Immunity Standard
IEC 801-2 Electrostatic Discharge
IEC 801-3 RF Radiated
IEC 801-4 Fast Transient

EN 50081-1: Electromagnetic Compatibility - Generic Emission Standard
EN 55022 Radiated, Class B

EN61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use

Date of Issue: 8-10-1998

P. Cesa - Technical Director
On behalf of
Hanna Instruments S.r.l.

Recommendations for Users

Before using this product, make sure that it is entirely suitable for the environment in which it is to be used.

Operation of this instrument in residential areas could cause unacceptable interferences to radio and TV equipment, requiring the operator to take all necessary steps to correct interferences.

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 24VAC or 60VDC.

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

Hanna Instruments reserves the right to modify the design, construction and appearance of its products without advance notice.

MAN9321R2
03/97

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